



AEROSPACE MATERIAL SPECIFICATION

AMS4002™

REV. B

Issued 2012-08
Reaffirmed 2017-11
Revised 2024-03

Superseding AMS4002A

Aluminum Alloy Tubing, Seamless, Drawn
1.8Cu - 1.0Mg - 0.8Si - 0.20Cr
Solution Heat Treated, Stress-Relieved by Stretching, and Aged (2013-T6511)
(Composition Similar to UNS A92013)

RATIONALE

AMS4002B results from a Five-Year Review and update of this specification with changes to update wording to prohibit unauthorized exceptions (see 3.4.1.1, 3.7, and 8.3), update Applicable Documents (see Section 2), relocate Definitions (see 2.4), and allow the use of the immediate prior specification revision (see 8.4).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of seamless, drawn tubing having nominal wall thickness of 0.120 to 0.400 inch (3.00 to 10.00 mm), inclusive (see 8.5).

1.2 Application

This material has been used typically for parts requiring a high-strength, non-weldable alloy, but usage is not limited to such applications. Parts are usually solution heat treated and aged before use.

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.

AMS2355 Quality Assurance, Sampling and Testing, Aluminum Alloys and Magnesium Alloy, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings

AMS2772 Heat Treatment of Aluminum Alloy Raw Materials

AS7766 Terms Used in Aerospace Metals Specifications

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<https://www.sae.org/standards/content/AMS4002B/>

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 B660 Packaging/Packing of Aluminum and Magnesium Product

ASTM B666/B666M Identification Marking of Aluminum and Magnesium Products

2.3 ANSI Accredited Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ANSI H35.1/H35.1M Standard Alloy and Temper Designation System for Aluminum

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products

ANSI H35.2M Dimensional Tolerances for Aluminum Mill Products (Metric)

2.4 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2355:

Table 1 - Composition

Element	Min	Max
Silicon	0.6	1.0
Iron	--	0.40
Copper	1.5	2.0
Manganese	--	0.25
Magnesium	0.8	1.2
Chromium	0.04	0.35
Zinc	--	0.25
Titanium	--	0.15
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.2 Condition

Product shall be supplied in the following condition and temper: condition T6511, drawn, solution heat treated and stress-relieved by stretching to produce a nominal permanent set of 1.5%, but not less than 1%, nor more than 3%, and artificially aged (refer to ANSI H35.1/H35.1M).

3.2.1 Product shall be supplied with an as-extruded surface finish; light polishing to remove minor surface conditions is permissible provided such conditions can be removed within specified dimensional tolerances.

3.2.2 Product may receive minor straightening, after stretching, of an amount necessary to meet the requirements of 3.6.

3.3 Heat Treatment

Tubing shall conform to the following requirements, determined on the mill produced size, in accordance with AMS2355 and as specified herein:

3.3.1 Solution Heat Treatment

Shall be in accordance with AMS2772, and as follows:

Heat to 1013 °F ± 10 °F (545 °C ± 6 °C), hold at heat for a time commensurate with section thickness, and cool rapidly.

3.3.2 Artificial Aging Heat Treatment

Heat to 374 °F ± 10 °F (190 °C ± 6 °C), hold at heat for a time of 7 to 9 hours, and air cool.

3.4 Properties

Tubing shall conform to the following requirements, determined in accordance with AMS2355 on the mill produced size.

3.4.1 Tensile Properties

Shall be as shown in Table 2 for tubing having nominal wall thickness of 0.120 to 0.400 inch (3.00 to 10.00 mm), inclusive.

3.4.1.1 Tensile property requirements for tubing outside the wall thickness range of 3.4.1 shall be as agreed upon by the purchaser and producer and reported per 4.4.1 (see 8.5).

Table 2A - Minimum longitudinal tensile properties, inch/pound units

Nominal Wall Thickness Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D % Cut Out Specimen	Elongation in 2 Inches or 4D % Full Section Specimen
Over 0.120 to 0.400, incl	60.0	56.0	7	--

Table 2B - Minimum longitudinal tensile properties, SI units

Nominal Wall Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D % Cut Out Specimen	Elongation in 50.8 mm or 4D % Full Section Specimen
Over 3.00 to 10.00, incl	414	386	7	--

3.5 Quality

Tubing, as received by the purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the tubing.

3.5.1 Detrimental imperfections include, but are not limited to, cracks, splits, seams, inclusions, or severe crosshatching (surface breaks) that cannot be removed by lightly hand-sanding, using 180 grit or finer sandpaper.

3.6 Tolerances

Shall conform to all applicable requirements of ANSI H35.2 or ANSI H35.2M.

3.7 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The producer of tubing shall supply all samples for the producer's tests and shall be responsible for the performance of all required tests. The purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (see 3.1), tensile properties (see 3.4.1), quality (see 3.5), and tolerances (see 3.6) are acceptance tests and, except for composition, shall be performed on each lot of tubing.

4.3 Sampling and Testing

Shall be in accordance with AMS2355.

4.4 Reports

The producer of tubing shall furnish with each shipment a report stating that the tubing conforms to the composition and tolerances and showing the numerical results of tests on each inspection lot to determine conformance to the other acceptance test requirements. This report shall include the purchase order number, inspection lot number(s), AMS4002B, size, and quantity. The report shall also identify the producer, the product form, and the size of the mill product.

4.4.1 When material produced to this specification is beyond the sizes allowed in the scope of tables, or other exceptions are taken to the technical requirements listed in Section 3 (see 5.1.1), the report shall contain a statement "This material is certified as AMS4002B(EXC) because of the following exceptions:" and the specific exceptions shall be listed.

4.5 Resampling and Retesting

Shall be in accordance with AMS2355.

5. PREPARATION FOR DELIVERY

5.1 Identification

Shall be in accordance with ASTM B666/B666M.

5.1.1 When technical exceptions are taken (see 4.4.1), the material shall be marked with AMS4002(EXC).

5.2 Packaging

5.2.1 Tubing shall be oiled, prior to shipment, with a light corrosion-inhibiting oil.

5.2.2 Tubing shall be prepared for shipment in accordance with ASTM B660, and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the tubing to ensure carrier acceptance and safe delivery.

6. ACKNOWLEDGMENT

A producer shall mention this specification number in all quotations and when acknowledging purchase orders.

7. REJECTIONS

Tubing not conforming to this specification, or to modifications authorized by the purchaser, will be subject to rejection.