ASTM B88

Standard Specification for Seamless Copper Water Tube

2016 Edition · Technical Summary

Item	Description
Designation	ASTM B88-2016 (fixed designation B 88; 2016 = year of last revision)
Title	Standard Specification for Seamless Copper Water Tube
Publisher	ASTM International
Metric companion	ASTM B88M (SI-unit version; companion specification)
Units	Inch-pound units
Tube types	Type K (heavy wall, green), Type L (medium wall, blue), Type M (light wall, red)
Tempers	O60 soft anneal, O50 light anneal, H58 drawn (per ASTM B601)
Materials	UNS C10200, C12000, C12200 (phosphorus-deoxidized / oxygen-free coppers)
Applications	Potable hot & cold water distribution, plumbing, HVAC, fire sprinkler systems, underground water services (Type K)

Note: The referenced Scribd page (document/619661518) is only a viewer shell without the standard text. This document is not a verbatim reproduction of the official standard; it is a technical summary compiled from multiple public sources. For the authoritative full text, purchase the official edition from ASTM International (www.astm.org).

1. Scope

This specification covers **seamless copper water tube** in standard sizes, in Types K, L and M, for general plumbing and similar applications in fluid conveyance, including potable hot and cold water distribution, sanitary plumbing, fire sprinkler systems, and HVAC. The tube is produced by the seamless process from coppers of UNS No. C10200, C12000, or C12200, and is suitable for use with solder, flared, or compression-type fittings. The standard does not purport to address all safety concerns associated with its use; the user is responsible for establishing appropriate safety and health practices.

2. Materials and Manufacture

Materials — The material of manufacture shall be a form of such purity and soundness as to be suitable for processing into the products prescribed. When heat identification or traceability is required, the purchaser shall specify the details desired.

Manufacture — The product shall be manufactured by such hot-working, cold-working, and annealing processes as to produce a uniform wrought structure. It shall be hot- or cold-worked (drawn) to the finished size, then annealed when required to meet the specified temper.

Form of supply — Tube furnished in coils shall be annealed after coiling. Tube furnished in straight lengths is normally supplied in the drawn temper (H58); by agreement, annealed straight-length tubing may be supplied. Standard lengths are typically 12 ft, 18 ft, or 20 ft with a tolerance of ±1 in. (12 ft for some Type K sizes; see the standard's length table).

3. Chemical Composition

Element	C10200 (OF)	C12000 (DLP)	C12200 (DHP)
Copper (incl. silver), min / %	99.95	99.90	99.90
Phosphorus / %	—	0.004–0.012	0.015–0.040
Typical role	High conductivity, vacuum use	Brazing / welding	Most common water-tube grade

These limits do not preclude the presence of other elements; by agreement, limits may be established for unnamed elements. C12200 (DHP) is the most widely used grade — deoxidized with phosphorus, it has no hydrogen-embrittlement risk and excellent brazeability.

4. Tempers and Mechanical Property Requirements

Acceptance or rejection based on mechanical properties depends on **tensile strength**, tested per Test Methods E8/E8M. Rockwell hardness (Test Methods E18) applies only when specified in the order; tests are made on the inside surface of the tube. Grain size (Test Methods E112) applies to annealed tempers when specified.

Temper	Name	Form	Rockwell Hardness	Tensile Strength min	Avg Grain Size / mm
O60	Soft anneal	Straight lengths / coils	F: 50 max	30 ksi (≈205 MPa)	0.040 min
O50	Light anneal	Straight lengths / coils	F: 55 max	30 ksi (≈205 MPa)	0.040 max
H58	Drawn	Straight lengths	30T: 30 min	36 ksi (≈250 MPa)	—

Where suitable equipment is not available for the specified Rockwell hardness, other scales and values may be agreed between purchaser and supplier. A light straightening operation is acceptable.

5. Performance Requirements

5.1 Expansion test (annealed tube) — When specified, annealed (O) tube shall be capable of expansion per Test Method B153: at least **40 %** expansion of outside diameter for standard sizes up to and including 1 in., and at least **30 %** for larger sizes, without visible cracking or rupture.

5.2 Hydrostatic or air pressure test — Tube shall withstand, without leakage:

· an internal hydrostatic pressure producing a fiber stress of 6000 psi, calculated as **P = 2St / (D − 0.8t)** (P = pressure, psi; t = wall thickness, in.; D = outside diameter, in.; S = allowable stress, 6000 psi); **or**

· an internal air pressure of **60 psig for 5 s** with easy visual detection of any leakage (e.g., under water or by pressure-differential method).

5.3 Eddy-current test — Each tube up to and including 3-1/8 in. OD shall be eddy-current tested per Practice E243. Notch-depth standards are **22 % of wall thickness** (rounded to 0.001 in., tolerance ±0.0005 in.). For speed-insensitive units, maximum unbalance signal: ≤ 0.2 % up to 3/8 in., ≤ 0.3 % for 1/2–2 in., ≤ 0.4 % for over 2–3 in. Signals caused by minor mechanical damage, soil, or moisture are not grounds for rejection if dimensions remain within limits.

