



AEROSPACE MATERIAL SPECIFICATION

AMS4553™**REV. E**

Issued 1990-07
Reaffirmed 2004-04
Revised 2022-11

Superseding AMS4553D

Brass, Seamless, Tubing
85Cu - 15Zn
Annealed (O61)
(Composition similar to UNS C23000)

RATIONALE

AMS4553E results from a Five-Year Review and update of this specification with changes to prohibit unauthorized exceptions (3.7.1, 3.8, 4.4.1, 8.5), update form (1.1), applicable documents (Section 2), composition (3.1), residual stress test nomenclature previously embrittlement (3.4.2, 4.2.2), expansion test nomenclature previously flarability (3.4.3, Table 7), cleanliness (3.5.3), and allow the use of the immediate prior specification revision (8.4).

1. SCOPE

1.1 Form

This specification covers a copper alloy (brass) in the form of seamless tubing with nominal OD of 0.405 inch (10.29 mm) to 10.75 inches (273.05 mm) and nominal weight of 0.253 lb/ft (0.38 kg/m) to 66.142 lb/ft (98.43 kg/m) (see 8.6).

1.2 Application

This tubing has been used typically for parts requiring resistance to corrosion by salt, fresh water, salt air, or gases, but usage is not limited to such applications.

1.3 Classification

Tubing is classified by nominal working pressures as follows:

Type I - Nominal working pressure 100 psi (689 kPa)

Type II - Nominal working pressure 200 psi (1379 kPa)

Type III - Nominal working pressure 300 psi (2068 kPa)

Type IV - Nominal working pressure 450 psi (3103 kPa)

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Documents

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2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2223 Tolerances Copper and Copper Alloy Seamless Tubing

AS7766 Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B153 Expansion (Pin Test) of Copper and Copper-Alloy Pipe and Tubing

ASTM B154 Mercurous Nitrate Test for Copper Alloys

ASTM B251/B251M General Requirements for Wrought Seamless Copper and Copper-Alloy Tube

ASTM B601 Temper Designations for Copper and Copper Alloys—Wrought and Cast

ASTM B858 Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys

ASTM E8/E8M Tension Testing of Metallic Materials

ASTM E18 Rockwell Hardness of Metallic Materials

ASTM E243 Electromagnetic (Eddy-Current) Examination of Copper and Copper-Alloy Tubes

ASTM E478 Chemical Analysis of Copper Alloys

2.3 Definitions

Terms used in AMS are defined in AS7766.

2.3.1 Copper temper designations are defined in ASTM B601.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with ASTM E478, or by other analytical methods acceptable to purchaser.

Table 1 - Composition

Element (3.1.1)	Min	Max
Copper	84.0	86.0
Lead	--	0.05
Iron	--	0.05
Zinc (3.1.2)	remainder	
Sum of Named Elements (3.1.3)	99.8	--

- 3.1.1 These composition limits do not preclude the presence of other elements. Limits may be established and analysis required for unnamed elements by agreement between the manufacturer or supplier and purchaser.
- 3.1.2 Zinc may be reported as "remainder," as the difference between the sum of results for all elements and 100%, or as the result of direct analysis.
- 3.1.3 When all the named elements in the table are analyzed, the sum shall be 99.8% minimum, but such determination is not required for routine acceptance of each lot.

3.2 Condition

Fully recrystallized in the soft annealed (O61) temper (see 2.3.1). Tubing shall be acid cleaned after final annealing when specified.

3.3 Fabrication

Tubing shall be produced by a seamless process. The external and internal surface finishes shall be produced by any method which will result in surfaces free from laps, folds, tears, and extraneous materials and which show no oxide discoloration. Processing shall not affect limits of wall thickness or corrosion resistance.

3.4 Properties

Shall conform to the following requirements:

3.4.1 Tensile Properties

Shall be as shown in Table 2, determined in accordance with ASTM E8/E8M:

Table 2 - Minimum tensile properties

Property	Value
Tensile Strength	40.0 ksi (276 MPa)
Yield Strength, 0.5% Extension Under Load	12.0 ksi (83 MPa)
Elongation in 8 Inches (203.2 mm)	30%

- 3.4.1.1 Tensile specimens shall be of the full section of tube and shall conform to the requirements of ASTM E8/E8M, unless limitations of the testing machine preclude the use of such specimen; in which case longitudinal specimens cut from tube shall be tested.

3.4.2 Residual Stress Test

Specimens of tubing, nominally 6 inches (152 mm) in length or twice the diameter, whichever is greater, shall withstand, without cracking, the mercurous nitrate test performed in accordance with ASTM B154, Procedure A, or the Ammonia Vapor Test in accordance with ASTM B858.

3.4.3 Expansion Test

Tube specimens shall withstand 20% expansion of the original outside diameter, determined in accordance with ASTM B153.

3.4.4 Hydrostatic Pressure Test

Tubing shall withstand an internal hydrostatic pressure (P) based on Equation 1, without developing leaks and without an increase in mean diameter of more than 0.2%. The tube need not be tested at a pressure of over 1000 psi (6.90 MPa).

$$P = \frac{2 St}{D - 0.8 t} \quad (\text{Eq. 1})$$

where:

P = internal pressure at minimum yield, ksi (MPa)

S = allowable yield stress (7.0 ksi [48.3 MPa])

t = wall thickness, inches (mm)

D = nominal OD, inches (mm)

3.5 Quality

3.5.1 Visual Imperfections

Tubing, as received by purchaser, shall be uniform in quality and condition and shall have a finish conforming to the best practice for high quality aircraft tubing. It shall be smooth and free from heavy scale, oxide, burrs, seams, tears, grooves, laminations, slivers, pits, and other surface imperfections detrimental to usage of the tubing.

3.5.2 Surface Imperfections

Slight surface imperfections, such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale patterns, are acceptable provided the imperfections are removable within tolerances specified for wall thickness.

3.5.3 Cleanliness

Tubing shall be free from grease or other foreign matter. A clean white cloth shall be drawn through the length of the bore of the test sample. The observation of metallic flakes or particles shall be cause for rejection. Discoloration of the cloth, without the presence of flakes or particles, is acceptable.

3.5.4 Eddy-Current Examination

Tubing, under 2.5 inches (64 mm) in OD, shall be tested in accordance with ASTM E243 is not acceptable if a discontinuity indication exceeds the discontinuity indication of a single artificial defect as defined in ASTM E243 and appendix.

3.6 Tolerances

Shall be as follows:

3.6.1 Diameter, Wall Thickness, and Length

Shall be in accordance with AMS2223.

3.6.2 Weight

For any lot of tubing, the tolerance for overweight shall be 10% maximum. For calculating weight, the density shall be 0.316 pounds per cubic inch (8.75 kg/m³).