SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4159D

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Superseding AMS 4159C

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)

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 applications requiring a combination of high strength, 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 canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2355 Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
AMS 2772 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: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or 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 34	Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)
ASTM G 47	Determining Susceptibility to Stress Corrosion Cracking of 2XXX and 7XXX Aluminum Alloys

2.3 ANSI Publications:

Available from ANSI, 25 West 43rd Street, New York, NY 10036 or 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 AMS 2355.

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 (see AS1990). Solution and overaging heat treatments shall be performed in accordance with AMS 2772.

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 product size in accordance with AMS 2355:

3.3.1 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
3.000 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

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

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

3.3.2.2 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.

3.3.3 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 G 34.

3.3.4 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 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 to 1.499 inches (12.70 to 38.07 mm), inclusive, in nominal thickness, not exceeding 600 pounds (272 kg) per piece, or a 10-to-1 width-to-thickness ratio shall meet ultrasonic Class B. Extrusions 1.500 inches (38.10 mm) and over in nominal thickness, not exceeding 600 pounds (272 kg) per piece, or a 10-to-1 width-to-thickness ratio shall meet ultrasonic Class A.

3.5 Tolerances:

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

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), tensile properties (3.3.1), conductivity (3.3.2), 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.