



## 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 reapproval. 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<sup>a</sup>

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 Classification 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 Results to Determine Conformance with Specifications<sup>5</sup>

E 53 Test Methods for Determination of Copper Content of Copper by Gravimetry<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) Testing 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>8</sup>

E 527 Practice for Numbering Metals and Alloys<sup>9</sup>

2.2 ASME Standards:<sup>10</sup>

B16.23 Cast Copper Alloy Solder Joint Drainage Fittings—DWV

B16.29 Wrought Copper and Copper Alloy Solder Drainage Fittings—DWV

2.3 CSA Standards:<sup>11</sup>

B158.1 Cast Brass Solder Joints Drainage, Waste, and 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 non-pressure applications and conforming to the particular dimensions and conforming to the particular dimensions of 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, if subsequent testing by the purchaser establishes that the material does not meet the 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.

<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 03.06.

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

<sup>8</sup> Annual Book of ASTM Standards, Vol 03.05.

<sup>9</sup> Annual Book of ASTM Standards, Vol 01.01.

<sup>10</sup> Available from American Society of Mechanical Engineers (ASME) International Headquarters, Three Park Ave., New York, NY 10016-5900.

<sup>11</sup> Available from CSA, 178 Rexdale Rd., Rexdale, ON, Canada M5

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

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

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

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	
1/4	1.375 (34.9)	0.0015 (0.038)	0.040 (1.02)	0.003 (0.076)	0.650 (0.967)
1/2	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)	2.67 (4.27)
5	5.125 (130)	0.002 (0.051)	0.072 (1.83)	0.008 (0.20)	4.43 (6.58)
6	6.125 (156)	0.002 (0.051)	0.083 (2.11)	0.008 (0.20)	6.10 (8.98)
8	8.125 (206)	+0.002 (0.051) -0.004 (0.10)	0.102 (2.77)	0.011 (0.28)	10.8 (15.8)

<sup>A</sup>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).

- 1. ASTM designation and year of issue (for example, B 306-99),
  - 2. Dimensions (Section 11 and Table 1),
  - 3. Total length, each size, and
  - 4. When product is purchased for agencies of the U.S. Government.
- The following options are available and shall be specified in the contract or purchase order when required:
- 1. Electromagnetic (eddy-current) test (Section 9.2),
  - 2. Pneumatic test (Section 9.3),
  - 3. Certification (Section 20),
  - 4. Test report (Section 21).

**Material and Manufacture**

**Materials:**  
1.1 The material of manufacture shall be billets, bars, or pipe of the Copper UNS<sup>12</sup> No. C12200 and shall be of such thickness as to be suitable for processing into the tubular products described.

**Manufacture:**  
2.1 The tube shall be manufactured by such hot- or cold-working processes as to produce a homogeneous uniform wall structure in the finished product. The tube shall be drawn to the finished size and wall thickness.

2.4—Tubes are normally joined with soldered fittings.

**Chemical Composition**

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

Copper, incl. silver, %	99.9
Phosphorus, %	0.015-0.040

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

**Temper**  
1.1 Tube shall be furnished in the H58 temper as defined in Specification B 601.

<sup>12</sup>Refer to Practice E 527 for explanation of Unified Numbering System (UNS).

**8. Mechanical Property Requirements 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 3/4-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. 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 casting 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 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 separate determinations for each specified element with a limit value.

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

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

### 14.2 Retests:

14.2.1 When requested by the manufacturer or supplier 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 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 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 tube and shall conform to the requirements specified in 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, Fig. 13, Tension Test Specimens for Large-Diameter Pipe Products, of Test Methods E 8 shall be used when a full-section specimen cannot be tested.

## 16. Test Methods

### 16.1 Chemical Composition:

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

Element	Test Method
Copper	E 53
Phosphorus	E 53

16.2 Test method(s) used for the determination of electrical properties required by contractual or purchase order agreements shall be as agreed upon between the manufacturer or supplier and the purchaser.

16.2 The finished product shall conform with the mechanical properties and other requirements of this specification when tested or examined in accordance with the following appropriate test method or practice:

Test	Test Method
Tensile	E 8
Pneumatic	Section 16.2.3
Electromagnetic examination (eddy current)	Practice E 243

16.2.1 Tensile strength shall be determined in accordance with Test Methods E 8.

16.2.1.1 Whenever test results are obtained from both full-size and machined specimens and they differ, the test results on the full-size specimens shall be used.

16.2.1.2 Test results are not seriously affected by variations in speed of testing. A considerable range of testing speed is permissible; however, the rate of stressing to the yield strength shall not exceed 100 ksi (690 MPa)/min. Above the yield strength, the movement per minute of the testing machine head under load shall not exceed 0.5 in./in. (12.7 mm/mm) of gage length (or distance between grips for full-section specimens).

16.2.2 Electromagnetic (Eddy-Current) Test—Each tube up to and including 3 1/8-in. (79.4-mm) outside diameter, shall be subjected to an eddy-current test. Testing shall follow the procedures in Practice E 243. Tubes shall be passed through an eddy-current test unit adjusted to provide information on the detectability of the tube for the intended application.

