

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 1376A

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Superseding AMS 1376

REMOVER, PAINT Epoxy Paint Systems

1. SCOPE:

- 1.1 Form: This specification covers an acid-type, thickened paint remover in the form of a liquid.
- 1.2 Application: Primarily for removing amine-cured, epoxy coating systems from aluminum alloys.
- 1.3 Precautions: This material is not intended for use on aircraft engine parts. Paint remover covered by this specification is toxic and contains ingredients harmful to skin and eyes. Information on necessary precautions to be followed when using this paint remover is provided in 5.1.3. This paint remover contains acidic material which may cause hydrogen embrittlement. This paint remover should not be used on magnesium.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications and Aerospace Recommended Practices 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.

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2.1.1 Aerospace Material Specifications:

- AMS 2350 - Standards and Test Methods
- AMS 2470 - Anodic Treatment of Aluminum Alloys, Chromic Acid Process
- AMS 2473 - Chemical Treatment for Aluminum Alloys, General Purpose Coating
- AMS 2825 - Material Safety Data Sheets
- AMS 4037 - Aluminum Alloy Sheet and Plate, 4.4Cu - 1.5Mg - 0.60Mn
(2024; -T3 Flat Sheet, -T351 Plate)
- AMS 4041 - Aluminum Alloy Sheet and Plate, Alclad, 4.4Cu - 1.5Mg - 0.60Mn
(Alclad 2024 and 1-1/2% Alclad 2024-T3 Flat Sheet; 1-1/2%
Alclad 2024-T351 Plate)
- AMS 4045 - Aluminum Alloy Sheet and Plate, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr
(7075; -T6 Sheet, T651 Plate)
- AMS 4049 - Aluminum Alloy Sheet and Plate, Alclad, 5.6Zn - 2.5Mg - 1.6Cu
0.23Cr (Alclad 7075; -T6 Sheet, T651 Plate)
- AMS 4911 - Titanium Alloy Sheet, Strip, and Plate, 6Al - 4V, Annealed

2.1.2 Aerospace Recommended Practices:

- ARP 1512 - Corrosion of Aluminum Alloys by Aircraft Maintenance Chemicals,
Sandwich Test

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

- ASTM D1193 - Reagent Water
- ASTM F483 - Total Immersion Corrosion Test for Aircraft Maintenance
Chemicals

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:

- VV-W-95 - Wax, Paraffin, Technical
- PPP-C-1337 - Container, Composite (Steel Drum with Polyethylene Inserts)
- PPP-P-1892 - Paint, Varnish, Lacquer, and Related Materials; Packaging,
Packing, and Marking of

2.3.2 Federal Standards:

- Federal Test Method Standard No. 141 - Paint, Varnish, Lacquer and
Related Materials, Methods of
Inspection, Sampling and Testing

2.3.3 Military Specifications:

- MIL-C-5541 - Chemical Conversion Coatings on Aluminum and Aluminum Alloys
- MIL-D-6998 - Dichloromethane, Technical
- MIL-T-23397 - Tape, Pressure-Sensitive Adhesive, for Masking During Paint
Stripping Operations
- MIL-C-81706 - Chemical Conversion Materials for Coating Aluminum and
Aluminum Alloys

2.3.4 Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
MS-24694 - Screw, Machine, Flat Countersunk Head, 100 Deg, Structural,
Cross Recessed, UNC-3A and UNF-3A

