AEROSPACE MATERIAL SPECIFICATION

AMS1389™

Issued 2022-04

Sealing Compound, Polythioether Rubber
Light-Cured, for Integral Fuel Tanks and General Purpose,
Intermittent use to 360 °F (182 °C)

RATIONALE

New specification for light cured polythioether cure on demand (CoD) integral fuel tank and general purpose sealing compounds.

1. SCOPE

1.1 Form

This specification covers polythioether rubber fuel resistant sealing compounds, supplied as a two-component system, which cure rapidly when exposed to a cure on demand (CoD) light source used to initiate a reaction that generates crosslinking of sealant polymers. Type 2 compounds also cure at ambient conditions, without light exposure.

1.2 Application

This product is intended for use on aircraft integral fuel tanks and fuselage for repair of fillet and fastener seals as well as initial sealing of fasteners and sealing of seams and joints (non-faying surfaces), for service from -80 to +320 °F (-62 to +160 °C), with short-term exposures (approximately 6 cumulative hours) up to 360 °F (182 °C), but usage is not limited to such applications. This product is not recommended for use on aircraft windshields or canopies, or other applications where crazing or degradation of plastic components may occur. Sealing compound must be applied at temperatures above 50 °F (10 °C) but will cure at temperatures as low as 20 °F (-7 °C) when exposed to a light source in accordance with manufacturer instructions. Sealing compound applied to exterior surfaces shall be overcoated with applicable coatings.

1.2.1 Notice

This material is mixing ratio sensitive.

The light source required for cure on demand shall be within the range of visible through UV-A (780 to 315 nm) and use shall be in accordance with manufacturer instructions (4.5.4.5). Ambient light sources must be taken into consideration during application processes as they may decrease worklife and affect sealing compound cure.

All sealing compounds covered by this specification require an adhesion promoter as recommended by the manufacturer for proper adhesion.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org

For more information on this standard, visit
https://www.sae.org/standards/content/AMS1389/

1.3 Classification

All sealing compounds covered by this specification are classified as follows:

Type 1 – Two-part, cures only when activated by exposure to a designated light source.

Type 2 – Two-part, cures when activated by exposure to a designated light source or after a designated time without exposure to light (hereafter also referred to as ambient cure).

1.3.1 Grades

The material shall be supplied in the following Grades:

Grade 1 – Cured specific gravity from 1.21 to 1.50 Max
Grade 2 – Cured specific gravity of 1.20 Max

1.3.2 Classes

Class B – Suitable for application by extrusion gun or spatula.

B-CoD Cures only by exposure to light source (Type 1 material)
B-2 Cures by exposure to light source or by chemical reaction with no light source required (Type 2 material)
B-8 Cures by exposure to light source or by chemical reaction with no light source required (Type 2 material)

Class R – Suitable for robotic applications.

R-CoD Cures only by exposure to light source (Type 1 material)

1.4 Safety - Hazardous Materials

Shall be in accordance with AS5502 (1.1).

2. APPLICABLE DOCUMENTS

Shall be in accordance with AS5502 (Section 2).

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2629 Fluid, Jet Reference

AMS3020 Oil, Reference, for “L” Stock Rubber Testing

AMS3021 Fluid, Reference, for Testing Di-Ester (Polyol) Resistant Material

AMS3276 Sealing Compound, Integral Fuel Tanks and General Purpose, Intermittent Use to 360 °F (182 °C)

AMS3277 Sealing Compound, Polythioether Rubber Fast Curing for Integral Fuel Tanks and General Purpose, Intermittent Use to 360 °F (182 °C)

AMS4045 Aluminum Alloy Sheet and Plate, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr 7075: (-T6 Sheet, -T651 Plate), Solution and Precipitation Heat Treated

AMS4911 Titanium Alloy, Sheet, Strip, and Plate, 6Al - 4V, Annealed

AMS5516 Steel, Corrosion-Resistant, Sheet, Strip, and Plate, 18Cr - 9.0Ni (SAE 30302), Solution Heat Treated

AMS-C-27725 Coating, Corrosion Preventive, Polyurethane For Aircraft Integral Fuel Tanks for Use to 250 °F (121 °C)

AS5127 Aerospace Standard Test Methods for Aerospace Sealants Methods for Preparing Sealant Test Specimens

AS5127/1 Aerospace Standard Test Methods for Aerospace Sealants Two-Component Synthetic Rubber Compounds

AS5502 Standard Requirements for Aerospace Sealants and Adhesion Promoters

2.2 U.S. Government Publications

Copies of these documents are available online at http://quicksearch.dla.mil.

MIL-PRF-23377 Primer Coating, Epoxy High Solids

MIL-PRF-85285 Coating, Polyurethane, Aircraft and Support Equipment

MIL-PRF-85582 Primer Coatings: Epoxy, Waterborne

2.3 PRI Publications

Available from Performance Review Institute, 161 Thorn Hill Road, Warrendale, PA 15086-7527, Tel: 724-772-1616, www.pri-network.org.

