1. Product Overview

C44300 (Admiralty brass, arsenical) is a copper-zinc-tin-arsenic alloy containing approximately 71% copper, 1% tin, a small controlled amount of arsenic (0.02-0.06%), with the balance zinc. It belongs to the family of single-phase alpha brasses engineered for heat-exchanger and condenser tube service. The tin addition enhances resistance to general corrosion and impingement in salt and brackish waters, while the arsenic is essential: it suppresses dezincification - the selective loss of zinc that would otherwise destroy conventional brass in aggressive waters.

C44300 occupies the entry level of the copper-alloy heat-exchanger tube range. It offers good corrosion performance at lower cost than aluminum brass (C68700) and far lower cost than cupronickel (C70600 or C71500). It is therefore selected for moderate-duty service: fresh-water and mildly brackish coolers, oil coolers, heater intercoolers and distiller tubes where water velocity and corrosivity are moderate. For severe seawater, polluted water, or high-velocity service, C68700 or the cupronickel grades are preferred.

The alloy is supplied predominantly as seamless and welded thin-wall tube per ASTM B111 and ASTM B543, in straight lengths or as U-bends. Its good ductility and formability allow tube expansion into tubesheets, flaring and bending without cracking.

Because the protective surface film of Admiralty brass is thinner and less robust than that of cupronickel, C44300 should not be exposed to sulfide-bearing water, ammonia or prolonged stagnant conditions. In clean, flowing, low-to-moderate-velocity service, however, it provides reliable, economical performance.

1.1 Key Features

- Single-phase alpha brass - good ductility, formability and tube-expandability.
- Tin (0.9-1.2%) improves corrosion resistance and impingement performance vs plain brass.
- Arsenic (0.02-0.06%) inhibits dezincification - essential for long service life in aggressive water.
- Economical heat-exchanger tube alloy - lower cost than C68700 (Al brass) and cupronickel.
- Good thermal conductivity (≈ 115 W/(m·K)) - efficient heat transfer in coolers and condensers.
- Suitable for fresh-water, mildly brackish and moderate-velocity service.
- Seamless (ASTM B111) and welded (ASTM B543) tube available in straight or U-bend form.
- Full heat-lot traceability with EN 10204 3.1 / 3.2 mill test certificates.

1.2 Typical Applications

Application	Description
Heat exchanger tubes	Shell-and-tube coolers, heaters and intercoolers (fresh water / mild brackish)
Condenser tubes	Surface condensers in low-to-moderate-corrosivity water
Oil coolers	Lube-oil and transformer-oil coolers with water on the shell or tube side
Distiller tubes	Low-temperature distillation and evaporator tubing
Feedwater heaters	Low-pressure feedwater heater tubes in clean-water service
Petrochemical coolers	Process coolers in mildly corrosive water (not sulfide service)
HVAC	Chilled-water coils and heat-recovery exchangers

1.3 At-a-Glance Specification

Attribute	Value
UNS designation	C44300 (Admiralty brass, arsenical)
EN designation	CuZn28Sn1As (CW702R equivalent)
Alloy system	Cu-Zn-Sn-As, single-phase alpha brass
Product forms	Seamless tube, welded tube (straight or U-bend)
Tempers	Annealed (O61 / OS025), light-drawn (H55)
Density	8.53 g/cm³ (0.308 lb/in³)
Conductivity	≈ 25% IACS
Melting range	920 – 955 °C
Thermal conductivity	≈ 115 W/(m·K)
Max seawater velocity	≈ 1.5 – 2.0 m/s
Max service temp.	200 °C continuous (pressure / structural)
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.

1.4 When to Choose C44300

C44300 is the cost-effective choice when service conditions are moderate: clean or mildly brackish water, design velocity up to about 1.5-2.0 m/s, and no sulfide or ammonia contamination. It is preferred over plain brass (C26000 / C27000) because the tin and arsenic additions provide essential dezincification and corrosion protection. If the service water is polluted, sulfide-bearing, or the velocity exceeds 2.0 m/s, upgrade to C68700 (aluminum brass, 2.0-2.5 m/s) or to cupronickel C70600 (3.0-3.5 m/s) / C71500 (3.5-4.5 m/s). C44300 is also unsuitable for ammonia-bearing environments (stress-corrosion cracking risk).

2. Chemical Composition & Standards

C44300 is a four-element alloy: copper, zinc, tin and arsenic. Copper provides the matrix and the protective oxide film. The high zinc content (about 26-29%) makes the alloy a brass - lighter, cheaper and with good hot and cold workability - but also makes it vulnerable to dezincification without the arsenic addition. Tin (0.9-1.2%) improves corrosion resistance, particularly against impingement and saltwater attack, and strengthens the alloy modestly. Arsenic (0.02-0.06%) is the critical inhibitor: it blocks the selective dissolution of zinc that would otherwise cause rapid failure of ordinary brass in aggressive waters. The microstructure is a single-phase alpha (f.c.c.) solid solution, ensuring uniform corrosion behaviour and good ductility.

