



Designation: B 43 – 98<sup>e1</sup>

## Standard Specification for Seamless Red Brass Pipe, Standard Sizes<sup>1</sup>

This standard is issued under the fixed designation B 43; 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.*

<sup>e1</sup> NOTE—Referenced Documents were editorially corrected in November 2003.

### 1. Scope\*

1.1 This specification<sup>2</sup> covers seamless red brass (Copper Alloy UNS No. C23000)<sup>3</sup> pipe in all nominal pipe sizes, both regular and extra-strong. In the annealed temper (O61), the pipe is suitable for use in plumbing, boiler feed lines, and for similar purposes. In the drawn general purpose temper (H58), the pipe is suitable for architectural applications, such as guard railings and stair hand railings.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

1.3 The following hazard caveat pertains only to the test method portion, Section 9, 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.*

1.4 **Warning**—Mercury is a definite health hazard in use and disposal. (See 9.1.)

### 2. Referenced Documents

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

#### 2.2 ASTM Standards:

B 153 Test Method for Expansion (Pin Test) of Copper and Copper-Alloy Pipe and Tubing<sup>4</sup>

B 154 Test Method for Mercurous Nitrate Test for Copper and Copper Alloys<sup>4</sup>

B 601 Practice for Temper Designations for Copper and Copper Alloys—Wrought and Cast<sup>4</sup>

E 8 Test Methods of Tension Testing of Metallic Materials<sup>5</sup>

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications<sup>6</sup>

E 53 Methods for Chemical Analysis of Copper<sup>7</sup>

E 62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods)<sup>7</sup>

E 112 Test Methods for Determining Average Grain Size<sup>5</sup>

E 243 Practice for Electromagnetic (Eddy Current) Examination of Copper and Copper Alloy Tubes<sup>8</sup>

E 255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition<sup>7</sup>

E 478 Test Methods for Chemical Analysis of Copper Alloys<sup>9</sup>

E 527 Practice for Numbering Metals and Alloys (UNS)<sup>10</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *tube, seamless*—a tube produced with a continuous periphery in all stages of the operations.

3.1.1.1 *pipe*—a seamless tube conforming to the particular dimensions commercially known as nominal or standard pipe sizes.

3.1.2 *lengths*—straight pieces of the product.

3.1.2.1 *standard*—uniform lengths recommended in a Simplified Practice Recommendation or established as a Commercial Standard.

#### 3.2 Definition of Term Specific to This Standard:

3.2.1 *capable of*—as used in this specification, the test need not be performed by the producer of the material. However,

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B-5 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> For ASME Boiler and Pressure Vessel Code applications see related Specification SB-43 in Section II of that Code.

<sup>3</sup> The system for copper and copper alloys (see Practice E 527) is a simple expansion of the former standard designation system accomplished by the addition of a prefix “C” and a suffix “00.” The suffix can be used to accommodate composition variations of the base alloy.

<sup>4</sup> Annual Book of ASTM Standards, Vol 02.01.

<sup>5</sup> Annual Book of ASTM Standards, Vol 03.01.

<sup>6</sup> Annual Book of ASTM Standards, Vol 14.02.

<sup>7</sup> Annual Book of ASTM Standards, Vol 03.05.

<sup>8</sup> Annual Book of ASTM Standards, Vol 03.03.

<sup>9</sup> Annual Book of ASTM Standards, Vol 03.06.

<sup>10</sup> Annual Book of ASTM Standards, Vol 01.01.

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

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 Orders for material under this specification shall include the following information:

- 4.1.1 Temper (see 6.1),
- 4.1.2 Pipe size, regular or extra-strong (see 11.2),
- 4.1.3 Length (see 11.3),
- 4.1.4 Total length of each size, and
- 4.1.5 If material is required to meet *ASME Boiler and Pressure Vessel Code* (see 6.1, 6.2, or 6.3),
- 4.1.6 Certification, if required (see 20.1),
- 4.1.7 Mill test report, if required (see 21.1),
- 4.1.8 Hydrostatic test, if required, and
- 4.1.9 Pneumatic test, if required.
- 4.1.10 Mercurous Nitrate Test, if required (Section 9).

