



Designation: B 306 – 99

## Standard Specification for Copper Drainage Tube (DWV)<sup>1</sup>

This standard is issued under the fixed designation B 306; 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 approval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

### 1. Scope \*

1.1 This specification establishes the requirements for seamless copper tube (DWV) produced from Copper UNS No. C12200 and intended for sanitary drainage, waste, and vent piping.

NOTE 1—Fittings used for soldered or brazed connections in drainage, waste, or vent systems are described in ASME Standards B16.23 and B16.29 and CSA Standard B158.1.

NOTE 2—The assembly of copper drainage, waste, and vent systems by soldering is described in Practice B 828.

NOTE 3—Solders for joining copper drainage, waste, or vent systems are described in Specification B 32. The requirement for acceptable fluxes for these systems are described in Specification B 813.

1.2 Values stated in inch-pound units are the standard. SI values given in parentheses are for information only.

1.3 The following hazard statement pertains only to the test method described in Section 16.2.3 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 and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- B 32 Specification for Solder Metal<sup>2</sup>
- B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast<sup>3</sup>
- B 813 Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube<sup>3</sup>
- B 828 Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings<sup>3</sup>
- E 8 Test Methods for Tension Testing of Metallic Materials<sup>4</sup>
- E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials<sup>4</sup>

- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications<sup>5</sup>
- E 53 Methods for Chemical Analysis of Copper<sup>6</sup>
- E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods)<sup>6</sup>
- E 243 Practice for Electromagnetic (Eddy-Current) Examination of Seamless Copper and Copper-Alloy Tubes<sup>7</sup>
- E 255 Practice for Sampling Copper and Copper Alloys for Determination of Chemical Composition<sup>6</sup>
- E 527 Practice for Numbering Metals and Alloys (UNS)<sup>8</sup>
- 2.2 ASME Standards:<sup>9</sup>
  - B16.23 Cast Copper Alloy Solder Joint Drainage Fittings—DWV
  - B16.29 Wrought Copper and Copper Alloy Solder Joint Drainage Fittings—DWV
- 2.3 CSA Standards:<sup>10</sup>
  - B158.1 Cast Brass Solder Joints Drainage, Waste, and Vent Fittings

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *tube, DWV, n*—seamless copper tube intended for sanitary drainage, waste, and vent piping and other nonpressure applications and conforming to the particular dimensions for tube commonly known as copper drainage tube.

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *capable of*—the test need not be performed by the producer of the material. However, should subsequent testing by the purchaser establish that the material does not meet these requirements, the material shall be subject to rejection.

### 4. Ordering Information

4.1 Include this information for contracts or purchase orders for products furnished to this specification.

4.1.1 ASTM designation and year of issue (for example, B 306 – 99),

4.1.2 Dimensions (Section 11 and Table 1),

<sup>1</sup> 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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<sup>2</sup> Annual Book of ASTM Standards, Vol 02.04.

<sup>3</sup> Annual Book of ASTM Standards, Vol 02.01.

<sup>4</sup> Annual Book of ASTM Standards, Vol 03.01.

<sup>5</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>6</sup> Annual Book of ASTM Standards, Vol 03.05.

<sup>7</sup> Annual Book of ASTM Standards, Vol 03.03.

<sup>8</sup> Annual Book of ASTM Standards, Vol 01.01.

<sup>9</sup> Available from ASME, 345 E. 47th St., New York, NY 10017.

<sup>10</sup> Available from CSA, 178 Rexdale Rd., Rexdale, ON, Canada M9W 1R3.

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

**TABLE 1 Standard Dimensions, Weights, and Tolerances for Diameter and Wall Thickness**

NOTE 1—All tolerances in this table are plus and minus except where otherwise noted.

