

 AEROSPACE MATERIAL SPECIFICATION	SAE AMS-S-29574		REV. A
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Superseded by AMS3277			
Sealing Compound, Polythioether, for Aircraft Structures, Fuel and High Temperature Resistant, Fast Curing At Ambient and Low Temperatures			

RATIONALE

Technical requirements of this specification have been incorporated into AMS3277. This specification was never used for reference or material purchase since MIL-S-29574 was still active at the time this specification was generated.

CANCELLATION NOTICE

This document has been declared "CANCELLED" as of February 2011 and has been superseded by AMS3277. By this action, this document will remain listed in the Numerical Section of the Aerospace Standards Index noting that it is superseded by AMS3277.

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NOTICE

This document has been taken directly from U.S. Military Specification MIL-S-29574, Amendment 1, and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-S-29574, Amendment 1. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

1. SCOPE:

1.1 Form:

This specification establishes the requirements for two types and three classes of a two component, fast curing at low and ambient temperature, polythioether sealing compound for use in sealing integral fuel tanks and other aircraft structures. Temperature capabilities are identified in 1.2.1.

1.2 Classification:

The sealing compound shall be classified as follows:

1.2.1 Types: There are two types of sealants furnished to this document. Additionally, Type I is furnished in 3 grades as shown below.

Type I - Fuel resistant sealant for use from -80°F to +300°F (-62°C to +149°C) with intermittent use to +400°F (204°C).

Grade A - For general use in fuel tanks and aircraft structures

Grade AI - Ambient cure or immediate heat cure at temperatures up to 350°F (175°C) immediately after application. Available as Class B and Class C.

Grade B - Enhanced craze resistance, for use with acrylic aircraft transparencies.

Type II - Corrosion inhibitive, fuel resistant sealant for use from -80°F to +300°F (-62°C to +149°C) with intermittent use to +360°F (+182°C).

1.2.2 Classes:

Class A - Suitable for brush application

Class B - Suitable for application with extrusion gun or spatula

Class C - Suitable for faying surface sealing applications

1.2.3 Application time: The minimum application time in hours for each class shall be:

Class A - 1/4, 1/2, 2

Class B - 1/4, 1/2, 2

Class C - 4

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. Unless otherwise specified, the applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.2 U.S. Government Publications:

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

L-P-378	Plastic Sheet and Strip, Thin Gauge, Polyolefin
Q-S-1926	Sodium Chloride, Technical
P-D-680	Dry Cleaning Solvent
QQ-A-250/4	Aluminum alloy, 2024, Plate and Sheet
QQ-A-250/12	Aluminum Alloy 7075, Plate and Sheet
QQ-A-250/13	Aluminum Alloy Alclad 7075, Plate and Sheet
QQ-P-416	Plating, Cadmium (Electrodeposited)
PPP-B-636	Box, Shipping, Fiberboard
PPP-C-96	Can, Metal, 28 Gage and Lighter
PPP-D-729	Drums, Shipping and Storage, Steel 55 Gallons (208 Liters)
PPP-P-704	Pails, Metal, Shipping, Steel, 1 Through 12 Gallons
MIL-S-5002	Surface Treatments and Inorganic Coatings for Metal Surfaces of Weapons Systems
MIL-S-5059	Steel, Corrosion Resistant (18-8) Plate, Sheet and Strip
MIL-C-5541	Chemical Conversion Coatings on Aluminum Alloys
MIL-D-6998	Dichloromethane, Technical
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Number 0-148
MIL-P-8184	Plastic Sheet, Acrylic, Modified
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-S-8802	Sealing Compound, Temperature Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion
MIL-T-9046	Titanium and Titanium Alloy, Sheet, Strip and Plate
MIL-A-9962	Abrasive Mats, Non-Woven, Non-Metallic
MIL-L-10547	Liner, Case, and Sheet, Overwrap, Water Vaporproof or Waterproof, Flexible
MIL-P-23377	Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base
MIL-P-25690	Plastic, Sheets and Parts, Modified Acrylic Base, Monolithic, Crack Propagation Resistant
MIL-C-27725	Coating, Corrosion Preventive, for Aircraft Integral Fuel Tanks
MIL-S-38714	Packaging and Packing of Two-Component Materials in Semkits
MIL-C-81706	Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys
MIL-C-83286	Coating, Urethane, Aliphatic Isocyanate, for Aerospace Applications
MIL-C-83430	Sealing Compound, Integral Fuel Tanks and Fuel Cavities, Intermittent Use to 360°F (182°C)
MIL-C-87962	Cloths, Cleaning, for Aircraft Fuel Tanks
FED-STD-313	Material Safety Data Sheets, Preparation and Submission of
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-147	Palletized Unit Loads

2.3 ASTM Publications:

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

ASTM A 108	Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM B 117	Method of Salt Spray (Fog) Testing
ASTM D 412	Rubber Properties in Tension
ASTM D 2240	Rubber Property Durometer Hardness

2.4 SAE Publications:

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

AMS 2629	Jet Reference Fluid
AMS 4377	Magnesium Alloy, Sheet and Plate, 3.0 Al 1.0 Zn, Cold Rolled, Partially Annealed (AZ31B-H26)
AMS 3166	Solvents, Cleaning, Cleaning Prior to Application of Sealing Compounds (DoD Adopted)

2.5 Uniform Classification Committee, Agent Publications:

Available from Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.