#### 5. Chemical Composition

5.1 The material shall conform to the following chemical requirements:

Copper, %	84.0 to 86.0
Lead, max, %	0.05
Iron, max, %	0.05
Zinc	remainder

5.2 These specification limits do not preclude the presence of other elements. Limits for unnamed elements are to be established by agreement between manufacturer or supplier and purchaser.

5.2.1 For copper alloys in which zinc is specified as the remainder, either copper or zinc shall be permitted to be taken as the difference between the sum of all the elements analyzed and 100 %.

5.2.1.1 When all the elements in the table in 5.1 are analyzed, their sum shall be 99.8 % minimum.

#### 6. Temper

6.1 All pipe shall normally be furnished in the O61 (annealed) (see Practice B 601) condition.

6.2 In the O61 (annealed) temper, the degree of annealing shall be sufficient to produce complete recrystallization with an average grain size not in excess of 0.050 mm. The surface of the test specimen for grain size determination shall approximate a radial longitudinal section and shall be prepared and examined in accordance with Test Methods E 112.

6.3 The pipe is permitted to be furnished in the H58 (drawn general purpose) temper, if agreed upon between the manufacturer and the purchaser. (See Table 1.)

**TABLE 1 Tensile Requirements**

Temper Designation		Tensile Strength, min. ksi (MPa)	Yield Strength <sup>A</sup> min. ksi (MPa)	Elongation in 2-in. min. %
Standard	Former			
O61	Annealed	40.0 (276)	12.0 (83)	35
H58	Drawn general purpose	44.0 (303)	18.0 (124)	...

<sup>A</sup> At 0.5 % extension under load.

#### 7. Mechanical Properties

7.1 Material in the O61 (annealed) temper specified to meet the requirements of the *ASME Boiler and Pressure Vessel Code* only shall have tensile properties as prescribed in Table 1.

7.2 All H58 (drawn general purpose) material shall have the tensile properties as prescribed in Table 1.

#### 8. Expansion Test

8.1 Specimens in the O61 (annealed) temper shall withstand an expansion of 25 % of the outside diameter when expanded in accordance with Test Method B 153. The expanded pipe shall show no cracking or rupture visible to the unaided eye. Pipe ordered in the drawn (H) condition is not subject to this test.

NOTE 1—The term “unaided eye,” as used herein, permits the use of corrective spectacles necessary to obtain normal vision.

8.2 As an alternative to the expansion test for pipe over 4 in. (102 mm) in diameter in the O61 (annealed) condition, a section 4 in. in length shall be cut from the end of one of the lengths for a flattening test. This 4-in. specimen shall be flattened so that a gage set at three times the wall thickness will pass over the pipe freely throughout the flattened part. The pipe so tested shall develop no cracks or flaws visible to the unaided eye (see Note 1) as a result of this test. In making the flattening test the elements shall be slowly flattened by one stroke of the press.

#### 9. Mercurous Nitrate Test

9.1 **Warning**—Mercury is a definite health hazard and therefore equipment for the detection and removal of mercury vapor produced in volatilization is recommended. The use of rubber gloves in testing is advisable.

9.2 When the test is required to be performed, the test specimens, cut 6 in. (152 mm) in length, shall, after proper cleaning, withstand an immersion for 30 min without cracking in the standard mercurous nitrate solution prescribed in Method B 154. Immediately after removal from the solution, the specimen shall be wiped free of excess mercury and examined for cracks.

9.3 Product of the O61 (annealed) temper shall pass the mercurous nitrate test when tested in accordance with Test Method B 154.

9.3.1 The test need not be performed except when indicated in the contract or purchase order at the time of placing of the order.

#### 10. Nondestructive Testing

10.1 The material shall be tested in the final size but is permitted to be tested prior to the final anneal or heat treatment, when these thermal treatments are required, unless otherwise agreed upon by the manufacturer or supplier and purchaser.

10.2 *Eddy-Current Test*—Each piece of material from 1/8 in. up to and including 2 1/2 in. nominal outside diameter or within the capabilities of the eddy-current tester, shall be subjected to an eddy-current test. Testing shall follow the procedures of Practice E 243 except for determination of “end effect.” The material shall be passed through an eddy-current testing unit

adjusted to provide information on the suitability of the material for the intended application.

