Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 1376

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Revised

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: Paint remover covered by this specification is toxic and contains ingredients harmful to skin and eyes. Information on necessary measures to be followed in use of this paint remover is provided in 5.1.5. This paint remover contains acidic material which may cause hydrogen embrittlement.

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

2.1 SAE Publications: Available from Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

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 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 - 0.26Cr (7075; -T6 Sheet, -T651 Plate)
AMS 4049 - Aluminum Alloy Sheet and Plate, Alclad, 5.6Zn - 2.5Mg - 1.6Cu - 0.26Cr (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 D2667 - Biodegradability of Alkylbenzene Sulfonates
ASTM F483 - Total Immersion Corrosion Test for Aircraft Maintenance Chemicals

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120 except as specified in 2.3.6.

Printed in U.S.A.

2.3.1 Federal Specifications:

VV-W-95 - Wax, Paraffin, Technical
PPP-C-1337 - Containers, Metal, 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

2.3.5 USAF ANA Standards:

AN 315 - Nut, Plan, Airframe
AN 509 - Screw
AN 960 - Washer, Flat

2.3.6 U. S. Department of Labor, Occupational Safety and Health Administration Forms: Available from regional offices of U. S. Department of Labor, Bureau of Labor Standards.

OSHA Form 20 - Material Safety Data Sheet

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be a thixotropic paint remover consisting of organic solvents, evaporation retarders, wetting agents, and other ingredients to provide a product meeting the requirements of 3.2. The acid active ingredient shall be hydroxyaectic acid.

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 vapors in such concentration as to become a medical hazard to personnel when used for its intended purpose in accordance with manufacturer's recommendations.

3.2.2 Biodegradability: Surfacants used shall be not less than 90% biodegradable, determined in accordance with ASTM D2667. The vendor of the paint remover shall furnish certification from the surfacant manufacturer of the percent biodegradability of the surfactants.

3.2.3 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.

3.2.4 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.

3.2.5 Effect on Metallic Surfaces:

3.2.5.1 Sandwich Corrosion: Specimens, after test, shall show a rating not worse than 2, determined in accordance with ARP 1512.

3.2.5.2 Total Immersion Corrosion: The product shall neither show evidence of pitting of the panels nor cause a weight change of any single panel greater than 0.4 mg/cm^2/24 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

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

3.2.6 Storage Stability:

3.2.6.1 Short-Term: The paint remover shall not cake, clot, gel, or separate after being stored, undisturbed, at room temperature for 6 days in a darkened area. The remover shall not polymerize or show significant changes in physical appearance.

3.2.6.2 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 except that accelerated storage stability need not be determined. 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.

3.2.7 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° C ± 2 (75° F ± 3).

3.2.7.1 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.

3.2.8 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.

3.2.9 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.

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

3.2.11 Performance: The paint remover, used in accordance with the manufacturer's recommendation, shall show satisfactory performance in actual use. This service performance test shall be performed after the product has met all other technical requirements of this specification.

3.3 Quality: Paint remover shall be homogeneous, uniform in consistency, suitable for spray, 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 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 perform such confirmatory testing as he deems 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 consistency (3.2.3), flammability (3.2.4), total immersion corrosion (anodized aluminum alloys only) (3.2.5.2), short-term storage stability (3.2.6.1), paint stripping efficiency (3.2.7), rinsability (3.2.8), and volatility (3.2.10) requirements are classified as acceptance tests.

4.2.2 Periodic Tests and Qualification Tests: Tests to determine conformance to all technical requirements of this specification are classified as periodic tests and as qualification tests.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, qualification test material shall be submitted to the cognizant qualification 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 submitted 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 5,000 gal (18,925 dm^3) offered for delivery at one time.

4.3.1 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 (3.8 dm^3) 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 Acceptable 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 Periodic Tests and Qualification Tests: As agreed upon by purchaser and vendor.

4.4 Approval:

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

4.4.2 Vendor shall use ingredients, manufacturing procedures, and methods of routine inspection of production paint remover which are essentially the same as those used on the approved sample paint remover. If any change is necessary in ingredients or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in ingredients and processing and, when requested, sample paint remover. Production paint 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 conducted at 24° C ± 3 (75° F ± 5) and at a relative humidity of 50% ± 5, unless otherwise specified.

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 x 4 x 3/4 in. (1 x 100 x 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 paint 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. (3.2 - 4.8 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 paint remover continues to burn. The above procedure shall be repeated on another similarily prepared panel except that it shall be placed in an oven for 15 min. ± 1 at 45° C ± 2 (113° F ± 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 from AMS 4041 and AMS 4049 aluminum alloys, shall be prepared as follows; each test panel shall be approximately 0.125 x 3 x 4 in. (3.18 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 test 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. ± 5. Remove the couples and place them in an oven, maintained at 38° C ± 1 (100° F ± 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 distilled water; close the desiccator and maintain it at 25° C ± 1 (77° F ± 2), keeping it tightly sealed. After the 48 hr, remove the couples from the desiccator, them, 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 (3.8 dm^3) of paint remover shall be stored in a glass bottle. The bottle shall be protected from light and stored for 6 months at 24° C ± 3 (75° F ± 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 Test 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, protected with wax, and the panels prepared as follows:

Step 1 - Chemically treat in accordance with AMS 2473 or MIL-C-5541, Class A using MIL-C-81706, or equivalent.

