



AEROSPACE MATERIAL SPECIFICATION	AMS4165™	REV. K
	Issued 1960-06 Reaffirmed 2013-12 Revised 2025-03 Superseding AMS4165J	
Aluminum Alloy, Extrusions, 4.4Cu - 1.5Mg - 0.60Mn (2024-T3511), Solution Heat Treated, Cold Worked, Stress-Relieved by Stretching, and Straightened (Composition similar to UNS A92024)		

RATIONALE

AMS4165K results from a Five-Year Review and update of this specification with changes to update wording to prohibit unauthorized exceptions (see 3.3.2, 3.4.1.1, and 8.5), relocate Definitions (see 2.4), remove obsolete weight criteria from Ultrasonic Inspection (see 3.4.1), and update Applicable Documents (see Section 2) and Hardness (see 8.2).

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of extruded bars, rods, wire, profiles, and tubing produced with cross-sectional area of 32 square inches (206 cm²), maximum (see 8.6).

1.1.1 Tubing shall be additionally classified as follows:

Type	Description
I	Tubing extruded from hollow billets using die and mandrel
II	Tubing extruded from solid billets using porthole or spider die or similar tooling

When no type is specified, Type I shall apply (see 8.6).

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.

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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

ARP823 Minimizing Stress-Corrosion Cracking in Wrought High-Strength Aluminum Alloy Products

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 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 E10 Brinell Hardness of Metallic Materials

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	--	0.50
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
Aluminum	remainder	

3.2 Condition

Solution heat treated, cold worked, 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 (refer to ANSI H35.1/H35.1M). Solution heat treatment 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 in accordance with AMS2355 on the mill product:

3.3.1 Longitudinal Tensile Properties

Shall be as shown in Tables 2 or 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

3.3.2 Mechanical property requirements for extrusions outside the cross-sectional area limit of 1.1 shall be as agreed upon by the purchaser and producer and reported per 4.4.1 (see 8.6).

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.