10.2.1 Notch-depth standards rounded to the nearest 0.001 in. (0.025 mm) shall be 10 % of the nominal wall thickness. The notch depth tolerances shall be ±0.0005 in. (0.013 mm). Alternatively, when a manufacturer uses speed insensitive equipment that allows the selection of a maximum imbalance signal, a maximum imbalance signal of 0.3 % is permitted to be used.

10.2.2 Material that does not actuate the signaling device of the eddy-current test shall be considered as conforming to the requirements of this test. Material with discontinuities indicated by the testing unit is permitted to be reexamined or retested, at the option of the manufacturer, to determine whether the discontinuity is 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 material provided the dimensions of the material are still within prescribed limits and the material is suitable for its intended application.

10.3 *Hydrostatic Test*—When specified, the material shall stand, without showing evidence of leakage, an internal hydrostatic pressure sufficient to subject the material to a fiber stress of 6000 psi (41 MPa), determined by the following equation for thin hollow cylinders under tension. The material need not be tested at a hydrostatic pressure of over 1000 psi (6.9 MPa) unless so specified.

$$P = 2St/(D - 0.8t)$$

where:

- $P$  = hydrostatic pressure, psi (or MPa),
- $t$  = wall thickness of the material, in. (or mm),
- $D$  = outside diameter of the material in. (or mm), and
- $S$  = allowable stress of the material, psi (or MPa).

10.3.1 For material less than ½ in. (12.7 mm) in outside diameter and less than 0.060 in. (1.5 mm) in wall thickness, the test is permitted to be made at the option of the manufacturer by pneumatically testing to the requirements of 10.4.

10.4 *Pneumatic Test*—When specified, the material shall be subjected to an internal air pressure of 60 psi (415 kPa) minimum for 5 s without showing evidence of leakage. The test method used shall permit easy visual detection of any leakage, such as by having the material under water or by the pressure-differential method. Any evidence of leakage shall be cause for rejection.

**11. Dimensions and Permissible Variations**

11.1 For the purpose of determining conformance with the dimensional requirements prescribed in this specification, any measured value outside the limiting values for any dimensions may be cause for rejection.

11.2 *Standard Dimensions, Wall Thickness, and Diameter Tolerances*—The standard dimensions, wall thickness, and diameter tolerances shall be in accordance with Table 2.

11.3 *Length and Length Tolerances*—The standard length of red brass pipe is 12 ft (3.66 m) with a tolerance of ±½ in. (13 mm).

11.4 *Squareness of Cut*—The departure from squareness of the end of any pipe shall not exceed the following:

Outside Diameter, in. (mm)	Tolerance
Up to ¾ (15.9), incl	0.010 in. (0.25 mm)
Over ¾ (15.9)	0.016 in./in. (0.016 mm/mm) of diameter

11.5 *Roundness*—The roundness tolerance for straight length tubes with a wall thickness to outside diameter ratio of 0.01 to 0.05 (inclusive) shall be 6 % of the nominal outside diameter. For tubes with a wall thickness to outside diameter ratio over 0.05, the roundness tolerance shall be 3 % of the nominal outside diameter.

11.5.1 The measurement for roundness shall be made from the outside diameter. The deviation from roundness is measured as the difference between the major and minor diameters as determined at any one cross section of the tube. The major and minor diameters are the diameters of two concentric circles just enclosing the outside surface of the tube at the cross section.

11.6 *Straightness Tolerance*—For pipe of H58 (drawn general purpose) temper of Nominal Pipe Sizes from ¼ to 12 in. inclusive, the maximum curvature (depth of arc) shall not exceed ½ in. (13 mm) in any 10-ft (3048-mm) portion of the total length. For H58 temper pipe of other sizes, and for the O61 (annealed) temper, no numerical values are established, however, the straightness of the pipe shall be suitable for the intended application.

**12. Workmanship, Finish and Appearance**

12.1 The material shall be free of defects of a nature that interfere with normal commercial applications. It shall be well cleaned and free of dirt.