OP 2007 Appendix G9 Additional Requirements for the Aerospace Sealants and Associated Materials (G9) QPG

PRI-QPL-AMS1389 Products Qualified Under AMS1389

2.4 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 D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension

ASTM D2240 Standard Test Method for Rubber Property-Durometer Hardness

ASTM D5032 Standard Practice for Maintaining Constant Relative Humidity by Means of Aqueous Glycerin Solutions

3. TECHNICAL REQUIREMENTS

3.1 Materials

The basic sealing compound ingredient shall be polythioether synthetic rubber. The sealing compound shall cure rapidly by exposure to a light source according to manufacturer instructions. Type 2 shall also cure by the addition of a curing agent as a backup curing mechanism in lieu of light exposure. Neither the base compound nor the cured sealant shall be red or pink in color.

3.2 Date of Packaging

Shall be in accordance with AS5502 (3.1).

3.3 Toxicological Formulations

Shall be in accordance with AS5502 (3.2).

3.4 Quality

Shall be in accordance with AS5502 (3.3).

3.5 Shelf Life

Shelf life shall be a minimum of 9 months from date of packaging when stored between 60 °F and 80 °F (16 °C and 27 °C). Material may be retested for shelf life extension per 4.3.3.

3.5.1 Premixed Frozen Material

Shelf life of premixed and frozen material shall be a minimum of 30 days at -80 °F (-62 °C). The date of mix/freeze shall be within the shelf life of the unmixed material.

3.6 Properties

The sealing compound shall be mixed and cured using CoD light exposure in accordance with 4.5.4.5 for Type 1 and for Type 2. Type 2 shall also be mixed and cured without light exposure where marked. Both types shall conform to the requirements shown in Table 1 as determined in accordance with specified test methods:

Table 1 - Properties

Paragraph	Property	Requirement	Test Method
3.6.1	Nonvolatile Content, (% by weight), min Class B Class R	 97 % 85 %	AMS1389 4.6.1
3.6.2	Flow Class B, max Class R, max	 0.30 inch (7.6 mm) 0.10 inch (2.5 mm)	 AS5127/1 (5.5.1) AS5127/1 (5.5.2)
3.6.3	Application Time, min		AS5127/1 (5.6.2)
3.6.3.1	Class B-CoD – From the beginning of mixing, not less than 15 grams per minute shall be extruded.	8 hours	
3.6.3.2	Class B-2 – From the beginning of mixing, not less than 15 grams per minute shall be extruded.	2 hours	
3.6.3.3	Class B-8 - From the beginning of mixing, not less than 15 grams per minute shall be extruded.	8 hours	
3.6.3.4	Class R-CoD - From the beginning of mixing, not less than 15 grams per minute shall be extruded.	8 hours	
3.6.4	Tack-Free Time, max		AS5127/1 (5.8)
3.6.4.1	Standard Conditions All Types and Classes (measured from end of CoD light exposure) Type 2 only (measured from beginning of mixing, no light exposure) Class B-2 Class B-8	10 minutes 96 hours 120 hours	

3.6.4.2	Low-Temperature, 20 °F (-7 °C) (measured from end of CoD light exposure) All Types, Class B only	10 minutes	
3.6.5	Curing – Time to Achieve 25 Durometer Type A Hardness, min		AMS1389 4.6.2
3.6.5.1	Standard Conditions (measured from end of CoD light exposure) All Types and Classes	10 minutes	AMS1389 4.6.2.1
3.6.5.2	Standard Conditions, Type 2 only (measured from beginning of mixing, no light exposure) Class B-2 Class B-8	96 hours 168 hours	AMS1389 4.6.2.1
3.6.5.3	Low Temperature 20 °F (-7 °C), (measured from end of CoD light exposure) Class B-CoD only	10 minutes	AMS1389 4.6.2.2
3.6.6	Depth of Cure (measured from end of CoD light exposure plus 10 minutes) Bottom Surface (tape side), min	25 Durometer Type A Hardness and 90% of top surface (3.6.5.1) hardness	AMS1389 4.6.18
3.6.7	Specific Gravity Grade 1 Grade 2	1.21 to 1.50 max 1.20 max	AMS1389 4.6.3
3.6.8	Ultimate Hardness		
3.6.8.1	Ultimate Hardness (measured from end of CoD light exposure plus 24 hours), all Types and Classes		
3.6.8.1.1	Top Surface	40 Durometer Type A Hardness	AMS1389 4.6.4
3.6.8.1.2	Bottom Surface (tape side)	40 Durometer Type A Hardness, min and 90% of top surface, min	AMS1389 4.6.18
3.6.8.2	Ultimate Hardness, Type 2 only, no light exposure Class B-2 Class B-8	21 days 60 days	AMS1389 4.6.4
3.6.9	Resistance to Thermal Expansion	Sealant flush with groove within +0.010 and -0.050 inch (+0.25 and -1.3 mm) at the wide end and within +0.005 and -0.050 inch (+0.13 and -1.3 mm) at the narrow end of the test block	AS5127/1 (6.4) Standard Heat Cycle in accordance with AMS1389 4.5.3

