SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4035 REV. L

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Superseding AMS4035K

Aluminum Alloy, Sheet and Plate
4.4Cu - 1.5Mg - 0.60Mn (2024-0)
Annealed; or when specified, “As Fabricated” (2024-F)
(Composition similar to UNS A92024)

RATIONALE

AMS4035L adds -F temper to the specification (3.2.1), -T62/-T72 response to heat treatment requirements (3.3.2, Table 4), and ultrasonic inspection requirements for plate (3.4.1), and revises Acceptance (4.2.1) and Periodic (4.2.2) Tests. Its publication will facilitate the cancellation of AMS-QQ-A-250/5.

1. SCOPE

1.1 Form

This specification covers an aluminum alloy in the form of sheet and plate supplied in the annealed (O) condition. When specified, product shall be supplied in the “as fabricated” (F) temper.

1.2 Application

These products have been used typically for formed structural parts which will be subsequently heat treated, but usage is not limited to such applications.

1.2.1 Certain design and processing procedures may cause these products to become susceptible to stress-corrosion cracking after heat treatment; 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 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.

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/AMS4035L

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 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 Heat-Treatable Aluminum Alloy Products

AS1990 Aluminum Alloy Tempers

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 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 American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, 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 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

Annealed in accordance with AMS2772.

3.2.1 When specified, material may be provided in the “as fabricated” (F) temper. Requirements of 3.3.1 do not apply to the F temper.

3.3 Properties

The product shall conform to the following requirements, determined in accordance with AMS2355 on the mill produced size:

3.3.1 As Annealed (O Temper) (See AS1990)

3.3.1.1 Tensile Properties

Shall be as shown in Table 2.

TABLE 2A - TENSILE PROPERTIES, INCH/POUND UNITS

Nominal Thickness Inches	Tensile Strength ksi, max	Yield Strength at 0.2% Offset ksi, max	Elongation in 2 inches or 4D %, min
0.010 to 0.499, incl	32.0	14.0	12
Over 0.499 to 1.750, incl	32.0	--	12

TABLE 2B - TENSILE PROPERTIES, SI UNITS

Nominal Thickness Millimeters	Tensile Strength MPa, max	Yield Strength at 0.2% Offset MPa, max	Elongation in 50.8 mm or 4D %, min
0.25 to 12.67, incl	221	96	12
Over 12.67 to 44.45, incl	221	--	12

3.3.1.2 Bending

Product up to 0.499 inch (12.67 mm) shall withstand, without cracking, bending at room temperature through an angle of 180 degrees around a diameter equal to the bend factor shown in Table 3 times the nominal thickness of the product with axis of bend parallel to the direction of rolling. For thickness greater than 0.499 to 1.750 inches (12.67 to 44.45 mm), bend testing is not required unless specified by the customer and agreed to by the supplier. Bend parameters will be specified and agreed to at the time of order entry for these thicknesses.

TABLE 3 - BENDING PARAMETERS

Nominal Thickness Inches	Nominal Thickness Millimeters	Bend Factor
0.010 to 0.032, incl	0.25 to 0.81, incl	0
Over 0.032 to 0.063, incl	Over 0.81 to 1.60, incl	1
Over 0.063 to 0.128, incl	Over 1.60 to 3.25, incl	4
Over 0.128 to 0.499, incl	Over 3.25 to 12.67, incl	6

3.3.2 Response to Heat Treatment (-T42, -T62, -T72 Temper)

The product, as received by purchaser, shall have the following properties shown in Table 4 after solution and precipitation heat treatment to the -T42 temper (See AS1990) in accordance with AMS2772. Material in the -T42 condition shall have the following properties shown in Table 4 after proper aging to the -T62 and -T72 temper (See AS1990) in accordance with AMS2772,

3.3.2.1 Tensile Properties

Shall be as shown in Table 4.