**13. Sampling**

13.1 *Sampling*—The lot size, portion size, and selection of sample pieces shall be as follows:

13.1.1 *Lot Size*—The lot size shall be as follows:

Pipe Size, in.	Lot Weight, lb (kg)
Up to 1½, incl	5 000 (2270) or fraction thereof
Over 1½ to 4, incl	10 000 (4550) or fraction thereof
Over 4	40 000 (18 100) or fraction thereof

13.1.2 *Portion Size*—Sample pieces shall be taken for test purposes from each lot according to the following schedule:

Number of Pieces in Lot	Number of Sample Pieces to be Taken <sup>AA</sup>
1 to 50	1
51 to 200	2
201 to 1500	3
Over 1500	0.2 % of total number of pieces in the lot, but not to exceed 10 sample pieces

<sup>AA</sup> Each sample piece shall be taken from a separate tube.

**TABLE 2 Standard Dimensions, Weights, and Tolerances**  
**NOTE—All tolerances are plus and minus except as otherwise indicated.**

Nominal or Standard Pipe Size, in.	Outside Diameter, in. (mm)	Average Outside Diameter Tolerances, <sup>A</sup> in. (mm) All Minus	Wall Thickness, in. (mm)	Tolerance, <sup>B</sup> in. (mm)	Theoretical Weight, lb/ft (kg/m)
Regular					
1/8	0.405 (10.3)	0.004 (0.10)	0.062 (1.57)	0.004 (0.10)	0.253 (0.376)
1/4	0.540 (13.7)	0.004 (0.10)	0.082 (2.08)	0.005 (0.13)	0.447 (0.665)
3/8	0.675 (17.1)	0.005 (0.13)	0.090 (2.29)	0.005 (0.13)	0.627 (0.933)
1/2	0.840 (21.3)	0.005 (0.13)	0.107 (2.72)	0.006 (0.15)	0.934 (1.39)
3/4	1.050 (26.7)	0.006 (0.15)	0.114 (2.90)	0.006 (0.15)	1.27 (1.89)
1	1.315 (33.4)	0.006 (0.15)	0.126 (3.20)	0.007 (0.18)	1.78 (2.65)
1 1/4	1.660 (42.2)	0.006 (0.15)	0.146 (3.71)	0.008 (0.20)	2.63 (3.91)
1 1/2	1.900 (48.3)	0.006 (0.15)	0.150 (3.81)	0.008 (0.20)	3.13 (4.66)
2	2.375 (60.3)	0.008 (0.20)	0.156 (3.96)	0.009 (0.23)	4.12 (6.13)
2 1/2	2.875 (73.0)	0.008 (0.20)	0.187 (4.75)	0.010 (0.25)	5.99 (8.91)
3	3.500 (88.9)	0.010 (0.25)	0.219 (5.56)	0.012 (0.30)	8.56 (12.7)
3 1/2	4.000 (102)	0.010 (0.25)	0.250 (6.35)	0.013 (0.33)	11.2 (16.7)
4	4.500 (114)	0.012 (0.30)	0.250 (6.35)	0.014 (0.36)	12.7 (18.9)
5	5.562 (141)	0.014 (0.36)	0.250 (6.35)	0.014 (0.36)	15.8 (23.5)
6	6.625 (168)	0.016 (0.41)	0.250 (6.35)	0.014 (0.36)	19.0 (28.3)
8	8.625 (219)	0.020 (0.51)	0.312 (7.92)	0.022 (0.56)	30.9 (46.0)
10	10.750 (273)	0.022 (0.56)	0.365 (9.27)	0.030 (0.76)	45.2 (67.3)
12	12.750 (324)	0.024 (0.61)	0.375 (9.52)	0.030 (0.76)	55.3 (82.3)
Extra Strong					
1/8	0.405 (10.3)	0.004 (0.10)	0.100 (2.54)	0.006 (0.15)	0.363 (0.540)
1/4	0.540 (13.7)	0.004 (0.10)	0.123 (3.12)	0.007 (0.18)	0.611 (0.909)
3/8	0.675 (17.1)	0.005 (0.13)	0.127 (3.23)	0.007 (0.18)	0.829 (1.23)
1/2	0.840 (21.3)	0.005 (0.13)	0.149 (3.78)	0.008 (0.20)	1.23 (1.83)
3/4	1.050 (26.7)	0.006 (0.15)	0.157 (3.99)	0.009 (0.23)	1.67 (2.48)
1	1.315 (33.4)	0.006 (0.15)	0.182 (4.62)	0.010 (0.25)	2.46 (3.66)
1 1/4	1.660 (42.2)	0.006 (0.15)	0.194 (4.93)	0.010 (0.25)	3.39 (5.04)
1 1/2	1.900 (48.3)	0.006 (0.15)	0.203 (5.16)	0.011 (0.28)	4.10 (6.10)
2	2.375 (60.3)	0.008 (0.20)	0.221 (5.61)	0.012 (0.30)	5.67 (8.44)
2 1/2	2.875 (73.0)	0.008 (0.20)	0.280 (7.11)	0.015 (0.38)	8.66 (12.9)
3	3.500 (88.9)	0.010 (0.25)	0.304 (7.72)	0.016 (0.41)	11.6 (17.3)
3 1/2	4.000 (102)	0.010 (0.25)	0.321 (8.15)	0.017 (0.43)	14.1 (21.0)
4	4.500 (114)	0.012 (0.30)	0.341 (8.66)	0.018 (0.46)	16.9 (25.1)
5	5.562 (141)	0.014 (0.36)	0.375 (9.52)	0.019 (0.48)	23.2 (34.5)
6	6.625 (168)	0.016 (0.41)	0.437 (11.1)	0.027 (0.69)	32.2 (47.9)
8	8.625 (219)	0.020 (0.51)	0.500 (12.7)	0.035 (0.89)	48.4 (72.0)
10	10.750 (273)	0.022 (0.56)	0.500 (12.7)	0.040 (1.0)	61.1 (90.9)