3.6.10	Hydrolytic Stability, min	20 Durometer Type A Hardness	AMS1389 4.6.5
3.6.11	Shaving and Sanding	No rolling or tearing of sealant, smooth finish	AMS1389 4.6.6
3.6.12	Paintability	No separation from sealant	AMS1389 4.6.7
3.6.13	Chalking	No visual chalk	AMS1389 4.6.8
3.6.14	Resistance to Thermal Rupture	No blistering or sponging, 0.156 inch (3.96 mm) deformation, max	AMS1389 4.6.9 Air aging at 320 °F (160 °C), 10 psi (69 kPa), 30 minutes
3.6.15	Resistance to Hydrocarbons		
3.6.15.1	Weight Loss, max	8%	AMS1389 4.6.10
3.6.15.2	Flexibility	No cracking or checking	AMS1389 4.6.10
3.6.15.3	Volume Swell, max	25%	AMS1389 4.6.11
3.6.16	Low Temperature Flexibility	No visual evidence of cracking, checking, or loss of adhesion	AMS1389 4.6.12
3.6.17	Tensile Strength and Elongation, Class B only, min		AMS1389 4.6.13 AS5127/1 (7.7)
3.6.17.1	Cure per 4.5.4.5	250 psi (1724 kPa)/250% elongation	
3.6.17.2	Cure per 4.5.4.5 + 2 hours at 360 °F (182 °C)	150 psi (1034 kPa)/50% elongation	
3.6.17.3	Cure per 4.5.4.5 + 12 days at 140 °F (60 °C) + 60 hours at 160 °F (71 °C) + 6 hours at 180 °F (82 °C), all in AMS2629 Type 1	125 psi (862 kPa)/100% elongation	
3.6.17.4	Cure per 4.5.4.5 + 12 days at 140 °F (60 °C) + 60 hours at 160 °F (71 °C) + 6 hours at 180 °F (82 °C) all in AMS2629 Type 1 + 24 hours at 120 °F (49 °C) + Standard Heat Cycle as in 4.5.3	100 psi (689 kPa)/50% elongation	
3.6.17.5	Cure per 4.5.4.5 + 72 hours at 140 °F (60 °C) in AMS2629 Type 1 + 72 hours air dry at 120 °F (49 °C) + 7 days heat aging at 285 °F (141 °C)	150 psi (1034 kPa)/50% elongation	
3.6.17.6	Cure per 4.5.4.5 + Standard Heat Cycle as in 4.5.3	100 psi (689 kPa)/50% elongation	

3.6.17.7	Cure per 4.5.4.5 + 48 hours in MIL-PRF-83282 at 140 °F (60 °C)	125 psi (862 kPa)/100% elongation	
3.6.17.8	Cure per 4.5.4.5 + 72 hours in AMS3020	125 psi (862 kPa)/100% elongation	
3.6.17.9	Cure per 4.5.4.5 + 72 hours in AMS3021	125 psi (862 kPa)/100% elongation	
3.6.18	Time to Adhesion	20 pounds force per inch (3500 N/m)/100% Cohesive failure	AMS1389 4.6.14
3.6.19	Corrosion	No corrosion or signs of deterioration	AMS1389 4.6.15
3.6.20	Peel Strength, min	20 pounds force per inch (3500 N/m)/100% Cohesive failure	AMS1389 4.6.16
3.6.20.1	Peel Strength for Repair, min	10 pounds force per inch (1750 N/m)/100% Cohesive failure	AMS1389 4.6.16.2
3.6.20.2	Repairability, min	10 pounds force per inch (1750 N/m)/100% cohesive failure	AMS1389 4.6.17
3.6.21	Storage Stability		AS5127/1 (Section 9)
3.6.21.1	Accelerated Storage Flow Application Time, min Tack-Free Time, max Curing – Standard Conditions, max Peel Strength, min	 Same as 3.6.2 Same as 3.6.3 Same as 3.6.4 Same as 3.6.5 Same as 3.6.20	AS5127/1 (9.1)
3.6.21.2	Long-Term Storage Application Time, min Tack-Free Time, max Curing – Standard Conditions, max	 Same as 3.6.3 Same as 3.6.4 Same as 3.6.5	AMS1389 4.6.19

3.7 Curing Equipment Required for Qualification Testing

Directed energy equipment required for performance of qualification testing as required in this document shall meet the following criteria:

1. Powered by rechargeable battery or 110V
2. PPE requirements limited to shielding glasses and gloves only
3. Not heavier than 25 pounds (11.3 kg)
4. Total cure on demand light exposure time not to exceed 10 minutes

The qualification report shall include the cure on demand light equipment and parameters (distance, duration, equipment settings as applicable) used for qualification testing.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

Shall be in accordance with AS5502 (4.1).

4.1.1 Source Inspection

Shall be in accordance with AS5502 (4.1.1).

4.1.2 Sampling

Shall be in accordance with AS5502 (4.1.2).

4.2 Classification of Tests

4.2.1 Qualification Tests

Shall be in accordance with AS5502 (4.2.1). Any changes in ingredients and/or processing of the adhesion promoter(s) used to qualify the sealing compounds shall require retesting of all technical requirements in Table 1 which rely on the use of adhesion promoter for qualification.

4.2.1.1 Qualification Requirements for Type 1 Compounds

Type 1, Class B shall be the first material that is qualified for each supplier of Type 1 sealing compound. If the manufacturer produces no Type 1, Class B product, another Type 1 compound may be substituted. In either case, the qualifying sealing compound shall be tested for and shall meet all technical requirements of this specification except for requirements unique to other types and classes of the sealing compound.

