



Designation: B608 – 18

## Standard Specification for Welded Copper-Alloy Pipe<sup>1</sup>

This standard is issued under the fixed designation B608; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This specification establishes the requirements for arc-welded pipe for use in brackish water or seawater piping systems.

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

1.3 The following hazard statement pertains only to the test method described in 8.2 and 14.3.2 of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

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

### 2. Referenced Documents

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

**B169/B169M** Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar

**B171/B171M** Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers

**B846** Terminology for Copper and Copper Alloys

**E8/E8M** Test Methods for Tension Testing of Metallic Materials

**E29** Practice for Using Significant Digits in Test Data to

#### Determine Conformance with Specifications

**E62** Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)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**E76** Test Methods for Chemical Analysis of Nickel-Copper Alloys (Withdrawn 2003)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>

**E190** Test Method for Guided Bend Test for Ductility of Welds

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

**E478** Test Methods for Chemical Analysis of Copper Alloys

#### 2.2 ASME Standards:<sup>4</sup>

**Boiler and Pressure Vessel Code**, Rules for Construction of Nuclear Facility Components, Section III, Division I

**Boiler and Pressure Vessel Code**, Nondestructive Examination, Section V

**Boiler and Pressure Vessel Code**, Pressure Vessels, Section VIII, Division I

**Boiler and Pressure Vessel Code**, Welding, Brazing, and Fusing Qualifications, Section IX

#### 2.3 AWS Standards:<sup>5</sup>

**A5.6/A5.6M** Specification for Copper and Copper - Alloy Electrodes for Shielded Metal Arc Welding

**A5.7/A5.7M** Specification for Copper and Copper - Alloy Bare Welding Rods and Electrodes

### 3. Terminology

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

### 4. Ordering Information

4.1 Include the following information in contracts or purchase orders for product furnished under this specification:

4.1.1 ASTM specification designation and year of issue (for example, B608 – 02),

4.1.2 Copper [Alloy] UNS No. required (Section 5 and Table 1),

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

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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](http://www.astm.org).

<sup>4</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

<sup>5</sup> Available from American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166-6672, <http://www.aws.org>.

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

**TABLE 1 Chemical Requirements**

| Copper Alloy UNS Number | Composition, %      |                    |          |           |          |           |                |             |                 |             |           |      |
|-------------------------|---------------------|--------------------|----------|-----------|----------|-----------|----------------|-------------|-----------------|-------------|-----------|------|
|                         | Copper <sup>A</sup> | Nickel incl Cobalt | Aluminum | Lead, max | Iron     | Zinc, max | Manganese, max | Sulfur, max | Phosphorus, max | Carbon, max | Tin       | Si   |
| C61300 <sup>B</sup>     | remainder           | 0.15 max           | 6.0–7.5  | 0.01      | 2.0–3.0  | 0.10      | 0.20           | ...         | 0.015           | ...         | 0.20–0.50 | 0.10 |
| C61400                  | remainder           | ...                | 6.0–8.0  | 0.01      | 1.5–3.5  | 0.20      | 1.0            | ...         | 0.015           | ...         | ...       | ...  |
| C70620                  | 86.5 % min          | 9.0–11.0           | ...      | 0.02      | 1.0–1.8  | 0.50      | 1.0            | 0.02        | 0.02            | 0.05        | ...       | ...  |
| C71520                  | 65.0 % min          | 29.0–33.0          | ...      | 0.02      | 0.40–1.0 | 0.50      | 1.0            | 0.02        | 0.02            | 0.05        | ...       | ...  |

<sup>A</sup> Silver counting as copper.

<sup>B</sup> When the product is for subsequent welding applications and is so specified by the purchaser, chromium shall be 0.05 % max, cadmium 0.05 % max, zinc 0.05 % max, and zirconium 0.05 % max.

