

MIL-V-87939 (USAF)  
14 March 1989

## MILITARY SPECIFICATION

### VAPOR SUPPRESSING - FIRE EXTINGUISHING AGENT, FOAM CONCENTRATES FOR USE ON HYPERGOLIC PROPELLANTS

This specification is approved for use by the Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers the requirements for gel forming foam liquid combination vapor suppression and fire extinguishing agents. The agents consists of appropriate acrylic gelling agents and alpha olefin sulfonate surfactants to conform to this specification. The surfactants and gelling agents are to be supplied as separate entities to be proportioned into water hose streams in a ratio of 1 part gelling agent, 1 part surfactant, and 8 parts water by dispensing equipment at the time of application to liquid propellant spills.

1.2 Classification. Concentrates shall be of the following types:

Type F1 - gelling agent for use on spills of hydrazine fuels or hypergolic mixture of hydrazine fuel and nitrogen tetroxide oxidant

Type F2 - foam forming surfactant for use on spills of hydrazine fuels or hypergolic mixtures of hydrazine fuel and nitrogen tetroxide oxidant

Type O1 - gelling agent for use on spills of nitrogen tetroxide oxidant

Type O2 - foam forming surfactant for use on spills of nitrogen tetroxide oxidant

1.3 Part or Identifying Number (PIN). A specification-based PIN has been included to identify types and sizes (see 6.5).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Headquarters Air Force Engineering and Services Center (HQ AFESC/RDCF), Tyndall Air Force Base, FL 32403-6001, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC No. N/A

FSC 6850

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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## 2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

## SPECIFICATIONS

## FEDERAL

TT-E-489	Enamel, Alkyd, Gloss (for Exterior and Interior Surfaces)
VV-F-800	Fuel Oil, Diesel
PPP-C-1337	Containers, Metal, With Polyethylene Inserts

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MIL-P-27402	Propellant, Hydrazine - uns-Dimethylhydrazine (50% $N_2H_4$ - 50% UDMH)
MIL-P-26539	Propellant, Nitrogen Tetroxide

## STANDARDS

## FEDERAL

FED-STD-313	Material Safety Data Sheet, Preparation and Submission
FED-STD-595	Colors

## MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of US Military Property

2.2 Other Publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) specified in the solicitations. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issues of the nongovernment documents which are current on the date of the solicitation.

## UNDERWRITERS LABORATORIES, INC (U.L.)

UL 162	Standard for Foam Equipment and Liquid Concentrates
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(Application for copies should be addressed to the Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL , 60062.)

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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 412                      Standard for Evaluating Foam Fire Fighting Equipment  
of Aircraft Rescue and Fire Fighting Vehicles

(Application for copies should be addressed to the National Fire  
Protection Association, Batterymarch Park, Quincy, MA 02269)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D96                      Test Method for Water and Sediment in Crude Oils  
  
D1068                    Test Methods for Iron in Water  
  
D1218                    Refractive Index and Refractive Dispersion of  
Hydrocarbon Liquids, Test for  
  
D3673                    Chemical Analysis of Alpha Olefin Sulfonates  
  
E70                      pH of Aqueous Solutions with the Glass Electrode  
  
E527                    Numbering Metals and Alloys (UNS)  
  
E729                    Standard Practice for Conducting Acute Toxicity  
Test with Fish, Macroinvertebrates and Amphibians

(Application for copies should be addressed to the American Society  
for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103).

AMERICAN PUBLIC HEALTH ASSOCIATION (APHA)

Standard Methods for the Examination of Water and Waste Water.

(Application for copies should be addressed to the American Public  
Health Association, 1015 - 18th Street, N.W. Washington, DC 20036)

(Nongovernment standards and other publications are normally available  
from the organizations which prepare or which distribute the documents. These  
documents also may be available in or through libraries or other informational  
services).

2.3 Order of Precedence. In the event of a conflict between the text of  
this specification and the references cited herein, the text of this specifica-  
tion shall take precedence. Nothing in this specification however, shall super-  
seede applicable laws and regulations unless a specific exemption has been  
obtained.

3. REQUIREMENTS

3.1 Qualification. Liquid concentrate fire extinguishing agent components  
furnished under this specification shall be products which are qualified for

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listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3 and 6.3).

**3.2 Materials.** Concentrates shall consist of four materials, supplied in separate containers. The foam materials are: An acid-containing, acrylic emulsion copolymer for the fuel (Type F1), a surfactant for the fuel (Type F2), an acid-containing, crosslinked acrylic emulsion copolymer for the oxidizer (Type O1), and a surfactant for the oxidizer (Type O2) and other components as required to conform to performance requirements of this specification. Each component and the mixtures of individual components shall conform to the requirements specified. The materials shall have no adverse effects on the health of personnel when used as intended or handled as specified by Air Force directives.