4.2.1.2 Qualification Requirements for Type 2 Compounds

Type 2, Class B-2 shall be the first material that is qualified for each supplier of Type 2 sealing compound. If the manufacturer produces no Type 2, Class B-2 product, another Type 2, Class B compound may be substituted. In either case, Class B sealing compound shall be tested for and shall meet all technical requirements of this specification except for requirements unique to other classes of the sealing compound.

4.2.1.3 Qualification Requirements for Subsequent Classes and Application Times

Once qualification for Type 2, Class B has been obtained according to the requirements in 4.2.1.1, other classes of the sealing compound and additional application times of qualified classes may be qualified. The formulation for other classes and application times shall be the same as the qualified Type 2, Class B, except for minor variations necessary for conformance to viscosity and application time requirements. All compounds shall meet all technical requirements of this specification. Additional application times of qualified classes need only to be tested to the initial acceptance tests listed in Table 2. Additional classes of the sealing compound need only to be tested to the initial acceptance tests listed in Table 2 plus all peel strength tests listed in Table 5, and other tests as defined by the QPL agency. Any unique qualification tests for the sealant’s class and application time shall also be tested per OP 2007 Appendix G9.

4.2.2 Initial Acceptance Tests

Requirements shown in Table 2 are initial acceptance tests and shall be performed on each batch in accordance with AS5502 (4.2.2.1).

Table 2 - Initial acceptance tests

Test	Requirement Paragraph
Nonvolatile Content	3.6.1
Flow	3.6.2
Application Time	3.6.3
Tack Free Time	3.6.4
Curing – Standard Conditions	Type 1: 3.6.5.1 Type 2: 3.6.5.2
Depth of Cure	3.6.6
Specific Gravity	3.6.7
Ultimate Hardness	3.6.8
Peel Strength	3.6.20 and 4.6.16.1

4.2.3 Final Acceptance Tests

Requirements shown in Table 3 are final acceptance tests and shall be performed on each lot. Acceptance tests of the final packaged product shall consist of the following in accordance with AS5502 (4.2.2.2).

Table 3 - Final acceptance tests

Test	Requirement Paragraph
Flow	3.6.2
Application Time	3.6.3
Tack Free Time	3.6.4
Curing – Standard Conditions	Type 1: 3.6.5.1 Type 2: 3.6.5.2
Depth of Cure	3.6.6

4.3 Sampling and Testing

Shall be in accordance with AS5502 (4.3)

4.3.1 For Qualification Tests

Samples shall be from a production batch of material. Enough material, including adhesion promoter, shall be supplied to perform all required tests. Samples shall be identified as specified herein and below:

SEALING COMPOUND, POLYTHIOETHER RUBBER, LIGHT-CURED, FOR INTEGRAL FUEL TANKS AND GENERAL PURPOSE, INTERMITTENT USE TO 360 °F (182 °C)
AMS1389
TYPE, GRADE, CLASS_____
MANUFACTURER'S IDENTIFICATION_____
NAME OF MANUFACTURER_____
BATCH/LOT NUMBER_____
DATE OF PACKAGING_____
SHELF LIFE EXPIRATION DATE_____
STORE BETWEEN 60 °F AND 80 °F (16 °C AND 27 °C)

4.3.2 Acceptance Tests

Shall be in accordance with AS5502 (4.3.1).

4.3.2.1 Batch and Lot

Shall be in accordance with AS5502 (4.3.1.1).

4.3.2.2 Initial and Final Acceptance Tests

Shall be in accordance with AS5502 (4.3.1.2 and 4.3.1.3).

4.3.3 Shelf-Life Surveillance and Extension

4.3.3.1 Shelf-Life Testing

The inspections to be conducted for shelf-life surveillance and extension are listed in Table 4. Tests are to be conducted in accordance with test methods outlined herein for acceptance tests.

Table 4 - Shelf-life testing

Test	Requirement Paragraph
Flow	3.6.2
Application Time	3.6.3
Curing – Standard Conditions	Type 1: 3.6.5.1 Type 2: 3.6.5.2
Peel Strength	3.6.20 and 4.6.16.1

4.3.3.2 Time and Limits of Shelf Life Extensions

If tests are being performed at the end of the stated shelf life to update the shelf life of the sealing compound and all tests are passed, the shelf-life will be extended an additional three months. A maximum of three extensions are allowed.

4.4 Approval

Shall be in accordance with AS5502 (4.4).

4.5 Test Methods

4.5.1 Standard Tolerances

Unless otherwise specified herein, standard tolerances of AS5127 (Section 3) “Standard Tolerances” shall apply.

4.5.2 Standard Test Conditions

Standard laboratory conditions shall be as specified in AS5127 (Section 4). Test specimens shall be prepared and immediately after completion of preparation, shall be placed under 77 °F (25 °C) and 50% ± 5% relative humidity to cure according to 4.5.4.5. Except as otherwise directed herein, tests shall be performed at conditions in accordance with AS5127 (Section 4).

4.5.3 Standard Heat Cycle

Standard heat cycle shall consist of sealant cure per 4.5.4.5 and the following cycle, which shall be repeated 6 times.

