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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 1476A

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Superseding AMS 1476

DEODORANT, AIRCRAFT TOILET

1. SCOPE:

1.1 Form: This specification covers a biodegradable deodorant in the form of a liquid concentrate, solid, or gel.

1.2 Application: Primarily as an additive for use in aircraft toilet systems to control odor, color, and corrosion.

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 ensure 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 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 except that the issue of APHA publications in effect on the date of invitation to bid or request for proposal shall apply.

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 2825 - Material Safety Data Sheets
AMS 4049 - Aluminum Alloy Sheet and Plate, Alclad, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr, (Alclad 7075; -T6 Sheet, -T651 Plate)

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 D56 - Flash Point by Tag Closed Tester
ASTM D445 - Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
ASTM D471 - Rubber Property - Effect of Liquids
ASTM D1193 - Reagent Water
ASTM D1331 - Surface and Interfacial Tension of Solutions of Surface-Active Agents
ASTM D1568 - Sampling and Chemical Analysis of Alkylbenzene Sulfonates
ASTM D2667 - Biodegradability of Alkylbenzene Sulfonates
ASTM E70 - pH of Aqueous Solutions with the Glass Electrode
ASTM F483 - Total Immersion Corrosion Test for Aircraft Maintenance Chemicals
ASTM F484 - Stress Crazing of Acrylic Plastics in Contact with Liquid or Semi-Liquid Compounds
ASTM F485 - Effects of Cleaners on Unpainted Aircraft Surfaces
ASTM F502 - Effects of Cleaning and Chemical Maintenance Materials on Painted Aircraft Surfaces

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

2.3.1 Military Specifications:

MIL-P-83310 - Plastic Sheet, Polycarbonate, Transparent

2.3.2 Military Standards:

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

2.4 APHA Publications: Available from American Public Health Association, 1015 Eighteenth Street, N.W., Washington, DC 20036.

Standard Methods for the Examination of Water and Waste Water

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall consist of a biodegradable material with suitable additives, such as reodorants, buffers, etc, necessary to provide a deodorant meeting the requirements of 3.2.

3.1.1 The deodorant shall be free of soaps; non-ionic, cationic, anionic, and amphoteric detergents are acceptable provided the deodorant contains adequate foam depressors to comply with 3.2.2.2.1.

3.1.2 The deodorant shall dilute readily with water with minimum agitation.

3.2 Properties: The deodorant shall conform to the following requirements; tests shall be performed in accordance with specified test methods.

3.2.1 Deodorant As Received in Concentrate Form: Shall be tested as the liquid Ø concentrate, except that if the deodorant is received in the form of a solid or gel, it shall be dissolved at the ratio of 1 part by weight deodorant to 5 parts ASTM D1193, Type IV, water.

3.2.1.1 Flash Point: Shall be not lower than 93°C (200°F), determined in accordance with ASTM D56.

3.2.1.2 Color: The deodorant shall exhibit a deep blue color to mask organic waste and indicate a chemically-charged toilet. The dye shall be pH stable and shall not break down when tested for 72 hours + 1 in a water solution having a pH of 3 - 11. Formic acid and sodium hydroxide shall be used for adjusting the pH of water solution.

3.2.1.3 Storage Stability: The deodorant shall be stable after storage at room Ø temperature for not less than 12 months. The deodorant shall, if supplied as a liquid concentrate, show no evidence of layering or separation and shall contain no lumps or show evidence of skin formation after being subjected to five freeze-thaw cycles as in 3.2.1.3.1.

3.2.1.3.1 Two 6 ounce (175 mL) samples of deodorant shall be placed in two Ø 8 ounce (250 mL) clear glass bottles or in ziplock plastic bags, sealed, and exposed for 8 hours + 0.25 to -23°C (-9°F), or lower if necessary to completely freeze the deodorant samples. At the end of the freezing period, the samples shall be removed to a room temperature environment and allowed to thaw for 16 hours + 0.5. This shall constitute one complete freeze-thaw cycle. The samples shall be subjected to five complete freeze-thaw cycles. At the end of the fifth cycle, the samples shall be examined for conformity to 3.2.1.3.

3.2.1.4 Environmental Properties: Standards vary from area to area and, therefore, acceptance standards for the following environmental properties shall be as agreed upon by purchaser and vendor:

3.2.1.4.1 Biodegradability: The deodorant shall show not less than 90% surfactant reduction to be adequately biodegradable, determined in accordance with ASTM D2667.