<sup>A</sup> The average outside diameter of a tube is the average of the maximum and minimum outside diameters as determined at any one cross section of the pipe.

<sup>B</sup> Maximum deviation at any one point.

13.1.3 *Sampling for Visual and Dimensional Examination*—Minimum sampling for visual and dimensional examination shall be as follows:

Lot size (Pieces/lot)	Sample size
2 to 8	Entire lot
9 to 90	8
91 to 150	12
151 to 280	19
281 to 500	21
501 to 1200	27
1201 to 3200	35
3201 to 100 000	38
10 001 to 350 000	46

In all cases, the acceptance number is zero and the rejection number is one. Rejected lots are permitted to be screened and

resubmitted for visual and dimensional examination. All defective items shall be replaced with acceptable items prior to lot acceptance.

#### 14. Number of Tests and Retests

14.1 *Chemical Analysis*—Samples for chemical analysis shall be taken in accordance with Practice E 255. Drillings, millings, etc., shall be taken in approximately equal weight from each of the sample pieces selected in accordance with 13.1.2 and combined into one composite sample. The minimum weight of the composite sample that is to be divided into three equal parts shall be 150 g.

14.1.1 Instead of sampling in accordance with Practice E 255, the manufacturer shall have the option of determining

conformance to chemical composition as follows: Conformance shall be determined by the manufacturer by analyzing samples taken at the time the castings are poured or samples taken from the semi-finished product. If the manufacturer determines the chemical composition of the material during the course of manufacture, he shall not be required to sample and analyze the finished product. The number of samples taken for determination of chemical composition shall be as follows:

14.1.1.1 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.

14.1.1.2 When samples are taken from the semi-finished product, a sample shall be taken to represent each 10 000 lb (4550 kg) or fraction thereof, except that not more than one sample shall be required per piece.

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

14.1.1.4 In the event that heat identification or traceability is required, the purchaser shall specify the details desired.

**14.2 Retests:**

14.2.1 If any test specimen shows defective machining or develops flaws, it shall be discarded and another specimen substituted.

14.2.2 If the results of the test on one of the specimens fail to meet the specified requirements, two additional specimens shall be taken from different sample pieces and tested. The results of the tests on both of these specimens shall meet the specified requirements. Failure of more than one specimen to meet the specified requirements for a particular property shall be cause for rejection of the entire lot.