4 hours at 260 °F (127 °C) followed by
40 minutes at 320 °F (160 °C) followed by
1 hour at 360 °F (182 °C)

Cool to under 100 °F (38 °C) between cycles

4.5.4 Preparation of Test Specimens

4.5.4.1 Surface Preparation and Cleaning of Test Specimens

Panels shall be prepared, cleaned, surface treated, and coated in accordance with AS5127 (Section 6) prior to application of sealant for testing.

4.5.4.2 Preparation of Sealing Compound

Sealing compound shall be prepared in accordance with AS5127/1 (Section 4) “Preparation of Sealing Compound” and subparagraphs (4.1) “Qualification Testing”, (4.2) “Acceptance Testing”, and (4.3) “Thawing of Quick-Frozen Sealing Compound” as applicable.

4.5.4.3 Application of Adhesion Promoter

Prior to any application of the sealing compound to any panel substrate, the surface shall be treated with adhesion promoter as specified by the sealant manufacturer in accordance with AS5127 (6.9) “Application of Adhesion Promoter”. The adhesion promoter specified must be documented and will be included on the PRI-QPL-AMS1389.

4.5.4.4 Application of Sealing Compound

Unless otherwise specified herein, freshly mixed sealing compound shall be applied to test panels in accordance with AS5127 (6.10) “Application of Sealing Compound.”

4.5.4.5 Curing of Sealing Compounds

For Type 1 and Type 2 light cure, sealant shall be fully cured using the cure on demand light source at standard conditions according to AS5127 (Section 4). The sealant manufacturer shall specify the light equipment to be used for sealant cure, limited to the range of visible through UV-A (780 to 315 nm), including exposure duration, stand-off distance, energy level, wavelength, and any other parameters necessary to ensure sealant cure. Cure on demand light exposure shall take place at standard conditions in accordance with AS5127 (Section 4) immediately after sample preparation. Testing of the cured sealant shall commence not more than 2 days after curing.

For Type 2 cure without light exposure, sealant shall be fully cured in accordance with AS5127 (6.11) “Curing of Sealing Compounds.” For Class B sealing compounds, B-2 sealing compound shall be cured for 21 days and B-8 sealing compound for 60 days at standard conditions (4.5.2). Tests on the cured sealing compound shall commence not more than 2 days after the completion of the specified cure.

4.6 Test Procedures

Standard Test Methods are in accordance with AS5127 and AS5127/1. In the event of a conflict between the text of this document and AS5127 and/or AS5127/1, the text of this document takes precedence.

4.6.1 Nonvolatile Content

Three samples of cured sealing compound shall be tested. Weigh a cup to the nearest 0.001 gram (W1). Transfer 11 to 12 grams of mixed sealing compound to the cup. Sealing compound shall be cured in accordance with 4.5.4.5 and allowed to stabilize in a desiccator for no less than 5 minutes after cure, then weighed to the nearest 0.001 gram (W2). Place the sealing compound and uncovered cup in an air circulating or friction oven that has been preheated to 158 °F (70 °C). After heating for seven days, place the sealing compound and cup in a desiccator and cool to room temperature. Weight to the nearest 0.001 gram (W3). Calculate the percent nonvolatile content as shown in Equation 1 per AS5127/1 (5.1).

4.6.2 Curing – Time to Hardness

4.6.2.1 Standard Conditions: The instantaneous hardness shall be determined in accordance with ASTM D2240 using a Type A Durometer after the sealing compound is cured in accordance with 4.5.4.5. The specimen shall be allowed to stabilize at standard conditions in accordance with AS5127 (Section 4) for a minimum of 10 minutes. The reading shall be taken on two 0.125 inch (3.18 mm) thick specimens, stacked back to back to make a total thickness of 0.25 inch (6.35 mm). If the thickness is less than 0.125 inch (3.18 mm) thick, multiple pieces may be stacked to obtain a total thickness of at least 0.25 inch (6.35 mm).

4.6.2.2 Low Temperature, 20 °F (-7 °C): Sealant compound shall be maintained at the required testing temperature under light protected environment for no less than 4 hours. Then specimen shall be removed from the testing temperature and immediately cured in accordance with 4.5.4.5. After the specimen is cured, the specimen shall be allowed to stabilize at standard conditions in accordance with AS5127 (Section 4) for a minimum of 10 minutes before reading the Type A Durometer. The reading shall be taken on two 0.125 inch (3.18 mm) thick specimens, stacked back to back to make a total thickness of 0.25 inch (6.35 mm). If the thickness is less than 0.125 inch (3.18 mm) thick, multiple pieces may be stacked to obtain a total thickness of at least 0.25 inch (6.35 mm).

4.6.3 Specific Gravity

Specimens shall be prepared in accordance with AS5127/1 (6.1) except that the sealant compound shall be cured in accordance with 4.5.4.5 followed by testing in accordance with AS5127/1 (6.1).

4.6.4 Ultimate Hardness

The instantaneous Type A Durometer hardness shall be determined in accordance with ASTM D2240 after the sealing compound has been cured in accordance with 4.5.4.5. The specimen shall be maintained at standard conditions in accordance with AS5127 (Section 4) for 24 hours. The reading shall be taken using two 0.125 inch (3.18 mm) thick specimens, stacked back to back to make a total thickness of 0.25 inch (6.35 mm). If the thickness is less than 0.125 inch (3.18 mm), multiple pieces may be stacked to obtain a total thickness of at least 0.25 inch (6.35 mm).

