AEROSPACE MATERIAL SPECIFICATION

AMS4159™	REV. G

Issued 1974-12
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Superseding AMS4159F

Aluminum Alloy, Extrusions, 7.7Zn - 2.4Mg - 1.6Cu - 0.16Cr (7049-T76511), Solution Heat Treated, Stress Relieved, Straightened, and Overaged (Composition similar to A97049)

RATIONALE

AMS4159G results from a Five-Year Review and update of this specification with changes to update standard language related to unauthorized exceptions (see 3.3.1, 4.4.1, and 8.4), relocate Definitions (see 2.4), and update Applicable Documents (see Section 2) and Ordering Information (see 8.5).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of extruded bars, rods, wire, profiles, and tubing with a nominal diameter or least thickness (wall thickness of tubing) up to 5.000 inches (127 mm), inclusive (see 8.5).

1.2 Application

These extrusions have been used typically for structural applications requiring a combination of high strength and good exfoliation-corrosion resistance and stress-corrosion resistance, 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 +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

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/AMS4159G/

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 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 G34	Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)
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	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)

2.4 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	--	0.25
Iron	--	0.35
Copper	1.2	1.9
Manganese	--	0.20
Magnesium	2.0	2.9
Chromium	0.10	0.22
Zinc	7.2	8.2
Titanium	--	0.10
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% nor more than 3%, and overaged to the T76511 temper (refer to ANSI H35.1/H35.1M). Solution and overaging 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 Mechanical property requirements for product outside of the range covered by 1.1 shall be agreed upon between the purchaser and producer and reported per 4.4.1 (see 8.5).

3.3.2 Tensile Properties

Shall be as shown in Table 2.

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

Nominal Diameter or Least Thickness (Wall Thickness of Tubing) Inches	Specimen Orientation	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D %
Up to 3.000, excl	Longitudinal	78.0	70.0	7
	Long-Trans.	76.0	68.0	5
3.00 to 5.000, incl	Longitudinal	76.0	68.0	7
	Long-Trans.	74.0	66.0	5

Table 2B - Minimum tensile properties, SI units

Nominal Diameter or Least Thickness (Wall Thickness of Tubing) Millimeters	Specimen Orientation	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
Up to 76.20, excl	Longitudinal	538	483	7
	Long-Trans.	524	469	5
76.20 to 127.00, incl	Longitudinal	524	469	7
	Long-Trans.	510	455	5

3.3.3 Conductivity

Shall be not lower than 38.0% IACS (International Annealed Copper Standard) (22.0 MS/m).

3.3.3.1 If conductivity is below 38.0% IACS (22.0 MS/m), the extrusions are not acceptable.

3.3.3.2 Extrusions found to be unacceptable may be given additional overaging heat treatment, and if, upon completion of such treatment, they develop conductivity/property relationships conforming to 3.3.1 and 3.3.2, they shall be acceptable.

3.3.4 Exfoliation-Corrosion Resistance

Specimens, cut from extrusions, shall not exhibit exfoliation corrosion, at any plane, greater than that illustrated in Photo B, Figure 2, of ASTM G34.

3.3.5 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 20.0 ksi (138 MPa) when tested in accordance with ASTM G47.

3.4 Quality

Extrusions, as received by the 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 (see 8.5), extrusions shall be subjected to ultrasonic inspection in accordance with ASTM B594. Extrusions 0.500 to 1.499 inches (12.70 to 38.07 mm), inclusive, in nominal thickness shall meet ultrasonic Class B. Extrusions 1.500 inches (38.10 mm) and over in nominal thickness shall meet ultrasonic Class A.

3.5 Tolerances

Shall conform to all applicable requirements of ANSI H35.2 or ANSI H35.2M.

3.6 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 extrusions shall supply all samples for the producer's tests and shall be responsible for the performance of all required tests. The 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 (see 3.1), tensile properties (see 3.3.2), conductivity (see 3.3.3), ultrasonic inspection when specified (see 3.4.1), and tolerances (see 3.5) are acceptance tests and, except for composition, shall be performed on each inspection lot.

4.2.2 Periodic Tests

Exfoliation-corrosion resistance (see 3.3.4) and stress-corrosion resistance (see 3.3.5) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by the purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2355 and the following:

4.3.1 For Tensile Properties and Electrical Conductivity

From extrusions having a nominal weight under 1 pound per linear foot (1.5 kg/m), one tension-conductivity sample shall be selected from each inspection lot weighing 1000 pounds (455 kg) or less; from lots weighing more than 1000 pounds (455 kg), one additional sample shall be taken from each 1000 pounds (455 kg) or fraction thereof in excess of the first 1000 pounds (455 kg). From extrusions having a nominal weight of 1 pound per linear foot (1.5 kg/m) or more, one tension-conductivity sample shall be taken from each inspection lot consisting of 1000 feet (305 m) or less; from inspection lots consisting of over 1000 feet (305 m), one additional sample shall be taken for each 1000 feet (305 m) or fraction thereof in excess of the first 1000 feet (305 m). Only one tension-conductivity sample shall be taken from any one piece when more than one piece is available.