AEROSPACE MATERIAL SPECIFICATION

AMS4305™	REV. A

Issued 2005-08
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Superseding AMS4305

Aluminum Alloy, Extruded Profiles (7449-T79511)
8.1Zn - 1.8Cu - 2.2Mg - 0.16Zr
Solution Heat Treated, Stress Relieved, and Overaged
(Composition similar to UNS A97449)

RATIONALE

AMS4305A results from a Five-Year Review and update of this specification with changes to prohibit unauthorized exceptions (3.4.3, 3.7, 4.4.1, 5.1.1, 8.5), relocate definitions (2.4), update form (1.1), applicable documents (Section 2, 3.2), intergranular attack (3.5.2, 8.2), and 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 profiles 0.500 to 1.750 inches thick (12.70 to 44.20 mm), inclusive, with a maximum cross-sectional area of 20 square inches (129 cm²) and a maximum circle size of 10 inches (254 mm).

1.2 Application

These extrusions have been used typically for machined parts requiring dimensional stability during machining processes and high strength and toughness in service, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS

The issue of the following document 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)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS4305A/

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

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 B557 Tension Testing of Wrought and Cast Aluminum- and Magnesium-Alloy Products

ASTM B594 Ultrasonic Inspection of Aluminum-Alloy Wrought Products

ASTM B645 Linear-Elastic Plane Strain Fracture Toughness Testing of Aluminum Alloys

ASTM B660 Packaging/Packing of Aluminum and Magnesium Products

ASTM B666/B666M Identification Marking of Aluminum and Magnesium Products

ASTM E9 Compression Testing of Metallic Materials at Room Temperature

ASTM E399 Linear-Elastic Plane-Strain Fracture Toughness of Metallic Materials

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

2.3 ANSI Accredited Publications

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

ANSI H35.1/H35.1M Alloy and Temper Designation Systems 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	--	0.12
Iron	--	0.15
Copper	1.4	2.1
Manganese	--	0.20
Magnesium	1.8	2.7
Zinc	7.5	8.7
Zirconium + Titanium	--	0.25
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.2 Condition

Solution heat treated, stress-relieved by stretching to produce a nominal permanent set of 1.5%, but not less than 1% or more than 3%, and over-aged to the T79511 temper (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 imperfections is permissible, provided such imperfections can be removed within the 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

Shall be in accordance with AMS2772 and as follows:

3.3.1 Solution Heat Treatment

Heat to 870 to 890 °F (466 to 477 °C), hold at heat for a time commensurate with section thickness but not less than 15 minutes, and quench in water.

3.3.2 Over-Aging Heat Treatment

It is recommended that extrusions be over-aged by heating to 250 °F ± 7 °F (121 °C ± 4 °C), holding at heat for 6 to 26 hours, then increase temperature to 302 °F ± 5 °F (150 °C ± 3 °C), holding for 15 to 19 hours, and air cool. Alternate treatment may be used, provided the aged materials meet the specified requirements of 3.4.

3.4 Properties

Extrusions shall conform to the following requirements, determined in accordance with AMS2355 on the mill product.

3.4.1 Longitudinal and long transverse tensile properties of extrusions, with a maximum cross-sectional area of 20 square inches (129 cm²) and a maximum circle size of 10 inches (254 mm), shall be as specified in Table 2.

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

Normal Thickness Inches	Specimen Orientation	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
0.500 to 1.750, incl	Longitudinal	91.0	87.0	9
	Long-Transverse	86.0	82.0	6

Table 2B - Minimum tensile properties, SI units

Normal Thickness Millimeters	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 5.65√A or 5D %
12.70 to 44.50, incl	Longitudinal	627	600	8
	Long-Transverse	593	565	5

3.4.2 Longitudinal compressive yield strength, when specified, shall be 90.0 ksi (620 MPa), minimum (see 8.6).

3.4.3 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).

3.4.4 Electrical Conductivity

Shall be not lower than 35.5% IACS (International Annealed Copper Standard) (20.0 MS/m), determined on the surface of the test coupon prior to turning.

3.4.5 Stress Corrosion Cracking

Specimens cut from extrusions 0.750 inch (19.05 mm) and over in nominal thickness, shall show no evidence of stress corrosion cracking when stressed in long transverse direction to 45 ksi (310 MPa) in accordance with ASTM G47, and exposed for 20 days.

3.4.6 Fracture Toughness

Plain strain fracture toughness (K_{IC}) for the L-T and T-L specimen orientations and configurations conforming to ASTM E399 and ASTM B645 shall be not lower than the values specified in Table 3 for products with a nominal thickness of 0.750 to 1.750 inch (19.05 to 44.50 mm).

Table 3 - Minimum fracture toughness properties

Normal Thickness Inches	Nominal Thickness Millimeters	Specimen Orientation	K_{IC} ksi √inch	K_{IC} MPa √m
0.750 to 1.750, incl	19.05 to 44.50, incl	L-T	23	25
		T-L	16	18

3.5 Quality

Product, 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.

3.5.1 When specified, each extruded profile shall be subjected to ultrasonic inspection in accordance with ASTM B594 and shall meet the following requirements:

3.5.1.1 Each extrusion having a maximum width-to-thickness ratio of 10:1 shall meet ultrasonic class B requirements, as described in ASTM B594.

3.5.1.2 The ultrasonic class for other extruded profiles in excess of 10:1 maximum width-to-thickness ratio shall be as agreed upon by cognizant engineering personnel.

3.5.2 Intergranular Attack (IGA)

No IGA is permitted on sections up to 0.750 inch (19.05 mm) thick. IGA, if found during visual inspection, shall be removed by suitable means (machining, sanding, chemical milling, etc.) as long as no minimum section dimensions are violated (see 8.2).

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 the extrusions shall supply all samples for producer'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 products conform to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.4.1), electrical conductivity (3.4.3), tolerances (3.6), and, when specified, ultrasonic soundness (3.5.1) are acceptance tests and, except for composition, shall be performed on each lot.

4.2.2 Periodic Tests

Compressive yield strength (3.4.2), stress corrosion resistance (3.4.4), and fracture toughness (3.4.5) are periodic tests and shall be performed at a frequency selected by the producer unless, frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2355.

4.4 Reports

The producer of extrusions shall furnish with each shipment a report stating that the product conforms to the composition, tolerances, and ultrasonic inspection (when required), and showing the numerical results of tests on each inspection lot to determine conformance to the other acceptance test requirements and to the periodic tests when performed. This report shall include the purchase order number, inspection lot number(s), AMS4305A, 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 or tables, or other exceptions are taken to the technical requirements listed in Section 3, the report shall contain a statement "This material is certified as AMS4305A(EXC) because of the following exceptions:" and the specific exceptions shall be listed (see 5.1.1).

4.5 Resampling and Retesting

Shall be in accordance with AMS2355.