



## Standard Terminology for Copper and Copper Alloys<sup>1</sup>

This standard is issued under the fixed designation B 846; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

<sup>ε1</sup> NOTE—The term stress relief was editorially corrected in November 2000.

### 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 Shapes<sup>2</sup>

B 379 Specification for Phosphorized Coppers—Refinery Shapes<sup>2</sup>

### 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.

**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.

**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

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 02.01.

flat plate normally used for melting. The customary size is about 3 ft (0.914 m) square, about  $\frac{1}{2}$  to  $\frac{7}{8}$  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.

**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).

**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.”)

**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.

**ends**—straight pieces, shorter than the nominal length, left over after cutting the product into mill lengths, stock lengths, or specific lengths. They are subject to minimum length and maximum weight requirements.

**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.  
—ingots or ingot bars suitable for remelting.

**flash**—as in welding, the metal that protrudes at the weld of the tube, internally, externally, or both, as a result of the pressure applied when a forge-type seam is produced; the two types of flash are internal flash and external flash.

**flat product**—a rectangular or square solid section of relatively great length in proportion to thickness. Included in the designation “flat product” depending on the width and thickness, are plate, sheet, strip, and bar. Also included is the product known as “flat wire.”

**flat wire**—a product up to and including 0.188 in. (4.78 mm) in thickness and up to and including  $\frac{1}{4}$  in. (31.8 mm) in width.

**foil**—a term often applied to thin sheet or strip usually 0.005 in. (0.13 mm) or less in thickness.

**herringbone**—a series of long continuous waves running at various angles to the rolling direction.

**high-conductivity copper**—copper that in the annealed condition has a minimum electrical conductivity of 100 % IACS.

**hot working**—controlled mechanical operations for shaping a