2.1 Chemical Composition (wt%)

Element	Symbol	Content (% mass)	Note
Copper (incl. Ag)	Cu	70.0 – 73.0	Matrix; protective oxide film
Tin	Sn	0.9 – 1.2	Corrosion resistance; impingement performance
Arsenic	As	0.02 – 0.06	Dezincification inhibitor (essential)
Zinc	Zn	Remainder (≈ 25.7 – 29.0)	Brass matrix; lowers cost
Lead	Pb	≤ 0.07	Trace (machinability / impurity)
Iron	Fe	≤ 0.06	Trace
Antimony	Sb	≤ 0.10	Trace
Nickel	Ni	≤ 0.10	Trace

Composition limits conform to ASTM B111. Arsenic must be within 0.02-0.06% for effective dezincification inhibition; verify on the MTC for each heat lot.

2.2 Applicable Standards by Product Form

Product form	Common standards
Seamless condenser tube	ASTM B111/B111M; JIS H3300; GB/T 8890
Welded condenser tube	ASTM B543; JIS H3320
U-bend tube	ASTM B395; TEMA RCB; customer drawing
Seamless pipe / tube (general)	ASTM B43 (as applicable)
Bar / rod / shapes	ASTM B36 (as applicable); EN 12164
Plate / sheet / strip	ASTM B36; EN 1652; GB/T 2040

2.3 Heat-Exchanger Tube Alloy Comparison

Property	C44300 Admiralty	C68700 Al-brass	C70600 90/10 CuNi
Alloy type	Cu-Zn-Sn-As	Cu-Zn-Al-As	Cu-Ni-Fe
Tin (Sn)	0.9-1.2%	0%	0%
Arsenic (As)	0.02-0.06%	0.02-0.06%	0%
Seawater corrosion	Good (clean water)	Very good	Excellent
Impingement resistance	Moderate	Good	Very good
Dezincification	Inhibited (As)	Inhibited (As)	N/A (no Zn)
Sulfide / polluted water	Not recommended	Susceptible	Resistant
Max seawater velocity	1.5-2.0 m/s	2.0-2.5 m/s	3.0-3.5 m/s
Thermal conductivity	≈ 115 W/(m·K)	≈ 100 W/(m·K)	≈ 40 W/(m·K)
Relative cost	Lowest	Medium	High
Best for	Moderate-duty HX tubes	Clean seawater HX tubes	Severe / high-velocity seawater

3. Physical, Thermal & Electrical Properties

The values below are typical room-temperature properties for C44300 in the annealed condition. Because C44300 is a brass (high zinc content), its density is lower than pure copper, and its electrical and thermal conductivity are significantly reduced - though still substantially higher than cupronickel alloys, which is why it remains an efficient heat-transfer material. The alloy is essentially non-magnetic in the annealed condition. 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	8.53	g/cm³
Melting point (solidus)	—	920	°C
Melting point (liquidus)	—	955	°C
Specific heat capacity	cp	0.38	J/(g·K)
Thermal conductivity	λ	115	W/(m·K)
Thermal expansion coeff.	α	18.2	× 10□⁶ / K
Electrical conductivity	σ	25	% IACS
Electrical resistivity	ρ	0.069	μΩ·m
Modulus of elasticity	E	105	GPa
Shear modulus	G	39	GPa
Poisson's ratio	ν	0.33	—
Magnetic permeability	μ	≈ 1.0	essentially non-magnetic
Max continuous service temp.	—	200	°C

Sources: ASTM B111 property data; CDA alloy data sheet for C44300. 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 C44300 condenser tube per ASTM B111. As a single-phase alpha brass, C44300 has moderate strength and good ductility - sufficient for tube expansion, flaring and U-bend forming. Annealed tempers (O61 / OS025) are preferred for expanded tube-to-tubesheet joints and formed components where ductility is needed. Light-drawn (H55) temper offers higher strength for structural or pressure applications. For pressure-containing design, always verify against the MTC and the applicable code (e.g. ASME BPVC, TEMA).

Temper	Tensile (typ.)	Yield 0.5% EUL (typ.)	Elong. (min.)	Hardness (typ.)
Annealed (O61)	325 – 380 MPa	110 – 150 MPa	≥ 35%	60 – 75 HV
Annealed grain (OS025)	325 – 380 MPa	110 – 150 MPa	≥ 35%	60 – 75 HV
Light-drawn (H55)	≥ 390 MPa	≥ 290 MPa	≥ 10%	85 – 105 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

C44300 is supplied predominantly as seamless and welded thin-wall heat-exchanger tube in straight lengths or as U-bends. Custom lengths, end-finishing (plain, expanded, bevelled) and U-bend forming are available on request. The alloy is not generally used as heavy-wall pipe for severe seawater service - that duty is reserved for cupronickel.

