

1. Product Overview

C68700 (arsenical aluminum brass, CuZn20Al2As) is a single-phase α -brass with ~2% aluminum and a small controlled addition of arsenic (0.02-0.06%). The aluminum forms a tenacious, self-healing aluminum-oxide (Al_2O_3) surface film that provides outstanding resistance to corrosion in clean, flowing seawater, brackish water and salt solutions. The arsenic inhibits dezincification - the selective leaching of zinc that degrades ordinary brass in prolonged aqueous service.

C68700 is the workhorse tube material for power-station condensers, oil-refinery heat exchangers, desalination plant evaporators and marine cooling systems. It is supplied mainly as seamless condenser tube per ASTM B111 and welded tube per ASTM B543, in annealed or light-drawn tempers. Its combination of good strength, excellent thermal conductivity, moderate cost and proven seawater performance makes it one of the most widely used heat-exchanger tube alloys in the world.

1.1 Key Features

- Aluminum-rich protective surface film (Al_2O_3) gives excellent seawater corrosion resistance.
- Arsenic addition (0.02-0.06%) inhibits dezincification in long-term aqueous service.
- Single-phase alpha brass microstructure - good ductility and cold formability.
- Higher strength than pure copper grades (C11000/C12200) at similar thermal performance.
- Cost-effective versus cupronickel (C70600/C71500) for clean, flowing seawater service.
- Full heat-lot traceability with EN 10204 3.1 / 3.2 mill test certificates.
- Third-party inspection (SGS, BV, TUV) available on request.

1.2 Typical Applications

Application	Description
Power-plant condensers	Surface condenser tubing in fossil-fuel and nuclear plants
Heat exchangers	Oil-refinery and petrochemical shell-and-tube exchangers
Desalination	Multi-stage flash (MSF) and multi-effect distiller (MED) evaporator tubes
Marine cooling	Shipboard coolers, box coolers, keel-cooler tubing
Auxiliary coolers	Lube-oil, jacket-water and air-cooler bundles
Brine service	Salt-solution and brine-handling heat-exchanger tubing
HVAC	Large-capacity water-cooled chiller condenser tubes

1.3 At-a-Glance Specification

Attribute	Value
UNS designation	C68700 (arsenical aluminum brass)
EN designation	CW702R (CuZn20Al2As); DIN 2.0415
Alloy system	Cu-Zn-Al-As, single-phase alpha brass
Product forms	Seamless condenser tube; welded tube; plate; bar
Tempers	Annealed (O61, OS025), light-drawn (H55)
Density	8.33 g/cm ³ (0.301 lb/in ³)
Conductivity	≈ 23% IACS
Melting range	925 – 1 020 °C
Thermal conductivity	≈ 100 W/(m·K)
Max service temp.	200 °C continuous (pressure / structural)
Surface finish	Bright annealed / mill; ID cleaned for tube service
Certificates	MTC EN 10204 3.1 / 3.2, SGS, BV, TUV
MOQ	500 kg per specification

Composition and property limits conform to ASTM B111 / B543. Exact values should be verified against the material test certificate (MTC) for each order.

2. Chemical Composition & Standards

C68700 is a copper-zinc alloy with approximately 77% copper, 2% aluminum, a small arsenic addition, and the balance zinc. The aluminum is not merely a strengthener - it oxidizes preferentially at the surface to form a thin, adherent and self-renewing Al₂O₃ film that is the key to the alloy's seawater corrosion resistance. The arsenic acts as a dezincification inhibitor: it disrupts the selective dissolution of zinc and re-deposition of porous copper that would otherwise occur in ordinary brass under stagnant or warm aqueous conditions. The microstructure is a single-phase alpha (f.c.c.) solid solution, which preserves the ductility and cold-forming response of a conventional brass.

2.1 Chemical Composition (wt%)

Element	Symbol	Content (% mass)	Note
Copper (incl. Ag)	Cu	76.0 – 79.0	Balance / matrix
Aluminum	Al	1.8 – 2.5	Forms protective Al ₂ O ₃ film
Arsenic	As	0.02 – 0.06	Dezincification inhibitor
Lead	Pb	≤ 0.07	Free-machining / impurity control
Iron	Fe	≤ 0.06	Trace
Zinc	Zn	Remainder	Balance (≈ 17 – 21%)
Other (total)	—	≤ 0.10	Combined residual

Composition limits conform to ASTM B111 / B543. Verify against the MTC for each heat lot.

