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400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 3100

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ADHESION PROMOTER
For Polysulfide Sealing Compounds

1. SCOPE:

1.1 Form: This specification and its supplementary detail specifications cover adhesion promoters in liquid form.

1.2 Application: Primarily for use in enhancing the adhesion of polysulfide adhesives or sealant compounds to MIL-C-27725 integral fuel tank coating or other substrates such as painted or primed surfaces and bare titanium alloys.

1.3 Classification: Adhesion promoter shall be classified by color and type of solvent as shown in the detail specifications.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2473 - Chemical Treatment for Aluminum Alloys, General Purpose Coating
AMS 2820 - Aerosol Packaging
AMS 2825 - Material Safety Data Sheets
AMS 4911 - Titanium Alloy Sheet, Strip, and Plate, 6Al - 4V, Annealed

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D1266 - Sulfur in Petroleum Products (Lamp Method)
ASTM D3227 - Mercaptan Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometric Method)

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Specifications:

QQ-A-250/4 - Aluminum Alloy 2024, Plate and Sheet
TT-S-735 - Standard Test Fluids, Hydrocarbon
TT-T-548 - Toluene, Technical
CCC-C-419 - Cloth, Duck, Cotton, Unbleached, Plied Yarns, Army and Numbered
PPP-P-1892 - Paint, Varnish, Lacquer, and Related Materials, Packaging, Packing, and Marking of

2.3.2 Military Specifications:

MIL-P-5425 - Plastic, Sheet, Acrylic, Heat Resistant
MIL-P-8802 - Sealing Compound, Temperature Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion
MIL-P-23377 - Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant
MIL-C-27725 - Coating, Corrosion Preventive, for Aircraft Integral Fuel Tanks
MIL-C-38736 - Compound, Solvent, for Use in Integral Fuel Tanks
MIL-S-83430 - Sealing Compound, Integral Fuel Tanks and Fuel Cell Cavities, Intermittent Use to 360°F (182°C)

3. TECHNICAL REQUIREMENTS:

3.1 Detail Specification:. The requirements for a specific adhesion promoter shall consist of all requirements specified herein in addition to requirements specified in the applicable detail specification. In case of conflict between requirements of this specification and requirements of an applicable detail specification, requirements of the detail specification shall govern.

3.2 Material: The adhesion promoter shall be a dyed liquid formulated to meet the requirements of 3.3.

3.3 Properties: The promoter shall conform to the requirements specified in the applicable detail specification determined in accordance with test methods specified in 4.5.

3.4 Quality: Adhesion promoter, as received by purchaser, shall be uniform in quality and condition, clean, free from sedimentation or turbidity, and free from foreign materials and other contaminants detrimental to usage of the adhesion promoter.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of adhesion promoter shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the adhesion promoter conforms to the requirements of this specification and the applicable detail specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to the following requirements are classified as acceptance tests and shall be performed on each lot:

Requirement	Paragraph Reference
Chemical Control	See Detail Specification
Color	See Detail Specification
Peel Strength	See Detail Specification
Solvent Identification	See Detail Specification

4.2.2 Preproduction and Qualification Tests: Tests to determine conformance to all technical requirements of this specification and an applicable detail specification are classified as preproduction and qualification tests and shall be performed prior to or on the initial shipment of adhesion promoter to a purchaser, when a change in material, processing, or both requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 Qualification: For direct U.S. Military procurement and for procurement for use on U.S. Military contracts, adhesion promoter shall be a product which has been tested, has passed the qualification tests of 4.2.2, and has been listed or approved for listing on the applicable U.S. Military qualified products list.

4.3 Sampling: Shall be as follows:

4.3.1 For Acceptance Tests: Sufficient adhesion promoter shall be taken at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.1 A lot shall be all adhesion promoter produced in a single production run from the same batches of raw materials under the same fixed conditions and presented for vendor's inspection at one time. An inspection lot shall not exceed 500 gal (1900 L) and may be packaged and delivered in smaller quantities under the basic lot approval provided lot identification is maintained.

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

4.3.2 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.3.3 For Qualification Tests: Samples shall consist of three aerosol containers or three brown glass small-mouth bottles (See 5.1.1), each containing a minimum net weight of 16 oz (450 g) of adhesion promoter. Samples shall be identified as specified herein and forwarded to the activity responsible for qualification as designated in the letter of authorization from that activity (See 8.2). Samples for qualification shall be identified as follows:

ADHESION PROMOTER
FOR
POLYSULFIDE SEALING COMPOUND

Specification AMS 3100/*
Manufacturer's Number
Name of Manufacturer
Submitted by (Name) (Date) for qualification tests in accordance with AMS 3100 under authorization (reference authorizing letter)

* Insert applicable detail specification number

4.4 Approval:

4.4.1 Adhesion promoter shall be approved by purchaser before adhesion promotor for production use is supplied, unless such approval be waived by purchaser. For direct U.S. Military procurement and for procurement for use on U.S. Military contracts, the adhesion promoter shall be listed, or approved for listing, on the applicable U.S. Military qualified products list. Results of tests on production adhesion promotor shall be essentially equivalent to those on the approved (qualified) sample.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production adhesion promoter which are essentially the same as those used on the approved (qualified) sample. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material, processing, or both and, when requested, sample adhesion promoter. Production adhesion promoter made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Test Panel Preparation:

4.5.1.1 Panel Material, Size, and Coating: Shall be as follows:

4.5.1.1.1 Aluminum Alloy: QQ-A-250/4 aluminum alloy sheet -T81 temper, nominally 0.040 x 2.75 x 6 in. (1 x 70 x 150 mm) with chemical film applied in accordance with AMS 2473.

4.5.1.1.2 Titanium Alloy: AMS 4911 titanium alloy sheet or strip, nominally 0.040 x 2.75 x 6 in. (1 x 70 x 150 mm).

4.5.1.1.3 Acrylic: MIL-P-5425 acrylic plastic sheet, nominally 0.22 x 2.75 x 6 in. (5.5 x 70 x 150 mm).

4.5.1.1.4 MIL-C-27725 Coating: Aluminum alloy panels as in 4.5.1.1.1 shall be coated with MIL-C-27725 corrosion preventive coating, in accordance with manufacturer's instructions, to produce a dry film thickness of 0.0008 - 0.0015 in. (20 - 37.5 m) and cured for not less than 14 days at 25°C ± 1 (77°F ± 2) and 50% ± 5 relative humidity.

4.5.1.1.5 Aged MIL-C-27725 Coating: Panels prepared as in 4.5.1.1.4 shall be aged, immediately after curing, by immersion in jet reference fluid (See 4.5.3) for 12 days + 0.5 at 60°C ± 1 (140°F + 2), followed immediately by 60 hr + 0.5 at 70°C ± 1 (160°F + 2), followed immediately by 6 hr ± 0.5 at 80°C ± 1 (180°F ± 2), followed immediately by air drying for 66 hr + 0.5 at 95°C + 1 (200°F + 2), followed by air drying for 5 hr ± 0.5 at 125°C + 1 (255°F + 2), followed by air drying for 4 hr ± 0.5 at 140°C ± 1 (280°F ± 2), and finally air drying for 72 min. ± 6 at 150°C ± 1 (300°F ± 2).

4.5.1.1.6 MIL-P-23377 Primer: Aluminum alloy panels as in 4.5.1.1.1 shall be coated with MIL-P-23377 epoxy primer, in accordance with manufacturer's instructions, to produce a dry film thickness of 0.0006 - 0.0009 in. (15 - 22.5 m), and cured for not less than 14 days at 25°C ± 1 (77°F ± 2) and 50% ± 5 relative humidity.

