



400 Commonwealth Dr., Warrendale, PA 15096

**AEROSPACE
MATERIAL
SPECIFICATION**

Submitted for recognition as an American National Standard

AMS 4166C
Superseding AMS 4166B

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ALUMINUM ALLOY EXTRUSIONS
5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr (7075-T73)
Solution Heat Treated and Overaged

UNS A97075

1. SCOPE:

- 1.1 Form: This specification covers an aluminum alloy in the form of extruded bars, rods, wire, shapes, and tubing.
- 1.2 Application: Primarily for parts requiring high strength and resistance to stress-corrosion cracking.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

- AMS 2205 - Tolerances, Aluminum Alloy and Magnesium Alloy Extrusions
- MAM 2205 - Tolerances, Metric, Aluminum Alloy and Magnesium Alloy Extrusions
- AMS 2350 - Standards and Test Methods
- AMS 2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings
- MAM 2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings, Metric (SI) Units

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2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B594 - Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications

ASTM G47 - Determining Susceptibility to Stress-Corrosion Cracking of High-Strength Aluminum Alloy Products

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

2.3.2 Military Standards:

MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

MIL-STD-1537 - Electrical Conductivity Test for Measurement of Heat Treatment of Aluminum Alloys, Eddy Current Method

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, \emptyset determined in accordance with AMS 2355 or MAM 2355:

| | min | max |
|-------------------------|-----------|------|
| Zinc | 5.1 | 6.1 |
| Magnesium | 2.1 | 2.9 |
| Copper | 1.2 | 2.0 |
| Chromium | 0.18 | 0.28 |
| Iron | -- | 0.50 |
| Silicon | -- | 0.40 |
| Manganese | -- | 0.30 |
| Titanium | -- | 0.20 |
| Other Impurities, each | -- | 0.05 |
| Other Impurities, total | -- | 0.15 |
| Aluminum | remainder | |

3.2 Condition: Solution heat treated and overaged; heat treatments shall be performed in accordance with MIL-H-6088.

3.2.1 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 dimensional tolerances.

3.3 Properties: Extrusions shall conform to the following requirements, determined in accordance with AMS 2355 or MAM 2355:

3.3.1 Tensile Properties:

3.3.1.1 Longitudinal: Shall be as specified in Table I:

TABLE I

| Nominal Diameter or Least Thickness and Area (bars, rods, wire, and shapes) or Nominal Wall Thickness and Area (tubing) inches | Tensile Strength psi, min | Yield Strength at 0.2% Offset psi, min | Elongation in 2 in. or 4D %, min | |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------|----------------------------------------|----|
| | | | 2 in. | 4D |
| 0.062 to 0.249, incl Area up to 20 sq in., incl | 68,000 | 58,000 | 7 | |
| Over 0.249 to 1.499, incl Area up to 25 sq in., incl | 70,000 | 61,000 | 8 | |
| Over 1.499 to 2.999, incl Area up to 25 sq in., incl | 69,000 | 59,000 | 8 | |
| Over 2.999 to 4.499, incl Area up to 20 sq in., incl | 68,000 | 57,000 | 7 | |
| Area over 20 to 32 sq in., incl | 65,000 | 55,000 | 7 | |

TABLE I (SI)

| Nominal Diameter or Least Thickness and Area (bars, rods, wire, and shapes) or Nominal Wall Thickness and Area (tubing) Millimetres | Tensile Strength MPa, min | Yield Strength at 0.2% Offset MPa, min | Elongation %, min | |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------|----------------------|-------|
| | | | in 50 mm | in 5D |
| 1.60 to 6.30, incl Area up to 130 cm ² , incl | 470 | 400 | 7 | |
| Over 6.30 to 35.00, incl Area up to 160 cm ² , incl | 485 | 420 | 8 | 7 |
| Over 35.00 to 70.00, incl Area up to 160 cm ² , incl | 475 | 405 | 8 | 7 |
| Over 70.00 to 110.00, incl Area up to 130 cm ² , incl | 470 | 395 | 7 | 6 |
| Area over 130 to 200 cm ² , incl | 450 | 380 | 7 | 6 |

3.3.1.2 Long Transverse: Rectangular bars and shapes, tested in the long-transverse direction, shall meet the requirements of Table II.

TABLE II

| Nominal Diameter or Least Thickness and Area (bars, rods, wire, and shapes) or Nominal Wall Thickness and Area (tubing) Inches | Tensile Strength psi, min | Yield Strength at 0.2% Offset psi, min | Elongation in 2 in. or 4D %, min |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------|----------------------------------------|
| 0.062 to 0.249, incl | | | |
| Area up to 20 sq in., incl | 65,000 | 55,000 | 3 |
| Over 0.249 to 0.499, incl | | | |
| Area up to 20 sq in., incl | 67,000 | 58,000 | 4 |
| Over 0.499 to 0.749, incl | | | |
| Area up to 25 sq in., incl | 66,000 | 57,000 | 4 |
| Over 0.749 to 1.499, incl | | | |
| Area up to 25 sq in., incl | 66,000 | 56,000 | 4 |
| Over 1.499 to 2.999, incl | | | |
| Area up to 25 sq in., incl | 63,000 | 52,000 | 4 |
| Over 2.999 to 4.499, incl | | | |
| Area up to 20 sq in., incl | 60,000 | 48,000 | 3 |
| Area over 20 to 32 sq in., incl | 57,000 | 46,000 | 3 |

