

AEROSPACE MATERIAL SPECIFICATION

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Superseding AMS 3378

Sealant, Silicone, Two-Part, General Purpose
Room Temperature Vulcanizing
Non-Fuel Resistant

1. SCOPE:

1.1 Form:

This specification covers a two-component silicone rubber sealant and compatible primers.

1.2 Application:

Primarily for sealing aircraft structures within a temperature range of -65 to +450 °F (-54 to +232 °C). The sealant is also compatible with AS1241 phosphate ester fire resistant hydraulic fluids.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to insure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

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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SAE WEB ADDRESS:

2.1 SAE Publications:

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

AMS 2471	Anodic Treatment of Aluminum Alloys, Sulfuric Acid Process, Undyed Coating
AMS 2473	Chemical Treatment for Aluminum Alloys, General Purpose Coating
AMS 2825	Material Safety Data Sheets
AMS 3819	Cloths, Cleaning, for Aircraft Primary and Secondary Structural Surfaces
AMS 4045	Aluminum Alloy Sheet and Plate, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr, (7075; - T6 Sheet, - T651 Plate), Solution and Precipitation Heat Treated
AMS 4049	Aluminum Alloy Sheet and Plate, Alclad, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr, (Alclad 7075; - T6 Sheet - T651 Plate), Solution and Precipitation Heat Treated
AMS 4911	Titanium Alloy, Sheet, Strip, and Plate, 6al 4v, Annealed
AMS 5516	Steel Sheet, Strip, and Plate, Corrosion Resistant, 18Cr - 9.0Ni (SAE 30302), Solution Heat Treated
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft
AS4491	Sealant Cartridge
AS5127	Sealant Test Methods ¹
AS5502	Standard Requirements for Aerospace Sealants

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM D 412	Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 1193	Reagent Water
ASTM D 2240	Rubber Property - Durometer Hardness

3. TECHNICAL REQUIREMENTS:

3.1 Classification: This specification shall cover materials defined in AS5127/1 as Class B.

3.2 Application Time: Dash numbers following the sealing compound classification (e.g. B-2), shall be used to designate the minimum application time in hours.

3.3 Materials:

The basic ingredient shall be a silicone liquid polymer that when mixed with a curing agent will convert to an elastomeric material. The sealant base shall contain the basic polymer, the curing agent shall contain the curing agent plus whatever ingredients will be necessary for the curing agent to be one-tenth the mass of the base. The sealant shall cure upon addition of the curing agent to the base and shall not depend on solvent evaporation as a part of the curing system.

- 3.3.1 Toxicity: The sealant shall not contain any constituents that would prove toxicologically hazardous during the normal course of handling, mixing, or final application. The manufacturer shall supply all necessary toxicological data to the procuring activity.
- 3.3.2 Color: The curing agent shall possess sufficient color contrast to the base compound to permit easy identification of unmixed or incompletely mixed sealant, except where coloration requirements of the cured sealant would preclude this (e.g. white or clear sealants.)
- 3.3.3 Storage Life: The sealant shall meet the requirements of 3.4.1 and 3.4.2 after storage at 75 °F $\pm$ 10 (24 °C $\pm$ 6) for 12 months from date of manufacture (date of last acceptance test conducted by manufacturer). Premixed-frozen material shall meet the requirements of 3.4.4 after 5 days storage at -65 °F $\pm$ 2 (-54 °C $\pm$ 1).
- 3.3.3.1 Storage Life Updating: At the expiration of the storage life time, sealant meeting the requirements of 3.4.1.2, through 3.4.1.5 may have its storage life extended for a period not to exceed 6 months.
- 3.3.4 Primer: The sealant may require the use of a one-part primer on some substrates to ensure acceptable adhesion. Such a primer shall be supplied by the sealant vendor and it shall be the same primer used to qualify the sealant to this specification. The primer shall be clear and free of particulate matter and shall impart a readily visible stain to the applied surface. Primer shall be supplied in an amount compatible with the amount of sealant furnished (See 5.1), and instructions for its proper storage, handling, and use (including a representative sampling of the substrates where primer use is recommended) shall also be included.

3.4 Properties:

The sealant shall conform to the following requirements; tests shall be performed on the sealant supplied and in accordance with specified test methods, insofar as practicable:

3.4.1 Uncured Properties. Shall be as follows:

	Property	Requirement	AS5127/1 Test Method
3.4.1.1	Nonvolatile Content: minimum	95%	5.1
3.4.1.2	Flow, maximum	0.75 inch (19 mm)	5.5.1
3.4.1.3	Application Time:	At the end of the rated application time, measured from the beginning of mixing, 15 grams/minute, minimum shall be extruded	5.6.2
3.4.1.4	Tack Free Time, maximum	24 hours measured from the beginning of mixing	5.8

	Property	Requirement	AS5127/1 Test Method
3.4.1.5	Cure Rate (time to attain a 40 Durometer A Hardness) maximum	48 hours	5.9

3.4.2 Cured Properties: Shall be as follows, determined in accordance with specified test procedures following Standard Cure per AS5502.

