

Shim Stock, Laminated

RATIONALE

AMS-DTL-22499 has been reaffirmed to comply with the SAE five-year review policy.

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1. SCOPE:

1.1 Scope:

This specification covers the requirements for surface bonded laminated shim stock.

1.2 Classification:

Shim stock shall be of the following compositions, types, and classes, as specified in the contract or purchase order (see 6.2):

Compositions:

Composition 1 - Aluminum alloy.

Composition 2 - Brass.

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## 1.2 (Continued):

Composition 3 - Corrosion resisting steel.  
Composition 4 - Carbon steel.  
Composition 5 - Titanium alloy.  
Composition 6 - Polyimide plastic.

## Types:

Type I All laminations.  
Type II One-half solid stock.

## Classes:

Class 1 .002 inch laminations.  
Class 2 .003 inch laminations.

## 2. APPLICABLE DOCUMENTS:

The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

## 2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS QQ-A-250/1	Aluminum 1100, Plate and Sheet.
AMS QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet
AMS QQ-A-250/8	Aluminum Alloy, 5052, Plate and Sheet
AMS 5513	Steel, Corrosion Resistant, Sheet, Strip and Plate
AMS 5516	Steel, Corrosion Resistant, Sheet, Strip and Plate
AMS 5903	Steel Sheet, Strip, and Plate, Corrosion Resistant
AMS 5904	Steel Sheet and Strip, Corrosion Resistant
AMS 5905	Steel Sheet and Strip, Corrosion Resistant
AMS 5906	Steel Sheet and Strip, Corrosion Resistant
AMS 5910	Steel Sheet, Strip, and Plate, Corrosion Resistant
AMS 5911	Steel Sheet and Strip, Corrosion Resistant
AMS 5912	Steel Sheet and Strip, Corrosion Resistant
AMS 5913	Steel Sheet and Strip, Corrosion Resistant

## 2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 36 Brass Plate, Sheet, Strip and Rolled Bar  
ASTM B 121 Leaded Brass Plate, Sheet, Strip and Rolled Bar  
ASTM B 601 Temper Designations for Copper and Copper Alloys - Wrought and Cast  
ASTM D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds

## 2.3 ANSI Publications:

Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI/ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes.

## 2.4 U.S. Government Publications:

Available from DODSSP Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

QQ-S-698 Steel, Sheet and Strip, Low Carbon

MIL-I-24768/13 Insulation, Plastic, Laminated, Thermosetting, Cotton-Fabric-Base. Phenolic-Resin (FBE)

MIL-I-24768/15 Insulation, Plastic, Laminated, Thermosetting, Cotton-Fabric-Base. Phenolic-Resin (FBI)

MIL-P-46112 Plastic Sheet and Strip, Polyimide.

MIL-T-9046 Titanium Alloy, Sheet, Strip, and Plate

MIL-DTL-22499/1 Shim Stock, Laminated, Aluminum Alloy

MIL-DTL-22499/2 Shim Stock, Laminated, Brass

MIL-DTL-22499/3 Shim Stock, Laminated, CRES

MIL-DTL-22499/4 Shim Stock, Laminated, Carbon Steel

## 3. REQUIREMENTS:

### 3.1 First article:

When specified in the contract or purchase order, preproduction samples of shim stock of the composition, type, class, nominal size and lateral dimensions specified (see 1.2 and 3.2) shall be subjected to first article inspection (see 4.3 and 6.3).