2.3.5 USAF ANA Standards:

AN315 - Nut, Plain, Airframe
AN960 - Washer, Flat

3. TECHNICAL REQUIREMENTS:

- 3.1 Material: Shall be a thixotropic paint remover consisting of organic
Ø solvents, evaporation retarders, wetting agents, and other ingredients to provide a product meeting the requirements of 3.2. The acid active ingredient shall be an organic acid or acids.
- 3.2 Properties: The paint remover shall conform to the following requirements; tests shall be performed in accordance with specified test methods on the product supplied:
- 3.2.1 Toxicity: The product shall be free from chemicals and solvents in the compound mixture which may prove dangerously corrosive or may produce
Ø vapors in such concentration as to become a medical hazard to personnel when used in accordance with manufacturer's recommendation for its intended purpose. Contains dichloromethane and organic acids. May be fatal if swallowed, may cause skin burns. Do not use in confined spaces.
- 3.2.2 Consistency: The paint remover shall flow to a point between 160 and 230 mm in 2 min., determined in accordance with 4.5.1. The remover shall be of such consistency that a smooth, even coating can be applied by brushing, flowing, or spraying onto, and will adhere to, the vertical surface of test panels and painted surfaces of aircraft for sufficient time for the remover to be effective.
- 3.2.3 Flammability: The paint remover shall not continue to burn longer than 3 sec after removal of the flame, determined in accordance with 4.5.2.
- 3.2.4 Effect on Metallic Surfaces:
- 3.2.4.1 Sandwich Corrosion: Specimens, after test, shall show a rating not worse than 2, determined in accordance with ARP 1512.

3.2.4.2 Total Immersion Corrosion: The product shall neither show evidence of pitting of the panels nor cause a weight change of any panel greater than 0.4 mg/cm^2 per 24 hr, determined in accordance with ASTM F483 on the following test panels:

AMS 4037 Aluminum Alloy, anodized as in AMS 2470
AMS 4041 Aluminum Alloy
AMS 4045 Aluminum Alloy, anodized as in AMS 2470
AMS 4049 Aluminum Alloy
AMS 4911 Titanium Alloy

3.2.4.3 Dissimilar Metal Corrosion: There shall be no significant discoloration or evidence of corrosion, determined in accordance with 4.5.3.

3.2.5 Storage Stability:

3.2.5.1 Short-Term: The paint remover shall not cake, clot, gel, or separate after being stored, undisturbed, at $25^\circ\text{C} \pm 5$ ($77^\circ\text{F} \pm 10$) for 6 days in a darkened area. The remover shall not polymerize or show significant changes in physical appearance.

3.2.5.2 Extended: Paint remover, stored as in 4.5.4, shall show no visible evidence of deterioration. It shall, after storage, meet all the other technical requirements of this specification. After being examined as in 4.5.4 for short-term stability, the paint remover shall completely lift the finish from test panels prepared and tested in accordance with 4.5.5.

3.2.6 Paint Stripping Efficiency: The paint remover, tested in accordance with 4.5.5, shall remove at least 90% of the paint from the exposed surface within 60 min. at $24^\circ\text{C} \pm 3$ ($75^\circ\text{F} \pm 5$).

3.2.6.1 Relative Stripping Efficiency: Shall be equal to, or better than, that of the control formula of 4.5.5, measured as the time to produce equal percentages of stripping or as the percentage of panel area stripped in equal lengths of time.

3.2.7 Rinsability: The loosened paint and spent remover shall be easily removed by water rinsing, determined in accordance with 4.5.6. If residues or noticeable water breaks occur, they shall not adversely affect the drying or adhesion of an applied paint system.

3.2.8 Refinishing Properties of Stripped Surfaces: Following stripping and wiping clean, using cloths saturated with methyl ethyl ketone or other suitable solvent, the paint remover shall leave a surface suitable for refinishing, including re-surface treatment, determined in accordance with 4.5.7.

3.2.9 Volatility: Shall be equal to, or less than, the volatility of distilled water, determined in accordance with 4.5.8.

- 3.3 Quality: Paint remover, as received by purchaser, shall be homogeneous, uniform in consistency, suitable for spraying, brushing, or flowing application, and free from skins and lumps and from foreign materials detrimental to usage of the paint remover.

4. QUALITY ASSURANCE PROVISIONS:

- 4.1 Responsibility for Inspection: The vendor of the product shall supply all samples for vendor's test 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 product conforms to the requirements of this specification.

4.2 Classification of Tests:

- 4.2.1 Acceptance Tests: Tests to determine conformance to requirements for consistency (3.2.2), flammability (3.2.3), total immersion corrosion (anodized aluminum alloys only) (3.2.4.2), short-term storage stability (3.2.5.1), paint stripping efficiency (3.2.6), rinsability (3.2.7), and volatility (3.2.9) are classified as acceptance tests and shall be performed on each lot.

