

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 4013C

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Superseding AMS 4013B

ALUMINUM SHEET, LAMINATED Surface Bonded

1. SCOPE:

1.1 Form: This specification covers aluminum and aluminum alloy foil in the form of laminated sheet.

1.2 Application: Primarily for shims in which thickness is to be adjusted by removal of laminations as required.

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 2350 - Standards and Test Methods

AMS 4016 - Aluminum Alloy Sheet and Plate, 2.51lg - 0.25Cr (5052-H32)

AMS 4017 - Aluminum Alloy Sheet and Plate, 2.51lg - 0.25Cr (5052-H34)

AMS 4041 - Aluminum Alloy Sheet and Plate, Alclad, 4.4Cu - 1.51lg - 0.50Mn
(Alclad 2024 and 1-1/2% Alclad 2024, -T3 Flat Sheet; 1-1/2%
Alclad 2024-T351 Plate)

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

2.2.1 Military Standards:

MIL-STD-549 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

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3. TECHNICAL REQUIREMENTS:

3.1 Composition:

3.1.1 Laminations: Shall be 1100, 1145, 3003, or 5052 aluminum alloy foil. The choice of alloy shall be at the discretion of the producer except when a particular aluminum alloy is specified by purchaser.

3.1.2 Solid Base: Shall be AMS 4041 aluminum alloy sheet except that when laminations are of 5052 aluminum alloy foil, the base shall be AMS 4016 or AMS 4017 aluminum alloy sheet.

3.1.3 Adhesive: Shall be a composition which will meet the fabrication and quality requirements of this specification.

3.1.4 Fabrication:

3.1.4.1 Laminated shim stock shall be fabricated from hard or extra hard laminations, in combination with a solid base when required. Laminations shall be 0.003 in. + 0.0003 (0.075 mm + 0.008) thick unless thickness of 0.002 in. + 0.0002 (0.050 mm + 0.005) is specified. Laminations shall be bonded together throughout the whole surface area by an adhesive which will permit peeling of the layers for adjustment of shim thickness. The thickness of each layer of adhesive shall not exceed 0.0003 in. (0.008 mm).

3.1.4.2 Shim stock shall be of the following thicknesses and combinations of laminations and solid base:

<u>Nominal Thickness of Shim Stock</u>		All Laminated	Half Solid Half Laminated	Three Quarters Solid One Quarter Laminated
<u>Inch</u>	<u>Millimetres</u>			
0.006	0.150	X		
0.008	0.200	X		
0.010	0.250	X		
0.016	0.400	X		
0.020	0.500	X		
0.032	0.800	X		
0.047	1.175	X		
0.062	1.550	X	X	
0.094	2.350	X	X	
0.125	3.125	X	X	X
0.190	4.750	X	X	X

3.2 Properties: Laminations shall be bonded together in such a manner that any shape can be cut from the shim stock without causing the laminations in the shape to separate. Normal handling shall not cause separation of laminations.

3.3 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.

3.4 Tolerances: Shall be as specified in Table I.

TABLE I

Nominal Total Thickness Inch	Tolerance, Inch	
	Plus	Minus
Up to 0.008, incl	0.001	0.0005
Over 0.008 to 0.010, incl	0.0015	0.0005
Over 0.010 to 0.015, incl	0.0015	0.001
Over 0.015 to 0.021, incl	0.002	0.001
Over 0.021 to 0.033, incl	0.003	0.002
Over 0.033 to 0.048, incl	0.005	0.002
Over 0.048 to 0.063, incl	0.006	0.002
Over 0.063 to 0.080, incl	0.007	0.002
Over 0.080 to 0.094, incl	0.009	0.003
Over 0.094 to 0.109, incl	0.010	0.003
Over 0.109 to 0.125, incl	0.012	0.003
Over 0.125 to 0.156, incl	0.015	0.003
Over 0.156 to 0.187, incl	0.018	0.003
Over 0.187 to 0.190, incl	0.018	0.005

TABLE I (SI)

Nominal Total Thickness millimetres	Tolerance, Millimetre	
	Plus	Minus
Up to 0.20, incl	0.02	0.012
Over 0.20 to 0.25, incl	0.038	0.012
Over 0.25 to 0.40, incl	0.038	0.02
Over 0.40 to 0.52, incl	0.05	0.02
Over 0.52 to 0.82, incl	0.08	0.05
Over 0.82 to 1.20, incl	0.12	0.05
Over 1.20 to 1.58, incl	0.15	0.05
Over 1.58 to 2.00, incl	0.17	0.05
Over 2.00 to 2.35, incl	0.22	0.08
Over 2.35 to 2.72, incl	0.25	0.03
Over 2.72 to 3.12, incl	0.30	0.08
Over 3.12 to 3.90, incl	0.38	0.08
Over 3.90 to 4.68, incl	0.45	0.08
Over 4.68 to 4.75, incl	0.45	0.12

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 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 product conforms to the requirements of this specification.
- 4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and shall be performed on each lot.
- 4.3 Sampling: Sufficient sheet shall be selected at random from each lot to perform all required tests. The number of determinations for each requirement shall be not less than two.
- 4.4 Reports:
- 4.4.1 The vendor of the sheet shall furnish with each shipment a report showing the results of tests for chemical composition or stating that the chemical composition of the shim stock conforms to the requirements specified. This report shall include the purchase order number, AMS 4013C, shim stock thickness, foil thickness and alloy, size, and quantity.
- 4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 4013C, contractor or other direct supplier of sheet, part number, and quantity. When sheet for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of sheet to determine conformance to the requirements of this specification and shall include in the report either a statement that the sheet conforms or copies of laboratory reports showing the results of tests to determine conformance.
- 4.5 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the sheet may be based on the results of testing two additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the sheet represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

- 5.1 Identification: Laminated shim stock shall be marked with not less than the nominal thickness, thickness of each lamination, percentage of total thickness which is laminated, and AMS 4013C.
- 5.2 Packaging: