

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 1800

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FOAM, FIRE EXTINGUISHING LIQUID Protein and Fluoroprotein

1. SCOPE:

- 1.1 Form: This specification covers two types of fire extinguishing foam concentrate in the form of a liquid.
- 1.2 Application: Primarily for use in mechanical generating equipment for extinguishing fires in flammable liquids such as gasoline and oils. At time of use, six parts of the concentrate will be diluted with 94 parts of fresh or sea water to form a fire extinguishing liquid.
- 1.3 Classification: This specification covers two types of foam concentrate as follows:

Type I - Protein
Type II - Fluoroprotein

1.3.1 Unless a specific type is ordered, either type may be supplied.

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 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)
- 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)
- AMS 4376 - Magnesium Alloy Plate, 3.0Al - 1.0Zn (AZ31B-H26)
- AMS 4911 - Titanium Alloy Sheet, Strip, and Plate, 6Al - 4V, Annealed
- AMS 5045 - Steel Sheet and Strip, 0.25 Max Carbon, Hard Temper

2.1.2 Aerospace Recommended Practices:

- ARP 1511 - Corrosion of Low-Embrittling Cadmium Plate by Aircraft
Maintenance Chemicals
- 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 D96 - Water and Sediment in Crude Oils
- ASTM D97 - Pour Point of Petroleum Oils
- ASTM D445 - Kinematic Viscosity of Transparent and Opaque Liquids (and
the Calculation of Dynamic Viscosity)
- ASTM D460 - Sampling and Chemical Analysis of Soap and Soap Products
- ASTM D910 - Aviation Gasolines
- ASTM D1193 - Reagent Water
- ASTM D1298 - Density, Relative Density (Specific Gravity), or API Gravity
of Crude Petroleum and Liquid Petroleum Products by Hydrometer
Method
- ASTM E11 - Wire Cloth Sieves for Testing Purposes
- ASTM E70 - pH of Aqueous Solutions with the Glass Electrode
- ASTM F483 - Total Immersion Corrosion Test for Aircraft Maintenance
Chemicals
- ASTM F484 - Stress Cracking of Acrylic Plastics in Contact with Liquid or
Semi-Liquid Compounds
- ASTM F502 - Effects of Cleaning and Chemical Maintenance Materials on
Painted Aircraft Surfaces
- ASTM F519 - Mechanical Hydrogen Embrittlement Testing of Plating Processes
and 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 Military Specifications:

MIL-P-25690 - Plastic, Sheets and Parts, Modified Acrylic Base,
Monolithic, Crack Propagation Resistant

2.3.2 Military Standards:

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

3. TECHNICAL REQUIREMENTS:

3.1 Material: Shall be essentially a concentrated, homogeneous solution of hydrolyzed proteins, foam stabilizers, metallic salts, and other additives as required to produce a product meeting the requirements of 3.2. For Type II foam, fluorine-based and other surfactants may be included to produce a fluoroprotein type agent meeting the requirements of 3.2.

3.2 Properties: The product shall conform to the following requirements; tests shall be performed in accordance with specified test methods on the product supplied in concentrated form, except as specified in 3.2.8:

3.2.1 Specific Gravity: Shall be not lower than 1.12, determined in accordance with ASTM D1298 at 15°/15°C (60°/60°F).

3.2.1.1 Specific gravity of production shipments of the product shall be within +0.03 of the preproduction value, established as in 4.4.1, but in no case lower than 1.12.

3.2.2 Viscosity (Kinematic):

3.2.2.1 At 0°C (32°F): Shall be not greater than 110 cSt (110 mm²/s), determined in accordance with ASTM D445 at 0°C (32°F). Viscosity of production shipments of the product shall be within +20 cSt (+20 mm²/s) of the preproduction value established as in 4.4.1, but in no case greater than 110 cSt (110 mm²/s).

3.2.2.2 At 20°C (68°F): Shall be not greater than 30 cSt (30 mm²/s), determined in accordance with ASTM D445 at 20°C (68°F).

3.2.3 pH: Shall be 6.5 - 7.5, determined in accordance with ASTM E70 at 20°C (68°F).