	Property	Requirement	AS5127/1 Test Method
3.4.2.1	Specific Gravity, maximum	1.50	6.1
3.4.2.2	Resistance to Thermal Rupture	The sealant shall not blister nor sponge and shall retain a pressure of 10 psi (69 kPa) with no more than 0.125 inch (3.18 mm) deformation	7.2 ¹
3.4.2.3	Low-Temperature Flexibility	No visual evidence of cracking, checking, or loss of adhesion	7.6
3.4.2.4	Peel Strength:		8.1 ¹
3.4.2.4.1	Resistance to Water, minimum	4 pounds force/inch (701 N/m) of width, 100% cohesive failure	
3.4.2.4.2	Resistance to Heat, minimum	50% of value obtained when tested as in 4.5.4.1, with no value less than 2 pounds force/inch width (350 N/m) of width, 100% cohesive failure. Tackiness or sponging, if found, shall noticeably diminish in specimens exposed 168 hours $\pm$ 1 and tackiness shall disappear.	

	Property	Requirement	AS5127/1 Test Method
3.4.2.5	Corrosion	No evidence of corrosion under the sealant. No deterioration of sealant.	7.9 ¹
3.4.2.6	Tensile Strength and Elongation, minimum	Table 1	7.7 ¹
3.4.2.7	Repairability, minimum	4 pounds force/inch (701 N/m) of width, 100% cohesive	8.2 ¹
3.4.2.8	Hydrolytic Stability	Maximum of 5 Durometer points hardness change	6.6
3.4.3	Accelerated Storage Stability per AS5502		
3.4.3.1	Flow, maximum	0.75 inch (19 mm)	5.5.1
3.4.3.2	Application Time	At the end of the rated application time, measured from the beginning of mixing 15 grams/minute, minimum shall be extruded	5.6.2
3.4.3.3	Tack Free Time	24 hours, measured from maximum the beginning of mixing	5.8
3.4.3.4	Cure Rate (time to attain a 40 Durometer A Hardness), maximum	48 hours	5.9
3.4.4	Mixed – Frozen Stability per AS5502		
3.4.4.1	Flow, maximum	0.75 inch (19 mm)	5.5.1
3.4.4.2	Application Time	At the end of the rated application time, measured from the end of thawing, 15 grams/minute, minimum shall be extruded	5.6.2

	Property	Requirement	AS5127/1 Test Method
3.4.4.3	Tack Free Time, maximum	24 hours after thawing of sealant	5.8
3.4.4.4	Cure Rate (time to attain a 40 Durometer A Hardness after thawing), maximum	48 hours	5.9

3.5 Quality:

The base and curing agent, as received by purchaser, shall be uniform in quality and consistency and free of agglomerates, foreign particles, or entrapped air. There shall be no separation of materials which cannot be readily dispersed. The cured compound shall present an appearance of smooth homogeneity.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of sealant 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 sealant conforms to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for the following requirements are acceptance tests and shall be performed on each lot:

Requirement	Reference Paragraph
Flow	3.4.1.2
Application Time	3.4.1.3
Tack Free Time	3.4.1.4
Cure Rate	3.4.1.5
Peel Strength, Water Immersion Using Substrates 4.5.1.2 and 4.5.1.5 Only	3.4.2.4.1

4.2.2 Qualification Tests: All technical requirements are qualification tests and shall be performed prior to or on the initial shipment of sealant to a purchaser, when a change in ingredients and/or processing requires reapproval per AS5502, and when purchaser deems confirmatory testing to be required.

