AEROSPACE MATERIAL SPECIFICATION

AMS4165	REV. H

Issued 1960-06
Revised 2003-08
Reaffirmed 2013-12

Superseding AMS4165G

Aluminum Alloy, Extrusions
4.4Cu - 1.5Mg - 0.60Mn (2024-T3511)
Solution Heat Treated, Stress-Relieved by Stretching, and Straightened
(Composition similar to UNS A92024)

RATIONALE

AMS4165H has been reaffirmed to comply with the SAE five-year review policy.

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 parts subject to excessive warpage during machining due to residual stresses and for parts requiring high strength and whose fabrication does not normally involve welding, but usage is not limited to such applications.

1.2.1 Certain processing procedures may cause these extrusions to become susceptible to stress-corrosion cracking; ARP823 recommends practices to minimize such conditions.

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 supplied 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, 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

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/AMS4165H

2.1 (Continued):

AMS 2772 Heat Treatment of Aluminum Alloy Raw Materials

ARP823 Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products

AS1990 Aluminum Alloy Tempers

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

2.3 ANSI Publications:

Available from ANSI, 25 West 43rd Street, New York, NY 10036 or www.ansi.org.

ANSI H 35.2 Dimensional Tolerances for Aluminum Mill Products

ANSI H 35.2M 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	--	0.50
Iron	--	0.50
Copper	3.8	4.9
Manganese	0.30	0.9
Magnesium	1.2	1.8
Chromium	--	0.10
Zinc	--	0.25
Titanium	--	0.15
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminium	remainder	

3.2 Condition:

Solution heat treated and stress-relieved by stretching to produce a nominal permanent set of 1.5%, but not less than 1% nor more than 3%, to the T3511 temper (See AS1990). Solution heat treatment 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 in accordance with AMS 2355 on the mill product:

3.3.1 Longitudinal Tensile Properties: Shall be as shown in Table 2 or Table 3, as applicable.

3.3.1.1 Bars, Rods, Wire, and Profiles:

TABLE 2A - Minimum Longitudinal Tensile Properties, Inch/Pound Units

Nominal Diameter or Thickness Inches	Nominal Cross-Sectional Area Square Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 inches or 4D %
Up to 0.249, incl	All	57.0	42.0	12
Over 0.249 to 0.749, incl	All	60.0	44.0	12
Over 0.749 to 1.499, incl	All	65.0	46.0	10
Over 1.499	Up to 25, incl	70.0	52.0	10
Over 1.499	Over 25 to 32, incl	68.0	48.0	8

TABLE 2B - Minimum Longitudinal Tensile Properties, SI Units

Nominal Diameter or Thickness Millimeters	Nominal Cross-Sectional Area Square Centimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
Up to 6.32, incl	All areas	393	290	12
Over 6.32 to 19.02, incl	All areas	414	303	12
Over 19.02 to 38.07, incl	All areas	448	317	10
Over 38.07	Up to 161, incl	483	359	10
Over 38.07	Over 161 to 206, incl	469	330	8

3.3.1.2 Round Tubing:

TABLE 3A - Minimum Longitudinal Tensile Properties, Inch/Pound Units

Nominal Wall Thickness Inches	Nominal Cross-Sectional Area Square Inches	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 inches or 4D %
Up to 0.249, incl	All	57.0	42.0	10
Over 0.249 to 0.749, incl	All	60.0	44.0	10
Over 0.749 to 1.499, incl	All	65.0	46.0	10
Over 1.499	Up to 25, incl	70.0	48.0	10
Over 1.499	Over 25 to 32, incl	68.0	46.0	8

TABLE 3B - Minimum Longitudinal Tensile Properties, SI Units

Nominal Wall Thickness Millimeters	Nominal Cross-Sectional Area Square Centimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D %
Up to 6.32, incl	All areas	393	290	10
Over 6.32 to 19.02, incl	All areas	414	303	10
Over 19.02 to 38.07, incl	All areas	448	317	10
Over 38.07	Up to 161, incl	483	331	10
Over 38.07	Over 161 to 206, incl	469	317	8

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, 0.50 inch (12.7 mm) and over in nominal diameter or least distance between parallel sides, not exceeding 600 pounds (272 kg) in weight per piece, 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.