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

(a) Notch depth standards, rounded to the nearest 0.001 in., shall be 22 % of the wall thickness. The notch depth tolerance shall be ±0.0005 in.

(b) 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 and shall not vary by more than +0.001, -0.000 in. from the hole diameter specified.

Tube Outside Diameter, in.	Diameter of Drilled Holes, in.	Drill Number
1/4 to 3/4, incl	0.025	72
Over 3/4 to 1, incl	0.031	68
Over 1 to 1 1/4, incl	0.038	64
Over 1 1/4 to 1 1/2, incl	0.042	58
Over 1 1/2 to 1 3/4, incl	0.046	56
Over 1 3/4 to 2, incl	0.052	55

  

Tube Outside Diameter, mm	Diameter of Drilled Holes, mm	Drill Number
6.0 to 19.0, incl	0.635	72
Over 19.0 to 25, incl	0.788	68
Over 25 to 32, incl	0.915	64
Over 32 to 38, incl	1.07	58
Over 38 to 46, incl	1.17	56
Over 46 to 50, incl	1.322	55

16.2.2.2 Alternatively, at the option of the manufacturer, using speed insensitive eddy-current units that are equipped to select a fraction of the maximum imbalance signal, the following percent maximum imbalance signals shall be used:

Standard Tube Size, in.	Maximum Percent Imbalance Signal Magnitude
Up to 1/2, incl	0.2
1/2 to 2, incl	0.3
Over 2 to 3, incl	0.4

  

Standard Tube Size, mm	Maximum Percent Imbalance Signal Magnitude
Up to 9, incl	0.2
13 to 50, incl	0.3
Over 50 to 76, incl	0.4

16.2.2.3 Tubes that do not activate the signalling device of the eddy-current tester shall be considered as conforming to the requirements of this test. At the option of the manufacturer, tubes with discontinuities indicated by the testing unit are not prohibited from being reexamined or retested to determine whether the discontinuities are cause for rejection. Signals that are found to have been caused by minor mechanical damage, soil, or moisture shall not be cause for rejection of the tubes provided the tube dimensions are still within prescribed limits and the tube is suitable for its intended application.

16.2.3 Pneumatic Test:  
16.2.3.1 The test method shall permit easy visual detection of leakage, such as having the tube under water or by the pressure differential method.

17. Significance of Numerical Limits

17.1 For the purpose of determining compliance with the specified limits for requirements of the properties listed in the following table, an observed value or a calculated value shall be rounded as indicated in accordance with the rounding method of Practice E 29:

Property	Rounded Unit for Observed or Calculated Value
Chemical composition	nearest unit in the last right-hand piece of figures of the specified limit
Hardness	nearest unit in the last right-hand piece of figures of the specified limit
Tensile strength	nearest ksi (5 MPa)

18. Inspection

18.1 The manufacturer, or supplier, shall inspect and make test necessary to verify the product furnished conforms to specification requirements.

18.2 Source inspection of the product by the purchaser shall be agreed upon between the manufacturer, or supplier, and the purchaser as part of the purchase order. In such case, the nature of the facilities needed to satisfy the inspector representing the purchaser that the product is being furnished in accordance with the specification shall be included in the agreement. All tests and the inspection shall be conducted so as not to interfere unnecessarily with the operations of the works.

18.3 By mutual agreement, the manufacturer, or supplier, has the option of conducting the final inspection simultaneously.

19. Rejection and Reheating

19.1 Rejection:

19.1.1 Product that fails to conform to the requirements of the product specification when inspected or tested by the purchaser, or purchaser's agent, is subject to rejection at the option of the purchaser.

19.1.2 Rejection shall be reported to the manufacturer or supplier promptly and in writing.

19.1.3 When requested by the manufacturer or supplier, a rehearing shall be granted.

19.2 Rehearing:

19.2.1 As a result of product rejection, the manufacturer or supplier has the option to make claim for retest to be conducted by the manufacturer or supplier and the purchaser. Samples of the rejected product shall be taken in accordance with the product specification and tested by both parties as directed in the product specification, or, alternatively, upon agreement by both parties, an independent laboratory shall be selected for the tests using the test methods prescribed in the product specification.

20. Certification

20.1 When specified in the contract or purchase order, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met.

21. Test Report (Mill)

21.1 When specified in the contract or purchase order, a report of the test results shall be furnished.

22. Product Marking

22.1 The name or trademark of the manufacturer and "DWV" shall be permanently incised on each length, at intervals not greater than 1 1/2 ft (0.457 m). DWV tube is further identified throughout its length by a continuous yellow color marking not less than 3/16 in. (4.76 mm) in height, including legend repeated at intervals not greater than 3 ft (0.914 m). The legend includes "DWV," the name or trademark or both, of the manufacturer, and the country of origin. The manufacturer has the option to include other information.