Uniform Freight Classification

2.6 National Motor Freight Traffic Association, Inc., Agent Publications:

Available from American Trucking Association, Traffic Department, 2200 Mill Road, Alexandria, VA 22314.

National Motor Freight Classification

2.7 Order of precedence:

In the event of conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets or MS standards), the text of this document takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS:

3.1 Bid sample:

The sealing compounds furnished under this specification shall be products which have been evaluated in response to an invitation for bid. The evaluation shall be completed before the award of the contract (see 4.3 and 6.3).

3.2 First article:

When specified (see 6.2.1), the sealing compound shall be subjected to first article inspection in accordance with 4.4.

- 3.2.1 Toxicological formulations: The material shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate medical service who will act as an advisor to the contracting agency.

3.3 Materials:

The sealing compound shall consist of a base compound which will cure to an elastomeric state upon addition of a separate curing agent.

- 3.3.1 Base compound: The base compound shall be primarily a synthetic polymer of the polythioether type. Neither the base compound nor the cured sealant shall be red or pink in color.
- 3.3.2 Curing agent: The curing agent shall be of sufficiently different color from the base compound to easily identify an incompletely mixed system. Type II curing agent shall have an added soluble chromate ion for corrosion inhibition.
- 3.3.3 Primer: A primer, as recommended by the manufacturer, is required. The primer shall be included as part of the package (see 5.1.1.1.1).

3.4 Examination of product:

After mixing and extrusion, the compound shall be uniform, free of skins, lumps, gels or coarse particles.

3.5 Properties before cure:

- 3.5.1 Viscosity of base compound: The viscosity of the base compound, when tested in accordance with 4.10.2 shall be as follows:

Class A - 100 to 500 poises (10 to 50 pascal seconds (Pa.s))

Class B - 9,000 to 18,000 poises (900 to 1800 Pa.s)

Class C - 1,000 to 4,000 poises (100 to 400 Pa.s)

- 3.5.2 Application time: The application time of the mixed sealing compound shall be as designated in 1.2.3. When tested as specified in 4.10.3, the viscosity or extrusion rate for the stated application item (see 1.2.3) shall be as follows:

Class A - 2,500 poises (250 Pa.s) max.

Class B - 15 grams per minute, min.

Class C - 30 grams per minute, min.

- 3.5.3 Tack-free time: When tested in accordance with 4.10.4, the mixed sealing compound shall cure to a tack-free condition in not more than the time in hours specified in the applicable portions of Tables I or II.
- 3.5.4 Assembly time (Class C): When tested in accordance with 4.10.5, the mixed Class C sealing compound shall have an assembly time of not less than 4 hours. The sealant shall squeeze out to a thickness of 0.005 inch (.13mm) or less at the bolts.
- 3.5.5 Flow (Class B only): When tested as specified in 4.10.6, the class B sealing compound shall flow within the limits of 0.1 to 0.75 inch (2.5 to 19 mm) within the specified test time.
- 3.5.6 Cure rate characteristics (see 4.8.1):
- 3.5.6.1 Standard temperature cure rate: After curing as specified in 4.10.7, the instantaneous hardness shall be as specified in the applicable portion of Table I.

Table I. Standard temperature cure characteristics 1/ 2/

Property for Application time of-	Class A			Class B			Class C
	1/4	1/2	2	1/4	1/2	2	4
Cure time, hours	1.5	3	14	1.5	3	14	24
Hardness, pts, min	25	25	25	30	30	25	30
Tack free time, hours, min	1	1.5	9	1	2	9	--
Assembly time, hours, min	-	-	-	-	-	-	8
Pressure Rupture, psi, (kPa), min	20 (138)	-	-	25 (175)	-	-	--

1/ All specimens cured at standard conditions (see 4.9.7).

2/ the "-" indicates no requirement for that property.

- 3.5.6.2 Low temperature cure rate (Class A-1/4 and 1/2; B-1/4 and 1/2 only: After curing as specified in 4.10.8, the instantaneous hardness shall be as specified in the applicable portion of Table II.
- 3.5.6.3 Fluid immersed curing rate (Class A-1/4 and 1/2; B-1/4 and 1/2 only: When tested in accordance with 4.10.9, A-1/4 and B-1/4 sealing compounds shall have a hardness of not less than 25 after curing for 2 hours and not less than 35 after curing for 4 hours. Class A-1/2 and B-1/2 hardness shall be not less than 25 after 3 hours and not less than 35 after 6 hours cure.

