



AEROSPACE MATERIAL SPECIFICATION

AMS4304™**REV. C**

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Superseding AMS4304B

Aluminum Alloy, Discontinuously Reinforced Sheet
2009/SiC/15w (T8P)
Solution Heat Treated, Stretched, and Precipitation Heat Treated

RATIONALE

AMS4304C has been declared "STABILIZED" by AMS Committee D Nonferrous Alloys Committee. This document will no longer be updated and may no longer represent standard industry practice. This document was stabilized because Committee D can find no producers for this document.

NOTE: Previously, this document was reaffirmed. The last technical update of this document occurred in September, 2009. Users of this document should refer to the cognizant engineering organization for disposition of any issues with reports/certifications to the specification, including exceptions listed on the certification. In many cases, the purchaser may represent a sub-tier supplier and not the cognizant engineering organization.

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1. SCOPE

1.1 Form

This specification covers discontinuously reinforced aluminum alloy (DRA) metal matrix composites (MMC) in the form of sheet.

1.2 Application

This sheet has been used typically for structural applications requiring high static strength, moderate fatigue strength, and high elastic modulus, 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 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 724-776-4970 (outside USA), www.sae.org.

AMS2355	Quality Assurance, Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
AMS2750	Pyrometry
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 646	Fracture Toughness Testing of Aluminum Alloys
ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM B 666/B 666M	Identification Marking of Aluminum and Magnesium Products
ASTM D 3553	Fiber Content by Digestion of Reinforced Metal Matrix Composites

2.3 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036, Tel: 212-642-4900, www.ansi.org.

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products

3. TECHNICAL REQUIREMENTS

3.1 Matrix Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2355.

TABLE 1 - COMPOSITION

Element	min	max
Silicon	--	0.25
Iron	--	0.05
Copper	3.2	4.4
Magnesium	1.0	1.6
Zinc	--	0.10
Oxygen (3.1.1)	--	0.60
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.1.1 Not required for routine acceptance.

3.2 Reinforcement Type and Volume Fraction

3.2.1 Reinforcement

Shall consist of silicon carbide whiskers (SiCw) having the following characteristics:

Crystal structure - Beta and alpha

Color - Gray-green

Width - One-half micrometer

Length - Up to 100 micrometers

3.2.2 Reinforcement Volume Fraction

The content of silicon carbide whiskers shall be $0.15\% \pm 0.02$, determined in accordance with ASTM D 3553.

3.3 Condition

Solution heat treated, stretched one-half to 1 percent, and precipitation heat treated to T8P condition (See AS1990). Pyrometry shall be in accordance with AMS2750.

3.4 Properties

Sheet shall conform to the following requirements, determined in accordance with AMS2355:

3.4.1 Tensile Properties

Shall be shown in Table 2 for sheet 0.060 to 0.130 inch (1.52 to 3.30 mm), inclusive, in thickness.

TABLE 2 - MINIMUM TENSILE PROPERTIES

Property	Specimen Orientation	Value
Tensile Strength	L	85.0 ksi (586 MPa)
	LT	71.0 ksi (490 MPa)
Yield Strength	L	64.0 ksi (441 MPa)
	LT	52.0 ksi (359 MPa)
Strain to Failure (One-inch gage)	L	3.3%
	LT	5.1%

3.4.2 Compressive Yield Strength

When specified, shall be not less than 58.0 ksi (400 MPa) in the longitudinal direction and not less than 55.0 ksi (379 MPa) in the transverse direction for sheet 0.060 to 0.130 inch (1.52 to 3.30 mm), inclusive, in thickness.

3.4.3 Fracture Toughness

When specified, the critical stress intensity factor (K_{IC}) shall be not less than 40 ksi $\sqrt{\text{inch}}$ (44 MPa $\sqrt{\text{m}}$) for sheet 0.070 to 0.090 inch (1.78 to 2.29 mm), inclusive, in thickness, determined in the L-T direction with 4 inch (102 mm) wide specimens in accordance with ASTM B 646.

3.5 Quality

Sheet, 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 sheet.

3.6 Tolerances

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

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The vendor of sheet 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 sheet conforms to specified requirements.

4.2 Classification of Tests

Composition (3.1), reinforcement type and volume fraction (3.2), longitudinal and long-transverse tensile properties (3.4.1), and when specified, compressive yield strength (3.4.2) and fracture toughness (3.4.3), and tolerances (3.6) are acceptance tests and shall be performed on each lot.

4.3 Sampling and Testing

With the following exceptions, shall be in accordance with AMS2355:

4.3.1 Longitudinal and long-transverse tensile properties shall be measured.