AEROSPACE MATERIAL SPECIFICATION

AMS4163™	REV. G

Issued 1968-05
Reaffirmed 2008-05
Revised 2022-10

Superseding AMS4163F

Aluminum Alloy, Extrusions
6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti (2219-T3511)
Solution Heat Treated, Stress-Relieved by Stretching, and Straightened
(Composition similar to A92219)

RATIONALE

AMS4163G results from a Five-Year Review and update of this specification with changes to update general agreement language related to unauthorized exceptions (3.3.3, 3.6, 8.5), applicable documents (Section 2), ultrasonic inspection (3.4.1), hardness (8.2), ordering information (8.6), and allow the use of the immediate prior specification revision (8.4).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of extruded bars, rods, wire, profiles, and tubing up to 2.999 inches (76.17 mm), inclusive, in thickness, nominal diameter or wall thickness with cross-sectional area 25 square inches (161 cm^2) and under (see 8.6).

1.2 Application

These extrusions have been used typically for structural parts requiring high strength up to 500 °F (260 °C) after proper precipitation heat treatment and which may require welding during fabrication, but usage is not limited to such applications.

1.2.1 Certain design and fabricating procedures may cause extrusions in the specified condition to become susceptible to stress-corrosion cracking; ARP823 recommends practices to minimize such conditions.

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.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
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SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS4163G/

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

ARP823 Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products

AS7766 Terms Used in Aerospace Metals Specifications

2.2 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)

2.3 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 B594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products

ASTM B660 Packaging/Packing of Aluminum and Magnesium Products

ASTM B666/B666M Identification Marking of Aluminum and Magnesium Products

ASTM E10 Brinell Hardness of Metallic Materials

ASTM G47 Determining Susceptibility to Stress Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products

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	--	0.20
Iron	--	0.30
Copper	5.8	6.8
Manganese	0.20	0.40
Magnesium	--	0.02
Zinc	--	0.10
Titanium	0.02	0.10
Vanadium	0.05	0.15
Zirconium	0.10	0.25
Other Elements, each	--	0.05
Other Elements, total	--	0.15

3.2 Condition

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%, to the -T3511 temper (refer to ANSI H35.1/H35.1M). Solution heat treatment shall be performed in accordance with AMS2772.

3.2.1 Extrusions may receive minor straightening, after stretching, of an amount necessary to meet the requirements of 3.5.

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

3.3 Properties

Extrusions, under 3.00 inches (76.2 mm) in thickness, nominal diameter or wall thickness for tubing, with cross-sectional area 25 square inches (161 cm^2) and under, shall conform to the following requirements, determined on the mill size in accordance with AMS2355:

3.3.1 As Solution Heat Treated and Stress Relieved by Stretching (-T3511 Temper)

3.3.1.1 Longitudinal Tensile Properties

Shall be as shown in Table 2.

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

Thickness, Nominal Diameter or Wall Thickness Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
Up to 0.499, incl	42.0	26.0	14
Over 0.499 to 2.999, incl	45.0	27.0	14

Table 2B - Minimum tensile properties, SI units

Thickness, Nominal Diameter or Wall Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
Up to 12.67, incl	290	179	14
Over 12.67 to 76.17, incl	310	186	14

3.3.2 Response to Temper Conversion (T82)

Product in the -T3511 temper, after precipitation heat treatment to the -T82 temper (refer to ANSI H35.1/H35.1M) in accordance with AMS2772, shall have the properties shown in Tables 3 and 4.

3.3.2.1 Tensile Properties

3.3.2.1.1 Longitudinal

Shall be as shown in Table 3.

Table 3 - Minimum longitudinal tensile properties

Property	Value
Tensile Strength	58.0 ksi (400 MPa)
Yield Strength at 0.2% Offset	42.0 ksi (290 MPa)
Elongation in 2 Inches (50.8 mm) or 4D	6%

3.3.2.1.2 Long-Transverse

Shall be as shown in Table 4.

Table 4 - Minimum long-transverse tensile properties

Property	Value
Tensile Strength	56.0 ksi (386 MPa)
Yield Strength at 0.2% Offset	39.0 ksi (269 MPa)
Elongation in 2 Inches (50.8 mm) or 4D	4%

3.3.2.1.2.1 Long-transverse tensile requirements apply only to extrusions from which a test specimen not less than 2.50 inches (63.5 mm) in length can be taken.

3.3.2.2 Stress-Corrosion Resistance (-T82)

Specimens, cut from extrusions 0.750 inch (19.05 mm) and over in thickness, nominal diameter or wall thickness, shall exhibit no evidence of stress-corrosion cracking when stressed in the short-transverse (perpendicular to grain flow) direction to 30.0 ksi (207 MPa) when tested in accordance with ASTM G47.

3.3.3 Mechanical property requirements for product outside of the range covered by 1.1 shall be agreed upon between purchaser and producer and reported per 4.4.1 (see 8.6).

3.4 Quality

Extrusions, 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 extrusions.

3.4.1 When specified, extrusions shall be subjected to ultrasonic inspection in accordance with ASTM B594. Extrusions 0.50 inch (12.7 mm) and over in thickness, nominal diameter or wall thickness, or a 10-to-1 width-to-thickness ratio, shall meet ultrasonic Class B.

3.5 Tolerances

Shall conform to all applicable requirements of ANSI H35.2 or ANSI H35.2M except that surface roughness tolerances shall be double those specified therein.

3.6 Exceptions

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