Nominal or Standard Drainage Tube Size, in.	Outside Diameter, in. (mm)	Tolerance in Average Outside Diameter, <sup>A</sup> in. (mm)	Wall Thickness, in. (mm)		Theoretical Weight, lb/ft (kg/m)
			Actual	Tolerance	
1¼	1.375 (34.9)	0.0015 (0.038)	0.040 (1.02)	0.003 (0.076)	0.650 (0.967)
1½	1.625 (41.3)	0.002 (0.051)	0.042 (1.07)	0.003 (0.076)	0.809 (1.20)
2	2.125 (54.0)	0.002 (0.051)	0.042 (1.07)	0.004 (0.10)	1.07 (1.59)
3	3.125 (79.4)	0.002 (0.051)	0.045 (1.14)	0.004 (0.10)	1.69 (2.51)
4	4.125 (105)	0.002 (0.051)	0.058 (1.47)	0.007 (0.18)	2.87 (4.27)
5	5.125 (130)	0.002 (0.051)	0.072 (1.83)	0.008 (0.20)	4.43 (6.59)
6	6.125 (156)	0.002 (0.051)	0.083 (2.11)	0.008 (0.20)	6.10 (9.08)
8	8.125 (206)	+0.002 (0.051) -0.004 (0.10)	0.109 (2.77)	0.011 (0.28)	10.6 (15.8)

<sup>A</sup> The average outside diameter is the average, at any one cross section, of the maximum and minimum measured diameters (usually at or very close to 90° to each other).

- 4.1.3 Total length, each size, and
- 4.1.4 When product is purchased for agencies of the U.S. Government.
- 4.2 The following options are available and shall be specified in the contract or purchase order when required:
  - 4.2.1 Electromagnetic (eddy-current) test (Section 9.2),
  - 4.2.2 Pneumatic test (Section 9.3),
  - 4.2.3 Certification (Section 20),
  - 4.2.4 Test report (Section 21).

**5. Material and Manufacture**

- 5.1 *Materials:*
  - 5.1.1 The material of manufacture shall be billets, bars, or tube of the Copper UNS<sup>11</sup> No. C12200 and shall be of such soundness as to be suitable for processing into the tubular products described.
- 5.2 *Manufacture:*
  - 5.2.1 The tube shall be manufactured by such hot- or cold-working processes as to produce a homogeneous uniform wrought structure in the finished product. The tube shall be cold drawn to the finished size and wall thickness.

NOTE 4—Tubes are normally joined with soldered fittings.

**6. Chemical Composition**

6.1 The material shall conform to the following requirements for UNS No. C12200:

Copper; incl silver, %	99.9
Phosphorous, %	0.015–0.040

6.1.1 These 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 Tube shall be furnished in the H58 temper as defined in Practice B 601.

**8. Mechanical Property Requirements**

8.1 *Tensile Strength:*

8.1.1 The tubes shall have a minimum tensile strength of 40 ksi (275 MPa) when tested in accordance with Test Methods E 8.

8.2 *Rockwell Hardness:*

8.2.1 The Rockwell hardness test, Test Methods E 18, is a quick and convenient method of checking for general conformity to the tensile strength requirement. For general information and assistance in testing, the approximate minimum hardness value is 30 as measured on the 30-T scale.

**9. Nondestructive Testing**

- 9.1 The tubes furnished shall be capable of conforming with the test requirements of any one of the following tests.
  - 9.2 *Electromagnetic (Eddy-Current) Test:*
    - 9.2.1 Each tube up to and including 3⅛-in. (79.4-mm) outside diameter shall be subjected to examination and the testing shall follow the procedures of Practice E 243.
      - 9.2.1.1 Tubes that do not actuate the signaling device, after it has been adjusted to detect discontinuities that would be unacceptable for this application, shall have met requirements of this test.
      - 9.2.2 This test is not required unless specified in the contract or purchase order.
    - 9.3 *Pneumatic Test:*
      - 9.3.1 Each tube shall withstand a minimum internal air pressure of 60 psi (400 kPa) for 5 s without leakage.
      - 9.3.2 This test is not required unless specified in the contract or purchase order.

**10. Purchases for U.S. Government Agencies**

10.1 When specified in the contract or purchase order, product purchased for agencies of the U.S. Government shall conform to the requirements stipulated in the Supplementary Requirements.

**11. Dimensions, Mass, and Permissible Variations**

11.1 *General*—For the purpose of determining conformance with the dimensional requirements given in this specification, any measured value outside the specified limiting values for any dimension is subject to rejection at the option of the purchaser.

11.2 *Weights*—Theoretical weights for the nominal or standard dimensions given in Table 1 are for information only.

<sup>11</sup> Refer to Practice E 527 for explanation of Unified Numbering System (UNS).

Actual weights will vary in accordance with the dimensional tolerances given in the table.