3.2.3.1 The pH shall not vary from the range 6.0 - 7.5, determined in accordance with ASTM E70 at 20°C (68°F) on a 6% solution of the product in synthetic sea water of the following nominal composition:

% by Weight

Magnesium Chloride (MgCl ₂ ·6H ₂ O)	1.10
Calcium Chloride (CaCl ₂ ·2H ₂ O)	0.16
Anydrous Sodium Sulfate (Na ₂ SO ₄)	0.40
Sodium Chloride, C.P. (NaCl)	2.50
ASTM D1193 Water	95.84



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3.2.3.2 The pH value of production shipments of the product shall be within ± 0.4 of the preproduction value, established as in 4.4.1 at 20°C (68°F), but in no case shall be outside the range 6.5 - 7.5.

3.2.3.3 The pH value of the product, after high temperature stability test at 60°C (140°F) of 3.2.7.2, shall be within ± 0.6 of the preproduction value, established as in 4.4.1, but in no case shall be outside the range 6.5 - 7.5.

3.2.4 Pour Point: Shall be not higher than -9°C (16°F), determined in accordance with 4.5.1. The pour point of production shipments of the product shall be within $\pm 3^\circ\text{C}$ ($\pm 5^\circ\text{F}$) of the preproduction value, established as in 4.4.1, but shall be not higher than -9°C (16°F).

3.2.5 Sedimentation: Shall be not greater than 0.25% by volume, determined in accordance with ASTM D96. Sediment, if present, shall be completely dispersible on mild shaking and shall readily pass through an 80-mesh (180- μm) screen, determined in accordance with 4.5.2.

3.2.6 Precipitation: The product shall be readily miscible with synthetic sea water (See 3.2.3.1) and shall show a precipitation of not more than 0.05% by volume, determined in accordance with 4.5.3.

3.2.7 Stability:

3.2.7.1 At -65°C (-85°F): Sedimentation shall not exceed 0.25% by volume, determined in accordance with 4.5.4. Sediment, if present, shall be completely dispersible on mild shaking and shall readily pass through an 80-mesh (180- μm) screen.

3.2.7.2 At 60°C (140°F): The product shall not show any physical, chemical, or performance changes in excess of limits permitted in 3.2.1.1, 3.2.2, 3.2.3.2, 3.2.4, 3.2.5, 3.2.6, 3.2.8 and 3.2.9 except that the product shall have sedimentation not greater than 1.0% by volume, determined in accordance with 4.5.5. Sediment, if present, shall be completely dispersible on mild shaking and shall readily pass through an 80-mesh (180- μm) screen.

3.2.8 Foam Characteristics:

3.2.8.1 Foam Expansion: The foam generated at 20°C $\pm$ 2 (68°F $\pm$ 4) from a 6% by volume premixed solution of the product in tap water shall have an expansion ratio greater than 7:1, determined in accordance with 4.5.6.1.

3.2.8.2 Drainage: The foam generated at 20°C $\pm$ 2 (68°F $\pm$ 4) from a 6% by volume premixed solution of the product in tap water shall have a 25% drainage time greater than 6.5 min., determined in accordance with 4.5.6.2.

3.2.9 Fire Extinguishment:

- 3.2.9.1 Coverage: The product as received and after exposure at 60°C (140°F) as in 3.2.7.2 shall control and completely extinguish the fire in the time periods shown below, determined in accordance with 4.5.7:

	90% Control	Total Extinguishment
Type I	140 sec	180 sec
Type II	75 sec	110 sec

- 3.2.9.2 Fluidity: The product shall extinguish the fire in a positive and progressive manner after start of foam application. The foam produced shall form a continuous blanket over gasoline, shall flow readily into corners of the tank, and shall not break up into separate masses or voids in the foam blanket, determined in accordance with 4.5.7.

- 3.2.9.3 Burnback: The foam blanket shall prevent complete reinvolverment of the fire within 10 min., determined in accordance with 4.5.8.

3.2.10 Corrosion of Metal Surfaces:

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

- 3.2.10.2 Total Immersion Corrosion: The product shall neither show evidence of corrosion nor cause a weight change of any single test panel greater than the following, determined in accordance with ASTM F483:

Test Panel	Weight Change mg/cm ² per 24 hr
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 - Titanium Alloy	0.1
AMS 5045 - Carbon Steel	0.8

- 3.2.10.3 Low-Embrittling Cadmium Plate: Test panels coated with low-embrittling cadmium plate shall not show a weight change greater than 0.3 mg/cm² per 24 hr, determined in accordance with ARP 1511.

- 3.2.11 Hydrogen Embrittlement: The product shall be non-embrittling, determined in accordance with ASTM F519, Method 1a, 1c or 2a.

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