1. Product Overview

C10200 is Oxygen-Free Copper (OFC) - a high-purity wrought copper containing at least 99.95% Cu (including silver) with oxygen controlled to a few parts per million and no residual deoxidant. It is produced by melting and casting under a protective, non-oxidising atmosphere so that no cuprous oxide (Cu_2O) particles are dispersed in the matrix. The result is an exceptionally pure, single-phase alpha copper that combines the high electrical and thermal conductivity of tough-pitch copper with a decisive advantage: it is immune to hydrogen embrittlement.

This makes C10200 the preferred grade whenever copper must be brazed, welded, or operated at elevated temperature in a hydrogen-bearing or reducing atmosphere - conditions under which ordinary tough-pitch copper (C11000) would crack. C10200 also offers slightly higher ductility and cleaner joining behaviour than C11000, at a cost premium that is justified in electrical, electronic, vacuum, superconductor and high-reliability applications.

The alloy is supplied across the full range of wrought product forms - busbar, rod, bar, wire, plate, sheet, strip, tube and custom shapes - in soft (annealed) and cold-worked tempers. It conforms to ASTM B152 (flat products), B187 (busbar, rod and shapes), B1 / B2 / B3 (wire) and B75 (seamless tube) as applicable, and is traceable by heat lot with EN 10204 mill test certificates.

1.1 Key Features

- Cu ≥ 99.95% - one of the highest-purity commercial coppers available.
- Oxygen controlled to ≤ 0.001% (a few ppm) - no Cu_2O in the microstructure.
- No deoxidant residue (unlike phosphorus-deoxidised C12200) - conductivity retained at ≥ 100% IACS.
- Immune to hydrogen embrittlement - safe for brazing, welding and service in hydrogen / reducing atmospheres.
- Superior brazeability and weldability vs tough-pitch C11000 (no steam reaction, no porosity).
- Excellent ductility - deep drawing, spinning, coining and cold heading without cracking.
- Non-magnetic; compatible with ultra-high vacuum (UHV) and electronic-grade cleanliness requirements.
- Full heat-lot traceability with EN 10204 3.1 / 3.2 mill test certificates.

1.2 Typical Applications

Application	Description
Busbars & conductors	High-current busbars, distribution bars, tap-off connections in switchgear
Electronic connectors	High-conductivity terminals, contacts, lead frames, IC packaging
Vacuum & electron devices	Vacuum-tube anodes, microwave components, particle-accelerator parts
Superconductors	Stabiliser and matrix copper for NbTi / Nb_3Sn and HTS magnets
Waveguides & RF	Precision waveguide, coax cable conductors, resonant cavities
Photovoltaic / battery	Solar cell ribbon, lithium-battery current collectors, busbars
Deep-drawn parts	Electronic enclosures, drawn cups, caps and shields
Anodes & electrodes	EDM electrodes, plating anodes, electrochemical cell components

1.3 At-a-Glance Specification

Attribute	Value
UNS designation	C10200 (Oxygen-Free Copper, OFC)
Also known as	OF, OFE, OF-HP (Oxygen-Free, High Purity)
Alloy system	Pure copper, single-phase alpha (f.c.c.)
Cu content (incl. Ag)	≥ 99.95%
Oxygen content	≤ 0.001% (a few ppm)
Deoxidant	None (atmosphere-melted)
Density	8.94 g/cm³ (0.323 lb/in³)
Conductivity	≥ 100% IACS (typically 101%)
Melting point	1 083 °C (1 981 °F)
Thermal conductivity	≈ 391 W/(m·K)
Max service temp.	200 °C continuous (pressure); higher for non-pressure
Product forms	Busbar, rod, bar, wire, plate, sheet, strip, tube, shapes
Certificates	MTC EN 10204 3.1 / 3.2, SGS, BV, TUV
MOQ	500 kg per specification

Composition and property limits conform to ASTM specifications for C10200. Exact values should be verified against the material test certificate (MTC) for each heat lot.