- 4.2.2 Preproduction Tests: Tests to determine conformance to all technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of the remover 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 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

- 4.3 Sampling: Shall be in accordance with the following; a lot shall be all paint remover manufactured at the same time from the same batches of raw materials and presented for vendor's inspection at one time. If paint remover cannot be identified by batch or tank, a lot shall consist of not more than 5000 gal (18,925 L) offered for delivery at one time.

4.3.1 For Acceptance Tests:

- 4.3.1.1 Bulk Quantity: Samples shall be selected in accordance with Federal Test Method Standard No. 141 except that the sample shall consist of not less than one gal (4 L) of paint remover from each lot.
- 4.3.1.2 Filled Containers: A random sample of filled containers shall be selected from each lot in accordance with MIL-STD-105 at inspection level I and acceptance quality level (AQL) 2.5% defective to verify conformance to all requirements of this specification regarding fill, closure, marking, and other requirements not involving tests.

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

4.4 Approval:

4.4.1 Paint remover shall be approved by purchaser before remover for production use is supplied, unless such approval be waived by purchaser. Results of tests on production remover shall be essentially equivalent to those on the approved sample.

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

4.5 Test Methods: Tests shall be conducted as follows; all tests shall be
Ø conducted at $24^{\circ}\text{C} \pm 3$ ($75^{\circ}\text{F} \pm 5$) and the relative humidity shall be noted:

4.5.1 Consistency: Shall be determined with a consistometer (Central Scientific Company Catalog No. 24925) or equivalent type instrument.

4.5.2 Flammability:

4.5.2.1 Preparation of Test Panels: One end of a clean AMS 4037 aluminum alloy panel $0.040 \times 4 \times 3/4$ in. ($1 \times 100 \times 20$ mm), anodized in accordance with AMS 2470, shall be held at an angle of approximately 45 degrees. The paint remover shall be poured along the upper edge of the panel allowing the remover to flow freely over the surface. Paint remover settling on the reverse side of the panel shall be wiped clean before proceeding with the test.

4.5.2.2 Procedure: A micro-burner flame, $1/8 - 3/16$ in. (3 - 5 mm) in height shall be passed, within a 2-sec period, back and forth along the lower edge of the panel. This operation shall be repeated three times at 3-sec intervals. If the paint remover ignites, the burner flame shall be removed and observation made to ascertain whether the remover continues to burn. The above procedure shall be repeated on another similarly prepared panel except that it shall be placed in an oven for 15 min. ± 1 at $45^{\circ}\text{C} \pm 2$ ($115^{\circ}\text{F} \pm 4$). The panel shall then be removed from the oven and subjected to the flame test as above.

