



Designation: B837 – 18

Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems¹

This standard is issued under the fixed designation B837; 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 reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification establishes the requirements for Type GAS seamless Copper UNS No. C12200 tube for use in above ground natural gas and liquefied petroleum (LP) gas fuel distribution systems, commonly assembled with flared fittings or brazed joints.

NOTE 1—Tube temper, size, and joining method are determined by installation code requirements.

1.2 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units which are provided for information only and are not considered standard.

1.3 The following safety hazard caveat pertains only to the test method(s) portion, Section 17, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards*:²

B153 Test Method for Expansion (Pin Test) of Copper and Copper-Alloy Pipe and Tubing

B577 Test Methods for Detection of Cuprous Oxide (Hydrogen Embrittlement Susceptibility) in Copper

¹ This specification is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.04 on Pipe and Tube.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast

B846 Terminology for Copper and Copper Alloys

B900 Practice for Packaging of Copper and Copper Alloy Mill Products for U.S. Government Agencies

B968/B968M Test Method for Flattening of Copper and Copper-Alloy Pipe and Tube

E3 Guide for Preparation of Metallographic Specimens

E8/E8M Test Methods for Tension Testing of Metallic Materials

E18 Test Methods for Rockwell Hardness of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry

E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)³

E112 Test Methods for Determining Average Grain Size

E243 Practice for Electromagnetic (Eddy Current) Examination of Copper and Copper-Alloy Tubes

E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

3. Terminology

3.1 For definitions of terms relating to copper and copper alloys, refer to Terminology **B846**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *liquefied petroleum (LP) gas, n*—any of the following hydrocarbons or mixtures of them: propane, propylene, butane (normal butane or isobutane) and butylene.

4. Ordering Information

4.1 Include the following specified choices when placing orders for product under this specification, as applicable:

4.1.1 ASTM designation and year of issue,

³ The last approved version of this historical standard is referenced on www.astm.org.

*A Summary of Changes section appears at the end of this standard

TABLE 1 Dimensions, Mass and Tolerances in Diameter and Wall Thickness for Standard Sizes of Type GAS Seamless Copper Tube for Natural Gas and Propane Fuel Distribution Systems (All Tolerances in This Table Are Plus and Minus)

Standard Size, in.	Actual Outside Diameter		Average Outside Diameter ^A Tolerances				Wall Thickness and Tolerance				Theoretical Mass	
	in.	(mm)	Annealed		Drawn		Wall Thickness		Tolerance ^B		lbs/ft	(kg/m)
			in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)		
3/8	0.375	(9.52)	0.002	(0.051)	0.001	(0.025)	0.030	(0.762)	0.003	(0.076)	0.126	(0.187)
1/2	0.500	(12.7)	0.0025	(0.064)	0.001	(0.025)	0.035	(0.889)	0.004	(0.10)	0.198	(0.146)
5/8	0.625	(15.9)	0.0025	(0.064)	0.001	(0.025)	0.040	(1.02)	0.004	(0.10)	0.285	(0.424)
3/4	0.750	(19.1)	0.0025	(0.064)	0.001	(0.025)	0.042	(1.07)	0.004	(0.10)	0.362	(0.539)
7/8	0.875	(22.3)	0.003	(0.076)	0.001	(0.025)	0.045	(1.14)	0.004	(0.10)	0.455	(0.677)
1 1/8	1.125	(29)	0.0035	(0.07)	0.0015	(0.038)	0.050	(1.27)	0.005	(0.13)	0.655	(0.975)

^A The average outside diameter of a tube is the average of the maximum and minimum outside diameter, as determined at any one cross section of the tube.

^B Maximum permissible deviation at any one point.