4.1.3 Dimensions required; diameter and wall thickness (Section 10),

4.1.4 Unit length required, and

4.1.5 When purchased for ASME Boiler and Pressure Vessel Code application (19.2).

4.2 The following options are available:

4.2.1 Determination of chemical composition (6.1.1),

4.2.2 Transverse Guided-Bend bend test (8.1),

4.2.3 Hydrostatic test (8.2),

4.2.4 Radiographic examination (8.3),

4.2.4.1 The number of pipe lengths to be examined,

4.2.5 Liquid Penetrant examination (8.4),

4.2.6 Weld reinforcement removal, (Section 9),

4.2.7 Certification (Sections 18 and 19), and

4.2.8 Test Report (Section 20).

## 5. Material and Manufacture

### 5.1 Material:

5.1.1 The pipe shall be made from annealed copper alloy sheet or plate that conforms to the requirements of Specification B169/B169M for Copper Alloys UNS Nos. C61300 and C61400 or Specification B171/B171M for Copper Alloys UNS Nos. C70620 and C71520. These specifications reference Test Methods E62, E76, and E478 for the appropriate chemical analysis.

### 5.2 Manufacture:

5.2.1 Welded joints shall be made either manually or automatically by an arc-welding process.

5.2.2 Filler metal, if used in an arc-welding process, shall conform to one of the following specifications and classifications shown for each base metal:

| Base Metal Copper Alloy UNS Number | Filler Metal AWS Specification |            |
|------------------------------------|--------------------------------|------------|
|                                    | A5.6/A5.6M                     | A5.7/A5.7M |
| C61300                             | ECuAl-A2                       | ERCuAl-A2  |
| C61400                             | ECuAl-A2                       | ERCuAl-A2  |
| C70620                             | ECuNi                          | ERCuNi     |
| C71520                             | ECuNi                          | ERCuNi     |

5.2.3 Welding procedures and welding operators shall be qualified in accordance with the ASME Boiler and Pressure Vessel Code, Section IX.

5.2.4 Each length of pipe may contain more than one longitudinally welded joint.

5.2.4.1 The welded joint shall be a full-penetration weld and may have a reinforcing bead on each side; such reinforcement shall not be more than 1/16 in. (1.6 mm) per side measured in the radial direction.

5.2.4.2 At no place shall the thickness of the weld section be less than the thickness of the adjacent base metal.

5.2.4.3 The contour of the weld bead shall be smooth, having no sharp valley or groove at the weld center or edges.

5.2.4.4 Smooth concavity of the weld bead contour is acceptable, provided the minimum weld bead thickness is not less than the thickness of the adjacent base metal.

5.2.4.5 Any offset of base metal edges at a weld that is not within the tolerance of 10.2.7 shall be flared at a 3 to 1 minimum taper over the width of the finished weld or, if necessary, by adding additional weld metal beyond what would otherwise be the edge of the weld. Such build-up welding shall be performed in accordance with the requirements of 5.2.3.

5.2.4.6 Weld reinforcement may be removed at the option of the manufacturer or when specified by the purchaser.

5.2.5 Weld defects shall be repaired by removal to sound metal and re-welding. A repaired weld shall meet all requirements of an original weld.

5.2.6 Base metal defects such as slivers, inclusions, or laps shall be repaired by removal to sound metal. Build-up welding shall be performed when such removal reduces the wall thickness below the minimum allowed by the specification. Such build-up welding shall be performed in accordance with the requirements of 5.2.3. The thickness of the repaired section shall meet the requirements of a welded joint.

5.2.7 Pipe shall be furnished in the as-welded condition (Section 3).

NOTE 1—Although no restriction is placed on the size of pipe that may be furnished under this specification, usage is normally limited to nominal sizes 4 in. and larger in diameter.

## 6. Chemical Composition

6.1 The pipe material shall conform to the chemical compositional requirements of Table 1 for the specified alloy.

6.1.1 When the material of manufacturer has been certified to conform to the requirements of the strip specification to which it was ordered, the determination of composition is not required of the tube manufacturer or supplier unless specified in the contract or purchase order.

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

6.3 When determining composition, copper may be taken as the difference between the sum of results for specified elements and 100 %.