AEROSPACE MATERIAL SPECIFICATION

AMS4162	REV. E

Issued 1968-05
Reaffirmed 2008-05
Revised 2014-09

Superseding AMS4162D

Aluminum Alloy, Extrusions
6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti (2219-T8511)
Solution Treated, Stress Relief Stretched, Straightened, and Precipitation Heat Treated
(Composition similar to A92219)

RATIONALE

AMS4162E revises Composition (3.1.1), Properties (3.3.1), and Reports (4.4.1), and is a Five Year Review and update of this specification.

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of extruded bars, rods, wire, profiles, and tubing under 3.00 inches (76.2 mm) in diameter, least thickness, or wall thickness and 25 in^2 (161 cm^2) or less in cross-sectional area (See 8.5).

1.2 Application

These extrusions have been used typically for structural parts requiring high strength up to 500 °F (260 °C), but usage is not limited to such applications. May be welded in the specified condition but properties are improved by reheat treatment after welding. Reheat treatment after welding, however, may reduce resistance to stress-corrosion cracking.

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 canceled 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 Alloys, 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**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS4162E

2.2 Aluminum Association Publications

Available from The Aluminum Association, 1525 Wilson Boulevard, Suite 600, Arlington, VA 22209, Tel: 703-358-2960, www.aluminum.org.

International Alloy Designations and Chemical Composition Limits for Wrought Aluminum and Wrought Aluminum Alloys ("Teal Sheets")

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 B 594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products

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

2.4 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, 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

3.1.1 In case there is a discrepancy in the values listed in Table 1 with those listed in the "International Alloy Designations and Chemical Composition Limits for Wrought Aluminum and Wrought Aluminum Alloys" (known as the "Teal Sheets"), the composition limits registered with the Aluminum Association and published in the "Teal Sheets" shall be the controlling composition.

3.2 Condition

Solution heat treated, stress-relieved by stretching to produce a nominal permanent set of 1.5%, but not less than 1% nor more than 3%, and precipitation heat treated to the T8511 temper (See AS1990). Heat treatments 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 shall conform to the following requirements, determined on the mill produced size in accordance with AMS2355:

3.3.1 Tensile Properties

Shall be as shown in Table 2 and Table 3 for extrusions under 3.00 inches (76.2 mm) in nominal diameter or least thickness (bars, rods, wire, profiles) or nominal wall thickness (tubing) and 25 square inches (161 cm^2) and under in cross-sectional area. Mechanical properties for product outside the range covered by 1.1 shall be agreed upon between purchaser and producer.

3.3.1.1 Longitudinal: Shall be as shown in Table 2.

TABLE 2 - 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%

3.3.1.2 Long-Transverse: Shall be as shown in Table 3.

TABLE 3 - 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%

3.3.1.2.1 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 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.

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 B 594. Extrusions 0.500 inch (12.70 mm) and over in nominal thickness, not exceeding 600 pounds (272 kg) per piece in weight, 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.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of extrusions 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 extrusions conform to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), longitudinal tensile properties (3.3.1.1), ultrasonic inspection when specified (3.4.1), and tolerances (3.5) are acceptance tests and, except for composition, shall be performed on each inspection lot.

4.2.2 Periodic Tests

Long-transverse tensile properties (3.3.1.2) and stress-corrosion resistance (3.3.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2355.

4.4 Reports

The vendor of extrusions shall furnish with each shipment a report stating that the extrusions conform to the chemical composition, ultrasonic inspection when specified, 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, AMS4162E, size or section identification number, and quantity. The report shall also identify the producer, the product form, and the size of the mill product.

4.4.1 When the product is outside the range covered by 1.1, the report shall contain a statement to that effect.

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.