4.1.2 Copper [Alloy] UNS No. (or other internationally recognized copper [alloy]) designation,

4.1.3 Temper (Sections 5 and 7),

4.1.4 Dimensions (Standard Size), diameter, and wall thickness (Table 1),

4.1.5 How furnished: straight lengths or coils,

4.1.6 Length—(Table 2 and 12.5),

4.1.7 Quantity—total weight or total length or number of pieces of each size, and

4.1.8 Intended application.

4.2 The following options are available but may not be included unless specified at the time of placing of the order, when required:

4.2.1 Tensile test (Section 9),

4.2.2 Electromagnetic (eddy-current) examination (Section 11),

4.2.3 Embrittlement test (Section 10),

4.2.4 Expansion test (Section 10),

4.2.5 Flattening test (Section 10),

4.2.6 Certification (Section 21),

4.2.7 Test report (Section 22), and

4.2.8 If product is purchased for agencies of the U.S. Government (see the Supplementary Requirements section of {this specification or the general requirements section} for additional requirements, if specified).

5. Materials and Manufacture

5.1 Materials:

5.1.1 The material of manufacture shall be a tube of Copper UNS No. C12200 of such purity and soundness as to be suitable for processing into the products prescribed herein. The finished tube shall have the properties and characteristics prescribed in this specification and shall be cold drawn to size.

TABLE 2 Standard Lengths^A and Tolerances

Standard Size, in.	Standard Length		Tolerance, all plus	
	ft.	(m)	in.	(mm)
3/8 – 1 1/8	Tubes Furnished in Straight Lengths			
	12	(3.7)	1	(25)
	20	(6.1)	1	(25)
3/8 – 1 1/8	Tubes Furnished in Coils			
	60	(18)	24	(600)
	100	(30.5)	24	(600)

^A Longer lengths are subject to agreement between the manufacturer or supplier and purchaser.

5.1.2 When specified in the contract or purchase order that heat identification or traceability is required, the purchaser shall specify the details desired.

NOTE 2—Because of the discontinuous nature of the processing of castings into wrought products, it is not practical to identify a specific casting analysis with a specific quantity of finished material.

5.2 Manufacture:

5.2.1 The product shall be manufactured by such hot-working, cold-working, and annealing processes as to produce a uniform wrought structure in the furnished product.

5.2.2 The product shall be hot- or cold-worked to the finished size and subsequently annealed, when required, to meet the temper properties specified.

5.2.3 Tube, when furnished in coils, shall be annealed after coiling.

5.2.4 Tube, when furnished in straight lengths, shall be normally furnished in the H58 (Drawn General Purpose) temper, except when the O60 (Soft Anneal) temper is specified in the purchase order or contract.

6. Chemical Composition

6.1 The chemical composition shall conform to the following chemical requirements of Copper UNS No. C12200:

Copper (incl. silver)	99.9 % min.
Phosphorus	0.015 to 0.040 %

6.2 These composition limits do not preclude the presence of other elements. When included in the contract or purchase order, and agreed upon by the manufacturer or supplier and the purchaser, limits shall be established and analysis required for unnamed elements.

7. Temper

7.1 Type GAS copper tube shall be furnished in either of the following tempers as defined in Classification B601.

Soft anneal	O60
Drawn general purpose	H58

8. Grain Size for Annealed Tempers

8.1 Grain size shall be the standard requirement for all product in the annealed tempers.

8.2 Acceptance or rejection based upon grain size shall depend only on the average grain size of a test specimen taken from each of two sample portions, and each specimen shall be

within the limits prescribed in **Table 3**, when determined in accordance with Test Methods **E112**.

9. Mechanical Property Requirements

9.1 Tensile Strength Requirement:

9.1.1 When specified in the contract or purchase order, the product shall conform to the tensile strength requirements in **Table 3**, when tested in accordance with Test Methods **E8/E8M**. Actual testing need not be performed unless specified at time of order placement.

9.1.2 Acceptance or rejection based upon mechanical properties shall depend only on tensile strength.

9.2 Rockwell Hardness Requirement:

9.2.1 When specified in the contract or purchase order, the product shall conform to the Rockwell Hardness requirement prescribed in **Table 3**, when tested in accordance with Test Methods **E18**.