4.6.5 Hydrolytic Stability

A sealing compound specimen measuring 0.50 inch (13 mm) thick x 3 inches (76 mm) in diameter shall be cured in accordance with 4.5.4.5 after which it shall be exposed for 120 days in an environment of 160 °F (71 °C) and 95% ± 5% relative humidity cabinet or by use of an aqueous glycerin solution in accordance with ASTM D5032. The 0.50 inch (13 mm) thick specimen may be exposed to light on both sides to ensure full depth of cure. If aqueous glycerin solutions are used, it shall be changed every 30 days or when it becomes cloudy, and the container shall be removed from the oven and cooled to standard conditions in accordance with AS5127 (Section 4) by frequently opening and closing the vent. After cooling, remove the specimen from the humidity cabinet or container and hold it for 14 days at standard conditions in accordance with AS5127 (Section 4). The instantaneous Type A Durometer hardness shall be determined according to ASTM D2240.

4.6.6 Shaving and Sanding

Specimens shall be prepared in accordance with AS5127/1 (6.7) except that the sealant compound shall be cured in accordance with 4.5.4.5. The cured specimens shall be allowed to stabilize at standard conditions in accordance with AS5127 (Section 4) for no less than 24 hours before testing in accordance with AS5127/1 (6.7).

4.6.7 Paintability

Specimens shall be prepared in accordance with AS5127/1 (6.8) except that the sealant compound shall be cured in accordance with 4.5.4.5 followed by testing in accordance with AS5127/1 (6.8).

4.6.8 Chalking

Specimens shall be prepared in accordance with AS5127/1 (7.1) except that the sealant compound shall be cured in accordance with 4.5.4.5 followed by testing in accordance with AS5127/1 (7.1).

4.6.9 Resistance to Thermal Rupture

Specimens shall be prepared in accordance with AS5127/1 (7.2) except that the sealant compound shall be cured in accordance with 4.5.4.5. The cured specimen shall be allowed to stabilize at standard conditions in accordance with AS5127 (Section 4) for no less than 24 hours before testing or exposing to fluids in accordance with AS5127/1 (7.2).

4.6.10 Weight Loss and Flexibility

Specimens shall be prepared in accordance with AS5127/1 (7.4) except that the sealant compound shall be cured in accordance with 4.5.4.5 followed by testing in accordance with AS5127 (7.4).

4.6.11 Volume Swell

Specimens shall be prepared in accordance with AS5127/1 (7.5) except that the sealant compound shall be cured in accordance with 4.5.4.5 followed by testing in accordance with AS5127 (7.5).

4.6.12 Low-Temperature Flexibility

Panels shall be prepared in accordance with AS5127/1 (7.6) except that the sealant compound shall be cured in accordance with 4.5.4.5. The cured sealant shall be allowed to stabilize at standard conditions in accordance with AS5127 (Section 4) for no less than 24 hours before testing or exposing to testing temperature. Panels shall be tested in accordance with AS5127/1 (7.6) with the exception that the cabinet temperature shall be reduced and stabilized to a temperature of -80 °F (-62 °C) prior to and during cyclic flexing.

4.6.13 Tensile Strength and Elongation

A 0.125 inch ± 0.015 inch (3.18 mm ± 0.4 mm) thick sheet of sealing compound shall be prepared and cured in accordance with 4.5.4.5. Critical to preparation method is avoiding air entrapment/voids within the sealant which will compromise specimen integrity.

Sufficient tensile specimens shall be cut from the sheet, using Die C as specified in ASTM D412. Three specimens shall be exposed to each of the environmental conditions defined in the applicable material specification. Where fluid immersion is specified, the specimens shall be immersed in at least 900 mL of fluid. Specimens to be tested after the fluid immersion shall be cooled to standard conditions in accordance with AS5127 (Section 4) and tested no more than 5 minutes after removal from the fluid. Specimens to be tested after oven aging shall be allowed to cool no less than 8 hours until the specimens reach standard conditions in accordance with AS5127 (Section 4) before testing. The tensile and elongation tests shall be conducted at standard test conditions in accordance with AS5127 (Section 4) and tested in accordance with ASTM D412 using a jaw separation rate of 20 inches ± 1 inch (508 mm ± 25 mm) per minute.

4.6.14 Time to Adhesion

Two AMS-C-27725 peel panels shall be prepared in accordance with AS5127/1 (8.1). Sealing compound shall cover 5 inches (127 mm) of one side of the panel surface in accordance with AS5127/1 (Figure 22). Adhesion promoter recommended by manufacturer shall be applied per 4.5.4.3 for both the substrate and reinforcing mesh. The sealed panels shall be cured in accordance with 4.5.4.5.1. After CoD light exposure, the panels shall be allowed to stabilize at standard conditions in accordance with 4.5.2 for 6 hours and then tested for peel strength.

4.6.15 Corrosion

Specimens shall be prepared and tested in accordance with AS5127/1 (7.9) except that the sealant compound shall be cured in accordance with 4.5.4.5 at standard conditions in accordance with AS5127 (Section 4). The cured specimen shall be allowed to stabilize at standard conditions in accordance with AS5127 (Section 4) for no less than 24 hours before exposing to fluids.

