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| AEROSPACE MATERIAL SPECIFICATION | AMS3278™ | REV. C |
| | Issued 2004-07 Revised 2022-11 | |
| Superseding AMS3278B | | |
| Sealing and Coating Compound, Polyurethane (PUR) Fuel Resistant, High Tensile Strength/Elongation for Integral Fuel Tanks/Fuel Cavities/General Purpose | | |

RATIONALE

AMS3278C results from a Five-Year Review and updates the test requirements to match the application of this sealant.

1. SCOPE

1.1 Form

This specification covers polyurethane (PUR) in the form of two-component sealing compounds.

1.2 Application

This product has been used typically for contact with fuels, but usage is not limited to such applications. Each application should be considered separately. This polyurethane (PUR) has a service temperature range of -65 to +250 °F (-54 to +121 °C) with a continuous fuel service temperature range of -65 to +160 °F (-54 to +71 °C). It may be used for faying surface sealing, wet-installation of fasteners, overcoat of fasteners, sealing joints and seams and, in some cases, as a non-structural adhesive.

NOTE: The use of the manufacturer's recommended adhesion promoter may be required to obtain proper adhesion.

1.3 Classification

Sealing compounds covered by this specification are classified as follows:

1.3.1 Types

- Type 1 - Non-corrosion inhibiting
- Type 2 - Corrosion inhibiting

1.3.2 Classes

Class A - For application by brush or spray. Available in the following application times:
A-4

Class B - For application by extrusion gun or spatula. Available in the following application times:
B-1/2
B-1

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<https://www.sae.org/standards/content/AMS3278C/>

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.

| | |
|-------------|--|
| 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 (302), Solution Heat Treated |
| AMS-S-8802 | Sealing Compound, Fuel Resistant, Integral Fuel Tanks and Fuel Cell Cavities |
| AMS-C-27725 | Coating, Corrosion Preventative, for Aircraft Integral Fuel Tanks for Use to 250 °F (121 °C) |
| AS5127 | Aerospace Standard Test Methods for Aerospace Sealants Methods for Preparing Aerospace 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 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 D1319 | Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption |
|------------|---|

2.3 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

| | |
|---------------|---|
| MIL-DTL-81706 | Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys |
| MIL-DTL-83133 | Turbine Fuel, Aviation, Kerosene Types, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37) |
| MIL-PRF-23377 | Primer Coatings: Epoxy, High Solids |
| MIL-PRF-85285 | Coating, Polyurethane, Aircraft and Support Equipment |
| MIL-PRF-85582 | Primer Coatings: Epoxy, Waterborne |

2.4 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-AMS3278 Products Qualified Under AMS3278

3. TECHNICAL REQUIREMENTS

3.1 Materials

The basic ingredient shall be synthetic rubber of the polyurethane type. The sealing compound shall cure by the addition of a curing agent. The curing agent shall possess sufficient color contrast to the base compound to permit easy identification of an unmixed or incompletely mixed sealing compound. 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 the date of packaging. Material may be retested for shelf life extension per 4.3.2.

3.6 Properties

The sealing compound, when mixed in accordance with the manufacturer's instructions and cured as specified in 4.5.3.5, shall conform to the requirements shown in Table 1, determined in accordance with the specified test methods. If the material requires an adhesion promoter, the manufacturer's recommended adhesion promoter shall be applied per 4.5.3.3 for resistance to thermal rupture (3.6.10), low temperature flexibility (3.6.13), shear strength (3.6.15), corrosion (3.6.16), peel strength (3.6.17), and reparability (3.6.18 and 3.6.19) testing. If used, adhesion promoter—including number of coats—must be noted in the test report and included on the PRI-QPL-AMS3278.

