

Steel, Carbon, Laminated Sheet, Surface Bonded

1. SCOPE:

1.1 Form:

This specification covers steel in the form of laminated sheet.

1.2 Application:

This material has been used typically for shims in which thickness is adjusted by removal of laminations as required, but usage is not limited to such applications.

1.3 Classification:

Materials are classified as follows:

1.3.1 Type:

- Type I - All laminations
- Type II - One half laminations
- Type III - Three quarters laminations

1.3.2 Class:

- Class 1 - 0.002 inch (0.05 mm) thick laminations
- Class 2 - 0.003 inch (0.075 mm) thick laminations

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.

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2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 5040	Steel, Sheet and Strip, 0.15 Carbon Maximum, Deep Forming Grade
AMS 5042	Steel, Sheet and Strip, 0.15 Carbon Maximum, Deep Forming Grade
AMS 5044	Steel, Sheet and Strip, 0.15 Carbon Maximum, Half Hard Temper
AMS 5047	Steel, Sheet and Strip, 0.08-0.13C, Aluminum Killed, Deep Forming Grade

2.2 American Society for Quality Publications:

Available from ASQ, 600 North Plankinton Avenue, Milwaukee, WI 53203 or www.asq.org

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

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

3.1.1 Laminations: Shall conform to AMS 5040, AMS 5042, AMS 5044 or AMS 5047.

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

3.2 Fabrication:

The laminated shim stock shall consist completely of laminations each 0.002 ± 0.0002 inch (0.05 ± 0.005 mm) thick or 0.003 ± 0.0003 inch (0.08 ± 0.008 mm) thick, or partly of such laminations combined with a single thicker lamination, as ordered, bonded together by an adhesive such that individual laminations may be peeled for adjustment of shim thickness. The thickness of each layer of adhesive shall not exceed 0.0003 inch (0.008 mm).

3.2.1 Sheet shall be of the thicknesses and combinations of laminations and solid base shown in Table 1.

TABLE 1 - Thickness Combinations of Shim Stock

Inch	mm	Type I Class 1 All Laminated, 0.002 in. (0.05 mm) Laminations	Type I Class 2 All Laminated, 0.003 in. (0.08 mm) Laminations	Type II Class 1 Half Solid, Half Laminated, 0.002 in. (0.05 mm) Laminations	Type II Class 2 Half Solid, Half Laminated, 0.003 in. (0.08 mm) Laminations	Type III Class 1 Three Quarters Solid, One Quarter Laminated, 0.002 in. (0.05 mm) Laminations	Type III Class 1 Three Quarters Solid, One Quarter Laminated, 0.003 in. (0.08 mm) Laminations
0.006	0.15	X					
0.008	0.20	X					
0.010	0.25	X					
0.012	0.31	X					
0.015	0.38	X	X				
0.016	0.41	X	X				
0.020	0.51	X	X				
0.021	0.53	X	X				
0.032	0.81	X	X				
0.033	0.84	X	X				
0.047	1.19	X	X				
0.048	1.22	X	X				
0.062	1.58	X	X	X	X		
0.063	1.60	X	X	X	X		
0.078	1.98	X	X	X	X		
0.080	2.03	X	X	X	X		
0.093	2.37	X	X	X	X		
0.094	2.39	X	X	X	X		
0.109	2.77	X	X	X	X		
0.121	3.07	X	X	X	X	X	X
0.125	3.18	X	X	X	X	X	X

3.3 Construction:

- 3.3.1 General Requirements: Laminations and solid stock, when applicable, shall be bonded together throughout the whole surface area in a manner which will permit peeling of the laminations without the aid of mechanical devices, for adjustment of shim thickness, without separation of the remaining laminations and solid part. Laminations shall be bonded together in such a manner that any shape can be cut from the material using suitable tools, without separation. Laminations shall remain intact without separation during normal handling. Requirements shall be applicable to laminations not less than eight hours after completion of bonding.
- 3.3.2 Surface Roughness: Flat surfaces of laminations, and solid stock when applicable, shall have a maximum roughness of 63 RA (microinches) on original surfaces and on metallic surfaces after peeling.
- 3.3.3 Water Resistance: Sheet shall withstand total immersion in water at $120^{\circ}\text{F} \pm 3$ ($49^{\circ}\text{C} \pm 3$) for at least three hours without separation of laminations or any evidence of corrosion.
- 3.3.4 Peel Strength: Each individual lamination shall have a peel strength no less than 1 pound per inch of width (180 gm/cm of width) and no more than 5 pounds per inch of width (900 gm/cm of width), except at the solid/laminate bond line which may be higher.

3.4 Quality:

Sheet, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from dents, creases, and other imperfections detrimental to usage of the sheet.

3.5 Thickness Tolerances:

Shall be as specified in Table 2.

TABLE 2A - Total Thickness Tolerances, Inch/Pound Units

Nominal Thickness				Tolerance, Inch	
Inches				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 2B - Total Thickness Tolerances, SI Units

Nominal Thickness				Tolerance, Millimeter	
Millimeters				Plus	Minus
Up	to	0.20, incl		0.025	0.013
Over	0.20	to 0.25, incl		0.038	0.013
Over	0.25	to 0.41, incl		0.038	0.025
Over	0.41	to 0.53, incl		0.05	0.025
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

3.6 Quality:

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

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 the specified requirements.

4.2 Classification of Tests:

Tests for all technical requirements are acceptance tests and shall be performed on each heat or lot as applicable.

4.3 Sampling and Testing:

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. Sampling shall be in accordance with ANSI/ASQC Z1.4. Lot acceptance criteria shall be based on a single sampling plan with a zero acceptance number.

4.4 Reports:

The vendor of sheet shall furnish with each shipment a report showing the results of tests for peel strength of each lot and stating that the sheet conforms to the other technical requirements. This report shall include the purchase order number, lot number, AMS 6387, type, class, dash number or length and width as applicable, and quantity.

4.5 Resampling and Retesting:

Shall be in accordance with ANSI/ASQC Z1.4.

5. PREPARATION FOR DELIVERY:

5.1 Identification:

Each sheet shall be legibly marked on one face with nominal shim stock thickness, thickness of each lamination, percentage of total thickness which is laminated, and AMS 6387.