4.5.3 Dissimilar Metal Corrosion:

- 4.5.3.1 Preparation of Test Panels: Four test panels, two each of AMS 4041 and AMS 4049 aluminum alloys, shall be prepared as follows; each panel shall be approximately 0.125 x 3 x 4 in. (3 x 75 x 100 mm). The two panels of AMS 4041 aluminum alloy shall have holes drilled as shown in Fig. 1. The other two panels of AMS 4049 aluminum alloy shall have holes located as specified in Note 3 of Fig. 1. The panels shall be cleaned by immersion for not less than 60 sec in boiling, reagent grade, isopropanol, rinsed several times in methyl ethyl ketone, and dried. Dissimilar metal couples shall be assembled as in Fig. 2, using a shim of polyethylene 0.010 in. (0.25 mm) in nominal thickness under one corner, with cadmium plated steel screws, nuts, and washers turned finger tight; in forming the couples, care shall be exercised to avoid making fingerprints on the test panels.
- 4.5.3.2 Procedure: Immerse the coupled panels completely in the paint remover for 60 min. $\pm$ 5. Remove the couples and place them in an oven, maintained at $38^{\circ}\text{C} \pm 1$ ($100^{\circ}\text{F} \pm 2$), for not less than 48 hours. Remove the panels from the oven and immediately suspend them in a clean desiccator having the lower portion filled with ASTM D1193 water; close the desiccator and maintain it at $25^{\circ}\text{C} \pm 1$ ($77^{\circ}\text{F} \pm 2$), keeping it tightly sealed. After the 48 hr, remove the couples from the desiccator, wash each panel with water, and clean the panels with acetone. Examine each panel for pitting, etching, and corrosion products.
- 4.5.4 Extended Storage Stability: One gal (4L) of paint remover shall be stored in a glass bottle. The bottle shall be protected from light and stored for 6 months at $24^{\circ}\text{C} \pm 3$ ($75^{\circ}\text{F} \pm 5$). After storage, the paint remover shall be subjected to all tests of this specification except the performance test (3.2.11).
- 4.5.5 Paint Stripping Efficiency:
- 4.5.5.1 Preparation of Panels: Test panels shall be made from AMS 4041 aluminum alloy and shall be nominally 0.020 x 3 x 6 in. (0.50 x 75 x 150 mm) in size. Panels double in area may be used by dividing panels into two areas with MIL-T-23397 foil masking tape. If double size panels are used, the masking tape should be sufficiently resistant to the paint remover to remain on the panels during the test. The edges of the panels shall be broken and smoothed, and the panels prepared as follows:
- 4.5.5.1.1 Chemically treat in accordance with AMS 2473 or MIL-C-5541, Class A using MIL-C-81706, or equivalent; apply one coat, 0.6 - 0.9 mil (15 - 22 μm) thick, of approved primer (See 8.2.1) and dry for 2 - 4 hr at room temperature; apply one mist coat of approved epoxy paint topcoat (See 8.2.1), grey, and dry for 30 - 35 min. at room temperature; apply one full coat to a total dry film thickness of 2 mil $\pm$ 0.3 (50 $\mu\text{m} \pm$ 0.8) obtained in two coats of epoxy paint topcoat (See 8.2.1), grey; the finished panels shall be cured for not less than seven days. Edges shall be protected with wax.

4.5.5.2 Procedure: Six panels, or 3 panels double in area, coated with epoxy paint as in 4.5.5.1 shall be placed on a rack so that the 6-in. (150-mm) dimension forms an approximate 65 deg angle with the horizontal. The test shall be performed in a well-ventilated, draft-free room. The test sample shall be poured along the top edge of three panels to completely cover each panel area, taking 15 sec + 1 for each wetting procedure. On the other three panel areas, a similar procedure shall be followed using freshly-prepared, well-mixed, control formula prepared as in 4.5.5.2.1. Note the time at which application is started and time when lifting or wrinkling of the coating is completed. After 30 min. + 0.5 exposure time, the top surface shall be broken by lightly brushing with a hard-fiber brush and a second application made of the remover. After an additional 30 min. + 0.5 exposure, the loosened film shall be brushed off and the panels rinsed, with brushing, under a stream of cool tap water. Observation shall be made to determine if coating has been removed by test sample more completely than by the comparison control formula. Retain panels for rinsability test of 4.5.6.

4.5.5.2.1 Paint Stripping Comparison Control Formula: Shall be prepared as follows: the comparison control formula does not conform to all requirements of this specification and is intended to be used only as a means of standardization in order that certain desired properties may be obtained:

Dichloromethane (MIL-D-6998)	120 mL
Phenol (89%) U.S.P.	70 mL
ASTM D1193 Water	10 mL
Aerosol 22 (See 8.2.2)	4 g
Tall Oil Fatty Acid (See 8.2.3)	8 g
Aerosol OT (75%) (See 8.2.2)	4 g
Klucel "H" (See 8.2.3)	2 g
Paraffin Wax (VV-W-95)	2 g
Dichloromethane (MIL-D-6998)	80 mL
Hydroxyacetic Acid (75%)	20% by volume

4.5.5.2.1.1 Mix 120 mL of dichloromethane, phenol, ASTM D1193 water, Aerosol 22, tall oil fatty acid, and Aerosol OT in the order named with constant stirring. Add Klucel "H" very slowly with continued stirring. Melt the paraffin wax (melting point 53° - 54°C (128° - 130°F)) and slowly add 80 mL dichloromethane to the melted wax. Slowly add the wax-dichloromethane mixture to the initial mixture while continuing stirring. Add hydroxyacetic acid to make 20% by volume and stir thoroughly.