23. Packaging and Package Marking

23.1 Packaging—The material shall be separated by size, composition, and temper, and prepared for shipment in such manner as to ensure acceptance by common carrier for transportation and to afford protection from the normal hazards of transportation.

23.2 Package Marking—Each shipping unit shall be legibly marked with the purchase order number, metal or alloy designation, temper, size, total length or piece count or both, and name of supplier. The specification number shall be shown when specified.

24. Keywords

24.1 drainage tube; sanitary tube; seamless copper tube; vent tube; waste tube

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order, for agencies of the U.S. Government.

S1. Referenced Documents

S1.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

S1.1.1 Federal Standards:<sup>13</sup>

Fed. Std. No. 102 Preservation, Packaging and Packing Levels

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

Fed. Std. No. 185 Identification Marking of Copper and Copper-Base Alloy Mill Products

S1.1.2 Military Standard:<sup>13</sup>

MIL-STD-129 Marking for Shipment and Storage

S1.1.3 Military Specification:<sup>13</sup>

MIL-C-3993 Packaging of Copper and Copper-Base Alloy Mill Products

S2. Quality Assurance

S2.1 Responsibility for Inspection:

S2.1.1 Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection and test requirements specified. Except as otherwise specified in the contract or purchase order, the manufacturer has the option to use his own or any of suitable facilities for the performance of the inspection and requirements unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspections or tests set forth when such inspections and tests are deemed necessary to assure that the material conforms to prescribed requirements.

S3. Identification Marking

S3.1 All material shall be properly marked for identification in accordance with Fed. Std. No. 185 except that the alloy specification number and the alloy number shall be used.

S4. Preparation for Delivery

S4.1 Preservation, Packaging, Packing:

S4.1.1 Military Agencies—The material shall be separated by size, composition, grade, or class and shall be preserved and packaged, Level A or C, packed, Level A, B, or C as specified in the contract or purchase order, in accordance with requirements of MIL-C-3993.

<sup>13</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbin Ave., Philadelphia, PA 19111-5098, ATTN: NPODS.

1.2 *Civil Agencies*—The requirements of Fed. Std. No. 123 shall be referenced for definitions of the various levels of marking protection.

1.2 *Marking*:

1.2.1 *Military Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with MIL-STD-129.

1.2.2 *Civil Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with Fed. Std. No. 123.

## APPENDIX

(Nonmandatory Information)

### XI. METRIC EQUIVALENTS

XI.1 The SI unit for strength properties now shown is in accordance with the International System of Units (SI). The derived SI unit for force is the newton (N), which is defined as that force which when applied to a body having a mass of one kilogram gives it an acceleration of one metre per second squared ( $N = kg \cdot m/s^2$ ). The derived SI unit for pressure or

stress is the newton per square metre ( $N/m^2$ ), which has been named the pascal (Pa) by the General Conference on Weights and Measures. Since  $1 \text{ ksi} = 6\,894\,757 \text{ Pa}$ , the metric equivalents are expressed as megapascal (MPa), which is the same as  $Mn/m^2$  and  $N/mm^2$ .

### SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B 306 - 99) that may impact the use of this standard.

Sections 3.2.1, 13.2.2, 16.2.1.2, and 22.1 have been modified to replace nonmandatory language with mandatory language.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

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# Copper and Copper Alloy Tube, Pipe and Fittings

## COPPER and COPPER ALLOY TUBE and PIPE

### Seamless Copper Pipe:

Copper pipe is almost pure copper manufactured to the requirements of **ASTM B 42 - Standard Specification for Seamless Copper Pipe, Standard Sizes**. It may be manufactured from any of five (5) copper alloys (C10200, C10300, C10800, C12000, C12200) that all conform to the chemical composition requirements of alloys containing a minimum of 99.9% Copper (Cu) and a maximum of 0.04% Phosphorous (P). Available sizes are 1/8" to 12" diameters in regular wall thickness and 1/8" to 10" in extra strong wall thickness. The standard length for copper pipe is 12 feet.

Copper pipe is suitable for plumbing, boiler feed lines, refrigeration and for similar purposes.

Joints in seamless copper pipe can be threaded, flanged or brazed to fittings of the appropriate joint configuration.

### Seamless Red Brass Pipe:

(Red) Brass pipe is an alloy of copper manufactured to the requirements of **ASTM B 43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes**. It is manufactured from alloy C23000 which is comprised of approximately 85% Copper (Cu) with no greater than 0.05% Lead (Pb) and 0.05% Iron (Fe) and the remainder Zinc (Zn). Available sizes are 1/8" to 12" diameters in both regular and extra strong wall thickness. The standard length for red brass pipe is 12 feet.

Brass pipe is moderately resistant to many corrosive solutions and is often utilized for water supply and distribution.

Joints in red brass pipe can be threaded, flanged or brazed to fittings of the appropriate joint configuration. Fittings in the smaller sizes, normally those below 2" diameter are, screwed cast copper alloy or brazed cup cast copper alloy. Fittings above 2" diameter are normally threaded, flanged, brazed or in some cases grooved mechanical joint fittings are employed.