4.6.16 Peel Strength

The type and quantity of panels listed in Table 5 shall be used for the evaluation of peel strength. All panels shall be 2.75 x 6 inches (69.8 x 152 mm). The panels shall be prepared in accordance with AS5127/1 (8.1), using 20 to 40 mesh screen aluminum, sheet or Monel Metal shall be used as the reinforcement. To minimize risk of adhesion failure to mesh screens, cleaning the metal with a metal etch (per sealant manufacturer instructions) is recommended. Sealing compound shall cover 5 inches (127 mm) of one side of the panel surface in accordance with AS5127/1 (Figure 22). Adhesion promoter is required and shall be applied per 4.5.4.3 for both the substrate and reinforcing mesh. Class R material shall be prepared according to Class C instructions.

The sealing compound shall be cured in accordance with 4.5.4.5. The CoD light cured specimens shall be allowed to stabilize at standard conditions in accordance with AS5127 (Section 4) for no less than 24 hours before exposing to fluids. Panels of each substrate shall be subjected to the immersion media listed in Table 5. When 70-day exposures are specified, the fluid shall be changed every 14 days.

Table 5 - Peel strength panels

Quantity Required	Panel Thickness Inches (mm)	Panel Material	Immersion Media at 140 °F (60 °C)
6	0.040 (1.02)	Al alloy AMS4045	2 panels in AMS2629 Type 1 for 7 days 2 panels in AMS2629 Type 1/3% saltwater for 7 days 2 panels for Fuel/Saltwater Heat Cycle per 4.6.16.1
6	0.040 (1.02)	Al alloy AMS4045 conversion coated in accordance with AS5127 (6.2)	2 panels in AMS2629 Type 1 for 7 days 2 panels in AMS2629 Type 1/3% saltwater for 7 days 2 panels for Fuel/Saltwater Heat Cycle per 4.6.16.1
6	0.040 (1.02)	Al alloy AMS4045 sulfuric acid anodized in accordance with AS5127 (6.3)	2 panels in AMS2629 Type 1 for 7 days 2 panels in AMS2629 Type 1/3% saltwater for 7 days 2 panels for Fuel/Saltwater Heat Cycle per 4.6.16.1
6	0.025 to 0.040 (0.64 to 1.02)	AMS5516 stainless steel	2 panels in AMS2629 Type 1 for 7 days 2 panels in AMS2629 Type 1/3% saltwater for 7 days 2 panels for Fuel/Saltwater Heat Cycle per 4.6.16.1
10	0.025 to 0.040 (0.64 to 1.02)	AMS4911 titanium	2 panels in AMS2629 Type 1 for 7 days 2 panels in AMS2629 Type 1 for 70 days 2 panels in AMS2629 Type 1/3% saltwater for 7 days 2 panels in AMS2629 Type 1/3% saltwater for 70 days 2 panels for Fuel/Saltwater Heat Cycle per 4.6.16.1
10	0.040 (1.02)	Al alloy AMS4045 sulfuric acid anodized in accordance with AS5127 (6.3) and coated with AMS-C-27725	2 panels in AMS2629 Type 1 for 7 days 2 panels in AMS2629 Type 1 for 70 days 2 panels in AMS2629 Type 1/3% saltwater for 7 days 2 panels in AMS2629 Type 1/3% saltwater for 70 days 2 panels for Fuel/Saltwater Heat Cycle per 4.6.16.1
2	0.040 (1.02)	Al alloy AMS4045 sulfuric acid anodized in accordance with AS5127 (6.3), coated with MIL-PRF-23377 (cured 7 days at standard conditions)	2 panels in 3% saltwater for 7 days
2	0.040 (1.02)	Al alloy AMS4045 sulfuric acid anodized in accordance with AS5127 (6.3), coated with MIL-PRF-23377 (cured 2 hours at 200°F (93 °C))	2 panels in 3% saltwater for 7 days
2	0.040 (1.02)	Al alloy AMS4045 sulfuric acid anodized in accordance with AS5127 (6.3), primed with MIL-PRF-23377, coated with MIL-PRF-85285 urethane topcoat	2 panels in 3% saltwater for 7 days
2	0.040 (1.02)	Al alloy AMS4045 sulfuric acid anodized in accordance with AS5127 (6.3), coated with MIL-PRF-85582 water-based primer	2 panels in 3% saltwater for 7 days

6	0.040 (1.02)	Graphite/epoxy[1] in accordance with AS5127 (6.7)	2 panels in AMS2629 Type 1 for 7 days 2 panels in AMS2629 Type 1/3% saltwater for 7 days 2 panels for Fuel/Saltwater Heat Cycle per 4.6.16.1
6	0.040 (1.02)	Graphite/Bismaleimide in accordance with AS5127 (6.7)	2 panels in AMS2629 Type 1 for 7 days 2 panels in AMS2629 Type 1/3% saltwater for 7 days 2 panels for Fuel/Saltwater Heat Cycle per 4.6.16.1

NOTE 1: Graphite/epoxy panels may be constructed as specified in AS5127 (6.7) out of AS4/3501/6 or IM7/977-3 material.