5.4 Hydrogen embrittlement — C10200 and C12000 tube must be essentially free of cuprous oxide; C12200 is not subject to this requirement. In case of dispute, Procedure C of Test Methods B577 is the arbitration method.

6. Standard Dimensions, Wall Thickness, and Weights (Type K / L / M)

The standard dimensions and average outside-diameter tolerances (annealed / drawn) are given in Table 1 of the standard. Density for weight calculation: 0.323 lb/in³ (8.94 g/cm³).

Nominal Size / in.	OD / in.	K Wall / in.	L Wall / in.	M Wall / in.	K lb/ft	L lb/ft	M lb/ft
1/4	0.375	0.035	0.030	—	0.145	0.126	—
3/8	0.500	0.049	0.035	0.025	0.269	0.198	0.145
1/2	0.625	0.049	0.040	0.028	0.344	0.285	0.204
5/8	0.750	0.049	0.042	—	0.418	0.362	—
3/4	0.875	0.065	0.045	0.032	0.641	0.455	0.328
1	1.125	0.065	0.050	0.035	0.839	0.655	0.465
1-1/4	1.375	0.065	0.055	0.042	1.04	0.834	0.682
1-1/2	1.625	0.072	0.060	0.049	1.36	1.14	0.940
2	2.125	0.083	0.070	0.058	2.06	1.75	1.46
2-1/2	2.625	0.095	0.080	0.065	2.93	2.48	2.03
3	3.125	0.109	0.090	0.072	4.00	3.33	2.68
3-1/2	3.625	0.120	0.100	0.083	5.12	4.29	3.58
4	4.125	0.134	0.110	0.095	6.51	5.38	4.66
5–12	larger sizes available	per standard Table 1	per standard Table 1	per standard Table 1	—	—	—

Values compiled from published dimension/weight tables; some sources list minor variants (e.g., 1 in. K wall 0.065 in. vs 0.065/0.085 in. in older editions). Always verify against the official Table 1 of the edition ordered.

7. Dimensional Tolerances and Permissible Variations

Item	Requirement (summary)
Average OD tolerance	Ranges from ±0.001 in. (drawn, small sizes) to ±0.005 in. (annealed, larger sizes); e.g., 1/4 in.: 0.002 annealed / 0.001 drawn; 1-1/2 in.: 0.0045 annealed / 0.002 drawn
Wall thickness tolerance	Typically ±10 % of nominal wall (per standard Table 1)
Roundness (drawn, straight lengths)	t/D 0.01–0.03: 1.5 % of OD; 0.03–0.05: 1.0 %; 0.05–0.10: 0.8 % — no roundness tolerance for annealed or coiled tube
Length tolerance	±1 in. on standard 12 / 18 / 20 ft lengths
Squareness of cut	≤ 0.010 in. for sizes up to 1/2 in.; ≤ 0.016 in. per inch of OD for larger sizes

8. Referenced Documents

Standard	Title	Role in B88
ASTM B88M	Seamless Copper Water Tube (Metric)	Metric companion specification
ASTM B601	Temper Designations for Copper and Copper Alloys	Temper code definitions
ASTM B153	Expansion (Pin Test) of Copper Pipe and Tube	Expansion test for annealed tube
ASTM B577	Detection of Cuprous Oxide in Copper	Hydrogen-embrittlement / embrittlement test
ASTM E8/E8M	Tension Testing of Metallic Materials	Tensile test
ASTM E18	Rockwell Hardness Testing	Hardness test
ASTM E112	Determining Average Grain Size	Grain-size measurement
ASTM E243	Eddy-Current Examination of Copper Tube	Non-destructive eddy-current test

9. Type Selection Guide

Requirement	Recommended Choice	Rationale
Underground burial, high pressure	Type K (green)	Heaviest wall; highest pressure rating
General interior plumbing, fire sprinklers	Type L (blue)	Medium wall; balance of strength and cost
Low-pressure residential plumbing	Type M (red)	Lightest wall; most economical
Flexible runs around obstacles	Soft annealed coil (O60)	Can be bent by hand; annealed after coiling
Straight, rigid installations	H58 drawn	Stiffer, higher strength, precise dimensions

10. Workmanship, Sampling, and Certification (Reference)

· The material shall be clean and free from defects that interfere with normal commercial application.

· Sample pieces are selected from each lot of 5000 lb (or fraction thereof) of each size and type per the sampling schedule of the standard.

· Ordering information typically includes: ASTM B88 designation, type (K/L/M), temper, size, length or coil, quantity, and certification requirements.

· Mill test reports normally cover chemical composition and mechanical properties (EN 10204 3.1 or equivalent).

— End of Summary —