### Seamless Copper Tube, Bright Annealed:

Bright annealed copper tube is an almost pure copper tube manufactured to the requirements of **ASTM B 68 - Standard Specification for Seamless Copper Tube, Bright Annealed**. It may be manufactured from any one of the following alloys: C10200, C10300, C10800, C12000, or C12200 unless specified otherwise on the original contract or purchase order.

ASTM B68 tube is suitable for use in refrigeration, fuel oil, gasoline, or oil lines where the interior surface of the tube is essentially free of any scale or dirt and is specifically specified as ASTM B68.

This tube is provided in annealed tempers meeting O50 – Light annealed or O60 – Soft annealed in either straight lengths or coils.

It is the responsibility of the purchaser, when ordering to provide the requirements for alloy (UNS#), temper, dimensions (diameter and wall thickness), form (straight lengths or coils), and total length or number of pieces of any particular size. It is this requirement that forces this tube to be a special order tube and not a standard stocked material.

There is no specific requirements for identification of B68 tube and thus is not specifically designated as a tube permitted for use in most plumbing or mechanical codes. It is usually limited to use in specific manufacturing processes or production line type applications.

### Seamless Copper Tube:

Seamless copper tube manufactured to the **ASTM B 75 - Standard Specification for Seamless Copper Tube** may be either round, square, or rectangular and is suitable for general engineering applications. It may be manufactured from any one of the following alloys: C10100, C10200, C10300, C10800, C12000, or C12200 unless specified otherwise on the original contract or purchase order.

Tubes meeting this standard may be furnished in any of several tempers (H55, H58, H80, O60, or O50) ranging from light drawn (usually limited to round tubes) to light annealed.

It is the responsibility of the purchaser, when ordering, to provide the requirements for alloy (UNS#), temper, dimensions (diameter, wall thickness, or distance between parallel surfaces), form (straight lengths or coils), and total length or number of pieces of any particular size. It is this requirement that forces this tube to be a special order tube and not a standard stocked material.

It is usually limited to use in specific manufacturing processes or production line type applications.

### Seamless Copper Water Tube:

Copper water tube is a seamless, almost pure copper material manufactured to the requirements of **ASTM B 88 - Standard Specification for Seamless Copper Water Tube**, of three basic wall thickness dimensions designated as types K, L, and M. Type K is the thickest and type M is the thinnest with type L being of intermediate thickness. All three types of tube are manufactured from copper alloy C12200 having a chemical composition of a minimum of 99.9% Copper (Cu) and Silver (Ag) combined and a maximum allowable range of Phosphorous (P) of 0.015 % - 0.040 %.

Seamless copper water tube is manufactured in sizes 1/4" through 12" nominal. Types K and L are manufactured in drawn temper (hard) 1/4" through 12" and annealed temper (soft) coils 1/4" through 2" while type M is only manufactured in drawn (hard) temper 1/4" through 12".

Seamless copper water tube of drawn temper is required to be identified with a color stripe that contains the manufacturer's name or trademark, type of tube and nation of origin. This color

stripe is green for type K, blue for type L and red for type M. In addition to the color stripe the tube is incised with the type of tube and the manufacturer's name or trademark at intervals not in excess of 1½ ft. Annealed (soft) coils or annealed straight lengths are not required to be identified with a color stripe.

### Seamless Brass Tube:

Seamless brass tube is manufactured to the requirements of **ASTM B 135 – Standard Specification for Seamless Brass Tube** and may be either round, square, or rectangular and is suitable for general engineering applications. It may be manufactured from any one of the following alloys: C22000, C23000, C26000, C27000, C27200, C27400, C28000, C33000, C33200, C37000, or C44300 and these alloys contain Copper (Cu) concentrations of between 60% and 90% with various percentages of Zinc (Zn), Lead (Pb), and Tin (Sn) permitted, depending on the alloy.

Tubes meeting this standard may be furnished in any of several tempers ranging from light drawn to light annealed.

It is the responsibility of the purchaser, when ordering to provide the requirements for alloy (UNS#), temper, dimensions (diameter and wall thickness, or distance between parallel surfaces), form (straight lengths or coils), and total length or number of pieces of any particular size.

### Wrought Seamless Copper and Copper Alloy Tube:

**ASTM B 251 – Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube** covers a number of general requirements common to many wrought copper products. A few of these specifications are B 68, B75, B135, B466 and B743.

Products manufactured under the requirements of ASTM B251 may be of alloys of copper, brass or copper-nickel and may be produced in any number of tempers or shapes as specified by the purchaser.

### Air Conditioning & Refrigeration Tube:

Copper tube used for air conditioning and refrigeration applications in the field (sometimes called "refer" or "ACR" tube) is an almost pure copper material meeting the requirements of **ASTM B 280 – Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service**. It is manufactured from copper alloy C12200 having a chemical composition of a minimum of 99.9% Copper (Cu) and Silver (Ag) combined and a maximum allowable range of Phosphorous (P) of 0.015 % - 0.040 %.