2.2 Applicable Standards by Product Form

Product form	Common standards
Seamless condenser tube	ASTM B111/B111M; EN 12451 (CW702R); JIS H3300; GB/T 8890
Welded condenser tube	ASTM B543; EN 12452 (CW702R)
Plate / sheet	EN 1652 / 1172; GB/T 2040 (as applicable)
Bar / rod	EN 12163 / 12165 (CW702R); GB/T 4423 (as applicable)
Heat-exchanger tube	ASTM B111/B111M; TEMA tube class; API 660

2.3 Condenser-Tube Alloy Comparison

Property	C68700 Al-brass	C44300 Admiralty	C70600 90/10 CuNi
Main alloying	Al + As (Zn balance)	Sn + As (Zn balance)	Ni + Fe
Seawater corrosion	Very good (clean water)	Good	Excellent
Dezincification resistance	Yes (As inhibited)	Yes (As inhibited)	N/A (no Zn)
Sulfide / polluted water	Susceptible	Susceptible	Resistant
Max seawater velocity	≈ 2.0 – 2.5 m/s	≈ 1.5 – 2.0 m/s	≈ 3.0 – 3.5 m/s
Relative cost	Low	Lowest	Higher
Best for	Clean seawater HX	Fresh / brackish water	Polluted / high-velocity seawater

3. Physical, Thermal & Electrical Properties

The values below are typical room-temperature properties for C68700 in the annealed condition. Because C68700 is a copper-zinc alloy, its electrical conductivity is considerably lower than pure copper (C11000/C12200), but its thermal conductivity remains high enough for efficient heat transfer in condenser and heat-exchanger service. Values are representative; slight variations may occur between tube, plate and bar due to cold-work level and grain size.

Property	Symbol	Value	Unit
Density	ρ	8.33	g/cm ³
Melting point (solidus)	—	925	°C
Melting point (liquidus)	—	1 020	°C
Specific heat capacity	c_p	0.377	J/(g·K)
Thermal conductivity	λ	100	W/(m·K)
Thermal expansion coeff.	α	18.5	× 10 ⁻⁶ / K
Electrical conductivity	σ	23	% IACS
Electrical resistivity	ρ	0.075	μΩ·m
Modulus of elasticity	E	110	GPa
Shear modulus	G	42	GPa
Poisson's ratio	ν	0.33	—
Magnetic permeability	μ	≈ 1.0	non-magnetic
Max continuous service temp.	—	200	°C

Sources: ASTM B111 property data; CDA / EN alloy data sheet for CW702R. Values are typical annealed at 20 °C unless noted.

4. Mechanical Properties by Temper

Mechanical properties depend on temper, grain size and cold-work level. The table below summarizes typical values for C68700 condenser tube per ASTM B111. Annealed tempers (O61 / OS025) are used for expanded tube-to-tubesheet joints where ductility is needed; light-drawn temper (H55) is used where higher strength and closer dimensional control are required. For pressure-containing design, always verify against the material certificate and the applicable code (e.g. ASME BPVC, TEMA).

Temper	Tensile (typ.)	Yield 0.5% EUL (typ.)	Elong. (min.)	Hardness (typ.)
Annealed (O61)	315 – 380 MPa	120 – 150 MPa	≥ 50%	70 – 85 HV
Annealed grain (OS025)	315 – 380 MPa	120 – 150 MPa	≥ 45%	70 – 85 HV
Light-drawn (H55)	≥ 360 MPa	≥ 250 MPa	≥ 18%	90 – 110 HV

Yield is reported at 0.5% extension under load (EUL), the convention used in ASTM B111 for copper-alloy tube. Hardness in Vickers (HV). Values are indicative; verify against ASTM B111 specification limits and the MTC.

5. Product Forms & Size Range

C68700 is supplied predominantly as seamless or welded condenser tube. Plate, bar and custom profiles are available for heat-exchanger tubesheets, baffles and machined components. Custom lengths, end-finishing (plain, expanded, bevelled) and U-bend forming are available on request.

5.1 Standard Tube Size Range

Form	Typical size range	Notes
Seamless condenser tube	OD 6 – 51 mm; wall 0.5 – 3.0 mm	ASTM B111; straight or U-bend
Welded condenser tube	OD 16 – 51 mm; wall 0.7 – 2.5 mm	ASTM B543; straight lengths
U-bend tube	OD 12 – 38 mm; min. bend radius $\geq 2.5 \times$ OD	Stress-relieved after bending
Plate / sheet	Thick. 1 – 25 mm; width $\leq 1\,000$ mm	For tubesheets / baffles
Bar / rod	Dia. 5 – 80 mm; length 1 – 4 m	For machined fittings / plugs

5.2 Tube End Finishing & Lengths

- Straight lengths: 3 – 18 m (commonly 6 m / 12 m).
- Plain, squared, deburred or bevelled ends as specified.
- Expanded (expanded-diameter) ends for tubesheet joints available.
- U-bends supplied stress-relieved, with bend thinning controlled per TEMA / customer drawing.
- ID cleaned and passivated for heat-exchanger service; ends capped for shipment.

5.3 Packaging

- Straight tube: bundled in wooden cases with separator strips and end caps.
- U-bends: nested in cradles with foam protection at bend areas.
- Each bundle tagged with heat number, size, temper and quantity.
- Export seaworthy packing with moisture barrier and desiccant.

