



Designation: B552 – 19

# Standard Specification for Seamless and Welded Copper–Nickel Tubes for Water Desalting Plants<sup>1</sup>

This standard is issued under the fixed designation B552; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This specification establishes requirements for seamless and welded copper-nickel tubes from 0.250 to 2.125 in. (6.35 to 54.0 mm) in diameter for use in heat exchangers in water desalting plants. The following alloys are involved:

| Copper or<br>Copper Alloy UNS No. | Type of Metal                                 |
|-----------------------------------|-----------------------------------------------|
| C70600                            | 90-10 copper-nickel                           |
| C70620                            | 90-10 copper-nickel<br>(Modified for Welding) |
| C71500                            | 70-30 copper-nickel                           |
| C71520                            | 70-30 copper-nickel<br>(Modified for Welding) |
| C71640                            | copper-nickel-iron-manganese                  |
| C72200                            | copper-nickel                                 |

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

1.3 The following safety hazard caveat pertains only to the test methods of Section 16 described in this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to its use.*

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

<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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## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- B153 Test Method for Expansion (Pin Test) of Copper and Copper-Alloy Pipe and Tubing
- B154 Test Method for Mercurous Nitrate Test for Copper Alloys
- B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast
- B846 Terminology for Copper and Copper Alloys
- B858 Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys
- B968/B968M Test Method for Flattening of Copper and Copper-Alloy Pipe and Tube
- E3 Guide for Preparation of Metallographic Specimens
- E8/E8M Test Methods for Tension Testing of Metallic Materials
- E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)<sup>3</sup>
- E76 Test Methods for Chemical Analysis of Nickel-Copper Alloys (Withdrawn 2003)<sup>3</sup>
- E118 Test Methods for Chemical Analysis of Copper-Chromium Alloys (Withdrawn 2010)<sup>3</sup>
- E243 Practice for Electromagnetic (Eddy Current) Examination of Copper and Copper-Alloy Tubes
- E255 Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition
- E478 Test Methods for Chemical Analysis of Copper Alloys

## 3. Terminology

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

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

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

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

## 4. Classification

4.1 Tubes furnished to this specification are classified into two types, as follows:

- 4.1.1 Seamless tube, and
- 4.1.2 Welded tube.

## 5. Ordering Information

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

- 5.1.1 ASTM designation and year of issue;
  - 5.1.2 Copper Alloy UNS number designation;
  - 5.1.3 Whether seamless or welded (Section 4);
  - 5.1.4 Temper (Section 8);
  - 5.1.5 Dimensions: diameter and wall thickness (whether minimum or nominal), and length (Section 12);
  - 5.1.6 Total number of pieces of each size;
  - 5.1.7 How furnished, whether in straight lengths or coils; and
  - 5.1.8 Intended application.
- 5.2 The following options are available and shall be specified in the contract or purchase order when required:
- 5.2.1 Hydrostatic test (11.3),
  - 5.2.2 Pneumatic test (11.4),
  - 5.2.3 Certification (Section 20),
  - 5.2.4 Test report (Section 21),
  - 5.2.5 Package marking of the specification number (Section 22),
  - 5.2.6 Flattening Test (10.2), and
  - 5.2.7 Reverse Bend Test (10.3).

## 6. Materials and Manufacture

### 6.1 Material:

6.1.1 *Seamless Tube*—The material of manufacture shall be cast billets of the Copper Alloys UNS Nos. C70600, C70620, C71500, C71520, C71640, and C72200 and shall be of such quality and soundness as to be suitable for processing into finished lengths or coils of tube to meet the properties prescribed herein.

6.1.2 *Welded Tube*—The material of manufacture shall be strip of one of the Copper Alloy UNS Nos. C70600, C70620, C71500, C71520, C71640, and C72200 and shall be of such

purity and soundness as to be suitable for processing into the products prescribed herein.

### 6.2 Manufacture:

6.2.1 *Seamless Tube*—The product shall be manufactured by such hot extrusion or piercing, and subsequent cold working and annealing as to produce a uniform, seamless wrought structure in the finished product.

6.2.2 *Welded Tube*—The product shall be manufactured from flat rolled strip which is subsequently formed and welded. This is usually accomplished by a forge-weld process or a fusion-weld process.

6.2.2.1 For forged-welded tube, the edges of the strip shall be heated to a required welding temperature, usually by high-frequency electric current, and be pressed firmly together causing a forged-type joint to be formed with internal and external flash or bead.

6.2.2.2 The external flash (that portion of the weld which extends beyond the normal wall) shall always be removed.

6.2.2.3 The internal flash in forge-welded tube shall be removed to the extent that it shall not exceed 0.006 in. (0.15 mm) in height or 10 % of the nominal wall thickness, whichever is greater.

6.2.2.4 Fusion-welded tube shall be mechanically worked to produce a smooth external and internal surface without the application of scarfing or other removal of the weld bead.

6.2.3 The product shall be cold worked and annealed as necessary to meet properties of the temper specified.

## 7. Chemical Composition

7.1 The product shall conform to the chemical composition requirements specified in Table 1 for the Copper Alloy UNS number designation specified in the ordering information.

7.2 These composition limits do not preclude the presence of other elements. When required, limits for unnamed elements shall be established and analysis required by agreement between the manufacture or supplier and purchaser.

7.2.1 For copper alloys in which copper is specified as the remainder, copper may be taken as the difference between the sum of all the elements analyzed and 100 %.

TABLE 1 Chemical Requirements

| Copper or Copper Alloy<br>by UNS No. | Copper<br>(incl silver) | Nickel<br>(incl cobalt) | Composition, %    |          |                  |           |              | Other Named Elements                                   |
|--------------------------------------|-------------------------|-------------------------|-------------------|----------|------------------|-----------|--------------|--------------------------------------------------------|
|                                      |                         |                         | Lead,<br>max      | Iron     | Zinc,<br>max     | Manganese | Phosphorus   |                                                        |
| C70600                               | Remainder               | 9.0–11.0                | 0.05              | 1.0–1.8  | 1.0              | 1.0 max   | ...          | C 0.05 max<br>P 0.02 max<br>S 0.02 max                 |
| C70620                               | 86.5 min                | 9.0–11.0                | 0.02              | 1.0–1.8  | 0.50             | 1.0 max   | ...          |                                                        |
| C71500                               | Remainder               | 29.0–33.0               | 0.05              | 0.40–1.0 | 1.0              | 1.0 max   | ...          | C 0.05 max<br>P 0.02 max<br>S 0.02 max                 |
| C71520                               | 65.0 min                | 29.0–33.0               | 0.02              | 0.40–1.0 | 0.50             | 1.0 max   | ...          |                                                        |
| C71640                               | Remainder <sup>A</sup>  | 29.0–32.0               | 0.05 <sup>A</sup> | 1.7–2.3  | 1.0 <sup>A</sup> | 1.5–2.5   | <sup>A</sup> | C 0.06 max <sup>A</sup><br>S 0.03 max <sup>A</sup>     |
| C72200                               | Remainder <sup>A</sup>  | 15.0–18.0               | 0.05 <sup>A</sup> | 0.50–1.0 | 1.0 <sup>A</sup> | 1.0 max   | <sup>A</sup> | Cr 0.30–0.7<br>Si 0.03 max<br>Ti 0.03 max <sup>A</sup> |

<sup>A</sup> When the product is for subsequent welding applications and so specified by the purchaser, zinc shall be 0.50 % max, lead 0.02 % max, phosphorus 0.02 % max, sulfur 0.02 % max, and carbon 0.05 % max.