1.4 When to Choose C10200 over C11000

C10200 and C11000 (ETP, tough-pitch copper) have nearly identical room-temperature conductivity and mechanical properties. The decisive difference is oxygen: C11000 contains 0.02-0.05% oxygen dispersed as Cu_2O, while C10200 is oxygen-free. When C11000 is heated above about 400 °C in a hydrogen-bearing or reducing atmosphere, hydrogen diffuses in and reduces the cuprous oxide, generating steam that ruptures the grain boundaries - the classic 'hydrogen embrittlement' failure. C10200, having no oxygen to react, is immune. Choose C10200 whenever the part will be brazed in hydrogen, operated in a reducing atmosphere, or used in vacuum / electronic service where joint soundness and purity are critical. For ordinary plumbing, busbar or sheet-metal use without high-temperature reducing exposure, C11000 is more economical.

2. Chemical Composition & Standards

C10200 is essentially pure copper. The key metallurgical feature is the absence of both oxygen and residual deoxidant: the melt is prepared and cast under a controlled non-oxidising atmosphere (often carbon-monoxide-covered or vacuum / inert-gas melted) so that dissolved oxygen is reduced to a few parts per million and no cuprous oxide particles form during solidification. Because no phosphorus, lithium or boron is added as a deoxidiser, there is no residual solute to scatter charge carriers and lower conductivity - which is why C10200 retains ≥ 100% IACS, the same benchmark as tough-pitch C11000 and above phosphorus-deoxidised C12200.

2.1 Chemical Composition (wt%)

Element	Symbol	Content (% mass)	Note
Copper (incl. Ag)	Cu	≥ 99.95	Matrix; IACS reference conductor
Oxygen	O	≤ 0.001	A few ppm; no Cu_2O network
Phosphorus	P	Not added	No deoxidant residue (unlike C12200)
Hydrogen	H	trace (controlled)	Low; no embrittlement reaction
Silver	Ag	≤ 0.10 (counted as Cu)	Naturally occurring; reported separately
Lead	Pb	≤ 0.005	Trace impurity
Iron	Fe	≤ 0.004	Trace impurity
Other (each)	various	≤ 0.003	Bismuth, antimony, etc. controlled
Total impurities	—	≤ 0.05	Sum of all non-Cu, non-O elements

Composition limits conform to ASTM B152 / B187 / B1 for the C10200 UNS designation. Oxygen is the defining element: it must be essentially absent for hydrogen-embrittlement immunity. Verify on the MTC for each heat lot.

2.2 Applicable Standards by Product Form

Product form	Common standards
Busbar, rod & shapes	ASTM B187 (bus bar, rod and shapes); ASTM B188 (bus bar)
Plate / sheet / strip (electrical)	ASTM B152; ASTM B272 (flat products)
Wire - hard drawn	ASTM B1
Wire - medium-hard drawn	ASTM B2
Wire - soft / annealed	ASTM B3
Seamless tube	ASTM B75 (general purpose); ASTM B68 (thin-wall)
Round rod / bar	ASTM B133 (free-machining excluded); ASTM B187
Foil / thin strip	ASTM B152; customer specification

2.3 High-Conductivity Copper Comparison

Property	C10200 OFC	C11000 ETP	C12200 DHP
Cu (incl. Ag)	≥ 99.95%	≥ 99.90%	≥ 99.90%
Oxygen	≤ 0.001% (few ppm)	0.02 – 0.05%	Not added
Deoxidant	None	None	P 0.015 – 0.040%
Conductivity	≥ 100% IACS	≥ 100% IACS	≥ 85% IACS
Hydrogen embrittlement	Immune	Susceptible (>400 °C in H_2)	Immune
Brazeability / weldability	Excellent	Limited (steam reaction)	Excellent
Cost relative	Medium-high	Lowest	Low
Best for	Electronics, vacuum, busbar, welding	Plumbing, general busbar	Plumbing tubes, brazed joints

C10200 matches C11000 for conductivity while removing the oxygen that causes hydrogen embrittlement. C12200 trades some conductivity for deoxidation by phosphorus; choose it for plumbing tubes that will be brazed, not for peak electrical performance.

3. Physical, Thermal & Electrical Properties

C10200 exhibits the benchmark physical and electrical properties of high-purity copper. Because it contains neither oxygen particles nor residual deoxidant, its electrical conductivity equals that of tough-pitch C11000 - both serve as the International Annealed Copper Standard (IACS) reference at 100% (≈ 58 MS/m) at 20 °C. Thermal conductivity is similarly excellent, making C10200 an efficient conductor of both current and heat. The alloy is essentially non-magnetic. Values below are typical at room temperature for annealed material; cold work slightly increases strength and resistivity and slightly lowers conductivity.

Property	Symbol	Value	Unit
Density	ρ	8.94	g/cm³
Melting point	T_m	1 083	°C
Boiling point	—	2 567	°C
Specific heat capacity	c_p	0.385	J/(g·K)
Thermal conductivity	λ	391	W/(m·K)
Thermal expansion coeff.	α	17.0	× 10□⁶ / K (20 – 100 °C)
Electrical conductivity	σ	≥ 100 (typ. 101)	% IACS
Electrical resistivity	ρ	0.0172	μΩ·m (at 20 °C)
Temp. coeff. of resistance	α_r	0.00393	/°C (0 – 100 °C)
Modulus of elasticity	E	117	GPa
Shear modulus	G	44	GPa
Poisson's ratio	ν	0.34	—
Magnetic permeability	μ	≈ 1.0	essentially non-magnetic
Max continuous service temp.	—	200	°C (pressure)

Sources: ASTM B152 / B187 property data; CDA alloy data sheet for C10200 (OFC). Values are typical for annealed material at 20 °C unless noted.

4. Mechanical Properties by Temper

C10200 mechanical properties depend almost entirely on the degree of cold work and grain size, since the composition is fixed and there are no strengthening precipitates. The annealed (soft) temper gives maximum ductility - the defining property for deep drawing, spinning and forming - while cold-worked tempers deliver higher strength and stiffness for structural and busbar use. Because oxygen-free copper is slightly cleaner and more ductile than tough-pitch copper, its forming limits and fatigue performance in drawn parts are marginally better. Typical values at room temperature are shown below.

Temper	Tensile (typ.)	Yield 0.2% (typ.)	Elong. (min.)	Hardness (typ.)
Annealed (O61 / OS025)	220 – 260 MPa	30 – 70 MPa	≥ 45%	35 – 45 HRF
Cold-worked 1/4 hard (H01)	250 – 300 MPa	190 – 240 MPa	≥ 25%	45 – 55 HRB
Cold-worked 1/2 hard (H02)	290 – 360 MPa	240 – 300 MPa	≥ 12%	55 – 65 HRB
Cold-worked 3/4 hard (H03)	330 – 390 MPa	280 – 340 MPa	≥ 8%	65 – 72 HRB
Cold-worked full hard (H04)	≥ 345 MPa	≥ 310 MPa	≥ 6%	72 – 78 HRB
Spring (H06 / H08)	≥ 380 MPa	≥ 350 MPa	≥ 3%	≥ 78 HRB

Hardness shown in Rockwell F (soft) and Rockwell B (hard) scales. Values are indicative; verify against ASTM specification limits and the MTC for each lot. Annealed grain size per ASTM B187 / B152 (typically 0.010 – 0.040 mm for OS025).

5. Product Forms & Size Range

C10200 is supplied across the full range of wrought product forms to serve electrical, electronic and general copper applications. Busbar and rod are the highest-volume forms, followed by plate, sheet, strip, wire and seamless tube. Custom shapes, precision flat stock and drawn profiles are available to drawing.

Because oxygen-free copper is most often specified for its purity and joining behaviour, surface cleanliness and the absence of oxide inclusions are controlled throughout production. Mill-annealed, cold-rolled and precision-finished surfaces are offered per the applicable ASTM specification and customer requirements.