B 280 tube is produced in straight lengths or coils in tempers H58 or O60 respectively, although annealed straight lengths may be special ordered. Straight lengths are provided in sizes from 3/8" O.D. through 4 1/8" O.D. while annealed coils are supplied in sizes ranging from 1/8" O.D. through 1 5/8" O.D.

ACR tube is required to be identified in the following fashion:

**Coils:** The name or trademark of the manufacturer and ACR shall be permanently incised on each tube ¼" or larger at intervals not greater than 1½ ft.

**Hard Straight Lengths:** The name or trademark of the manufacturer and a mark indicating either L or ACR shall be incised at intervals not greater than 1½ ft. along the length of the tube. Hard straight lengths shall further be marked with a blue stripe containing

the manufacturer's name or trademark, the nation of origin, outside diameter and ACR repeating at intervals not greater than 3 ft.

Air conditioning and refrigeration tube (ASTM B 280) either coiled or straight length is further required to be cleaned and capped prior to shipping.

The maximum particulate residue limit for coils or straight lengths is 0.0035 g/ft<sup>2</sup> or as listed in Table 2 and Table 3 of the standard.

### Threadless Copper Pipe (TP):

Threadless copper pipe, often referred to as TP pipe, is a seamless copper pipe material manufactured to the requirements of **ASTM B 302 – Standard Specification for Threadless Copper Pipe, Standard Sizes**. This pipe may be manufactured from either of two alloys, C10300 or C12200 with C12200 being the most popular. Both of these alloys are composed of copper (Cu) concentrations in excess of 99.9% thereby making this material an almost pure copper product.

Threadless copper pipe (TP) is manufactured in drawn temper (hard) only and is furnished in H58 temper in nominal or standard sizes ¼" through 12". The outside diameter of threadless copper pipe (TP) is essentially the same as schedule 40 pipe, although the wall thickness is much less than that for the same size pipe. The available lengths for threadless copper pipe is 20 foot for sizes ¼" to 10" with 12" being furnished in 15 foot lengths.

Threadless copper pipe (TP) is required, by the standard, to be identified by a gray colored stripe throughout its length that contains the manufacturers name or trademark, the nation of origin and "TP". It is further required to be incised at intervals not less than 1½ feet with the manufacturers name or trademark and "TP" throughout its entire length.

Threadless copper pipe (TP) is usually joined by brazed socket-cup type fittings or socket-cup type flanges. *It should be noted that standard copper pressure fittings of the B16.22 or B16.18 type are not compatible for use with TP pipe.*

### Copper Drainage Tube:

Seamless copper tube used for sanitary drainage, waste and vent systems in plumbing applications is often referred to as "DWV" tube and is manufactured to the requirements of **ASTM B 306 – Standard Specification for Copper Drainage Tube (DWV)**. DWV tube is manufactured from alloy C12200 that is 99.9% copper (Cu) and has a phosphorous (P) content of between 0.015% to 0.040%.

DWV copper tube is furnished in H58 drawn (hard) temper only, in sizes 1¼" through 8". The standard length for DWV tube is 20 foot, however other lengths may be provided through prior agreement between the purchaser and the manufacturer.

DWV copper tube shall be identified in two manners. The first is by an incised mark, at intervals not greater than 1½ feet, containing the manufacturers name or trademark and "DWV". The second is by a continuous yellow stripe containing the manufacturer's name or trademark, the nation of origin and "DWV" to be repeated at intervals not greater than 3 feet.

Soldering of drainage pattern fittings meeting the ASME/ANSI B16.23 or B16.29 standards is the usual manner for joining DWV tube.



## Welded Copper Tube:

This is a copper tube that is manufactured from either sheet or strip and has a longitudinal seam that is free of any type of filler metal and is usually manufactured to the requirements of **ASTM B 447 – Standard Specification for Welded Copper Tube**.

Welded copper tube may be manufactured from any of the following alloys of copper: C10100, C10200, C10300, C10800, C11000, C12000, C12200, or C14200. Unless it is specifically specified in the contract for manufacturer any of the listed alloys shall be considered acceptable; however welded copper tube manufactured from alloy C11000 may not be used in applications where hydrogen embrittlement may occur.

Welded copper tube may be furnished in the annealed (soft), O60, O50 or drawn (hard) temper in sizes and lengths specified by the purchaser.

Essentially this tube is an engineered type tube where the purchaser must specify the type of copper alloy, the form of the tube (straight length or coil), temper, internal flash treatment, and dimensions (diameter, wall thickness, length).

## Welded Brass Tube:

Welded brass tube may be provided in either round, rectangular or square form and is manufactured to the requirements of **ASTM B 587 – Standard specification for Welded Brass Tube** for engineered applications.

Welded brass tube may be manufactured from any one of the following copper alloys: C21000, C22000, C23000, C26000, C26800, C27000, or C27200. the copper(Cu) content of these alloys ranges from 62.0% to 96.0% depending on the alloy chosen.

