



Standard Terminology for Copper and Copper Alloys¹

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1. Scope

1.1 The terms defined in this terminology standard are applicable to copper and copper alloy products specifications, test methods, practices, and other documents within the jurisdiction of Committee B-5 on Copper and Copper Alloys.

2. Referenced Documents

2.1 ASTM Standards:

B 170 Specification for Oxygen-Free Electrolytic Copper—Refinery Shapes²

B 379 Specification for Phosphorized Coppers—Refinery Shapes²

3. Significance and Use

3.1 This terminology is not intended to apply to any standard, test method, practice, or other document not within the jurisdiction of Committee B-5 on Copper and Copper Alloys.

4. Terminology

anneal (annealing)—a thermal treatment to change the properties or grain structure of the product. When applied to a cold-worked product having a single phase: to produce softening by recrystallization or recrystallization and grain growth, with the accompanying changes in properties. When applied to a product having two or more phases: to produce softening by changes in the phase relationship which may include recrystallization and grain growth.

arc welding—a group of welding processes wherein coalescence is produced by heating with an arc or arcs, with or without the application of pressure and with or without the use of filler metal.

as-welded condition—a condition created as a result of forming annealed sheet or plate into tubular form and welding without subsequent heat treatment or cold work.

average diameter (for round tubes only)—the average of the maximum and minimum outside diameters or the maximum and minimum inside diameters, whichever is applicable, as determined at any one cross section of the tube.

¹ This terminology is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.93 on Terminology.

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² *Annual Book of ASTM Standards*, Vol 02.01.

base metal—the sheet or plate from which the pipe is formed.

billet—refinery shape used for piercing or extrusion into tubular products or for extrusion into rods, bars, and shapes. Circular in cross section, usually 3 to 16 in. (76 to 406 mm) in diameter, normally ranging in weight from 100 to 4200 lb (63 to 28 200 kg).

blank—a piece of flat product intended for subsequent fabrication by forming, bending, cupping, drawing, hot pressing, and so forth.

buckle (centre bulge or oil can)—alternate bulges and hollows recurring along the length of a strip with the edges remaining relatively flat.

bus bar—includes material of solid rectangular or square cross section or a solid section with two plane parallel surfaces and round or other simple regular-shaped edges.

bus conductor stock—a bar, rod, or shape of high-conductivity copper used to make bus conductors.

cake—refinery shape used for rolling into plate, sheet, strip, or shape. Rectangular in cross section and of various sizes, normally ranging in weight from 140 to 62 000 lb (63 to 28 200 kg).

casting—a general term for a metal object produced at or near-finished shape by pouring or otherwise introducing molten metal into a mold and allowing it to solidify.

casting, centrifugal—a casting produced in a cylindrical mold rotating on its axis with the major axis of the product coinciding with the axis of rotation. The axis of rotation may be horizontal, vertical, or any angle in between.

casting, centrifuged—a casting produced in a mold, a number of which may be mounted around a central sprue. The molds are rotated, in a vertical position, about a central axis concentric with the central sprue.

casting, continuous—a casting produced by the continuous pouring and solidification of molten metal through a water-cooled mold which determines the cross-sectional shape. The length of the product is not restricted by mold dimensions.

casting, permanent mold—a product produced in a reusable mold constructed of a durable material, usually iron or steel, with the molten metal being introduced by gravity, low-pressure or vacuum.

casting, sand—a casting produced in a sand mold.

casting, semicentrifugal—a casting produced in a manner similar to the centrifugal casting except that a central core is used to allow the formation of other than a cylindrical inside

surface. The axis of rotation is always vertical.

cathode—unmelted, electrodeposited, and somewhat rough flat plate normally used for melting. The customary size is about 3 ft (0.914 m) square, about ½ to ⅞ in. (12.7 to 22.2 mm) thick, weighing up to about 300 lb (136 kg) and may have hanging loops attached. Cathodes may also be cut to smaller dimensions.

chemically refined copper—copper recovered from an aqueous solution by other than electrolytic means. Usually when this term is used alone it refers to chemically refined tough pitch copper. This designation applies to the following:

- copper cast in refinery shapes suitable for hot or cold working, or both, and by extension, to fabricators products made therefrom,
- ingots or ingot bars suitable for remelting.