5.1 Standard Size Range by Product Form

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 ≥ 2.5 × OD	Stress-relieved after bending
Plate / sheet	Thick. 1 – 25 mm; width ≤ 1 000 mm	For tubesheets, baffles (lighter duty)
Bar / rod	Dia. 5 – 80 mm; length 1 – 6 m	For fittings, small valve components

5.2 End Finishing & Special Processing

- Straight tube lengths: 3 – 18 m (commonly 6 m / 12 m).
- Plain, squared, deburred or bevelled ends as specified.
- U-bends supplied stress-relieved, with bend thinning controlled per TEMA / customer drawing.
- ID cleaned and ends capped for heat-exchanger service cleanliness.
- Tube ends prepared for expansion into tubesheets (annealed temper recommended).

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.
- Plate: palletized with interleave paper and edge protection.
- Each bundle tagged with heat number, size, temper and quantity.
- Export seaworthy packing with moisture barrier and desiccant.

6. Tolerances, Finish & Quality Control

C44300 tube is produced and inspected to ASTM B111 (seamless) or ASTM B543 (welded). Because heat-exchanger tube performance depends on dimensional accuracy and surface integrity, every lot is tested for dimensional tolerance, mechanical properties and pressure integrity. Hydrostatic or pneumatic testing is performed on each tube. Dezincification testing may be performed on request to verify the effectiveness of the arsenic addition.

6.1 Dimensional Tolerances (typical)

Parameter	Typical tolerance
Outside diameter	± 0.05 – 0.13 mm (ASTM B111 class)
Wall thickness	± 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)	≤ 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.
- Plate and bar supplied with mill, brushed or polished finish as specified.
- 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 (per spec.)	Each tube
Eddy-current test	ASTM E243 (non-destructive)	Each tube (on request)
Dimensional / ovality	Calipers / micrometers	Each tube
Grain size	ASTM E112	Each lot (OS025 temper)
Flaring / flange test	ASTM B111 tube test	Per specification
Dezincification test	ISO 6509 / customer spec.	On request

7. Corrosion Resistance & Service Conditions

C44300 Admiralty brass provides good corrosion resistance in clean, flowing, low-to-moderate-velocity waters. Its performance relies on a thin surface oxide film that is less robust than the complex films formed on aluminum brass or cupronickel. The tin addition strengthens this film compared to plain brass, and the arsenic addition is essential for preventing dezincification - the selective dissolution of zinc that causes rapid, porous failure of unprotected brass. However, C44300 has clear service limits that must be respected.

7.1 Corrosion Mechanisms & Performance

- General corrosion: good in clean fresh, brackish and salt water; typical rate < 0.05 mm/year in flowing clean water.
- Dezincification: inhibited by arsenic (0.02-0.06%); without As, brass dezincifies rapidly in aggressive water.
- Impingement / erosion-corrosion: moderate; tolerates seawater velocities up to about 1.5-2.0 m/s.
- Pitting resistance: moderate; pitting can occur under deposits or in stagnant conditions.
- Stress-corrosion cracking (SCC): susceptible to ammonia SCC - avoid ammonia-bearing environments and high residual stress.
- Sulfide / polluted water: not recommended; sulfide attack accelerates corrosion rapidly.
- Galvanic compatibility: compatible with steel and other copper alloys; avoid coupling to aluminium or stainless steel without insulation.
- Crevice corrosion: moderate risk under deposits or in stagnant zones.

7.2 Service Limits & Design Velocity

The recommended maximum water velocity for C44300 tubing is about 1.5-2.0 m/s - the lowest of the common heat-exchanger tube alloys. Above this range, impingement attack can erode the protective film and cause rapid wall thinning, particularly at tube inlets and pump discharges. For piping, keep design velocity at or below 1.5 m/s in straight runs and reduce further at bends. The recommended continuous service temperature is 200 °C for pressure and structural applications.

7.3 Design Practices

- Keep design water velocity ≤ 1.5 m/s (2.0 m/s max); reduce at bends, inlets and pump discharges.
- Avoid prolonged stagnant conditions - design for continuous or intermittent flow to prevent deposit attack.
- Exclude C44300 from sulfide-bearing, ammonia-bearing or polluted-water service; use cupronickel instead.
- For tube-to-tubesheet joints, use annealed temper (O61 / OS025) for reliable expansion and seal.
- Minimize residual stress in formed components (U-bends) to reduce ammonia SCC risk; stress-relieve after bending.
- Avoid galvanic coupling to aluminium or passive stainless steel in seawater; use insulating flanges if required.
- For more demanding service (velocity > 2.0 m/s, polluted water, sulfides), upgrade to C68700, C70600 or C71500.

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 C44300 Admiralty brass seamless and welded heat-exchanger tube for coolers, condensers, oil coolers and distiller applications in moderate-duty water service.

We provide project-specific mill test certificates (EN 10204 3.1 / 3.2), third-party inspection by SGS / BV / TUV, and value-added services including U-bend forming, tube-to-tubesheet preparation, custom cutting and bevelling, and technical consultation to help you select the correct alloy and temper for your service environment. Contact us for a quote or for assistance.

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