



AEROSPACE MATERIAL

Society of Automotive Engineers, Inc.

400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

SPECIFICATION

AMS 4012D

Superseding AMS 4012C

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ALUMINUM SHEET, LAMINATED Edge Bonded

1. SCOPE:

- 1.1 Form: This specification covers an aluminum or aluminum alloy in the form of sheet, laminated and edge bonded.
- 1.2 Application: Primarily for shims of special shapes 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 (AMS) shall apply.² The applicable issue of other documents shall be as specified in AMS 2350.
- 2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.
- 2.1.1 Aerospace Material Specifications:
- AMS 2350 - Standards and Test Methods
 - AMS 2355 - Quality Assurance Sampling and Testing of Aluminum-Base and Magnesium-Base Alloys, Wrought Products (Except Forgings and Forging Stock) and Flash Welded Rings
 - AMS 4041 - Aluminum Alloy Sheet and Plate, Alclad, 4.4Cu - 1.5Mg - 0.60Mn (Alclad 2024 and 1-1/2% Alclad 2024-T3 Flat Sheet; 1-1/2% Alclad 2024-T351 Plate)
- 2.2 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.
- 2.2.1 Military Standards:
- MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

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, unless otherwise specified.
- 3.1.2 Solid Base: Shall be AMS 4041 aluminum alloy sheet.
- 3.1.3 Adhesive: Shall be a composition which will meet the fabrication and quality requirements of 3.2 and 3.3.

3.2 Fabrication:

- 3.2.1 Sheet shall be fabricated from hard or extra-hard laminations, in combination with a solid base
Ø when required, pre-cut to the desired shape, stacked to the desired thickness, and bonded on the outside edge with adhesive such that individual laminations may be peeled for adjustment of shim thickness.

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- 3.2.1.1 Laminations shall be bonded together in such a manner that normal handling shall not cause separation.
- 3.2.2 Laminations shall be 0.003 in. $\pm$ 0.0003 (0.08 mm $\pm$ 0.008) thick unless 0.002 in. $\pm$ 0.0002 (0.05 mm $\pm$ 0.005) laminations are specified or required to produce the nominal laminate thickness.
- 3.2.3 Sizes: Unless otherwise specified, the product shall be of the following thicknesses and combinations of laminations and solid base:

Nominal Thickness of Shim Stock		All Laminated	Half Solid, Half Laminated	Three-Quarters Solid, One-Quarter Laminated
Inch	(mm)			
0.006	(0.15)	X		
0.008	(0.20)	X		
0.010	(0.25)	X		
0.016	(0.41)	X		
0.020	(0.51)	X		
0.032	(0.81)	X		
0.047	(1.19)	X		
0.062	(1.57)	X	X	
0.094	(2.39)	X	X	
0.125	(3.18)	X	X	X
0.190	(4.83)	X	X	X

3.3 Quality: Sheet, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the sheet.

3.4 Tolerances: Unless otherwise specified, 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 0.016, incl	0.0015	0.001
Over 0.016 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	0.03	0.013
Over 0.20 to 0.25, incl	0.038	0.013
Over 0.25 to 0.41, incl	0.038	0.03
Over 0.41 to 0.53, incl	0.05	0.03
Over 0.53 to 0.84, incl	0.08	0.05
Over 0.84 to 1.22, incl	0.13	0.05
Over 1.22 to 1.60, incl	0.15	0.05
Over 1.60 to 2.03, incl	0.18	0.05
Over 2.03 to 2.39, incl	0.23	0.08
Over 2.39 to 2.77, incl	0.25	0.08
Over 2.77 to 3.18, incl	0.30	0.08
Over 3.18 to 3.96, incl	0.38	0.08
Over 3.96 to 4.75, incl	0.46	0.08
Over 4.75 to 4.83, incl	0.46	0.13

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of sheet shall supply all samples and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by

Ø 4.4. Purchaser reserves the right to perform such confirmatory testing as he deems necessary to ensure that the sheet 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.

Ø 4.3 Sampling: Shall be in accordance with AMS 2355.

4.4 Reports:

4.4.1 The vendor of sheet shall furnish with each shipment three copies of a report stating that the sheet conforms to the chemical composition and other technical requirements of this specification. This report shall include the purchase order number, material specification number and its revision letter, shim stock thickness, foil thickness, percentage of total thickness which is laminated, size, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number and its revision letter, 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 a statement that the sheet conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

Ø 4.5 Resampling and Retesting: Shall be in accordance with AMS 2355.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Each sheet shall be marked near one end with AMS 4012D, manufacturer's identification, Ø nominal thickness, thickness of each lamination, and percentage of total thickness which is laminated.

5.2 Packaging: