



C10100 / C11000

Copper Data sheet

Material NOTE: The following data is for general reference only and NOT FOR DESIGN.

General

Badger Wire uses both grades of high conductivity high purity copper 99.9% in its wire range.

C10100 copper, also known as Oxygen Free Electronic (OFE) is 99.99% copper and due to low oxygen content achieves the highest level of electrical conductivity at 101% IACS, that is available in a commercial grade copper. As such it is used extensively in electrical conductor cabling, audio and electronics wiring industries.

C11000 copper, also known as Electrolytic Tough Pitch (ETP) copper is 99.9% purity and is more commonly used in the general electrical cable industry. ETP copper is rated at >100% IACS electrical conductivity, however most commercially available ETP is tested at or near 101%.

C11000 copper is preferred for cold forging eg fasteners, and hardware component applications due to surface finish and cold forge crack control.

Copper is a readily cold worked metal and will increase in tensile strength and reduced ductility with progressive cold work. Following cold work copper can be softened by annealing or stress relieving heat treatments.

(IACS = International Annealed Copper Standard)

Alloy designations

UNS C10100, OFHC, 10100, Cu-OFE

UNS C11000, Cu-ETP, C110, 11000

Applications

- Electrical conductors and components
- Radio transmission components
- Cold forged components, fasteners and hardware
- Binding & tie wires in decorative coatings industry
- Plasma deposition processes

Substitutable Alloys

Alloys that can be easily substituted for C11000, C10100, include C10200 alloy

Chemical Composition¹

Alloy	O ₂			Others	Cu(min)
C10100 OFE	-			trace	99.99 %
C11000 ETP	0.04			trace	99.90 %

NB: Assays in % max.

Physical Properties

Property	Value
Density	8.89 g/ cc
Melting point	1065 °C
Modulus of Elasticity	115 GPA
Resistivity	10.3E-08 Ohm-m
Electrical Conductivity	101% IACS

Mechanical properties

AS1567 Copper & Alloys – drawn wire, rod bar & strip

Temper	Ultimate Tensile strength	Elongation
	Mpa	%
O (Ultra High elongation) [™]	<260	>40%
O (Annealed)	210 (<260)	33-42
¼ hard	260-320	>20
½ hard	320-390	10-15
H (Hard Drawn)	>390	7%
SH (spring hard)	>400	< 2%

#: Typical averages

[™]Ultra High elongation is a proprietary product developed by Badger wire . Marketed as 'Double Annealed'

Physical performance

Ductility	Is a measure of elongation and ability to bend. Annealed copper is highly ductile.
Weldability	Readily weldable using commercial filler metals Soldering- excellent Brazing- Good Oxy cutting- Unable to due to oxide formation
Fabrication	Cold working capacity- excellent Hot forging rating- 65% of brass

¹ Complying with ASTM Copper Association

	<p>Machinability rating- 20% of free cutting brass Is readily formable in the annealed condition</p>
Corrosion	<p>Copper will oxidise in exposure to air. It is recommended that storage of bare copper includes a satisfactory coating and or atmosphere control. Copper is resistant to most chemicals and aqueous acids and alkalis. Copper suffers corrosion in environments of ammonia, amines, ammonia salts, oxidising acids, persulphates, perchlorates and mercury salts.</p> <p>C11000 ETP copper suffers hydrogen embrittlement when subject to elevated temperature in presence of >5% hydrogen, Eg; brazing, welding, Hydrogen annealing. In this case alternatives include OFE copper or deoxidised copper containing phosphorous.</p>
Appearance	Bright red yellow like appearance in drawn condition.
Surface coatings	<p>Copper alloy is readily anodised to provide a wear coating. Copper can be plated with many noble metals.</p>
Heat Treatment	<p>Copper is readily annealed at 375-650°C</p> <p>Stress relieving temperatures 275-350°C</p> <p>Copper will oxidise (blacken) in exposure to air at temperatures above 65°C. As such 'bright annealing' is typically undertaken in inert atmospheres, typically Nitrogen or Nitrogen / 2% Hydrogen mixtures. In line annealing during wire manufacture is conducted in steam inert atmospheres.</p>
Surface cleaning	Wire surface can be cleaned readily with mineral solvents.