

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

AMS4163E results from a Limited Scope Ballot to correct an error in Table 4.

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of extruded bars, rods, wire, profiles, and tubing.

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.

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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
- ARP823 Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products
- AS1990 Aluminum Alloy Tempers

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 594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products for Aerospace Applications
- ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products
- ASTM B 666/B 666M Identification Marking of Aluminum and Magnesium Products
- ASTM G 47 Determining Susceptibility to Stress Corrosion Cracking of 2XXX and 7XXX Aluminum Alloys

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	--	0.20
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 (See AS1990). 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 nominal diameter or least distance between parallel sides with cross-sectional area 25 square inches (161 cm²) 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 Tensile Properties

Shall be as shown in Table 2.

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

Nominal Diameter or Distance Between Parallel Sides 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

Nominal Diameter or Distance Between Parallel Sides 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 Heat Treatment

Extrusions shall meet the following requirements after being precipitation heat treated to the T85112 temper in accordance with AMS2772.

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

Specimens, cut from extrusions 0.750 inch (19.05 mm) and over in nominal diameter or least 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 G 47.