3.2.1.4.2 Total Alkalinity or Acidity: Shall be determined as ppm $CaCO_3$ in accordance with APHA Method 201.

3.2.1.4.3 Chemical Oxygen Demand: Shall be determined in accordance with APHA Method 220, using the dichromate reflux procedure.

3.2.1.4.4 Biological Oxygen Demand: The five-day biological oxygen demand at 20°C (68°F) shall be determined in accordance with APHA Method 219, using filtered raw sewage seed.

3.2.1.4.5 Total Inorganic Phosphate: Shall be determined in accordance with APHA Method 223E, stannous chloride procedure.

3.2.1.4.6 Phenols: Shall be determined by distilling 500 mL of the deodorant in accordance with APHA Method 222B, followed by chloroform extraction in accordance with APHA Method 222C.

3.2.1.4.7 Heavy Metals: Chromium, copper, cadmium, mercury, nickel, silver, and zinc contents shall be determined in accordance with APHA Method 211.

3.2.2 Deodorant in Diluted Form: Shall be as follows, determined on deodorant Ø diluted to prime charge (See 8.2) with ASTM D1193, Type IV, water.

3.2.2.1 Viscosity: Shall not exceed by more than 10% the viscosity of ASTM D1193, Type IV, water at 10°C (50°F) and 30°C (85°F), determined in accordance with ASTM D445.

3.2.2.2 Foam Volume: Shall not exceed 5 mL after testing in accordance with 3.2.2.2.1.

3.2.2.2.1 100 mL of the deodorant shall be put into a stoppered 250-mL graduated Ø cylinder and inverted 10 times in 15 seconds and the initial foam volume recorded; after standing undisturbed for 150 seconds ± 1, the foam volume shall again be measured and recorded. The second reading shall not exceed 5 millilitres.

3.2.2.3 Surface Tension: The deodorant shall have wetting characteristics such Ø that it reduces the surface tension of water to 10% below that of ASTM D1193, Type IV, diluent water, determined in accordance with ASTM D1331 at 25°C ± 3 (77°F ± 5).

3.2.2.4 Waste Material Reactivity: The deodorant shall mask color and odor of human waste materials. A green-blue color and an odor which remains slightly perfumed, never offensive or overpowering, shall be retained after testing as in 3.2.2.4.1.

3.2.2.4.1 To 1 pint (475 mL) of deodorant shall be added 1 pint (500 mL) of raw Ø sewage (the raw sewage shall be made up of 120 g of fresh feces and 825 mL fresh urine thoroughly mixed in a Waring blender, or similar high speed mixing device). A 1-gallon container or 5-L beaker is suitable for this purpose. The resultant mixture shall be agitated for 5 minutes using a 1-inch (25-mm) diameter 3-bladed propeller type stirrer running at 1000 rpm ± 100. The remaining urine/feces mixture shall be diluted with an equal volume of water and retained for use as the control sample when evaluating the odor of the deodorant/waste mixture as in 3.2.2.4.1.1.

3.2.2.4.1.1 After a lapse of 8 hours the odor of the control sample shall be rated as 4+, the deodorant/waste shall be rated as follows:

4+ = Very strong odor
3+ = Strong odor
2+ = Moderate odor (reodorant detectable)
1+ = Slight odor (reodorant noticeable)
0 = No presence of odor (reodorant predominant)

3.2.3 Deodorant Tested Both as Concentrate as Defined in 3.2.1 and in Diluted Form as Defined in 8.2:

3.2.3.1 pH: Shall be determined in accordance with ASTM E70 and reported. Ø

3.2.3.2 Effect on Unpainted Surfaces: There shall be no visible stains or residue on test panels, tested in accordance with ASTM F485. Ø

3.2.3.3 Effect on Painted Surfaces: The product shall neither decrease the hardness of the paint film by more than two pencil hardness levels nor shall it produce any streaking, discoloration, or blistering of the paint film, determined in accordance with ASTM F502. Ø

3.2.3.4 Effect on Metallic Surfaces:

3.2.3.4.1 Sandwich Corrosion: Specimens of AMS 4049 aluminum alloy, after test, shall show a rating not worse than 1, determined in accordance with ARP 1512.

3.2.3.4.2 Total Immersion Corrosion: The deodorant shall neither show evidence of corrosion of the panels nor cause a weight change greater than 0.3 mg/cm^2 per 24 hours for any panel of AMS 4049 aluminum alloy, determined in accordance with ASTM F483.