Essentially this tube is an engineered type tube where the purchaser must specify the type of copper alloy, the form of the tube (straight length or coil), dimensions, (distances between parallel surfaces if square or rectangular, inside and outside diameter if round), wall thickness, overall length, and temper.

## Medical Gas Tube:

Seamless copper tube used for the installation of non-flammable medical gases (and in some cases high-purity applications) where the gases being delivered are not considered flammable is manufactured to the requirements of **ASTM B819 – Standard Specification for Seamless Copper Tube for Medical Gas Systems**.

Medical gas tube may be provided in one of two types, type K or type L, in drawn (hard) H58 temper only. (Both of these types are defined and described in ASTM B88.) Alloy C12200 is the only alloy permitted for use for medical gas tube and is a minimum 99.9% pure copper (Cu) and silver (Ag) combined with no greater than 0.040% phosphorous (P).

Medical gas tube is required to be cleaned, by the manufacturer, so that the maximum interior surface residue does not exceed 0.0035 g/ft<sup>2</sup> of interior surface. Cleaning techniques may be found in CGA G4.1 although the manufacturer is not limited to those procedures or practices.

Medical gas tube is required, by the ASTM B 819 standard, to be identified with a continuous stripe of either green for type K or blue for type L containing the type of tube, the manufacturers name or trademark, the nation of origin at intervals not to exceed 3 feet. It is further required to be incised

with the type of tube, the manufacturers name or trademark at intervals not to exceed 1½ foot. Acceptable additional required markings in the color appropriate for type K (green) or type L (blue) shall be “OXY”, “MED”, “OXY/MED”, “OXY/ACR”, “ACR/MED”

## Fuel Gas Tube:

Seamless copper tube for fuel gas installations of natural gas or liquefied petroleum (LP) can, in some jurisdictions, use tube manufactured to the requirements of **ASTM B 837 – Standard specification for Seamless copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems**. This tube is manufactured from alloy C12200 that is 99.9% copper (Cu) and silver (Ag) combined and has a phosphorous (P) content of between 0.015% to 0.040% making it an almost pure copper material.

*(It should be noted that ASTM B837 copper tube is not permitted for use by NFPA 54 – National Fuel Gas Code as an acceptable copper tube material for fuel gas applications and adherence to applicable model, local, state and federal codes should be referred to prior to its use.)*

This tube is furnished in annealed (soft) (O60) temper in sizes 3/8” O.D. through 7/8” O.D. and in drawn (hard) (H58) temper in sizes 3/8” O.D. through 1 1/8” O.D.. Coils may be provided in 60 or 100 foot lengths while straight lengths may be provided in 12 or 20 foot lengths. Longer lengths may be provided upon prior agreement between the manufacturer or supplier and the purchaser.

This tube is required to be permanently marked (incised) with the mark “Type GAS” and the name or trademark of the manufacturer at intervals not to exceed 18 inches. Additionally, drawn (hard) temper straight lengths of tube shall be identified by a yellow colored stripe containing the type of tube, name or trademark of the manufacturer or both, and the country of origin.

## **COPPER and COPPER ALLOY FITTINGS**

### **Cast Bronze Threaded Fittings: Classes 125 and 250**

Cast bronze threaded fittings in class 125 and class 250 shall be manufactured to the requirements of **ANSI/ASME B16.15 – Cast Bronze Threaded Fittings**.

These fittings shall be produced to meet the general requirements of ASTM B 62, Alloy C83600 or the chemical and tensile requirements of ASTM B 584, alloys C83800 or C84400. Other alloys permitted for use to manufacture fittings from bar stock in smaller sizes for wrought plugs, caps, couplings and bushings shall meet the requirements of Alloy C36000 (Free Cutting Brass Rod, Bar and Shapes) or C32000 or C31400 (Leaded Brass)

Essentially, the elemental make-up of these cast brass fittings is approximately but not exactly equal to 85% Copper (Cu), 5% Tin (Sn), 5% Lead (Pb) and 5% Zinc (Zn). *(Although other elements may be part of the Alloy structure more detailed analysis of the Alloys can be obtained from Copper Development Association Inc from their website at <http://piping.copper.org>)*

These fittings shall be threaded in accordance with the requirements of ANSI/ASME B1.20.1 general-purpose pipe threads and the threads shall be tapered. Wrought couplings, caps, and bushings in nominal pipe sizes of  $\frac{1}{8}$ ",  $\frac{1}{4}$ ",  $\frac{3}{8}$ ", and  $\frac{1}{2}$ " may have straight internal threads.

Class 125 fittings shall be identified with the manufacturer's name or trademark and Class 250 fittings shall be marked with the manufacturer's name or trademark and the numbers "250". The requirement for marking may be omitted from fittings that are deemed too small to provide adequate surface area for marking.

### **Cast Copper Solder Joint Fittings: Pressure Applications**

Cast copper alloy fittings used in solder joint applications are to be manufactured to meet the requirements of **ANSI/ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings**.

These fittings shall be produced to meet the general requirements of ASTM B 62, Alloy C83600 or the chemical and tensile requirements of ASTM B 584, alloys C83800 or C84400.