TABLE II (SI)

| Nominal Diameter or Least Thickness and Area (bars, rods, wire, and shapes) or Nominal Wall Thickness and Area (tubing) Millimetres | Tensile Strength MPa, min | Yield Strength at 0.2% Offset MPa, min | Elongation in 50 mm or 4D %, min |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------|----------------------------------------|
| 1.60 to 6.30, incl | | | |
| Area up to 130 cm ² , incl | 450 | 380 | 3 |
| Over 6.30 to 12.50, incl | | | |
| Area up to 130 cm ² , incl | 460 | 400 | 4 |
| Over 12.50 to 18.00, incl | | | |
| Area up to 160 cm ² , incl | 455 | 395 | 4 |
| Over 18.00 to 35.00, incl | | | |
| Area up to 160 cm ² , incl | 455 | 385 | 4 |
| Over 35.00 to 70.00, incl | | | |
| Area up to 160 cm ² , incl | 435 | 360 | 4 |
| Over 70.00 to 110.00, incl | | | |
| Area up to 13,000 sq mm, incl | 415 | 330 | 3 |
| Area over 130 to 200 cm ² , incl | 395 | 315 | 3 |

3.3.1.3 Short Transverse: Bars, rods, shapes, and tubing, tested in the short-transverse direction shall meet the requirements of Table III.

TABLE III

| Nominal Diameter or Least Thickness and Area (bars, rods, wire, and shapes) or Nominal Wall Thickness and Area (tubing) Inches | Tensile Strength psi, min | Yield Strength at 0.2% Offset psi, min | Elongation in 2 in. or 4D %, min |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------|----------------------------------------|
| 1.500 to 2.999, incl Area up to 25 sq in., incl | 60,000 | 48,000 | 2 |
| Over 2.999 to 4.499, incl Area up to 20 sq in., incl | 57,000 | 44,000 | 2 |
| Area over 20 to 32 sq in., incl | 54,000 | 41,000 | 2 |

TABLE III (SI)

| Nominal Diameter or Least Thickness and Area (bars, rods, wire, and shapes) or Nominal Wall Thickness and Area (tubing) Millimetres | Tensile Strength MPa, min | Yield Strength at 0.2% Offset MPa, min | Elongation in 50 mm or 4D %, min |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------|----------------------------------------|
| Over 35.00 to 70.00, incl Area up to 160 cm ² , incl | 415 | 330 | 2 |
| Over 70.00 to 110.00, incl Area up to 130 cm ² , incl | 395 | 305 | 2 |
| Area over 130 to 200 cm ² , incl | 370 | 285 | 2 |

3.3.1.4 Tensile property requirements for product exceeding the size limits of 3.3.1.1, 3.3.1.2, and 3.3.1.3 shall be as agreed upon by purchaser and vendor.

3.3.2 Hardness: Should be not lower than 125 HB/10/500 or 130 HB/10/1000 but \emptyset the extrusions shall not be rejected on the basis of hardness if the longitudinal tensile property requirements are met.

3.3.3 Conductivity: Shall be as follows, determined in accordance with MIL-STD-1537 on the sample used for tensile testing:

3.3.3.1 Electrical conductivity shall be not lower than 38.0% IACS (International Annealed Copper Standard) (22.0 MS/m).

3.3.3.1.1 If the conductivity is 40.0% IACS (23.2 MS/m) or higher and longitudinal tensile properties meet the requirements of 3.3.1.1, the extrusions are acceptable.

- 3.3.3.1.2 If the conductivity is 38.0 - 39.9% IACS (22.0 - 23.1 MS/m), incl, if the longitudinal tensile properties meet the specified requirements, and if the longitudinal yield strength does not exceed the specified minimum by more than 11,900 psi (82 MPa), the extrusions are acceptable.
- 3.3.3.1.3 If the conductivity is below 40.0% IACS (23.2 MS/m) and the longitudinal yield strength exceeds the specified minimum value by more than 11,900 psi (82 MPa), the extrusions shall be given additional aging. If, after such additional treatment, the extrusions meet the requirements of 3.3.1.1 and 3.3.3.1 the extrusions are acceptable.

3.3.4 Stress-Corrosion Resistance: Specimens cut from extrusions 0.750 in. (19 mm) and over in nominal thickness shall meet the requirements of ASTM G47 when stressed to 75% of the specified minimum longitudinal yield strength.

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.

3.5 Tolerances: Tolerances shall conform to all applicable requirements of AMS 2205 or MAM 2205.

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 performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the extrusions conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), longitudinal tensile properties (3.3.1.1), conductivity (3.3.3), and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for transverse tensile properties (3.3.1.2 and 3.3.1.3), hardness (3.3.2), and stress-corrosion resistance (3.3.4) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with AMS 2355 or MAM 2355.

4.4 Reports: