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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 1435A

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Superseding AMS 1435

Submitted for recognition as an American National Standard

Fluid, Generic, Deicing/Anti-Icing Runways and Taxiways

1. SCOPE:

1.1 Form:

This specification covers deicing and anti-icing materials in the form of a fluid.

1.2 Application:

This deicing/anti-icing fluid has been used typically on runways, taxiways, and other aircraft maneuvering areas for the prevention and removal of frozen deposits of frost and ice. Fluids must not be used to deice/anti-ice aircraft.

1.3 Precautions:

1.3.1 Material Compatibilities: While this specification covers technical requirements for fluid deicing/anti-icing materials, it does not address the compatibility issue of combining deicers/anti-icers during the operational phase. Fluids meeting this specification are unique to each manufacturer and may be adversely affected by mixing with other deicing/anti-icing fluids. It is the user's responsibility to become familiar with the safe and proper use of applying multiple deicers/anti-icers.

1.3.2 Pavement Friction Evaluation: Airport authorities should ascertain the friction coefficient of the runway after the application of deicing/anti-icing fluid prior to aircraft landing operations.

1.3.3 Caution should be exercised in the use of glycol-water deicing/anti-icing solutions in and around aircraft electrical/electronic circuitry with noble metal coated wiring or terminals which could come into contact with the fluid. Exothermic reactions, which may result in fire, have been reported. This may occur where defectively insulated wires, switches, or circuit breakers carrying direct current are encountered. Deicing/anti-icing fluids based on glycols should contain an inhibitor to minimize this potential fire hazard (3.1).

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1.3.4 Airport authorities are advised that fluid products can cause failure of runway and taxiway lighting circuits. Damage potential depends on the condition of these systems, quantity of product usage, or the opportunity of product entry into electrical conduit systems. A comprehensive evaluation of the aeronautical lighting systems should be completed as part of winter operations planning.

1.4 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.

1.4.1 Some deicing/anti-icing formulations may be mildly toxic and contact with human skin and eyes should be avoided. Prolonged exposure to concentrations of vapor and windborne mists should be avoided. Prolonged exposure to concentrations exceeding any established threshold limit values (TLV) for those products or its major components should be avoided.

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. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

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

AMS 2470	Anodic Treatment of Aluminum Alloys, Chromic Acid Process
AMS 2475	Protective Treatments, Magnesium Alloys
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), Solution Heat Treated
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 4049	Aluminum Alloy Sheet and Plate, Alclad, 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr, (Alclad 7075; -T6 Sheet, -T651 Plate), Solution and Precipitation Heat Treated
AMS 4376	Magnesium Alloy Plate, 3.0Al - 1.0Zn, (AZ31B-H26), Cold Rolled and Partially Annealed
AMS 4911	Titanium Alloy Sheet, Strip, and Plate, 6Al - 4V, Annealed
MAM 4911	Titanium Alloy Sheet, Strip, and Plate, 6Al - 4V, Annealed (Metric)
AMS 5045	Steel Sheet and Strip, 0.25 Carbon, maximum, Hard Temper

2.2 ASTM Publications::

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

ASTM C 672	Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals
ASTM D 56	Flash Point by Tag Closed Tester
ASTM D 93	Flash Point by Pensky-Martens Closed Tester
ASTM D 891	Specific Gravity, Apparent, of Liquid Industrial Chemicals
ASTM D 1177	Freezing Point of Aqueous Engine Coolants
ASTM D 1193	Reagent Water
ASTM D 1568	Sampling and Chemical Analysis of Alkylbenzene Sulfonates
ASTM D 4057	Manual Sampling of Petroleum and Petroleum Products
ASTM D 4177	Automatic Sampling of Petroleum and Petroleum Products
ASTM E 70	pH of Aqueous Solutions with the Glass Electrode
ASTM F 483	Total Immersion Corrosion Test for Aircraft Maintenance Chemicals
ASTM F 484	Stress Crazing of Acrylic Plastics in Contact with Liquid or Semi-Liquid Compounds
ASTM F 485	Effects of Cleaners on Unpainted Aircraft Surfaces
ASTM F 502	Effects of Cleaning and Chemical Maintenance Materials on Painted Aircraft Surfaces
ASTM F 519	Mechanical Hydrogen Embrittlement Testing of Plating Processes and Aircraft Maintenance Chemicals
ASTM F 945	Stress Corrosion of Titanium Alloys by Aircraft Engine Cleaning Materials
ASTM F 1105	Preparing Aircraft Cleaning Compounds, Liquid Type, Solvent Based, for Storage Stability Testing
ASTM F 1110	Sandwich Corrosion Test
ASTM F 1111	Corrosion of Low Embrittling Cadmium Plate by Aircraft Maintenance Chemicals

2.3 U.S. Government Publications:

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

MIL-PRF-25690	Plastic, Sheets and Formed Parts, Modified Acrylic Base, Monolithic, Crack Propagation Resistant
MIL-P-83310	Plastic Sheet, Polycarbonate, Transparent
MIL-STD-290	Packaging of Petroleum and Related Products

2.4 APHA Publications:

Available from American Public Health Association, 1015 Eighteenth Street, NW, Washington, DC 20036.

Standard Methods for the Examination of Water and Waste Water

2.5 EPA Methods 40 Code of Federal Regulations (CFR) Part 797.1300 and 797.1400:

2.6 Organization for Economic Cooperation and Development::

OECD Guidelines for Testing of Chemicals Methods 202 and 203

3. TECHNICAL REQUIREMENTS:

3.1 Material:

The composition of the fluid shall be optional with the manufacturer. The fluid may contain additives, such as corrosion inhibitors, urea, formamide, etc, as required to produce a product meeting the requirements of this specification.

3.1.1 Environmental Information: The manufacturer of the fluid shall provide not less than the following information:

3.1.1.1 Biodegradability: Fluid shall be tested in accordance with APHA Standard Methods for Examination of Water and Waste Water. The manufacturer shall provide results of bioassays which shall contain not less than the following information:

3.1.1.1.1 The percent of fluid biodegraded in five days at 20 °C (68 °F).

3.1.1.1.2 The 5-day theoretical total oxygen demand (TOD) of the fluid, expressed in kilogram of oxygen per kilograms of fluid.

3.1.1.2 Ecological Behavior: A statement of the ecological behavior of the fluid, which shall include aquatic toxicity for the total formulation. The aquatic toxicity data shall be determined in accordance with EPA Methods 40 Code of Federal Regulations (CFR) Part 797.1300 and 797.1400 or OECD Guidelines for Testing of Chemicals (Organization for Economic Cooperation and Development, Methods 202 and 203, updated 1989) using test species required by regulatory agencies for permitted discharges. The LC50 concentration, the highest concentration at which 50% of the test species survive, shall be given in milligrams per liter.

3.1.1.3 Trace Contaminants: Report the presence, in percentage by weight, of sulfur, halogens, phosphate, nitrate, and heavy metals (lead, chromium, cadmium, and mercury).

3.1.2 Appearance: Fluid, as received by purchaser, shall be homogeneous, uniform in color, and free from skins, lumps, and foreign materials detrimental to usage of the product. If fluid is colored, it shall be blue.

3.2 Physical Properties:

The fluid, as supplied by vendor, shall conform to the following requirements: tests shall be performed in accordance with specified tests on the product in concentrated form as delivered by vendor, unless otherwise specified herein:

3.2.1 Flash Point: Shall be reported and shall be not lower than 100 ×C (212 ×F), determined in accordance with ASTM D 56 or ASTM D 93. In case of dispute, flash point determined in accordance with ASTM D 56 shall apply.

3.2.2 Specific Gravity: Shall be reported and shall be within ±0.015 of the preproduction value established in 4.2.3, determined in accordance with ASTM D 891.

3.2.3 pH: Shall be 7.0 to 11.5 and within ±0.5 of the preproduction value established in 4.2.3, determined in accordance with ASTM E 70.

3.2.4 Freezing Point:

3.2.4.1 Freeze point of fluid diluted 1:1 by weight with ASTM D 1193 Type IV water shall be reported and shall be lower than -14.5 °C (+6 °F) determined in accordance with ASTM D 1177.

3.2.4.2 Shall be reported and shall be within 4 °C (7 °F) of the preproduction value established in 4.2.3, determined in accordance with ASTM D 1177.

3.2.5 Effect on Aircraft Metals:

3.2.5.1 Sandwich Corrosion: Specimens, after testing in accordance with ASTM F 1110, shall not show corrosion worse than control panels run using ASTM D 1193, Type IV, water.

3.2.5.2 Total Immersion Corrosion: The fluid, tested in accordance with ASTM F 483 except that panels of AMS 4376 shall be tested for 24 hours, shall neither show evidence of corrosion of panels nor cause a weight change of any test panel greater than shown in Table 1.

TABLE 1 - Total Immersion Corrosion

Test Panel	Weight Change mg/cm^2 per 24 hours
AMS 4037 Aluminum Alloy, anodized as in AMS 2470	0.3
AMS 4041 Aluminum Alloy	0.3
AMS 4049 Aluminum Alloy	0.3
AMS 4376 Magnesium Alloy, dichromate treated as in AMS 2475	0.2
AMS 4911 or MAM 4911 Titanium Alloy	0.1
AMS 5045 Carbon Steel	0.8

3.2.5.3 Low-Embrittling Cadmium Plate: Test panels, coated with low-embrittling cadmium plate, shall not show a weight change greater than 0.3 mg/cm^2 per 24 hours, determined in accordance with ASTM F 1111.

3.2.5.4 Hydrogen Embrittlement: The fluid shall be nonembrittling, determined in accordance with ASTM F 519, Type 1a, 1c, or 2a.

3.2.5.5 Stress-Corrosion Resistance: The fluid shall not cause cracks in AMS 4911 or MAM 4911 titanium alloy specimens, determined in accordance with ASTM F 945, Method A.

3.2.5.5.1 The fluid shall be tested in accordance with ASTM F 945, Method A using AMS 4916 specimens. Report shall detail the effect of the fluid and the effect of control solution. The results shall be reported for informational purposes only.

3.2.6 Effect on Transparent Plastics:

3.2.6.1 The fluid, at 25 °C ± 2 (77 °F ± 4), shall not craze, stain, or discolor MIL-PRF-25690 stretched acrylic plastic, determined in accordance with ASTM F 484.

3.2.6.2 The fluid, at 25 °C ± 2 (77 °F ± 4), shall not craze, stain, or discolor MIL-P-83310 polycarbonate plastic, determined in accordance with ASTM F 484, except that the specimens shall be stressed for 30 minutes ± 2 to an outer fiber stress of 13.8 MPa (2000 psi).

3.2.7 Effect on Painted Surfaces: The fluid, at 25 °C ± 2 (77 °F ± 4), shall neither decrease the paint film hardness 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 F 502.

3.2.8 Effect on Unpainted Surfaces: The fluid, tested in accordance with ASTM F 485, shall neither produce streaking nor leave any stains requiring polishing to remove.

3.2.9 Rinsibility: The fluid shall be completely rinsible in tap water, determined in accordance with 3.2.9.1.

3.2.9.1 A 75 x 200 mm (3 x 8 inch) panel of clear glass shall be cleaned to provide a surface free of waterbreak, dried, and coated with the deicer/anti-icer fluid by pouring the fluid over the panel while it is held in a horizontal position. The coated panel shall be inclined at an angle of approximately 45 degrees for 10 minutes ± 0.5, then placed in a horizontal position for 24 hours ± 0.25 at room temperature. After the 24 hour exposure, the panel shall be rinsed in tap water for 5 to 6 minutes, followed by a rinse with ASTM D 1193, Type IV, water, allowed to air dry at ambient temperature, and examined for visible traces of the deicer/anti-icer fluid.

3.2.10 Runway Concrete Scaling Resistance: The condition of the runway concrete surface shall have a rating not greater than 1 for 50 freeze-thaw cycles, determined in accordance with ASTM C 672 except that concrete shall:

Be air-entrained with an air content as specified in ASTM C 672
Have a minimum cement content of 510 pounds per cubic yard ± 10 (302 kg/m^3 ± 6)
Have a slump, 1.5 inches ± 0.5 (38 mm ± 13)

A 25% by volume solution of the deicer/anti-icer fluid, as supplied by the manufacturer in commercial concentration, in tap water shall be substituted for calcium chloride. Performing more than one freeze-thaw cycle per day is acceptable.

3.2.11 Storage Stability: The fluid, after storage in accordance with ASTM F 1105, shall not exhibit separation or an increase in turbidity compared to unaged fluid. Any increase in turbidity shall be reported, but shall be acceptable if removed by mild agitation.

3.2.12 Performance: The fluid, used in accordance with manufacturer's recommendation, shall remove accumulated frozen deposits of frost and ice from airport taxiways and runways. Acceptance criteria and method of test shall be agreed upon by purchaser and vendor.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of fluid shall supply all samples for conformance testing and shall be responsible for obtaining independent laboratory confirmation of conformance to the requirements of this specification. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the fluid conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Flash point (3.2.1), specific gravity (3.2.2), and pH (3.2.3) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Freezing point (3.2.4), effect on aircraft metals (3.2.5), effect on transparent plastic (3.2.6), effect on painted surfaces (3.2.7), effect on unpainted surfaces (3.2.8), rinsibility (3.2.9), and runway concrete scaling resistance (3.2.10) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser, but in no case less than once every two years.

4.2.3 Preproduction Tests: All technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of fluid to a purchaser, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing:

Shall be in accordance with all applicable requirements of 4.3.1 or 4.3.2; a lot shall be all fluid produced in one continuous manufacturing process from the same batches of raw materials and presented for vendor's inspection at one time:

4.3.1 Drum Shipments: ASTM D 1568.

4.3.2 Bulk Shipments: ASTM D 4057 or ASTM D 4177.