Essentially, the elemental make-up of these cast brass fittings is approximately but not exactly equal to 85% Copper (Cu), 5% Tin (Sn), 5% Lead (Pb) and 5% Zinc (Zn). *(Although other elements may be part of the Alloy structure more detailed analysis of the Alloys can be obtained from Copper Development Association Inc from their website at <http://piping.copper.org>)*

These fittings (socket end diameter) are sized in accordance with the requirements of the ASTM B88 – Seamless Copper Water Tube (1/4" – 12" nominal diameters), while the sizes of any threaded connections (female or male) correspond to nominal pipe sizing.

Marking of these fittings shall be in accordance with MSS SP-25. They shall bear a permanent mark indicative of the manufacturer's name or trademark; although fittings in sizes less than  $\frac{1}{2}$ " may have this requirement omitted.

The actual burst strength of the fitting shall not be less than the burst strength, as computed, for type L seamless copper water tube of annealed temper.

### **Wrought Copper Solder Joint Fittings: Pressure Applications**

Wrought (Wrot) copper fittings used for pressure applications shall be manufactured to meet the requirements of **ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings**.

These fittings may be manufactured from any one of the following alloys: C10200, C12000, C12200, or C23000 or any copper alloy that contains at least 84% Copper (Cu) and a maximum of 16% Zinc (Zn). *(Although other elements may be part of the Alloy structure more detailed analysis of the Alloys can be obtained from Copper Development Association Inc from their website at <http://piping.copper.org>)*

These fittings (socket end diameter) are sized in accordance with the requirements of the ASTM B88 – Seamless Copper Water Tube (1/4" – 12" nominal diameters), while the sizes of any threaded connections (female or male) correspond to nominal pipe sizing and the requirements of ANSI/ASME B1.20.1.

These fittings shall have a burst pressure approximately equal to four (4) times the rated internal working pressure of type L seamless copper water tube in annealed temper.

Marking of these fittings shall be in accordance with MSS SP-25. They shall bear a permanent mark indicative of the manufacturer's name or trademark; however, marking may be omitted from any fitting if it could damage the soldering surfaces.

### **Cast Copper Solder Joint Drainage Fittings: Drain, Waste and Vent Applications**

Cast copper alloy fittings used for drainage, waste, and vent applications with solder joints are manufactured to the requirements of **ANSI/ASME B16.23 – Cast Copper Alloy Solder Joint Drainage Fittings – DWV**.

These fittings shall be produced to meet the general requirements of ASTM B 62, Alloy C83600 or the chemical and tensile requirements of ASTM B 584, alloys C83800 or C84400.

Essentially, the elemental make-up of these cast brass fittings is approximately but not exactly equal to 85% Copper (Cu), 5% Tin (Sn), 5% Lead (Pb) and 5% Zinc (Zn). *(Although other elements may be part of the Alloy structure more detailed analysis of the Alloys can be obtained from Copper Development Association Inc from their website at <http://piping.copper.org>)*

These fittings (socket end diameter) are sized in accordance with the requirements of the ASTM B306 – Copper Drainage Tube (1¼" – 8" nominal), while the size of any threaded connections (female or male) correspond to nominal pipe sizing (slip-joints are excepted).

Drainage fittings are required to be identified (marked) with a permanent mark containing the manufacturer's name or trademark and "DWV". Vent fittings shall be identified with the words "VENT ONLY" and have the manufacturer's name or trademark permanently marked in accordance with MSS SP-25.

All 90° fittings shall be pitched so that a slope of 0.25 in./ft. (2.1%) is developed in horizontal tube as referenced along a horizontal plane.

## **Cast Copper Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500**

Cast copper alloy flanges or flanged fittings shall be manufactured to the requirements of **ANSI/ASME B16.24 – Cast Copper Alloy Pipe Flanges, Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500**.

Cast copper alloy flanges may be manufactured from alloy C83600 a leaded red brass alloy, C922200 a leaded tin bronze alloy, or C95200 an aluminum bronze alloy. These alloys are about 85 – 86% copper (Cu) with other elements making the remainder. *(Although other elements may be part of the Alloy structure more detailed analysis of the Alloys can be obtained from Copper Development Association Inc from their website at <http://piping.copper.org>)*

Flanges and flanged fittings shall be identified with the manufacturer's name or trademark along with the ASTM specification number, the rating class for which the flange was designed (ie. 150, 300, etc.), and "B16" to indicate the flange conforms to the requirements of this standard. The nominal size shall be included, although it may be omitted from reducing flanges and reducing flanged fittings.

Cast copper alloy flanged fittings may be manufactured from alloy C83600 a leaded red brass alloy or C922200 a leaded tin bronze alloy.

Flanges and flanged fittings furnished to this standard have the same flange diameters and drilling templates (bolt hole arrangement and size) as prescribed in ASME/ANSI B16.1, B16.5, and B16.42.

Gasketing and bolting materials for use with cast copper flanges and flanged fittings shall be as prescribed in the applicable ANSI or ASME standards.