- 4.3 Sampling and Testing shall be per AS5502
- 4.4 Approval shall be per AS5502
- 4.5 Test Methods:
- 4.5.1 Test Panels: Shall be follows; sizes are specified in the applicable test method:
- 4.5.1.1 Bare Aluminum: AMS 4045 aluminum alloy.
- 4.5.1.2 Chemical Film Treated Aluminum: AMS 4049 aluminum alloy with chemical film applied in accordance with AMS 2473.
- 4.5.1.3 Anodized Aluminum: AMS 4049 aluminum alloy panels anodized in accordance with AMS 2471.
- 4.5.1.4 AMS-C-27725 Coating: Aluminum alloy panels as in 4.5.1.2 shall be coated with AMS-C-27725 corrosion preventive coating, in accordance with manufacturer's instructions, to produce a dry film thickness of 0.0008 to 0.0015 inch (20 to 38 μm).
- 4.5.1.5 MIL-PRF-23377 Primer: Aluminum alloy panels as in 4.5.1.2 shall be coated with MIL-PRF-23377 epoxy primer, in accordance with manufacturer's instructions, to produce a dry film thickness of 0.0006 to 0.0009 inch (15 to 23 μm).
- 4.5.1.6 Titanium: AMS 4911 titanium.
- 4.5.1.7 Steel: AMS 5516 corrosion-resistant steel.
- 4.5.2 Cleaning and Priming of Panels: Prior to application of sealant, all test panels shall be cleaned per AS5127. Apply primer supplied by vendor using AMS 3819 cloth per manufacturer's instructions. If the primer is allowed to dry for more than the manufacturer's recommended time limit prior to sealant application, the panels shall be cleaned and the primer re-applied.
- 4.5.3 Resistance to Thermal Rupture: Two panels conforming to 4.5.1.4 and two panels conforming to 4.5.1.5 shall be prepared per AS5127/1, para. 7.2. After standard cure per AS5502 one panel of each configuration shall be placed in fire resistant hydraulic fluid per AS1241 at $140\text{ }^{\circ}\text{F} \pm 2$ ($60\text{ }^{\circ}\text{C} \pm 1$) for 168 hours ± 4 . Following conditioning, test per AS5127/1, para. 7.2 at $450\text{ }^{\circ}\text{F} \pm 2$ ($232\text{ }^{\circ}\text{C} \pm 1$), and an air pressure of 10 psi ± 1 (69 kPa ± 7) for 60 minutes ± 2 after the pressure is applied. The test shall be repeated on the panels not immersed in the hydraulic fluid.
- 4.5.4 Peel Strength: Substrate test panels shall be prepared per AS5127 using stainless steel or monel wire cloth. Substitute exposures in AS5127 with those below.

- 4.5.4.1 Resistance to Water: 3 each test panels conforming to 4.5.1.1 through 4.5.1.7 shall be conditioned as follows: within two days after sealant cure per AS5502, completely immerse three peel specimens of each configuration in ASTM D 1193 Type IV water for 7 days $\pm$ 4 hours at 140 °F $\pm$ 2 (60 °C $\pm$ 1). A ratio of three specimens per quart (L) of distilled water shall be used. After conditioning, allow the specimens to cool, while immersed in the water, for 24 hours at 77 °F $\pm$ 2 (25 °C $\pm$ 1) prior to testing. The peel strength shall be measured within 10 minutes after removal from the water per AS5127.
- 4.5.4.2 Resistance to Heat: 8 each test panels conforming to 4.5.1.4 and 4.5.1.5 shall be conditioned as follows following standard cure per AS5502: tightly clamp eight peel specimens of each configuration together and place in circulating-air oven at 450 °F $\pm$ 2 (232 °C $\pm$ 1). At intervals of 1, 2, 4, 8, 24, 48, 96, and 168 hours $\pm$ 5 minutes, remove one specimen of each configuration from the oven and allow to cool at room temperature. Within one hour following removal from the oven, perform peel testing per AS5127. After completion of the 168-hour exposure test, all specimens shall be compared and examined for tackiness and sponging.
- 4.5.5 Corrosion: Test one AMS 4045 aluminum alloy panel, per AS5127/1, para. 7.9, omitting the conversion coating and AMS3100 adhesion promoter. Substitute the following conditions for those in AS5127: 20 days $\pm$ 4 hours at 140 °F $\pm$ 2 (60 °C $\pm$ 1) in a covered glass vessel containing a 3% aqueous sodium chloride solution with 3 inches (76 mm) of the panel exposed to the salt water and the remainder of the panel exposed to the air vapor mixture
- 4.5.6 Tensile Strength and Elongation: Using the conditions in Table 1, prepare and test specimens per AS5127/1, para. 7.7. Note that some silicones require exposure to air to cure, for these chemistries substitute a layer of PTFE – coated glass fabric (or equivalent) for the upper layer of polyethylene
- 4.5.7 Repairability: Prepare 3 test panels per AS5127/1, para. 8.2.a, omitting the conditioning in AMS 2629 fluid and subsequent drying operations.
- 4.6 Reports shall be per AS5502
- 4.6.1 A material safety data sheet conforming to AMS 2825, or equivalent, shall be supplied to each purchaser prior to, or concurrent with, the report of preproduction test results or, if preproduction testing be waived by purchaser, concurrent with the first shipment of the product for production use. Each request for modification of product formulation shall be accompanied by a revised data sheet for the proposed formulation.
- 4.7 Resampling and Retesting shall be per AS5502.
5. PREPARATION FOR DELIVERY:
- 5.1 Packaging shall be per AS5502