3.1.1 Specification sheets: The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheets, the latter shall govern.

### 3.2 Materials:

#### 3.2.1 Laminations and solid stock:

- 3.2.1.1 Composition 1: The laminations shall be manufactured from aluminum 1100, conforming to AMS-QQ-A-250/1 (processed to temper H19, with a minimum tensile strength of 24.0 ksi) or from aluminum alloy 5052, conforming to AMS QQ-A-250/8 (processed to temper H19 or H39, with a minimum tensile strength of 42.0 ksi).
- 3.2.1.1.1 Solid stock: The solid stock shall be manufactured from aluminum alloys conforming to AMS QQ-A-250/5 (alclad 2024) tempers T3, T4, T81 or T861 for use with AMS QQ-A-250/1 laminates; AMS QQ-A-250/8 (5052) tempers H32 or H34 for use with AMS QQ-A-250/8 laminates.
- 3.2.1.2 Composition 2: The laminations and solid stock shall be manufactured from brass conforming to UNS 26000 of ASTM B 36 or UNS C33500 of ASTM B 121, H01 temper or harder (ASTM B 601).
- 3.2.1.3 Composition 3: Unless otherwise specified, the laminations and solid stock shall be manufactured from corrosion resisting steel conforming to AMS 5516, AMS 5903, AMS 5904, AMS 5905, or AMS 5906, Type 302, annealed condition or harder.
- 3.2.1.3.1 Type 304: If Type 302 material cannot be procured to meet all of the requirements of this specification, then Type 304 material may be submitted for Type 302 material, conforming to AMS 5513, AMS 5910, AMS 5911, AMS 5912, or AMS 5913, annealed condition or harder.
- 3.2.1.4 Composition 4: The laminations shall be manufactured from carbon steel conforming to QQ-S-698, temper annealed or harder.
- 3.2.1.5 Composition 5: The lamination shall be manufactured from titanium alloy conforming to MIL-T-9046 (CP-1 annealed condition or harder).
- 3.2.1.5.1 Solid stock: The solid stock shall be manufactured from titanium alloy sheet conforming to MIL-T-9046 (AB-1 annealed condition).
- 3.2.1.6 Composition 6: The lamination shall be manufactured from the polyimide film conforming to MIL-P-46112 (Type "H" condition).
- 3.2.1.6.1 The solid stock shall be manufactured from phenolic resin cotton fabric base conforming to MIL-I-24768/13 or MIL-I-24768/15 (Type FBE or FBI condition).
- 3.2.2 Peel strength: Each individual shim lamination for composition 1 through 5 shall have a peel strength no less than 1 pound per linear inch and no more than 5 pounds per linear inch, except at the solid/laminate bond line which may be higher. For composition 6, each individual shim lamination shall have a peel strength no less than 1/2 pound per linear inch and no more than 2 1/2 pounds per linear inch, except at the solid/laminate bond line which may be higher.

### 3.3 Construction and dimensions:

The shim stock shall be fabricated from the materials specified herein. The applicable type, class and nominal size of the shim stock shall be as specified in Table I, the applicable specification sheet, or as otherwise required. The lateral dimensions shall be as specified in the contract or purchase order for compositions 5 and 6 (See 6.2 and 6). Unless otherwise specified, for compositions 1, 2, 3 and 4 the lateral dimensions shall be as specified in the applicable specification sheet, or as otherwise required. The tolerance of the specification width and length shall be 1/8 inch.

3.3.1 Construction details: The laminations and solid stock shall be bonded together throughout the whole surface area in a manner which will permit peeling of the laminations for adjustment of the shim thickness without separation of the remaining laminations and solid parts. The shim stock shall be capable of being cut, using suitable tools, without separation and shall remain intact with normal handling.

3.3.2 Tolerance on nominal size: The tolerance on nominal size shall be in accordance with Table II.

3.3.3 Tolerance on lamination thickness: The thickness of Class 1 and 2 laminations (see 1.2) shall be within  $\pm 0.0002$  inch and  $\pm 0.0003$  inch, respectively, of the values specified.

3.3.4 Thickness of bond: The thickness of the bond shall not exceed .0003 inch.

### 3.4 Water immersion:

The shim stock shall be capable of withstanding total immersion in water at a temperature of  $120^{\circ}\text{F} \pm 5^{\circ}\text{F}$  for a period of 3 hours without separation of laminations.

### 3.5 Workmanship:

The shim stock shall be uniform in quality, clean, and free of defects detrimental to functional performance of the material.

## 4. VERIFICATION:

### 4.1 Classification of inspections:

The inspection of the shim stock shall be classified as:

- a. First article inspections (see 4.2).
- b. Quality conformance inspections (see 4.4).

### 4.2 First article inspection:

The first article inspection shall consist of the inspection specified in 4.4 and the additional tests in 4.3. The contractor shall be responsible for the performance of the first article inspection (see 6.3).

