SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4469

Issued 2013-02

Aluminum Alloy Tubing, Seamless, Drawn
1.8 Cu - 1.0 Mg - 0.8 Si - 0.20 Cr
Solution Heat Treated, Stress-Relieved by Stretching, and Aged (2013-T4511)
(Composition Similar to UNS A92013)

RATIONALE

AMS4469 is a new specification for seamless, drawn tubing for 2013-T4511 alloy.

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of seamless, drawn tubing.

1.2 Application

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

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 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

AS1990 Aluminum Alloy Tempers

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

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 B 660 Packaging/Packing of Aluminum and Magnesium Product

ASTM B 666/B 666M Identification Marking of Aluminum Products

2.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products

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

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 T4511, 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%.

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

3.3.2 Shall be in accordance with AMS2772, and as follows: Heat to 1013 °F ± 10 (545 °C ± 6), hold at heat for a time commensurate with section thickness, and cool rapidly.

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 2A and 2B for tubing having nominal wall thickness of 0.120 to 0.400 inch (3.00 to 10.00 mm) inclusive.

TABLE 2A - MINIMUM LONGITUDINAL TENSILE PROPERTIES, INCH/POUND UNITS

Nominal Wall Thickness Inch	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	40.0	21.0	20	—

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	275	145	20	—

3.4.2 Response to Precipitation Heat Treatment to T6511 Temper (See AS1990).

Tubing having nominal wall thickness of 0.120 to 0.400 inch (3.00 to 10.00 mm) inclusive shall have the properties specified in Table 3A and 3B after being precipitation heat treated in accordance with AMS2772 and the following: heat to 374 °F ± 10 (190 °C ± 6), hold at heat for a time of 7 to 9 hours, and air cool.

TABLE 3A - MINIMUM LONGITUDINAL TENSILE PROPERTIES, INCH/POUND UNITS

Nominal Wall Thickness Inch	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 3B – 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	415	385	7	—

3.5 Quality

Tubing, as received by 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.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of tubing shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. 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 (3.1), tensile properties as solution heat treated (3.4.1) and after precipitation heat treatment (3.4.2), quality (3.4), and tolerances (3.5) 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 vendor 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 and periodic test requirements when performed. This report shall include the purchase order number, inspection lot number(s), AMS4469, size, and quantity. The report shall also identify the producer, the product form, and the size of the mill product.

4.5 Resampling and Retesting

Shall be in accordance with AMS2355.

5. PREPARATION FOR DELIVERY

5.1 Identification

Shall be in accordance with ASTM B 666/B 666M.

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 B 660, 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 vendor shall mention this specification number in all quotations and when acknowledging purchase orders.