Step 2 - One coat, 0.06 - 0.9 mil (15 - 23 μm) thick, of Desoto Super Koropon Primer, and dry for 2 - 4 hr at room temperature.

Step 3 - One mist coat of Desoto Super Koropon Epoxy Paint Topcoat, Grey, and dry for 30 - 35 min. at room temperature.

Step 4 - One full coat to a total dry film thickness of 2 mil ± 0.3 (50 μm ± 0.8) obtained in two coats of Desoto Super Koropon Epoxy Paint Topcoat, Grey.

4.5.5.1.1 Desoto Super Koropon and Desoto Super Koropon Topcoat, Grey, paint system is a proprietary amine-cured epoxy paint system manufactured by Desoto, Inc., 4th and Cedar Streets, Berkeley, CA 94710.

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 60 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 each 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 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
Distilled Water	10 mL
Aerosol 22 (See 4.5.5.2.1.1)	4 g
Tall Oil Fatty Acid (See 4.5.5.2.1.2)	8 g
Aerosol OT (75%) (See 4.5.5.2.1.1)	4 g
Klucel "H" (See 4.5.5.2.1.2)	2 g
Paraffin Wax (VV-W-95)	2 g
Dichloromethane (MIL-D-6998)	80 mL
Hydroxyacetic Acid (75%)	20% by volume

Mix dichloromethane, phenol, distilled 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.

4.5.5.2.1.1 Aerosol 22 and Aerosol OT are products of American Cyanamid Company.

4.5.5.2.1.2 Tall oil fatty acid and Klucel "H" are products of Hercules, Incorporated.

4.5.6 Rinsability: The panels used in the test of 4.5.5 shall be recoated with paint 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 4 gal (15 dm^3) per minute. The panels shall be examined for removal of the spent paint remover, residues, and water break. The panels shall be oven dried for 15 min. ± 1 at 70° C ± 5 (160° F ± 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 of 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 shall be considered acceptable if refinishing produces a tack-free film with undiminished adhesion.

4.5.8 Volatility: Bring sample and distilled 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. Distilled 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 the paint remover shall furnish with each shipment three copies of a report showing the results of tests on each lot to determine conformance to the acceptance test requirements and stating that the paint remover conforms to the other technical requirements of this specification. This report shall include the purchase order number, material specification number, manufacturer's identification, lot number, and quantity.

4.6.1 Reports of qualification test results shall include a completed copy of OSHA Form 20 Material Safety Data Sheet or equivalent covering product formulation. All requests for modification of formulation shall be accompanied by a similar form for the proposed formulation.

4.6.2 The vendor of the paint remover shall supply a certificate of compliance to biodegradability requirements (3.2.2).

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 suitable containers of a size agreed upon by purchaser and vendor. For direct U.S. Military procurement, the paint remover shall be packaged in containers conforming to Federal PPP-C-1337, Type I or Type II, Class 4, unless otherwise specified.

5.1.2 Each container shall be legibly marked to show AMS 1376, purchase order number, manufacturer's identification, lot number, and quantity.

5.1.3 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 this paint remover to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.1.4 For direct U.S. Military procurement, packaging shall be 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 5.1.3 will be acceptable if it meets the requirements of Level C.

5.1.5 Each unit package shall be marked to show the date of manufacture and shall be clearly marked to warn of hazardous chemicals. The following information shall be included on the product labeling:

5.1.5.1 Paint remover contained herein is toxic and contains ingredients harmful to skin and eyes.

5.1.5.2 Avoid contact of this paint remover with rubber, asphaltic-base floors, and walkways of a aircraft.

5.1.5.3 Avoid use in enclosed and unventilated areas.

5.1.5.4 Use goggle-type eyeglasses and rubber gloves, apron, and rubber boots when handling this product.

5.1.5.5 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.

5.1.5.6 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.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Paint remover not conforming to this specification or to authorized modifications will be subject to rejection.

8. NOTES:

8.1 For direct U.S. Military procurement, purchase documents should specify not less than the following:

Title, number, and date of this specification
Type and size of containers desired
Quantity of paint remover desired
Applicable level of packaging (See 5.1.4)

8.2 Similar Specifications: MIL-R-81903 is listed for information only and shall not be construed as an acceptable alternate unless all requirements of this AMS are met.