6. Tolerances, Finish & Quality Control

C68700 condenser tube is produced and inspected to ASTM B111 (or B543 for welded tube). Dimensional tolerances are governed by the specification and the ordered temper. Because the alloy's primary service is pressurized heat-exchanger tubing, every lot is tested for dimensional accuracy, mechanical properties and, on request, for dezincification resistance.

6.1 Dimensional Tolerances (typical)

Parameter	Typical tolerance
Outside diameter	$\pm 0.05 - 0.13$ mm (ASTM B111 class)
Wall thickness	$\pm 8 - 10\%$ of nominal wall
Length (straight)	+3 / -0 mm, or custom-cut to drawing
Straightness	≤ 1.5 mm in any 3 m length
Ovality (OD)	$\leq$ half the OD tolerance
U-bend thinning	max 17% of nominal wall at bend (per TEMA)

6.2 Surface Finish & Cleanliness

- Smooth, bright-annealed or mill-finish ID and OD; free from cracks, laminations and deep scratches.
- ID cleaned of residual drawing lubricant; ends capped to maintain cleanliness for HX service.
- OD may be supplied with protective paper film for handling.
- Surface meets customer cleanliness specification (e.g. TEMA, refinery spec).

6.3 Quality Control Test List

Test	Standard / method	Frequency
Chemical analysis	ASTM E478 / ICP-OES	Each heat
Tensile / elongation	ASTM E8 / E8M	Each lot
Hardness (HV)	ASTM E92	Each lot
Hydrostatic / pneumatic test	ASTM B111 (1 000 psi or as spec.)	Each tube
Eddy-current test	ASTM E243 (non-destructive)	Each tube (on request)
Dimensional / ovality	Calipers / micrometers	Each tube
Dezincification test	ISO 6509 / customer spec.	On request
Grain size	ASTM E112	Each lot (OS025 temper)
Flaring / flange test	ASTM B111 tube test	Per specification

7. Corrosion Resistance & Service Conditions

C68700 owes its corrosion resistance to the aluminum-rich oxide film that forms spontaneously on the surface and renews itself if locally damaged. In clean, flowing seawater and brackish water it gives long, trouble-free service. The arsenic addition suppresses dezincification, which is the principal failure mode of ordinary brass in warm aqueous environments. However, the alloy is not immune to all conditions - the notes below summarize the key limitations and design practices that should be observed.

7.1 Suitable Environments

- Clean, flowing seawater and brackish water (the alloy's primary service environment).
- Fresh cooling water with neutral pH and low sulfide / ammonia content.
- Most neutral salt solutions and brines at moderate temperature.
- Steam condensate and closed-loop treated cooling water.
- Atmospheric exposure (rural, urban, industrial and marine climates).

7.2 Environments to Avoid / Design Considerations

- Stagnant or low-velocity water (< 1 m/s): promotes deposit attack and under-deposit corrosion; maintain flow or provide cleaning.
- Polluted or sulfide-bearing seawater: sulfides attack the Al_2O_3 film and can cause rapid pitting; use cupronickel (C70600/C71500) instead.
- High-velocity seawater (> 2.5 m/s): risk of impingement / erosion-corrosion at tube inlets and bends; install inlet protection or use C70600/C71500.
- Ammonia-bearing environments: risk of stress-corrosion cracking (SCC); stress-relieve tubes after forming / bending and avoid ammonia-containing treatment chemicals.
- Strong acids, caustic alkalis, mercury and amines: avoid direct contact.
- Galvanic coupling with steel or aluminium: insulate joints or use sacrificial anodes in seawater systems.

7.3 Design Velocity & Temperature Limits

Recommended maximum seawater velocity for C68700 tubing is about 2.0-2.5 m/s in clean water; higher velocities favour cupronickel. The recommended continuous service temperature is 200 °C for pressure and structural applications. For steam condensers and refinery exchangers the design temperature is usually set by the shell-side / tube-side fluid rather than by the alloy limit.

8. About Gnee Metal

Gnee Metal is a supplier of copper and copper-alloy products for export markets. Our ISO 9001 / 14001 / 45001 certified plants serve customers in North America, Europe, the Middle East and Southeast Asia with C68700 seamless and welded condenser tube, U-bends, plate and bar for heat-exchanger and condenser applications.

We provide project-specific mill test certificates (EN 10204 3.1 / 3.2), third-party inspection by SGS / BV / TÜV, and value-added services including U-bend forming, tube-to-tubesheet preparation, precision cutting and technical consultation. Contact us for a quote or for help selecting the right temper and specification for your service environment.

Item	Detail
Website	chinacopperalloys.com
Email	sales@gneemetal.com
Certificates	ISO 9001 / ISO 14001 / ISO 45001
Third-party	SGS, Bureau Veritas, TÜV