5.1 Standard Size Range by Product Form

Form	Typical size range	Notes
Busbar	Thick. 3 – 25 mm; width 12 – 300 mm	ASTM B187 / B188; straight lengths 1 – 6 m
Round rod / bar	Dia. 3 – 100 mm; length 1 – 6 m	ASTM B187 / B133; cold-drawn or cold-headed
Square / hex bar	5 – 60 mm across flats	For electrical and forged components
Plate	Thick. 3 – 50 mm; width ≤ 1 200 mm	ASTM B152; for anodes, bus plates, flanges
Sheet / strip	Thick. 0.1 – 3 mm; width ≤ 600 mm	ASTM B152; deep-drawing and electronic stock
Foil	Thick. 0.02 – 0.1 mm	Battery, PV ribbon, electronic applications
Wire	Dia. 0.05 – 8 mm	ASTM B1 / B2 / B3; spring, lead, conductor
Seamless tube	OD 3 – 50 mm; wall 0.5 – 3 mm	ASTM B75; for conductors, vacuum lines

5.2 Surface Finish & Special Processing

- Busbar: mill, brushed or polished finish; edges rounded (radius per spec).
- Plate / sheet: mill-annealed, cold-rolled, precision-flat or mirror finish.
- Strip / foil: precision-rolled to tight thickness tolerance for electronic use.
- Wire: hard, medium-hard or annealed; bare, tinned or silver-plated on request.
- Surfaces free from oxide inclusions, laminations and cracks per ASTM acceptance criteria.
- Vacuum / electronic-grade cleanliness available (low outgassing, controlled surface).
- Custom cutting, flat stock squaring and drawn profiles to customer drawing.

5.3 Packaging

- Busbar / bar: bundled in wooden cases with separator strips and end protection.
- Plate / sheet: palletized with interleave paper and edge protectors.
- Strip / foil: coil on cores, moisture-barrier wrapped, desiccant included.
- Wire: coils or spools, individually bagged, desiccant included.
- Each bundle tagged with heat number, size, temper and quantity.
- Export seaworthy packing with moisture barrier and desiccant.

6. Tolerances, Finish & Quality Control

C10200 products are produced and inspected to the applicable ASTM specification (B152, B187, B1 / B2 / B3, B75, B188). Because the alloy is most often used in electrical, electronic and vacuum service, dimensional accuracy, surface integrity and verified conductivity are controlled on every lot. Hydrostatic or pneumatic testing applies to tube; electrical conductivity testing applies to busbar, rod and flat stock. Hydrogen-embrittlement testing may be performed on request to confirm oxygen-free behaviour.

6.1 Dimensional Tolerances (typical)

Parameter	Typical tolerance
Busbar thickness	± 0.08 – 0.25 mm (per ASTM B187 / B188 class)
Busbar width	± 0.15 – 0.50 mm
Rod diameter (cold-drawn)	h8 – h9 (e.g. ± 0.02 – 0.07 mm)
Plate thickness	± 0.10 – 0.40 mm (per thickness range)
Sheet / strip thickness	± 0.005 – 0.05 mm (precision strip tighter)
Wire diameter	± 0.005 – 0.04 mm (per AWG / metric class)
Tube OD / wall	Per ASTM B75 class; OD ± 0.05 – 0.13 mm
Straightness (bar)	≤ 1.5 mm in any 1 m length

6.2 Surface Finish & Cleanliness

- Smooth, oxide-inclusion-free surface per ASTM acceptance standard; no laminations or cracks.
- Surfaces cleaned of residual rolling lubricant for electrical / electronic service.
- Vacuum / UHV-grade cleanliness available on request (low outgassing, baked if required).
- Busbar edges rounded (radius) and burr-free for safe handling and assembly.
- Strip and foil supplied with controlled surface roughness for plating / bonding.