Table II. Low temperature curing characteristics

Property at Cure temperature of -	Class A				Class B			
	40°F		20°F		40°F		20°F	
Application time	1/4	1/2	1/4	1/2	1/4	1/2	1/4	1/2
Cure time, hours	4	8	8	16	4	8	8	16
Hardness, pts., min	20	20	20	20	25	25	25	25
Tack free time, hours	3	3	6	6	3	6	6	6
Pressure rupture, psi, (kPa), min.	20 (138)	20 (138)	20 (138)	20 (138)	25 (175)	25 (175)	25 (175)	25 (175)

- 3.5.7 Pressure rupture (Class A-1/4 and -1/2; B-1/4 - 1/2 only: Low temperature and standard cure test specimens shall be tested as specified in 4.10.10. Conformance to the appropriate section of Table I or Table II as noted.
- 3.5.8 Nonvolatile content: The minimum percent nonvolatile content of the freshly mixed sealing compound, when tested as specified in 4.10.11 shall be as follows:
- Class A - 84 percent
Class B - 97 percent
Class C - 98 percent
- 3.6 Properties after cure (see 4.8.2 for cure cycle):
- 3.6.1 Specific gravity: The specific gravity of the cured polythioether material shall be no greater than 1.50 when determined in accordance with 4.10.12.
- 3.6.2 Hardness: When tested in accordance with 4.10.13, the sealing compound shall have a hardness of not less than 40.
- 3.6.3 Peel strength: The as received peel strength of the sealing compound, when tested as specified in 4.10.14, shall be 20 pounds per inch width minimum. After immersion values shall be 20 pounds per inch width minimum or type I, and 15 pounds per inch width minimum for Type II. There shall be 100 percent cohesive failure of all test specimens.
- 3.6.4 Repairability: The sealing compound shall repair minor breaks in itself and other polythioether sealing compounds qualified to this specification. Additionally, these compounds shall repair polysulfide sealing compounds. A coat of sealing compound, applied over a cured and aged film of polythioether or polysulfide material as specified in 4.10.15, shall show satisfactory bonding, no lifting, blistering, loss of adhesion or other film irregularities. The film shall have a 10 pounds per inch width minimum peel strength, except Grade B to polysulfide shall be 5 pounds per inch width.
- 3.6.5 Tensile and elongation properties (classes B and C): When tested as specified in 4.10.16, tensile and elongation properties shall be in accordance with Table III.

- 3.6.6 Shear strength (class C only): The shear strength of the cured sealing compound shall be not less than 200 psi (1,380 kPa) when tested as specified in 4.10.17. At least 75 percent of the area of separation produced in the shear test specimens shall be within the sealing compound.
- 3.6.6.1 Shear strength after heat reversion test (class C only): When tested as specified in 4.10.17.1 the sealant shall remain elastomeric. The conditioned material, when evaluated in 4.10.17, shall have a minimum shear strength of 100 psi (690 kPa). At least 75 percent of the area of separation produced in the shear test specimens shall be within the sealing compound (cohesive failure).
- 3.6.7 Low-temperature flexibility: The compound shall withstand the bend test as specified in 4.10.18 without cracking, checking, or loss of adhesion.

Table III. Tensile strength and elongation. (Classes B and C only)

Condition	Tensile strength, psi (kPa) Min.	Elongation, % Min.
As cured (4.9.16.1)	250 (1725)	250
14-day immersion in jet reference fluid at 140° ± 2° F (60° ± 1° C) (4.10.16.2)	125 (862)	150
2 hours at 420° ± 5° F (215° ± 3° C) (4.10.16.3)	150 (1035)	100
72 hours immersion in jet reference fluid at 140° ± 2° F (60° ± 1° C), followed by 72 hours air-drying at 120° ± 2° F (49° ± 1° C), followed by 7 days at 300° ± 5° F (149° ± 3° C) or 141° ± 3° C (285° ± 5° F) for A-1/4 and B-1/4 (4.10.16.4)	150 (1035)	50
Standard heat aging, followed by 7 days immersion in jet reference fluid at 140° ± 2° F (60° ± 1° C) (4.10.16.5)	100 (690)	50

- 3.6.8 Resistance to thermal rupture: When tested in accordance with 4.10.19, the sealing compound shall retain a pressure of 10 pounds per square inch (psi) (70 kPa) with no more than 5/32 inch (4 mm) deformation.

