ASTM B280

Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

2018 Edition · Technical Summary

Item	Description
Designation	ASTM B280-18 (fixed designation B 280; 2018 = year of last revision)
Title	Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
Publisher	ASTM International — Subcommittee B05.04, Book of Standards Vol. 02.01
First approved	1953 (continuously revised; B280-18 superseded by B280-19/20/23)
Tube type	ACR tube — sized by actual outside diameter, supplied clean, dry (dehydrated), and end-capped
Materials	UNS C10200 (OF), C12000 (DLP), or C12200 (DHP) — manufacturer's option unless otherwise specified
Tempers	O60 soft anneal / O62 heavy anneal (coils); H55 light drawn / H58 drawn (straight lengths)
Applications	Field connection, repair, or alteration of air-conditioning and refrigeration units; refrigerant lines for split AC, VRF/VRV, chillers, commercial refrigeration

Note: The referenced Scribd page (document/877489376) 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 establishes the requirements for **seamless copper tube** intended for use in the **connection, repairs, or alterations of air-conditioning and refrigeration units in the field** (ACR tube). The tube shall be produced from UNS C10200, C12000, or C12200 copper; the manufacturer has the option to supply any one of them unless otherwise specified. Related documents: fittings for soldered or brazed connections are described in ASME B16.22; assembly by soldering in Practice B828; solders in Specification B32; acceptable fluxes in Specification B813. The standard does not purport to address all safety concerns associated with its use.

2. Materials and Manufacture

Materials — Billets, bars, or tubes of the specified copper shall be processed by hot or cold working into a homogeneous, uniform wrought structure.

Manufacture — Each tube shall be **cold drawn** to the finished size and wall thickness.

Coiled tube (annealed tempers) — shall be **bright annealed after coiling**, then **dehydrated** and either **capped, plugged, crimped, or otherwise closed at both ends** to preserve internal cleanliness.

Straight lengths (hard-drawn tempers) — shall be **cleaned** and either **capped, plugged, or otherwise closed at both ends**.

This clean-dry-capped delivery requirement is the key difference from ASTM B75/B88: residual oil, moisture, or debris inside refrigeration tubing can damage compressors and expansion devices.

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
Character	Oxygen-free, high conductivity	Deoxidized, low-residual P	Deoxidized, high-residual P; most common

C10200 offers excellent conductivity and resistance to hydrogen embrittlement; C12000/C12200 offer improved weldability and brazeability. Composition limits do not preclude presence of other elements.

4. Standard Dimensions (ACR Tube, Sized by Actual OD)

ACR tube differs from water tube (B88) in that sizes are designated by **actual outside diameter**. Coils are supplied from 1/8 in. to 1-5/8 in. (12 sizes, walls 0.030–0.060 in., typically 50-ft coils); straight lengths from 1/4 in. to 4-1/8 in. (14 sizes, walls 0.025–0.110 in., drawn temper).

Nominal Size / in.	Temper	OD / in.	Wall / in.	ID / in.	Bore Area / in²
1/8	A	0.125	0.030	0.065	0.0033
3/16	A	0.187	0.030	0.128	0.0129
1/4	A	0.250	0.030	0.190	0.0284
5/16	A	0.312	0.032	0.248	0.0483
3/8	A	0.375	0.032	0.311	0.076
3/8	D	0.375	0.030	0.315	0.078
1/2	A	0.500	0.032	0.436	0.149
1/2	D	0.500	0.035	0.430	0.145
5/8	A	0.625	0.035	0.555	0.242
5/8	D	0.625	0.040	0.545	0.233
3/4	A	0.750	0.035	0.680	0.363
3/4	A / D	0.750	0.042	0.666	0.348
7/8	A / D	0.875	0.045	0.785	0.484
1-1/8	A / D	1.125	0.050	1.025	0.825
1-3/8	A / D	1.375	0.055	1.265	1.26
1-5/8	A / D	1.625	0.060	1.505	—
2-1/8 … 4-1/8	D	2.125 … 4.125	0.070 … 0.110	—	—

A = annealed (coil form, soft); D = drawn (straight lengths). Larger straight sizes (1-5/8, 2-1/8, 2-5/8, 3-1/8, 3-5/8, 4-1/8 in.) per Table 1 of the standard. OD tolerance ±0.001–0.002 in.; wall tolerance ±0.0025–0.011 in.; roundness tolerance 0.8–1.5 % of OD depending on t/D ratio.