4.5.1.2 Cleaning of Panels: All test panels shall be cleaned by scrubbing and rinsing with MIL-C-38736 solvent using soap-free and grease-free rags or paper towels. After cleaning with solvent, surfaces of panels shall be wiped dry with clean rags or paper towels. If adhesion promoter is not required, allow the panels to dry in air at 25°C ± 1 (77°F ± 2) and 50% ± 5 relative humidity for not less than 15 min. nor more than 24 hr before applying sealant. If more than 24 hr elapse, reclean the test panel.

4.5.1.3 Application of Adhesion Promoter: When specified, adhesion promoter shall be applied to the cleaned surfaces immediately after cleaning according to manufacturer's instructions. The adhesion promoter shall be allowed to dry in air at 25°C ± 1 (77°F ± 2) and 50% ± 5 relative humidity for not less than 15 min. nor more than 24 hr before applying sealant. If more than 24 hr elapse, reclean the test panel and reapply the adhesion promoter.

4.5.2 Sealant: Sealants used for preparing peel test specimens shall be manganese-dioxide-curing conforming to MIL-S-83430, or to MIL-S-8802, Class B-2. Sealants shall be within their specified shelf life when used.

4.5.3 Jet Reference Fluid: Shall be composed of the following components:

Toluene (TT-T-548)	25 ± 1 volumes
Cyclohexane (Technical)	35 ± 1 volumes
Isooctane (TT-S-735)	40 ± 1 volumes
Tertiary dibutyl disulfide (doctor sweet)	1 ± 0.005 volume
Tertiary butyl mercaptan	0.0150 ± 0.0015 wt % of the other four components

4.5.3.1 Total sulfur and mercaptan sulfur of the jet reference fluid, determined in accordance with ASTM D1266 and ASTM D3227, respectively, shall meet the following requirements:

Total Sulfur, wt %	0.400 ± 0.005
Mercaptan Sulfur, wt %	0.0050 ± 0.0005

4.5.3.2 The fluid shall be stored out of contact with light and in containers which are inert to the fluid ingredients. (Welded aluminum, non-galvanized steel, and glass containers are suitable.) If not used within the 90 days after blending, the fluid shall be retested for mercaptan sulfur and total sulfur content.

4.5.4 Color: Adhesion promoter shall be applied, according to manufacturer's instructions, to test panels as in 4.5.1.1.1, allowed to air dry at 25°C ± 1 (77°F ± 2) and 50% ± 5 relative humidity for not less than 15 min., and visually inspected for color.

4.5.5 Peel Strength: Shall be determined on the panels specified in the applicable detail specification, using specimens prepared and tested as follows:

4.5.5.1 The center 4 in. (100 mm) of the panels shall be coated on one face with a 0.125 in. ± 0.016 (3.20 mm ± 0.40) thickness of sealing compound. An optional configuration consists of coating the bottom approximate 5 in. (125 mm) of the panel with sealant (Fig. 1). A 2.75 x 12 in. (70 x 300 mm) strip of wire screen [20 - 40 (850 - 425 μm) mesh aluminum or monel wire fabric or cotton duck conforming to CCC-C-419, Type II], shall be impregnated with sealant so that approximately 4 in. (100 mm) [5 in. (125 mm) for optional configuration] at one end is completely covered on both faces. The sealant shall be worked well into the screen or fabric. The sealant impregnated end of the screen or fabric shall be placed on the sealant coated panel and smoothed down on the layer of sealant, taking care not to trap air beneath the screen or fabric.

4.5.5.2 An additional approximately 0.031 in. (0.75 mm) thick coating of sealant shall be applied over the screen or fabric. Peel strength specimen configuration shall be as shown in Fig. 1.

4.5.5.3 Cure the sealant for 14 days ± 0.5 at 25°C ± 1 (77°F ± 2) and 50% ± 5 relative humidity. A cure of 48 hr ± 0.5 at 25°C ± 1 (77°F ± 2) and 50% ± 5 relative humidity, followed by 24 hr ± 0.5 at 60°C ± 1 (140°F ± 2) may be used for acceptance tests.