4.6.16.1 Fuel/Saltwater Heat Cycle

The Fuel/Saltwater cycle shall consist of the following cycle, which shall be repeated six times.

100 hours at 140 °F (60 °C) in AMS2629 Type 1/3% by weight saltwater followed by
10 hours at 160 °F (71 °C) in AMS2629 Type 1/3% by weight saltwater followed by
1 hour at 180 °F (82 °C) in AMS2629 Type 1/3% by weight saltwater

Cool to less than 100 °F (38 °C) between cycles and directly transfer to fresh test fluid for each successive cycle

4.6.16.2 Peel Strength for Repair

Two 0.040 x 2.75 x 6 inches (1.02 x 69.8 x 152 mm) AMS4045 aluminum alloy panels shall be sulfuric acid anodized in accordance with AS5127 (6.3) and coated with AMS-C-27725. Prepare peel panels in accordance with 4.6.16. Immerse the panels in AMS2629, Type 1 at 77 °F (25 °C) for 7 days. Test the panels in accordance with AS5127/1 (Section 8).

4.6.16.3 Peel Strength for Acceptance Test, Accelerated Storage, and Shelf-Life Testing (Only)

Prepare four 0.040 x 2.75 x 6 inches (1.02 x 69.8 x 152 mm) AMS4045 aluminum alloy panels, anodized in accordance with AS5127 (6.3), and coated with AMS-C-27725. Prepare peel panel in accordance with 4.6.16. Two peel panel specimens shall be held at standard conditions, and two panels conditioned in AMS2629 Type 1/3% by weight saltwater for 7 days at 140 °F (60 °C) prior to peel strength testing in accordance with AS5127/1 (8.1). Record values for AMS2629 and saltwater phases separately.

4.6.17 Repairability

Panels shall be prepared and tested in accordance with 4.6.16.2 and AS5127/1 (8.2) “Repairability”, with the following exceptions. AMS4045 aluminum alloy panels measuring 0.025 to 0.040 x 2.75 x 6 inch (0.64 to 1.02 x 69.8 x 152 mm) shall be sulfuric acid anodized in accordance with AS5127 (6.3) and overcoated with AMS-C-22725. Prepare two panels for the sealing compound being qualified to AMS1389 plus enough test panels so that there are two panels for all Class B sealing compounds that have already been qualified to AMS3277 (to a maximum of three) and two panels for at least one material qualified to AMS3276. The panels prepared with AMS1389 sealant shall be fully cured in accordance with 4.5.4.5.

4.6.18 Depth of Cure

The depth of cure jig shall be opaque polytetrafluoroethylene (PTFE) material conforming to Figure 1; the jig thickness shall be 0.375 inch (9.5 mm). The jig shall have the bottom orifice masked off with 3M 250 Masking Tape, or equivalent, flush with the jig. Sealing compound shall be extruded into the jig, completely filling the orifice and leveled to the surface of the jig, and the sealant shall then be cured in accordance with 4.5.4.5. The specimen shall be allowed to stabilize at standard conditions in accordance with AS5127 (Section 4) for a minimum of 10 minutes. The masking tape shall be removed from the underside and shall come away clean and free of sealing compound. Instantaneous hardness shall then be determined on both top and bottom surfaces using a Type A Durometer in accordance with ASTM D2240.

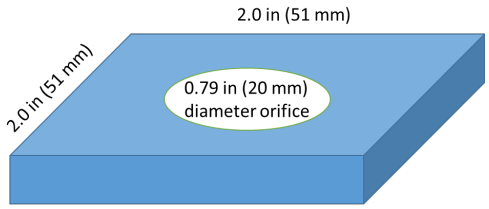

Figure 1 - Depth of cure jig

4.6.19 Long Term Storage

Long term storage shall be conducted in accordance with AS5127/1 (9.2). The period of storage shall be 9 months from date of packaging when stored between 60 °F and 80 °F (16 °C and 27 °C)

4.7 Reports

Shall be in accordance with AS5502 (4.5).

4.8 Resampling and Retesting

Shall be in accordance with AS5502 (4.6).

4.9 Qualification

Shall be in accordance with AS5502 (4.7). All products sold to this specification, including adhesion promoter(s) used for qualification testing, shall be listed, or approved for listing, on the qualified Products List, PRI-QPL-AMS1389. The qualified products list shall be in accordance with OP 2007.

5. PREPARATION FOR DELIVERY

Shall be in accordance with AS5502 (Section 5).

6. ACKNOWLEDGMENT

Shall be in accordance with AS5502 (Section 6).

7. REJECTIONS

Shall be in accordance with AS5502 (Section 7).

8. NOTES

8.1 Revision Indicator

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

8.2 Properties are divided into two classes: performance (acceptance tests) and application (preproduction or qualification tests) requirements. Performance requirements define those properties of the cured sealant and its performance in service. Application requirements define those properties of the uncured sealant and affect the application parameters of the sealant. Minor variations in application requirements during acceptance testing may not be cause for rejection if approved by the procuring agency.

8.3 Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

8.4 Purchase documents should specify not less than the following:

AMS1389
Type, Grade, Class of sealing compound desired
Type and size of containers (kits) desired
Quantity of containers (kits) desired.
Special packaging, if required

PREPARED BY SAE AMS G9 AEROSPACE SEALING COMMITTEE