5. Mechanical Property Requirements

Temper	Description	Tensile Strength	Elongation	Grain Size / mm	Form
O60	Soft anneal	≥ 30 ksi (205 MPa)	≥ 40 %	≥ 0.040	Coils
O62	Heavy anneal	30 ksi (205 MPa)	≥ 40 %	≤ 0.050 max	Coils / straight
H55	Light drawn	36–47 ksi (250–325 MPa)	—	—	Straight lengths

Temper	Description	Tensile Strength	Elongation	Grain Size / mm	Form
H58	Drawn (general)	≥ 36 ksi (250 MPa)	—	—	Straight lengths

Recrystallized grain size determined per Test Methods E112; tensile tests per E8/E8M. Acceptance is based on tensile strength.

6. Performance and Inspection Requirements

6.1 Flare (expansion) test — O60 and O62 tube shall pass the flare test of Test Method B153 and show no visible cracks or defects after flaring.

6.2 Cleanliness test — The internal surface residue shall not exceed **0.0035 g/ft² (0.038 g/m²)** of internal surface (typical commercial practice aims well below this, e.g., ≤ 0.02 g/m² with nitrogen charging).

6.3 Hydrogen-embrittlement test — C10200 and C12000 tube shall be essentially free of cuprous oxide and pass Procedure A of Test Methods B577; all tube shall pass Procedure B.

6.4 Eddy-current test — Straight tube up to and including 3-1/8 in. OD shall be eddy-current tested per Practice E243 to ensure freedom from defects.

7. Maximum Working Pressures (Reference, at Room Temperature)

Nominal Size / in.	Annealed Coils / psi	Annealed Straight / psi	Drawn Straight / psi
1/8	2613	—	—
3/16	1645	—	—
1/4	1195	—	—
5/16	1017	—	—
3/8	836	777	1524
1/2	618	664	1302
5/8	525	615	1206
3/4	435	538	1055
7/8	495	496	972
1-1/8	420	421	825
1-3/8	373	374	733
1-5/8	347	348	682
2-1/8	309	—	607
2-5/8	286	—	560
3-1/8	270	—	529
3-5/8	258	—	506
4-1/8	249	—	489

Working pressures vary with wall thickness and temper; always confirm against the pressure table of the applicable edition and the system design conditions (refrigerant type, temperature).

8. Referenced Documents

Standard	Title	Role in B280
ASME B16.22	Wrought Copper and Copper-Alloy Solder-Joint Pressure Fittings	Fittings for soldered/brazed joints

Standard	Title	Role in B280
ASTM B32	Solder Metal	Solders for joining copper systems
ASTM B153	Expansion (Pin Test) of Copper Pipe and Tube	Flare test for annealed tube
ASTM B577	Detection of Cuprous Oxide in Copper	Hydrogen-embrittlement test
ASTM B601	Temper Designations for Copper and Copper Alloys	Temper code definitions
ASTM B813	Liquid and Paste Fluxes for Soldering Copper	Acceptable fluxes
ASTM B828	Making Capillary Joints by Soldering Copper Pipe and Tube	Soldered assembly practice
ASTM E8/E8M	Tension Testing of Metallic Materials	Tensile test
ASTM E112	Determining Average Grain Size	Grain-size measurement
ASTM E243	Eddy-Current Examination of Copper Tube	Non-destructive test

9. Typical Applications and Selection Notes

Requirement	Recommendation	Rationale
Residential split AC linesets	1/4 + 3/8 in. annealed coil (50 ft)	Standard liquid and suction line pairing
VRF / VRV systems	1/2 or 5/8 in.	Manufacturer-specified line sizes
Commercial chillers / industrial	3/4 – 1-3/8 in. straight, H58	Rigid high-pressure runs
Capillary / instrumentation lines	1/8 in. annealed coil	Small-bore, hand-formable
High-pressure refrigerants (R410A / R32)	Verify wall vs. working pressure table	Higher pressures favor heavier wall / drawn temper

ACR tube is commonly nitrogen-charged at the factory. Do not leave ends open on site — cap immediately after cutting to preserve internal cleanliness.

— End of Summary —