4.5.5.4 Following cure, the panels shall be completely immersed in the fluid specified in the applicable detail specification in covered glass vessels and under the conditions specified in the applicable detail specification. Specimen-to-fluid ratio shall be approximately one panel per pint (0.5 L) of fluid. [Immersion in wide-mouth quart (litre) jars with two panels in each jar has been found suitable.] After specified exposure at 60°C ± 1 (140°F ± 2), panels shall be cooled in the fluid for 24 hr ± 0.5 at 25°C ± 1 (77°F ± 2).

4.5.5.5 The peel strength of conditioned panels shall be measured within 30 min. after removal from the test fluid. Two 1-in. (25-mm) wide sections shall be prepared by cutting completely through the sealant and fabric to the panel, lengthwise, along the panel and continuing completely along the free end of the fabric. The specimens shall be stripped back at an angle of 180 deg to the panel in a suitable tensile test machine. Jaw separation rate shall be 2 in. (50 mm) per minute. During peel strength testing, three cuts shall be made through the sealant to the panel in an attempt to promote adhesive failure. The cuts shall be made at approximately 1-in. (25-mm) intervals.

5.5.5.6 The peel strength for each specimen shall be the numerical average of the peak loads required to separate the strips of sealant fromm the panel or to cause cohesive failure of the sealant. Failure of the sealant to screen or fabric shall not be included in the peel strength values.

4.5.6 Storage Stability:

4.5.6.1 Long-Term Stability: After 120 days ± 4 storage at 27°C ± 3 (80°F ± 5) in the original unopened container, a sample of adhesion promoter shall be withdrawn and used for conducting the peel tests of Table I, Tests 1 and 2, of the applicable detail specification, using substrates in accordance with 4.5.1.1.3 and 4.5.1.1.5.

4.5.6.2 Short-Term Stability: Place 24 mL of adhesion promoter (less than 4 months old) into a 2-oz (60-mL) glass container with an approximate 1.20 in. (30 mm) mouth diameter. Allow the container to stand open for 60 min. + 1 in an atmosphere of 50% ± 5 relative humidity at 25°C ± 1 (77°F ± 2). Cap tightly and let stand for the time specified in the applicable detail specification. Use conditioned adhesion promoter to conduct peel tests in accordance with Table I, Tests 1 and 2 of the applicable detail specification, using substrates in accordance with 4.5.1.1.3 and 4.5.1.1.5.

4.5.7 Aging After Application: Apply adhesion promoter to the panels of 4.5.1.1.3 and 4.5.1.1.5. Protect the panels from atmospheric fallout and store at 25°C + 1 (77°F + 2) and 50% + 5 relative humidity for 120 hr + 4. After storage, peel specimens shall be prepared as in 4.5.5 and tested in accordance with Table I, Tests 1 and 2, of the applicable detail specification.

4.5.8 Chemical Control: Prepare standard infrared spectrographic analysis master charts of each preproduction test sample for comparison to production material.

4.5.9 Solvent Identification: Manufacturer shall certify whether or not the solvent composition contains halogenated compounds.

4.6 Reports: The vendor of adhesion promoter shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements and stating that the adhesion promoter conforms to the other technical requirements of this specification and the applicable detail specification. This report shall include the purchase order number, AMS 3100 and applicable detail specification number, vendor's adhesion promoter designation, lot number, and quantity.

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 adhesion promoter 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: If any specimen used in the above tests fails to meet the specified requirements, disposition of the adhesion promoter may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirement shall be cause for rejection of the adhesion promoter represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Packaging and Identification:

5.1.1 Unless otherwise specified, packaging shall be in either 2 oz (60 mL) or 1 pt (0.5 L) brown glass small-mouth bottles with caps which are sealed from air and which will not react with the adhesion promoter, or in aerosol containers conforming to AMS 2820 equipped with a spray nozzle which will provide a fine, steady spray and deposit the adhesion promoter evenly on a flat horizontal or a flat vertical surface. The size of aerosol containers shall be as specified by purchaser.