Table 1 - Properties

| Paragraph | Property | Requirement | Test Method |
|-----------|---|---|--|
| 3.6.1 | Nonvolatile Content by Weight, Minimum Class A-4 Classes B-1/2 and B-1 | 55% 85% | AS5127/1 (5.1) |
| 3.6.2 | Viscosity of Base Compound Class A-4 Classes B-1/2 and B-1 | 5 to 100 poises (0.5 to 10 Pa•s) 5000 to 10000 poises (500 to 1000 Pa•s) | AS5127/1 (5.3) Use No. 4 spindle at 20 rpm Use No. 7 spindle at 4 rpm |
| 3.6.3 | Flow (Initial), Maximum Class B only | 0.75 inch (19.0 mm) | AS5127/1 (5.5) AS5127/1 (5.5.1) |
| 3.6.4 | Application Time, Minimum Class A - From the beginning of mixing, the viscosity shall not exceed 2000 poises (200 Pa•s) A-4 Class B - From beginning of mixing, not less than 15 g/min shall be extruded B-1/2 B-1 | 4 hours 1/2 hour 1 hour | AS5127/1 (5.6) AS5127/1 (5.6.1) Use No. 5 spindle at 2 rpm AS5127/1 (5.6.2) |
| 3.6.5 | Tack-Free Time, Measured from the Beginning of Mixing, Maximum Class A-4 Class B-1/2 Class B-1 | 2.5 hours 3.5 hours 4 hours | AMS3278 (4.6.4) |
| 3.6.6 | Cure Time to Hardness, Time to Reach 50 Durometer A, Maximum Class A-4 Class B-1/2 Class B-1 | 24 hours 18 hours 20 hours | AS5127/1 (5.9) |
| 3.6.7 | Specific Gravity, Maximum | 1.2 | AS5127/1 (6.1) |
| 3.6.8 | 14-Day Hardness, Minimum | 50 Shore A | AS5127/1 (6.2) |
| 3.6.9 | Hydrolytic Stability, Minimum | 30 Durometer A | AS5127/1 (6.6) |
| 3.6.10 | Resistance to Thermal Rupture Class B only Fluid immersion shall be in adjusted JP-8 (4.6.2) | No blistering or sponging 0.125 inch (3.18 mm), maximum | AS5127/1 (7.2) 250 °F ± 5 °F (121 °C ± 3 °C) at 10 psi (69 kPa) for 60 minutes |
| 3.6.11 | Weight Loss and Flexibility Weight loss, maximum Flexibility | 8% No cracking or checking | AS5127/1 (7.4) |
| 3.6.12 | Volume Swell, Maximum In adjusted JP-8 (4.6.2) | 35% | AS5127/1 (7.5) |
| 3.6.13 | Low Temperature Flexibility In adjusted JP-8 (4.6.2) for 14 days at 160 °F (71 °C) | No cracking or checking No loss of adhesion | AS5127/1 (7.6) |

| Paragraph | Property | Requirement | Test Method |
|-----------|--|--|---|
| 3.6.14 | Tensile Strength/Elongation, Minimum Standard cure | 3000 psi (20.7 MPa) 350% elongation | AMS3278 (4.6.5) |
| | Standard cure + 24 hours at 250 °F ± 5 °F (121 °C ± 3 °C) + 7 days at 160 °F (71 °C) in adjusted JP-8 (4.6.2) | 700 psi (4.8 MPa) 300% elongation | |
| | Standard cure + 72 hours at 160 °F (71 °C) in adjusted JP-8 (4.6.2) + 72 hours at 120 °F (49 °C) in air + 7 days at 250 °F ± 5 °F (121 °C ± 3 °C) in air | 2500 psi (17.3 MPa) 300% elongation | |
| | Standard cure + 7 days at 250 °F ± 5 °F (121 °C ± 3 °C) in air | 2500 psi (17.3 MPa) 300% elongation | |
| | Standard cure + 14 days at 160 °F (71 °C) in adjusted JP-8 (4.6.2) | 700 psi (4.8 MPa) 300% elongation | |
| 3.6.15 | Shear Strength, Minimum Class A only | 280 psi (1.9 MPa) | AS5127/1 (7.8) |
| 3.6.16 | Corrosion Type 1 | No corrosion under sealant or signs of deterioration | AS5127/1 (7.9) |
| | Type 2 | No corrosion in fay surface area | AS5127/1 (7.10) Mixed Metal |
| 3.6.17 | Peel Strength, Minimum Class B only | 20 lbf/inch (3500 N/m) if 100% cohesive failure, or 45 lbf/inch (7900 N/m) with failure mode recorded (may be up to 100% adhesive failure) | AS5127/1 (8.1, Figure 22) and AMS3278 Table 5 |
| 3.6.18 | Repairability (to Itself), Minimum Class B only | 20 lbf/inch (3500 N/m) if 100% cohesive failure, or 45 lbf/inch (7900 N/m) with failure mode recorded (may be up to 100% adhesive failure) | AS5127/1 (8.2) |
| 3.6.19 | Repairability (to Sealants AMS-S-8802, AMS3276, and AMS3277), Minimum Class B only | 20 lbf/inch (3500 N/m) if 100% cohesive failure, or 45 lbf/inch (7900 N/m) with failure mode recorded (may be up to 100% adhesive failure) | AS5127/1 (8.2) |
| 3.6.20 | Accelerated Storage Stability Appearance | 3.4 | AS5127/1 (9.1) |
| | Viscosity of base compound | Same as 3.6.2 | |
| | Flow (Class B only) | Same as 3.6.3 | |
| | Application time | Same as 3.6.4 | |
| | Tack free time | Same as 3.6.5 | |
| | Cure time to hardness | Same as 3.6.6 | |
| | Shear strength (Class A only) | Same as 3.6.15 | |
| | Peel strength (Class B only), minimum: two aluminum AMS4045 panels, sulfuric acid anodized in accordance with AS5127 (6.3) and coated with AMS-C-27725 Type 2 (see 8.4), after 7 days immersion in adjusted JP-8 (4.6.2) at 160 °F (71 °C) | Same as 3.6.17 | |