TABLE 4A - MINIMUM TENSILE PROPERTIES, INCH/POUND UNITS

Temper	Nominal Thickness, Inches	Tensile Strength, ksi	Yield Strength at 0.2% Offset, ksi	Elongation in 2 inches or 4D, %
-T42	0.010 to 0.020, incl	62.0	38.0	12
	Over 0.020 to 0.249, incl	62.0	38.0	15
	Over 0.249 to 0.499, incl	62.0	38.0	12
	Over 0.499 to 1.000, incl	61.0	38.0	8
	Over 1.000 to 1.500, incl	60.0	38.0	7
	Over 1.500 to 1.750, incl	60.0	38.0	6
-T62	0.010 to 0.499, incl	64.0	50.0	5
	Over 0.499 to 1.750, incl	63.0	50.0	5
-T72	0.010 to 0.249, incl	60.0	46.0	5

TABLE 4B - MINIMUM TENSILE PROPERTIES, SI UNITS

Temper	Nominal Thickness, Millimeters	Tensile Strength, MPa	Yield Strength at 0.2% Offset, MPa	Elongation in 2 mm or 4D, %
-T42	0.25 to 0.51, incl	427	262	12
	Over 0.51 to 6.33, incl	427	262	15
	Over 6.33 to 12.68, incl	427	262	12
	Over 12.68 to 25.40, incl	421	262	8
	Over 25.40 to 38.10, incl	414	262	7
	Over 38.10 to 44.45, incl	414	262	6
-T62	0.25 to 12.68, incl	441	345	5
	Over 12.68 to 44.45, incl	434	345	5
-T72	0.25 to 6.33 incl	414	317	5

3.3.2.2 Bending (-T42 Temper Only)

Product up to 0.499 inch (12.67 mm) shall withstand, without cracking, bending at room temperature through an angle of 180 degrees around a diameter equal to the bend factor shown in Table 5 times the nominal thickness of the product with axis of bend parallel to the direction of rolling. For thickness greater than 0.499 to 1.750 inches (12.67 to 44.45 mm), bend testing is not required unless specified by the customer and agreed to by the supplier. Bend parameters will be specified and agreed to at the time of order entry for these thicknesses.

TABLE 5 - BENDING REQUIREMENTS

Nominal Thickness Inches	Nominal Thickness Millimeters	Bend Factor
0.010 to 0.020, incl	0.25 to 0.51, incl	4
Over 0.020 to 0.051, incl	Over 0.51 to 1.30, incl	5
Over 0.051 to 0.128, incl	Over 1.30 to 3.25, incl	6
Over 0.128 to 0.249, incl	Over 3.25 to 6.32, incl	8
Over 0.249 to 0.499, incl	Over 6.32 to 12.67, incl	10

3.4 Quality

The product, 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 product.

3.4.1 When specified, each plate 0.500 to 1.750 inches (12.70 to 44.45 mm) shall be ultrasonically inspected in accordance with ASTM B 594 and shall meet the requirements of 3.4.1.1 or 3.4.1.2.

3.4.1.1 Plates shall meet the requirement for ultrasonic class B for plate 0.500 to 1.499 inches (12.70 to 38.07 mm) in nominal thickness.

3.4.1.2 Plates shall meet the requirement for ultrasonic class A for plates 1.500 to 1.750 inches (38.10 to 44.45 mm) in nominal thickness.

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 the product 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 product conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Composition (3.1), tensile properties as annealed (3.3.1.1) (not applicable to -F temper), response to heat treatment to the -T42 temper (3.3.2), ultrasonic quality (3.4.1) (when specified), and tolerances (3.5) are acceptance tests and, except for composition, shall be performed on each inspection lot.

4.2.2 Periodic Tests

Bending as annealed (3.3.1.2), bending after response to heat treatment to the -T42 temper (3.3.2.2), and response to heat treatment to the -T62 and -T72 tempers (3.3.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing

Shall be in accordance with AMS2355.