3.2.3.5 Temperature Stability: The deodorant shall show no chemical or physical deterioration, including evidence of discoloration, layering, skinning, or other change denoting loss of stability after being exposed for 120 hours ± 1 to 2°C ± 2 (35°F ± 5) and to 50°C ± 5 (120°F ± 10). Ø

3.2.3.6 Fabric Stain Test: The deodorant shall not stain 2 x 2 inch (50 x 50 mm) samples of white 100% cotton, light-colored nylon, and light-colored wool when spotted with the deodorant. The spotted fabric samples shall be allowed to dry at 60°C ± 3 (140°F ± 5), washed with a commercial detergent, rinsed, and dried. The presence of any stain remaining on any of the three types of fabric shall be reported.

3.2.3.7 Solubility: The deodorant shall be fully soluble in both hard and soft water and shall produce no detectable precipitate, determined in accordance with 3.2.3.7.1.

3.2.3.7.1 One set of two samples of the deodorant shall be diluted in accordance with 3.2.2; the other sample shall be diluted using 20 grain hard water solution made up by dissolving 0.40 g + 0.005 of analytical reagent calcium acetate ($Ca(C_2H_3O_2)_2 \cdot H_2O$) and 0.28 g + 0.005 of analytical reagent magnesium sulfate ($MgSO_4.7H_2O$) in 1 L of boiling ASTM D1193, Type IV, water. After stirring vigorously for not less than 1 minute, both samples shall be allowed to stand undisturbed for 15 minutes ± 1, and examined for evidence of precipitation. Ø

3.2.3.8 Effect on Rubber and Plastic Materials: The deodorant shall neither cause swelling greater than 10%, determined in accordance with ASTM D471, nor cause staining, discoloration, or evidence of degradation of rubber or plastic materials normally incorporated in aircraft lavatory systems. Materials listed in 3.2.3.8.1 shall be tested in accordance with 3.2.3.8.2. When specified by purchaser, tests to determine changes in tensile strength and elongation shall be performed in accordance with ASTM D471 and the results obtained on exposed specimens shall be not lower than 75% of the tensile strength and elongation values determined on unexposed specimens.

3.2.3.8.1 Test specimens shall be composed of ethylene propylene (EPM), fluorosilicone (FVMQ), methyl-phenyl-silicone (PMQ), chloroprene (CR), acrylonitrile butadiene (NBR), and fluorocarbon (FKM) rubbers; of acetal, polysulfone, nylon, and polycarbonate plastics; of epoxy-glass fabric laminates; and of glass fabric.

3.2.3.8.2 Duplicate strips of each material listed in 3.2.3.8.1 shall be placed in test tubes containing the deodorant. Strips for determining volume change shall be totally immersed. Strips for determination of staining, discoloration, and evidence of degradation shall be partially immersed so that the bottom-half is in the deodorant and the top-half is in air. The test tubes shall be capped and stored at ambient temperature for 30 days. After this exposure, the immersed and non-immersed area of each of the partially immersed specimens shall be compared visually for evidence of staining, discoloration, or degradation and the results noted. Volume change shall be determined on the totally-immersed specimens and the values compared with those of untreated samples from the same source. Any change in volume shall be reported.

3.2.3.8.3 Effect on Polycarbonate Plastics: Deodorant shall not craze, stain, or discolor MIL-P-83310 polycarbonate plastic determined in accordance with test procedures specified in ASTM F484 on specimens stressed for 30 minutes ± 2 to an outer fiber stress of 3000 psi (20 MPa).

3.2.3.9 Miscibility: The deodorant shall be miscible in mixtures of water and either ethylene glycol or propylene glycol. A solution made up in accordance with 3.2.2, except that 50% of the diluent water shall be replaced with either ethylene glycol or propylene glycol, shall show complete stability after storage for 7 days at 24°C ± 3 (75°F ± 5).

3.3 Quality: The product, as received by purchaser, shall be homogeneous, free from skins and lumps, and uniformly blue in color, with a faint, pleasant, perfume odor.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of deodorant shall supply all Ø 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 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the deodorant conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for Ø flash point (3.2.1.1) and color (3.2.1.2) of the deodorant in concentrated form and for foam volume (3.2.2.2) and pH (3.2.3.1) of the deodorant in diluted form are classified as acceptance tests and shall be performed on each lot.

4.2.2 Preproduction Tests: Tests to determine conformance to all technical Ø requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of deodorant 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, contracting officer, or request for procurement.

4.3 Sampling: Shall be in accordance with ASTM D1568.

4.4 Approval:

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

4.4.2 Vendor shall use ingredients, manufacturing procedures, and methods of inspection on production deodorant which are essentially the same as those used on the approved sample deodorant. 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 by purchaser, sample deodorant. Production deodorant made by the revised procedure shall not be shipped prior to receipt of reapproval.