10. Performance Requirements

10.1 Expansion Test:

10.1.1 When specified in the contract or purchase order, tube furnished in the soft-anneal (O60) shall withstand expansion in accordance with Test Method **B153** to the following extent:

Standard Size (Actual Outside Diameter) in. (mm)	Expansion of Outside Diameter %	Tube Outside Diameter, in.	Diameter of Drilled Holes, in.	Drill No.
0.625 (15.9) and under	40	3/8 to 3/4, incl	0.025	72
Over 0.625 (15.9)	30	Over 3/4 to 1, incl	0.031	68
		Over 1 to 1 1/2, incl	0.036	64

10.1.2 The expanded tube shall show no cracking or rupture visible to the unaided eye.

10.2 Flattening Test:

10.2.1 When specified in the contract or purchase order, the flattening test in accordance with Test Method **B968/B968M** shall be performed.

10.2.1.1 During inspection, the flattened areas of the test specimen shall be free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable.

10.3 Microscopical Examination for Susceptibility to Hydrogen Embrittlement:

10.3.1 Tubes furnished in all coppers shall be capable of passing the embrittlement test specified in Procedure B of Test Methods **B577**. In case of a dispute, Procedure C of Test Methods **B577** shall be used as the referee method.

11. Nondestructive Testing

11.1 Each tube up to and including 1.125 in. (28.6 mm) outside diameter shall be subjected to an eddy-current test.

Testing shall follow the procedures of Practice **E243**, except for the determination of “end effect.” Tubes shall be passed through an eddy-current test unit adjusted to provide information on the suitability of the tube for the intended application.

11.1.1 Either notch depth or drilled hole standards shall be used.

11.1.1.1 Notch depth standards, rounded to the nearest 0.001 in. (0.025 mm), shall be 22 % of the standard wall thickness. The notch depth tolerance shall be plus and minus 0.0005 in. (0.013 mm). Alternatively, at the option of the manufacturer, using speed-insensitive eddy-current units that are equipped so that a fraction of the maximum unbalance signal can be selected, the following percent maximum unbalance signals may be used:

Standard Size, in. (mm)	Unbalanced Signal Magnitude, max. %
Up to 0.500 (12.7) incl.	0.2
0.625 (15.9) to 1.125 (29) incl.	0.3

11.1.1.2 Drilled holes shall be drilled radially through the wall using a suitable drill jig that has a bushing to guide the drill, care being taken to avoid distortion of the tube while drilling. The diameter of the drilled hole shall be in accordance with the following Table and shall not vary by either more than +0.001 in. (+0.025 mm) or –0.000 in. (–0.000 mm) of the hole diameter specified.

Tube Outside Diameter, mm	Diameter of Drilled Holes, mm	Drill No.
9.0 to 19.0, incl	0.64	72
Over 19.0 to 25, incl	0.79	68
Over 25 to 29, incl	0.92	64

11.1.2 Tubes that do not actuate the signaling device of the eddy-current tester shall be considered in conformance with the requirements of this test. Tubes with discontinuities indicated by the testing unit may, at the option of the manufacturer, be re-examined or retested to determine whether the discontinuity is cause for rejection. Signals that are found to have been caused by minor mechanical damage shall not be cause for rejection of the tubes, provided the tube dimensions are still within the specified limits and the tube is suitable for its intended application.

12. Dimensions, Mass, and Permissible Variations

12.1 For the purpose of determining conformance with the dimensional requirements prescribed in this specification, any

TABLE 3 Mechanical Property Requirements

Temper Designation		Tensile Strength		Average Grain Size, mm	Rockwell Hardness ^A	
Standard	Former	ksi, ^B min.	MPa min.		Scale	Hardness Value
O60	Soft anneal	30	(205)	0.035 min.	F	50 max
H58	Drawn general purpose	36	(250)	...	30T	30 min

^A Rockwell Hardness tests shall be made on the inside surface of the tube.

^B ksi = 1000 psi.