14.2.3 If the chemical analysis fails to conform to the specified limits, analysis shall be made on a new composite sample prepared from additional pieces selected in accordance with 13.1. The results of this retest shall comply with the specified requirements.

**15. Test Methods**

15.1 The properties enumerated in this specification shall, in case of disagreement, be determined in accordance with the following applicable methods:

Test	ASTM Designation (Section 2)
Chemical analysis	E 53, E 62, E 478
Tension	E 8
Expansion (pin test)	B 153
Mercurous nitrate	B 154

15.2 Tension test specimens shall be of the full section of the pipe and shall conform to the requirements of the section, Specimens for Pipe and Tube, of Methods E 8, unless the limitations of the testing machine preclude the use of such a specimen. Test specimens conforming to Type No. 1 of Fig. 13, Tension Test Specimens for Large-Diameter Tubular Products, of Methods E 8 is permitted to be used when a full section specimen cannot be tested.

15.3 Whenever tension test results are obtained from both full size and from machined test specimens and they differ, the results obtained from full size test specimens shall be used to determine conformance to the specification requirements.

15.4 Tension test results on material covered by this specification are not seriously affected by variations in speed of testing. A considerable range of testing speed is permissible; however, it is recommended that the rate of stressing to the yield strength not exceed 100 ksi (690 MPa)/min. Above the yield strength it is recommended that the movement per minute of the testing machine head under load not exceed 0.5 in./in. (0.5 mm/mm) of gage length (or distance between grips for full-section specimens).

**16. Significance of Numerical Limits**

16.1 For purposes 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 place of figures of the specified limit
Tensile Strength Yield Strength	nearest ksi (nearest 5 MPa)

**17. Inspection**

17.1 The manufacturer shall afford the inspector representing the purchaser, all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with the specified requirements.

**18. Rejection and Rehearing**

18.1 Material that fails to conform to the requirements of this specification shall be subject to rejection. Rejection is to be reported to the manufacturer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the manufacturer or supplier shall have the option to make claim for a rehearing.

**19. Packaging and Package Marking**

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

19.2 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.

**20. Certification**

20.1 When specified on the purchase order the manufacturer shall furnish to the purchaser a certificate stating that each lot has been sampled, tested, and inspected in accordance with this specification and has met the requirements. When material is specified to meet the requirements of *ASME Boiler and Pressure Vessel Code*, the certification requirements are mandatory.

## 21. Mill Test Report

21.1 When specified on the purchase order, the manufacturer shall furnish to the purchaser a test report showing results of tests required by the specification.

## 22. Keywords

22.1 copper alloy UNS No. C 23000; red brass pipe

## 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>11</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>11</sup>

MIL-STD-129 Marking for Shipment and Storage

S1.1.3 *Military Specification*.<sup>11</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 shall use his own or any other suitable facilities for the performance of the inspection and test 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 ASTM 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, and packed, Level A, B, or C, as specified in the contract or purchase order, in accordance with the requirements of MIL-C-3993.

S4.1.2 *Civil Agencies*—The requirements of Fed. Std. No. 102 shall be referenced for definitions of the various levels of packaging protection.

S4.2 *Marking*:

S4.2.1 *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.

S4.2.2 *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.

<sup>11</sup> Available from Standardization Documents Order Desk, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, ATTN: NPODS.

## APPENDIX

### (Nonmandatory Information)

#### X1. METRIC EQUIVALENTS

X1.1 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 ( $N = \text{kg} \cdot \text{m/s}^2$ ). The derived SI unit for pressure or

stress is the newton per square metre ( $\text{N/m}^2$ ), 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  $\text{MN/m}^2$  and  $\text{N/mm}^2$ .

## SUMMARY OF CHANGES

Committee B-5 has identified the location of selected changes to this standard since the last issue B 43 – 96 that may impact the use of this standard.

- (1) The minimum tensile strength requirement of the H58 temper (see Table 1) was changed to become 44.0 ksi (303 MPa). The previous value was 40.0 ksi.
- (2) Section 11.6, Straightness Tolerance, was added to include straightness requirements.

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