| Paragraph | Property | Requirement | Test Method |
|-----------|--|----------------|-----------------|
| 3.6.21 | Long-Term Storage Stability | | AMS3278 (4.6.3) |
| | Appearance | 3.4 | |
| | Viscosity of base compound | Same as 3.6.2 | |
| | Flow (Class B only) | Same as 3.6.3 | |
| | Application time | Same as 3.6.4 | |
| | Tack free time | Same as 3.6.5 | |
| | Cure time to hardness | Same as 3.6.6 | |
| | Shear strength (Class A only) | Same as 3.6.15 | |
| | Peel strength (Class B Only), minimum: two aluminum AMS4045 panels, sulfuric acid anodized in accordance with AS5127 (6.3) and coated with AMS-C-27725 Type 2 (see 8.4), after 7 days immersion in adjusted JP-8 (4.6.2) at 160 °F (71 °C) | Same as 3.6.17 | |

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).

4.2 Classification of Tests

Shall be in accordance with AS5502 (4.2).

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—resistance to thermal rupture (3.6.10), low temperature flexibility (3.6.13), shear strength (3.6.15), corrosion (3.6.16), peel strength (3.6.17), and repairability (3.6.18 and 3.6.19).

4.2.1.1 Qualification Requirements for Other Classes and Application Times

Once qualification within a sealant class has been obtained, 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 that of the class/application time originally qualified, except for minor variations necessary for conformance to viscosity and application time requirements. All compounds shall meet all technical requirements of this specification. 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 QPL agency. Additional application times of qualified classes need only to be tested to the initial acceptance tests listed in Table 2 or as defined by 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 per AS5502 (4.2.2.1).

Table 2 - Initial acceptance tests

| Test | Requirement |
|--|-------------|
| Nonvolatile Content | 3.6.1 |
| Viscosity of the Base Compound ⁽¹⁾ | 3.6.2 |
| Flow (Class B Only) | 3.6.3 |
| Application Time | 3.6.4 |
| Tack-Free Time | 3.6.5 |
| Cure Time to Hardness | 3.6.6 |
| Resistance to Thermal Rupture | 3.6.10 |
| Fluid Immersed Only in Adjusted JP-8 (4.6.2) | |
| Shear Strength (Class A Only) | 3.6.15 |
| Peel Strength (Class B Only) | 3.6.17 |
| Four aluminum panels, AMS4045, sulfuric acid anodized in accordance with AS5127 (6.3) and coated with AMS-C-27725 Type 2 (see 8.4) 7 day immersion at 160 °F (71 °C): two panels in adjusted JP-8 (4.6.2) and two panels in Adjusted JP-8 (4.6.2)/salt water | |

⁽¹⁾ Acceptance testing of viscosity of base compound shall be conducted on material in 1-quart or 1-liter cans regardless of type of packaging being procured.

4.2.3 Final Acceptance Tests

Requirements shown in Table 3 are final acceptance tests and shall be performed on each lot per AS5502 (4.2.2.2).

Table 3 - Final acceptance tests

| Test | Requirement |
|-----------------------|-------------|
| Flow (Class B Only) | 3.6.3 |
| Application Time | 3.6.4 |
| Tack-Free Time | 3.6.5 |
| Cure Time to Hardness | 3.6.6 |

4.3 Sampling and Testing

Shall be in accordance with AS5502 (4.3).

4.3.1 Acceptance Tests

Shall be in accordance with AS5502 (4.3.1).

4.3.1.1 Initial and Final Acceptance Tests

Sufficient material for initial acceptance testing shall be packaged in the same type containers that are being procured. Initial acceptance tests are those listed in Table 2. After successful completion of the initial acceptance tests, the batch shall be released for final packaging. During packaging, test kits shall be selected at random for final acceptance testing. Final acceptance testing is to be conducted on the final packaged product and consist of those tests outlined in Table 3.