11.3 *Wall Thickness and Diameter Tolerances*—Wall thickness and diameter tolerances shall be in accordance with Table 1.

11.4 *Roundness Tolerance*—The difference between the major and minor outside diameters as determined at any one cross section of the tube shall not exceed 1½ %, expressed to the nearest 0.001 in. (0.025 mm), of the outside diameter of the tube.

11.5 *Lengths and Tolerances:*

11.5.1 *Standard Length and Tolerances*—The standard length of the material shall be 20 ft (6.10 m). The length tolerance shall be plus 1 in. (25 mm), minus 0 in.

11.5.2 Tubes supplied in other than standard lengths and tolerances shall be in accordance with requirements established by agreement between the manufacturer or supplier and the purchaser.

11.6 *Squareness of Cut*—The departure from squareness of the end of any tube shall not exceed 0.016 in./in. (0.016 mm/mm) of diameter.

## 12. Workmanship, Finish, and Appearance

12.1 The product shall be free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable.

## 13. Sampling

13.1 Lot size, portion size, and selection of sample pieces shall be as follows:

13.1.1 *Lot Size*—An inspection lot shall be 10 000 lbs (5000 kg) or fraction thereof.

13.1.2 *Portion Size*—The number of pieces selected to be representative of the lot shall be as indicated in the following schedule:

Number of Pieces in Lot	Number of Pieces to be Selected
1 to 50	1
51 to 200	2
201 to 400	3

13.2 *Chemical Composition:*

13.2.1 The sample shall be taken in approximately equal weight from each portion piece selected in 13.1.2 and in accordance with Practice E 255. The minimum weight of the composite shall be 150 g.

13.2.2 Instead of sampling in accordance with Practice E 255, the manufacturer shall have the option of sampling at the time castings are poured or from the semifinished product.

13.2.3 The number of samples taken during the course of manufacture shall be as follows:

13.2.3.1 When samples are taken at the time the castings are poured, at least one sample shall be taken for each group of castings poured simultaneously from the same source of molten metal.

13.2.3.2 When samples are taken from the semifinished product, a sample shall be taken to represent each 10 000 lbs (5000 kg) or fraction thereof, except that not more than one sample per piece shall be required.

13.2.4 When the material composition has been determined during the course of manufacture, sampling of the finished product by the manufacturer is not required.

13.3 *Other Tests:*

13.3.1 Specimens for all other tests shall be taken from two of the sample pieces taken in 13.1.2. In the event only one sample piece is required, all specimens shall be taken from the piece selected.

## 14. Number of Tests and Retests

14.1 *Tests:*

14.1.1 *Chemical Analysis*—Composition shall be determined as the average of results from at least two replicate determinations for each specified element with a limiting value.

14.1.2 *Tensile Strength*—The test results shall be reported as the average of results obtained from two test specimens taken from each of the samples pieces selected in 13.1.2 and each test specimen must conform to specification requirements.

14.1.2.1 In the event only one piece was selected for test, both test specimens shall be taken from the piece selected.

14.2 *Retests:*

14.2.1 When requested by the manufacturer or supplier, he shall have the option to perform a retest when the test results obtained by the purchaser fail to conform with the product specification requirement(s).

14.2.2 Retesting shall be as directed in this specification for the initial test except for the number of test specimens which shall be twice that normally required for the test. Test results for all specimens shall conform to the specification requirement(s) in retest and failure to comply shall be cause for lot rejection.

## 15. Specimen Preparation

15.1 *Chemical Analysis:*

15.1.1 Preparation of the analytical specimens shall be the responsibility of the reporting laboratory.

15.2 *Tensile Test:*

15.2.1 The test specimen shall be of the full section of the tube and shall conform to the requirements specified in the section Specimens for Pipe and Tube in Test Methods E 8, unless the limitations of the testing machine precludes the use of such specimens.

15.2.2 Test specimens conforming to Specimen No. 1 in Fig. 13, Tension Test Specimens for Large-Diameter Tubular Products, of Test Methods E 8 are permitted to be used when a full-section specimen cannot be used.

## 16. Test Methods

16.1 *Chemical Composition:*

16.1.1 In case of dispute, chemical composition shall be determined as follows:

Element	Method
Copper	E 53
Phosphorus	E 62