## **Flared Copper Fittings: Cold Water Service**

Flared fittings for use with flared copper tube for cold water applications with a maximum water pressure of 175 psig are manufactured to the requirements of **ANSI/ASME B16.26 – Cast Copper Alloy Fittings for Flared Copper Tubes**.

These fittings shall be produced to meet the general requirements of ASTM B 62, Alloy C83600 or the chemical and tensile requirements of ASTM B 584, alloys C83800 or C84400.

Essentially, the elemental make-up of these cast brass fittings is approximately but not exactly equal to 85% Copper (Cu), 5% Tin (Sn), 5% Lead (Pb) and 5% Zinc (Zn). *(Although other elements may be part of the Alloy structure more detailed analysis of the Alloys can be obtained from Copper Development Association Inc from their website at <http://piping.copper.org>)*

These flared fittings are limited in size from 3/8" nominal to 2" nominal as designated by ASTM B88 for Seamless Copper Water Tube.

Marking of these fittings is limited to the manufacturer's name or trademark and that identification may be omitted from fittings less than 1/2" nominal size.

*(These flared fittings are normally limited to use in underground water service lines and in some rare cases above ground water distribution piping and should not be mistaken for 45° flared fittings manufactured for higher pressure applications.)*

## **NOTE:**

As additional information for flared fittings for copper tube applications it should be understood that forged or machined brass flared fittings for pressure applications are manufactured to the dimensions and configurations of SAE standards.

The flare dimension and configuration for a 45° single flare is to be in accordance with the specifications of SAE J533

## **Wrought Copper Solder Joint Drainage Fittings: Drain, Waste and Vent Applications**

Wrought (wrot) copper alloy fittings used for drainage, waste, and vent applications with solder joints are manufactured to the requirements of **ANSI/ASME B16.29 – Wrought copper And Wrought Copper Alloy Solder Joint Drainage Fittings – DWV**.

Fittings manufactured to this standard are to have a copper (Cu) content of not less than 84%.

These fittings (socket end diameter) are sized in accordance with the requirements of the ASTM B306 – Copper Drainage Tube while the size of any threaded connections (female or male) corresponds to nominal pipe sizing (slip-joints are excepted).

Drainage fittings are required to be identified (marked) with a permanent mark containing the manufacturer's name or trademark and "DWV".

All 90° fittings shall be pitched so that a slope of 0.25 in./ft. (2.1%) is developed in horizontal tube as referenced along a horizontal plane.

## **Wrought Copper Braze Joint Fittings**

Fittings manufactured with "braze cup depth sockets" (short cups) shall be manufactured to the requirements of **ANSI/ASME B16.50 – Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings**.

These fittings may be manufactured from any one of the following alloys: C10200, C12000, C12200, or C23000 or any copper alloy that contains at least 84% Copper (Cu) and a maximum of 16% Zinc (Zn). *(Although other elements may be part of the Alloy structure more detailed analysis of the Alloys can be obtained from Copper Development Association Inc from their website at <http://piping.copper.org>)*

Braze fittings (socket end diameter) are sized in accordance with the requirements of the ASTM B88 – Seamless Copper Water Tube (1/4" – 8" nominal diameters), while the sizes of any threaded connections (female or male) correspond to nominal pipe sizing and the requirements of ANSI/ASME B1.20.1.

The maximum operating pressure (MOP) for fittings manufactured to this standard shall be essentially equal to the maximum system operating pressure listed for type L annealed seamless copper water tube. *It should be noted that maximum pressure-temperature ratings for any system is dependent upon many factors, including valves and other in-line appurtenances, and these other in-line items must be taken into account when determining the MOP of the entire system.)*

Fittings manufactured with "short cup depth" for brazing applications only shall be identified with the manufacturer's name or trademark and have the letters "BZ" in upper-case letters permanently marked on each fitting. Fittings smaller than 1/2" or fittings where such marking may damage the brazing surfaces may have the marking requirement omitted.

## **Copper and Copper Alloy Braze Fittings for TP Pipe Applications:**

*The following reference information is provided for information only and should not be misconstrued to be the final specification document for Copper and Copper Alloy Braze Fittings for "TP" of Pipe applications)*

Fittings for use with copper and copper alloy threadless pipe ("TP"), or other copper alloy pipe types with O.D. dimensions equal to I.P.S. sizing are usually provided under standards other than ANSI or ASME. The most common reference standards are:

**MIL F-1183** for fittings smaller than 6 in. diameter and with a pressure rating of 200 lbs. W.S.P. (water steam pressure)

**MIL F-1183** for fittings over 6 in. diameter and with pressure Ratings of 150 lbs. W.S.P. (water steam pressure)

These fittings are manufactured from copper alloys meeting the requirements of ASTM B-61 or B-62 (C92200 or C83600 respectively). Many elements may be part of the Alloy structure and more detailed analysis of the Alloys can be obtained from Copper Development Association Inc or from their website at <http://piping.copper.org>)