4.3.1.2 Final Acceptance Tests for Different Types and/or Size Containers

If the batch is being packaged in different types and/or size containers, the final acceptance tests on the lot shall be conducted on each type and/or each size containers. If the sealing compound is being procured under different purchase orders, but the purchase orders call for the same type and size containers, it is only necessary to conduct the final acceptance tests one time.

4.3.2 Shelf Life Tests

The tests listed in Table 4 may be performed at the end of the stated shelf life to extend the expiration date an additional 3 months. Only one shelf-life extension shall be allowed.

Table 4 - Shelf life tests

| Test | Requirement |
|--|-------------|
| Appearance | 3.4 |
| Viscosity of Base Compound ⁽¹⁾ | 3.6.2 |
| Application Time | 3.6.4 |
| Tack-Free Time | 3.6.5 |
| Cure Time to Hardness | 3.6.6 |
| Shear Strength (Class A Only) | 3.6.15 |
| Peel Strength (Class B Only) | 3.6.17 |
| Two aluminum AMS4045 panels, sulfuric acid anodized per AS5127 (6.3), coated with AMS-C-27725 Type 2 (see 8.4), and aged in adjusted JP-8 (4.6.2) for 7 days at 160 °F (71 °C) | |

⁽¹⁾ Not required for sectional-type containers.

4.3.3 Qualification Test Samples

Sample batches shall be produced using production scaled equipment. Enough material shall be supplied to perform all required tests.

Samples shall be identified as specified herein and below:

AMS3278C Type and Class

MANUFACTURER'S IDENTIFICATION _____

BATCH/LOT NUMBER _____

DATE OF PACKAGING _____

SHELF LIFE EXPIRATION DATE _____

STORE BELOW 80 °F (27 °C)

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) shall apply.

4.5.2 Standard Test Conditions

Standard laboratory conditions shall be as specified in AS5127 (Section 4).

4.5.3 Preparation of Test Specimens

4.5.3.1 Cleaning and Surface Preparation of Test Panels

Test panels shall be cleaned and prepared with surface treatments and coatings per AS5127 (Section 6).

4.5.3.2 Preparation of Sealing Compound

Sealing compound shall be prepared in accordance with AS5127/1 (Section 4) and subsections 4.1 and 4.2.

4.5.3.3 Application of Adhesion Promoter

If manufacturer recommends the use of an adhesion promoter for qualification or initial acceptance testing, the adhesion promoter product used for qualification shall be reported and will be included on the PRI-QPL-AMS3278. Panel surfaces shall be prepared and cleaned in accordance with AS5127 (Section 6) before application of adhesion promoter. Application of adhesion promoter shall be in accordance with the manufacturer's instructions.

4.5.3.4 Application of Sealing Compound

Unless otherwise specified herein, freshly mixed sealing compound shall be applied to test panels in accordance with AS5127 (6.10). For Class A materials, the sealant may be applied in layers with a time equal to the application life used between the applications to permit release of solvents.

4.5.3.5 Curing of the Sealing Compound

Shall be in accordance with AS5127 (6.11). Curing prior to qualification testing shall be 14 days at standard conditions. Curing prior to acceptance testing may be accelerated 48 hours minimum at standard conditions followed by 48 hours at 140 °F (60 °C).

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 Peel Strength Test Panels

For both Type 1 and Type 2, the type and quantity of panels listed in Table 5 shall be used for the evaluation of peel strength. Test panel configuration shall be in accordance with 4.5.3, AS5127/1 (8.1), and AS5127/1 (Figure 22).

4.6.2 Adjusted JP-8 Test Fluid

The fluid to be used for all fuel soaks shall be JP-8 per MIL-DTL-83133, adjusted with reagent grade or higher toluene to obtain 25 volume percent aromatic content in accordance with ASTM D1319.

4.6.3 Long-Term Storage

Long-term storage testing shall be conducted in accordance with AS5127/1 (9.2). The period of storage shall be 9 months.

4.6.4 Tack Free Time

Tack free time shall be tested in accordance with AS5127/1 (5.8) with the exception that for Class A specimens, one brush coat 0.003 to 0.005 inch (0.076 to 0.127 mm) thick shall be applied to the metal or plastic substrate.

4.6.5 Tensile Strength and Elongation

Tensile strength and elongation shall be tested in accordance with AS5127/1 (7.7) with the exception that Class A specimens shall be made by applying four brush coats, one at a time with an hour dry time between each layer, such that the total thickness is 0.013 to 0.020 inch (0.33 to 0.51 mm).