- 4.2.1 First article sample: As soon as possible after the award of the contract and prior to production, the contractor shall submit the first article sample. Unless otherwise specified in the contract or purchase order, the first article sample shall consist of two 1 inch by 12 inch strips of shim stock (see 6.3).
- 4.3 First article testing:
- 4.3.1 Separation of laminations: Representative strips of the sample shim stock specified in 4.2.1 shall be allowed to stand for a minimum period of 8 hours following manufacture or until complete cure, whichever comes first, before being tested for peel strength. The laminations shall peel without separation of the remaining portion.
- 4.3.1.1 Laminations and bond thickness: In the process of performing the test specified in 3.1, the shim stock shall be dimensionally examined to determine compliance with the requirements of 3.3.3 and 3.3.4.
- 4.3.2 Peel strength: Peel strength shall be tested in accordance with ASTM D 903 (see 3.2.3). The number of peels per sample shall be in accordance with Table III.
- 4.3.3 Water immersion: Representative strips of the sample shim stock specified in 4.3.1 shall be immersed in water at  $120^{\circ}\text{F} \pm 5^{\circ}\text{F}$  for a period of 3 hours. At the end of the test period, the shim stock shall be examined to determine compliance with the requirements of 3.4.
- 4.4 Quality conformance inspection:
- 4.4.1 Lot: A lot shall consist of all of the shim stock of the same composition, type, class, nominal size and lateral dimensions, manufactured under essentially the same conditions, and submitted for acceptance at the same time.
- 4.4.2 Samples: Statistical sampling and inspection shall be in accordance with the general requirements of ANSI/ASQC Z1.4. Lot acceptance criteria shall be based on a single sampling plan with a zero acceptance number.
- 4.4.3 Examination: The sample shim stock, selected in accordance with 4.4.2, shall be visually and dimensionally examined to determine compliance with the requirements of this specification.
- 4.4.4 Inspection of material: The material used in the manufacture of the laminated shim stock furnished under this inspection shall have been inspected and accepted in accordance with the respective specifications specified herein. The contractor shall furnish certification that the above requirements have been met.

## 5. PACKAGING:

### 5.1 Packaging:

For acquisition purposes, the packaging requirements shall be as specified in the contract or purchase order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES:

### 6.1 Intended use:

The surface laminated shim stock covered by this specification is intended for use in the manufacturing of laminated shims. Note: Edge bonded shims shall comply to composition, type and class only - surface laminated construction does not apply.

### 6.2 Acquisition Requirements:

Acquisition documents should specify the following:

- a. Title, number and date of this specification and specification sheet as applicable.
- b. Composition/specification of laminate, temper or condition of material and either: type, class and nominal size (see 1.2, 3.2.1, and 3.3); or part number selected from the applicable specification sheet.
- c. Dimensions of shim stock (see 3.3).
- d. Quantity.
- e. Packaging requirements (see 5.1).
- f. Whether first article is required (see 3.1 and 6.3).
- g. Sampling plan (see 4.4.1 and 4.4.2).

### 6.3 First article:

When a first article inspection is required, the items should be a first article sample. The first article should consist of two 1 inch by 12 inch strips of shim stock or as otherwise specified in the contract or purchase order. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

## 6.4 Lateral dimensions available:

Some of the typical lateral dimensions of shim stock available from commercial stocks are shown in Table IV.

## 6.5 Subject term (Keyword) Listing:

Shim  
Shim Stock  
Laminated

TABLE I  
Construction and Dimensions

Nominal Thickness	Class 1(.002)		Class 2 (.003)	
	Type I	Type II	Type I	Type II
Inch	Applicable Compositions	Applicable Compositions	Applicable Compositions	Applicable Compositions
.006	1,2,3,4		1,2,3,4	
.008	1,2,3,4,6			
.010	1,2,3,4,6			
.012	1,2,3,4,6		1,2,3,4,6	
.015	1,2,3,4,5,6		1,2,3,4,5,6	
.016	1,2,3,4,5,6		1,2,3,4,5,6	
.020	1,2,3,4,5,6		1,2,3,4,5,6	
.021	1,2,3,4,5,6		1,2,3,4,5,6	
.032	1,2,3,4,5,6		1,2,3,4,5,6	
.033	1,2,3,4,5,6		1,2,3,4,5,6	
.048	1,2,3,4,5,6		1,2,3,4,5,6	
.062	1,2,3,4,5,6	1,2	1,2,3,4,5,6	1,2
.063	1,2,3,4,5,6	1,2	1,2,3,4,5,6	1,2
.078	1,2,3,4,5,6	3	1,2,3,4,5,6	
.080	1,2,3,4,5,6	3	1,2,3,4,5,6	
.093	1,2,3,4,5,6	1,2	1,2,3,4,5,6	1,2
.094	1,2,3,4,5,6	1,2	1,2,3,4,5,6	1,2
.109	5,6		5,6	1
.121	5,6	1	5,6	1
.125	1,2,3,4,5,6	1,2,3,4	1,2,3,4,5,6	1,2,3,4
.156	1,2,3,4		1,2,3,4	
.186	1,2,3,4	1,2	1,2,3,4	1,2
.187	1,2,3,4	1,2	1,2,3,4	1,2
.190	1,2,3,4	1,2	1,2,3,4	1
.250	1,2,3,4		1,2,3,4	
.251	1,2,3,4		1,2,3,4	
.375	1,2,3,4		1,2,3,4	
.376	1,2,3,4		1,2,3,4	