

Copper Alloys

C11000, Electrolytic Tough Pitch Copper (ETP): The most common type of copper used. With a minimum copper content of 99.90%, and an electrical conductivity of 101% IACS, it is used in such diverse applications as electrical conductors, roofing and flashing, heat exchanger fins and tanks.

C10100 and C10200, Oxygen Free Coppers: Used where the presence of oxygen in copper is undesirable, as in certain electronic parts, or metal to be welded. These coppers have higher purities than ETP and are cast by the refineries in a controlled atmosphere with oxygen excluded. Cryogenic grades of C10100 copper are also available.

C12200, Phosphorous Deoxidized Copper (DHP): Deoxidized with phosphorous, making it relatively easy to weld and high temperature braze. However, DHP has a much lower electrical conductivity - approximately 85% IACS.

C11400 and C14300 Coppers: Used where it is desired to avoid softening in copper that is soldered at relatively high temperatures, as in automotive heater and radiator fins. The addition of a small percentage of silver, as in C11400 copper, is effective without a significant change in thermal and electrical conductivities. The addition of .07% cadmium to C14300 copper has a similar result, except that the conductivities are reduced by approximately 4%.

The measure by which the electrical conductivity of all materials are compared is known as % IACS (percent International Annealed Copper Standard). A few comparative conductivity ratings follow:

Type of Metal % IACS

110 Electrolytic Tough-Pitch Copper.....	101
102 Oxygen-Free Copper.....	101
145 Tellurium Copper.....	95
Aluminum EC.....	62
Aluminum 6101.....	56
505 Phosphor Bronze 1.25%.....	48
Aluminum 5052.....	35
Stainless Steel 302.....	3

Based on the availability and cost, C11000 Electrolytic Tough Pitch (ETP) should be specified when suitable.

Temper

The hardness of the copper or copper alloys is obtained by annealing or cold finishing after the annealing process. Unlike steel and aluminum, copper and most copper alloys are not strengthened by heat treating in the final stages of processing. During annealing, air is excluded by flooding the furnaces with protective atmospheres controlled to prevent scaling, staining, or the penetration of the metal by oxygen or hydrogen. Cold finishing is defined as the permanent deformation or strain produced in the metal by external forces that are applied while the metal's temperature is below its recrystallization point. It can be achieved by rolling, bending, stretching, or hammering the metal while it is cold.

Copper Rod and Bar

Annealed Metal (Soft) - Produced by Annealing Hard Metal - Special Soft Tempers are used for short radius bending, cold heading and cold swaging. Cold worked surfaces are suitable for most polishing.

1/2 Hard Metal (Cold Worked) - Produced by Cold Drawing or Cold Rolling Soft Metal to Finish Size. Common Hard Temper Rectangular and Square Bar. Standard Bus Bar Temper. Used for parts requiring machining, large radius bends, slight cold heading and slight cold swaging.

Full Hard Temper (Cold Worked) - Produced by Cold Drawing or Cold Rolling Soft Metal to Finish Size. Common Hard Temper for Round Rods. Used for parts requiring machining. Generally not suitable for bending, cold heading and cold swaging. Hard tempers are favorable to blanking, shearing and machining.

Sheet, Strip and Roll Copper

Cold Rolled Annealed Temper (Soft Metal) - Produced by Annealing Hard Metal - Standard Soft Roll Copper is commonly used for deep drawing and spinning. The surface on drawn parts is suitable for most polishing requirements.

Soft Temper Annealed Metal (Soft Metal) - Produced by Annealing Hard Metal - Commonly used by sheet metal craftsmen. Used for moderate drawing and cupping. The surface on drawn parts is suitable for most polishing requirements.

1/4 Hard Metal (Cold Worked) - Produced by Cold Rolling Soft Metal to the Finish Thickness. Special Hard Temper suitable for shallow forming.

1/2 Hard Metal (Cold Worked) - Produced by Cold Rolling Soft Metal to the Finish Thickness. Special Hard Temper suitable for 90 deg. bends.

3/4 Hard Metal (Cold Worked) - Produced by cold Rolling Soft Metal to the Finish Thickness. Suitable for 90 deg. bends. Favorable to blanking, shearing and machining.