cladding ratio—ratio by percent thickness of the component layers, for example.

close nipple—a nipple with no shoulder or unthreaded portion between two threads; the shortest possible pipe nipple with complete threads.

coil—a length of the product wound into a series of connected turns. The unqualified term “coil” as applied to tube usually refers to a bunched coil.

coil, bunched—a coil in which the turns are bunched and held together such that the cross section of the bunched turns is approximately circular.

coil, double layer flat—a coil in which the product is spirally wound into two connected disk-like layers such that one layer is on top of the other. (Sometimes called “double layer pancake coil” or “double layer spirally wound coil.”)

coil, helical—See **coil, level or traverse wound**.

coil, level or traverse wound—a coil in which the turns are wound into layers parallel to the axis of the coil such that successive turns in a given layer are next to one another. (Sometimes called a “helical coil.”)

coil, level or traverse wound on a reel or spool—a coil in which the turns are positioned into layers on a reel or spool parallel to the axis of the reel or spool such that successive turns in a given layer are next to one another.

coil, single layer flat—a coil in which the product is spirally wound into a single disk-like layer. (Sometimes called “pancake coil” or “single layer spirally wound coil.”)

coil, stagger wound—a coil in which the turns are positioned into layers approximately parallel to the axis of the coil, but not necessarily with the fixed regularity of a level or traverse wound coil.

cold work—controlled mechanical operations for changing the form or cross section of a product and for producing a strain-hardened product at temperatures below the recrystallization temperature.

corner radius on square or rectangular wire—any configuration on the corner between a chamfer and a full radius. The measurement of a corner radius is the distance from the blend point on one surface to the extension of the other surface.

dents—depressions in the copper foil which do not significantly change the thickness of the copper foil.

deoxidized copper, high-residual phosphorus—copper

deoxidized with phosphorus residual in amounts 0.015 to 0.04 %. The copper is not susceptible to hydrogen embrittlement, as determined in Specification B 379. The copper is of relatively low-electrical conductivity due to the amount of phosphorus present.

NOTE 1—International Standards Organization specifications permit up to 0.050 % phosphorus.

deoxidized copper, low-residual phosphorus—copper deoxidized with phosphorus residual in amounts 0.004 to 0.012 %. The copper is not readily susceptible to hydrogen embrittlement, as determined in Specification B 379. The copper in the annealed condition has a minimum conductivity of 90 % IACS.

dewetting—a condition that results when molten solder has coated a surface and then receded leaving irregular-shaped mounds of solder separated by areas covered with a thin film but base metal is not exposed.

dish (cross or transverse bow)—the departure from flatness across the full width of the strip in the form of a single arc, excluding burrs.

disk—a round, commercially flat solid blank made from a flat rolled product.

distribution tube (Type D)—a seamless or welded copper tube known as copper distribution tube (Type D).

drawn stress relieved (DSR)—a thermal treatment of a cold-drawn tubular product to improve ductility without significantly affecting its tensile strength or microstructure.

electrolytic copper—copper of any origin, refined by electrolytic deposition including electrowinning. Usually when this term is used alone it refers to electrolytic tough pitch copper. This designation applies to the following:

- cathodes that are the direct product of the refining operation.

- electrodeposited copper cast in refinery shapes suitable for hot or cold working or both, and by extension, to fabricators’ products made therefrom.

- electrodeposited copper cast into ingots or ingot bars suitable for remelting.

embrittlement—the reduction of the normal ductility in a metal due to a physical or chemical change. As it relates to these test methods, embrittlement is the loss of ductility caused by the reaction of cuprous oxide in the copper product when exposed at elevated temperatures to a reducing atmosphere.

extrusion—a uniform metal shape, long in relation to its cross-sectional dimensions, produced by forcing a suitably preheated billet or preform through an orifice (die) of the desired cross section. Extrusions generally are furnished in straight lengths.

fire-refined copper—copper of any origin or type finished by furnace refining without having been processed at any stage by electrolytic or chemical refining. Usually when the term fire-refined copper is used alone it refers to fire-refined tough pitch copper. This designation applies to the following:

- copper cast in refinery shapes suitable for hot or cold working or both, and by extension, to fabricators’ products made therefrom.