6.3 Quality Control Test List

Test	Standard / method	Frequency
Chemical analysis	ASTM E478 / ICP-OES (Cu, O, P, impurities)	Each heat
Oxygen / hydrogen analysis	ASTM E2576 (inert gas fusion)	Each heat (key test)
Electrical conductivity	ASTM B193 / E1004 (eddy-current)	Each lot (busbar / rod / strip)
Tensile / elongation	ASTM E8 / E8M	Each lot
Hardness (HRF / HRB)	ASTM E18	Each lot
Dimensional inspection	Calipers / micrometers / laser	Each piece / sample
Hydrostatic / pneumatic test	ASTM B75 (tube)	Each tube
Grain size (annealed)	ASTM E112	Each lot (O61 / OS025)
Hydrogen-embrittlement test	ASTM B577 / B776	On request
Bend / formability test	ASTM E290 / customer method	Per specification

Electrical conductivity testing is mandatory for busbar and conductor stock; oxygen/hydrogen analysis confirms the defining property of the grade. Verify all values against the MTC.

7. Fabrication, Welding & Service Considerations

C10200 is among the most workable and joinable of all coppers. Its oxygen-free, deoxidant-free chemistry means it can be brazed and welded under hydrogen-bearing or reducing atmospheres without the steam-reaction cracking that limits tough-pitch C11000. Its very high purity also gives excellent ductility and consistent forming behaviour. The guidance below covers the fabrication and service practices that exploit these advantages.

7.1 Forming & Joining

- Cold formability: excellent - deep drawing, spinning, coining, cold heading and bending without cracking.
- Annealed temper (O61) gives maximum ductility for severe draws; cold-worked tempers give stiffness for formed busbar.
- Brazing: excellent with silver (BAg) and copper-phosphorus (BCuP) brazing alloys; no hydrogen embrittlement.
- Welding: gas-tungsten-arc (GTAW / TIG) and gas-metal-arc (GMAW / MIG) weld cleanly; superior to C11000 (no Cu_2O steam reaction).
- Soldering: excellent; surfaces accept tin-lead and lead-free solders readily after proper fluxing.
- Machining: poor to fair (pure copper is gummy); use free-machining C14500 (tellurium copper) if high-speed turning is the primary operation.
- Hydrogen / reducing atmosphere: safe for service above 400 °C - the defining advantage over C11000.

7.2 Service Limits & Design Notes

C10200 can operate continuously up to about 200 °C for pressure-containing and structural code applications; for non-pressure electrical and vacuum service, higher temperatures are acceptable, and the grade is valued precisely for its stability at elevated temperature in reducing / hydrogen atmospheres. Softening of cold-worked tempers begins near 200 °C, so spring temper parts should not see sustained service above this level without re-annealing consideration. Galvanically, C10200 is compatible with other copper alloys and with steel; it should be insulated from aluminium and from passive stainless steel in conductive media to avoid galvanic attack.

7.3 Design Practices

- Specify C10200 (not C11000) whenever the part will be brazed in hydrogen, operated in reducing atmosphere, or used in vacuum / electronic service.
- For busbar, specify ASTM B187 / B188 and require conductivity verification (≥ 100% IACS) on the MTC.
- Use annealed temper (O61 / OS025) for deep-drawn parts; use cold-worked tempers (H02 – H04) for formed busbar and springs.
- When machining is the dominant operation, switch to free-machining C14500 (tellurium) or C14700 (sulphur) to keep productivity.
- For plumbing tubes that will be brazed, C12200 (DHP) is usually sufficient and cheaper - choose C10200 only when peak conductivity or vacuum purity is required.
- Control surface cleanliness for vacuum / electronic parts; request baked / UHV-grade stock where outgassing matters.
- Verify oxygen content (≤ 0.001%) on the MTC for any part destined for high-temperature hydrogen service.

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 C10200 oxygen-free copper busbar, rod, bar, plate, sheet, strip, wire and seamless tube for electrical, electronic, vacuum and high-reliability applications.

We provide project-specific mill test certificates (EN 10204 3.1 / 3.2) with verified oxygen and conductivity data, third-party inspection by SGS / BV / TUV, and value-added services including custom cutting, flat-stock squaring, drawn profiles and technical consultation to help you select the correct grade and temper for your application. 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