- 3.6.9 Chalking: The sealant shall not chalk when tested in accordance with 4.10.20 in jet reference fluid containing metal ions.
- 3.6.10 Hydrolytic stability: When tested for hardness after exposure as specified in 4.10.21, the specimens shall retain 80 percent of their original hardness.
- 3.6.11 Corrosion: When tested in accordance with 4.10.22, there shall be no corrosion under the sealing compound and the sealing compound shall show no sign of deterioration.
- 3.6.12 Soluble chromate ion (Type II only): When tested in accordance with 4.10.23, the curing agent for Type II compound shall contain 3.0 percent minimum added free chromate ion available for corrosion inhibition.
- 3.6.13 Craze Resistance (Type I Grade B only): When tested as specified in 4.10.24, the sealing compound shall not cause the stressed acrylic specimens to craze, crack or cause other chemical degradation.
- 3.6.14 Properties after immediate heat cure (Type I Grade C only):
- 3.6.14.1 Sponging: The test specimen shall show no visible evidence of blowing, sponging, or other chemical degradation when examined after sectioning as specified in 4.10.25.1.
- 3.6.14.2 Shear strength: Shear strength of the type I, grade C compound after curing as specified in 4.10.25.2 shall be not less than 200 psi (1380 kPa).
- 3.6.15 Weight loss and flexibility: When tested in accordance with 4.10.26, the sealing compound shall not lose more than 4.0 percent by weight and shall not crack when bent through 180 degrees over a 1/8 inch mandrel.
- 3.7 Storage requirements:
- 3.7.1 Long term storage: After storage as specified in 4.10.27.1, the sealing compound shall meet all the requirements specified for accelerated storage (3.7.2) and Tables I and II, as applicable.
- 3.7.2 Accelerated storage stability: After storage in accordance with 4.10.27.2, the base compound shall show no shrinking, hardening, separation, nor settling of the material upon visual inspection. It shall meet the viscosity requirement in 3.5.1. The aged curing compound shall not be adversely affected and shall be capable of being restored by normal agitation to a condition suitable for use. The aged base compound and the aged curing compound, when mixed, shall meet the requirements for flow (3.5.5), cure rate (3.5.6), application time (3.5.2), assembly time (3.5.4), tack-free time (3.5.3) and shear strength (3.6.6). As received and after immersion peel strength on adherend numbers 5, 7 and 9 (see Table IX) shall be determined. Immersion conditions shall be 7 days at $140^{\circ} \pm 2^{\circ} \text{ F}$ ($60^{\circ} \pm 1^{\circ} \text{ C}$) in the JRF II/3 % NaCl solution in 4.10.14.3. The peel strength requirement (3.6.3) shall be 20 pounds per inch width minimum for classes A and B and 15 pounds per inch width, minimum for class C.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance: All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.1.1 Source Inspection: Materials procured by the Government under this specification shall be source inspected so there is assurance that the sealing compound meets the quality conformance inspection prior to leaving the manufacturer's plant. Note that the material shall be packaged and mixed in containers specified in Section 5 of this specification.

4.2 Classification of inspections:

The inspection requirements specified herein shall be classified as follows:

- a. Bid sample inspection (see 4.3)
- b. First article inspection (see 4.4)
- c. Quality conformance inspection (see 4.5)

4.3 Bid sample inspection:

The bid sample inspection shall consist of all the tests and inspections specified in Table IV.

Table IV. Bid sample inspection

Inspection	Requirement	Paragraph	Test
Materials	3.3		4.10.1
Examination of product	3.4		4.10.1
Viscosity	3.5.1		4.10.2
Application time	3.5.2		4.10.3
Tack free time	3.5.3		4.10.4
Assembly time (class C)	3.5.4		4.10.5
Flow (class B)	3.5.5		4.10.6
Curing rate characteristics	3.5.6		4.10.7
			4.10.8
			4.10.9
Pressure rupture	3.5.7		4.10.10
Nonvolatile content	3.5.8		4.10.11
Specific gravity	3.6.1		4.10.12
Hardness	3.6.2		4.10.13
Peel strength	3.6.3		4.10.14
Repairability	3.6.4		4.10.15
Tensile strength	3.6.5		4.10.16
Elongation	3.6.5		4.10.16
Shear strength	3.6.6		4.10.17
Heat reversion resistance	3.6.6.1		4.10.17.1
Low temp flexibility	3.6.7		4.10.18
Resistance thermal rupture	3.6.8		4.10.19
Chalking	3.6.9		4.10.20
Hydrolytic stability	3.6.10		4.10.21
Corrosion	3.6.11		4.10.22
Soluble chromate ion	3.6.12		4.10.23
Craze resistance 1/	3.6.13		4.10.24
Prop. after immediate heat cure 2/	3.6.14		4.10.25
Weight loss and flexibility	3.6.15		4.10.26
Long term storage	3.7.1		4.10.27
Accelerated storage	3.7.2		4.10.27

1/ Type I, Grade B only.

2/ Type I, Grade C only.