4.5.6 Rinsability: The panels used in the test of 4.5.5 shall be recoated with remover and placed in a draft-free location for not less than 45 minutes. After the 45 min., any remaining paint film shall be loosened from the surface. The panels shall be rinsed with tap water for 5 min. + 0.5 while brushing with a soft-bristle brush. Rate of flow of water shall be approximately 4 gal (15 L) per minute. The panels shall be examined for removal of the spent paint remover, residues, and water break. The panels

4.5.6 Rinsability (Cont'd.):

shall be oven dried for 15 min. ± 1 at $70^{\circ}\text{C} \pm 5$ ($160^{\circ}\text{F} \pm 9$), allowed to cool to room temperature, and examined for residues. Note if appreciable water break and residues occur.

- 4.5.6.1 Smut: After stripping the paint as specified in 4.5.5 and 4.5.6, if any residue or smut is present on the panels, the surfaces of the panels shall be wiped clean using cloths saturated with methyl ethyl ketone or other suitable solvent.

- 4.5.7 Refinishing Properties of Stripped Surfaces: The panels from 4.5.6.1 shall be refinished in accordance with 4.5.5.1 and the refinished surfaces examined for evidence of tackiness. A tack-free film is defined in Federal Test Method Standard No. 141, Method 4061. The adhesion of the finish shall be determined in accordance with Federal Test Method Standard No. 141, Method 6301, and compared with the adhesion of the finish on a new panel coated at the same time. The surface is acceptable if refinishing produces a tack-free film with undiminished adhesion.

- 4.5.8 Volatility: Bring sample and ASTM D1193 water to test temperature. A Petri dish, 90 mm in diameter and 15 mm deep, shall be placed on each pan of a two-pan beam balance. Sufficient paint remover shall be added to cover the entire bottom of one of the dishes. ASTM D1193 water shall be carefully poured into the other dish until the dish containing the paint remover is counterbalanced. The balance with the Petri dishes on the pans shall be exposed for 30 min. ± 1 in a draft-free location. At the end of the exposure period, the comparative loss in weight shall be determined.

- 4.6 Reports: Unless waived by purchaser, the vendor of paint remover shall furnish with each shipment a report showing the results of tests on each lot to determine conformance to the acceptance test requirements and stating that the remover conforms to the other technical requirements of this specification. This report shall include the purchase order number, AMS 1376A, manufacturer's identification, 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 paint remover for production use. Each request for modification of remover formulation shall be accompanied by a revised data sheet for the proposed formulation.

- 4.7 Resampling and Retesting: If any sample used in the above tests fails to meet the specified requirements, disposition of the paint remover may be based on the results of testing three additional samples for each original nonconforming sample. Failure of any retest sample to meet the specified requirements shall be cause for rejection of the paint remover 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 Paint remover shall be packaged in containers of a type and size agreed upon by purchaser and vendor.
- 5.1.2 Each container shall be legibly marked with not less than AMS 1376A, purchase order number, manufacturer's identification, lot number, and quantity.
- 5.1.3 Each unit package shall be marked with the date of manufacture and shall be clearly marked to warn of hazardous chemicals. The following information shall be included on the product labeling:
 - 5.1.3.1 Paint remover contained herein is toxic and contains ingredients harmful to skin and eyes.
 - 5.1.3.2 Avoid contact of this paint remover with rubber, asphaltic-base floors, and walkways of aircraft.
 - 5.1.3.3 Avoid use in enclosed and unventilated area.
 - 5.1.3.4 Use goggle-type eyeglasses and rubber gloves, apron, and rubber boots when handling this product.
 - 5.1.3.5 Be sure that drum is cool before opening. Warm remover may spurt when opening drums. Relieve pressure carefully prior to opening. Mix paint remover thoroughly prior to use.
 - 5.1.3.6 Store paint remover indoors or in an area well protected against weather conditions. Storage temperature should be kept between 2° - 27°C (35° - 80°F) to prevent excessive pressure buildup.
- 5.1.4 Containers of paint remover shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the paint remover to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.
- 5.1.5 For direct U.S. Military procurement, paint remover shall be packaged in containers conforming to Federal PPP-C-1337, Type I or Type II, Class 4. Containers of paint remover shall be packaged in accordance with Federal PPP-P-1892, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.1.1 and 5.1.4 will be acceptable if it meets the requirements of Level C.