**3.3 Concentrate Characteristic.** Concentrates, or solutions made from these concentrates, shall conform to the economical and physical requirements shown in Table I and Table II.

**3.3.1 Stability.** The concentrates (Types F1, F2, O1 and O2) shall conform to the following requirements after 10 days storage at  $65^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$  (see 4.7.11):

- a. Stratification: Nonvisible evidence following test (see 4.7.15).
- b. Precipitation: Less than 0.05 percent by volume, (see 4.7.16).

**3.3.2 Compatibility of Concentrates.** The concentrates of one manufacturer shall be compatible in all proportions with the corresponding concentrates furnished by other manufacturers listed on the qualified products list. Information regarding these materials may be obtained from the Air Force Engineering and Service Center, Tyndall Air Force Base, FL, 32403-6001. The concentrate mixtures shall conform to the following requirements after 10 days storage of the concentrates at  $65^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$  (see 4.7.11):

- a. Stratification: No visible evidence following test (see 4.7.15).
- b. Precipitation: Less than 0.05 percent by volume, (see 4.7.16).

**3.4 Foam Mixture Solutions Characteristics.** Mixtures of the two components for each of the two types of foams (Type F and Type O) shall conform to the chemical and physical requirements shown in Table II:

**3.4.1 Stability.** After 10 days storage of the concentrates at  $65^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$  (see 4.7.11): The 10-10-80 premix solution consisting of 10 parts each of Type F1 and F2 concentrates and 80 parts of fresh water, or Type O1 and O2 concentrates and 80 parts of fresh water, as applicable, shall conform to the following requirements

- a. Foamability: (See Table II).
- b. Fire performance: 50 ft<sup>2</sup> fire as specified in 3.5.
- c. Vapor suppression: (See Table II).

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3.4.2 Compatibility of Foam Mixture Solution. The concentrates of one manufacturer shall be compatible in all proportions with concentrate furnished by other manufacturers listed on the qualified products list. Information regarding these materials may be obtained from the Air Force Engineering and Services Center, Tyndall Air Force Base, FL 32403-6001. The solutions shall conform to the following requirements after 10 days storage of the concentrates at  $65^{\circ}\text{C} \pm 2.0^{\circ}\text{C}$  (see 4.7.11):

- a. Foamability: (See Table II).
- b. Fire performance 50ft<sup>2</sup> fire as specified in 3.5.
- c. Vapor suppression: (See Table II).

(3.3.2 applies to "concentrates" while 3.4.2 applies to "mixture solutions.")

3.5 Fire Performance. The foam shall conform to the fire performance requirements shown in Table III.

3.6 Material Safety Data Sheet.

3.6.1 The contracting activity shall be provided a material safety data sheet (MSDS) at the time of contract award. The MSDS shall be included with each shipment of the materials covered by this specification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of Inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification Inspection (see 4.3).
- b. Quality conformance inspection (see 4.5).
  - (1) Examination of filled containers.
  - (2) Quality conformance inspection.

4.3 Qualification Inspection. Qualification inspection shall be conducted at a Laboratory satisfactory to the Air Force Engineering Services Center, Tyndall Air Force Base. Qualification inspection shall consist of the test shown in Table IV.

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TABLE I. Physical and chemical requirements for concentrates of solution.

Requirement	Values				Applicable Publication	Test Paragraph
	Type F1	Type F2	Type O1	Type O2		
	Fuel	Fuel	Oxidizer	Oxidizer		
	acrylate	surfactant	acrylate	acrylate		
Refractive index						
minimum		1.3900 -		1.3800 -		
maximum		1.4100		1.4200	ASTM 1218	4.7.1
Brookfield viscosity of concentrate centipoise						
minimum at 25°C	-	1640	-	2780	ASTM 3716	4.7.2.1
Brookfield viscosity of 1% neutralized solution centipoise range						
minimum	4500 -	-	3000 -	-	-	4.7.2.1.1
maximum	6000		5000			
Hydrogen ion concentration: (pH) 10% solution	2.1-4.0	8.7-9.3	2.1-4.0	8.7-9.3	ASTM E70	4.7.3
Density, g/cc @25°C	1.020 - 1.070	-	1.020 1.070	-		4.7.4
Corrosion rate:						
General, (mpy)	1.0	1.0	1.0	1.0	ASTM E527	4.7.5
Localized, pits	none	none	none	none		
% solids						
minimum	19.5	-	27.5			4.7.6
maximum	20.5		28.5			
Fraction gelled (gms/l)	0.2	-	0.1	-		4.7.7
Iron content (ppm) max	5	10	5	10	ASTM 1068	4.7.8
Environmental impact						
COD, mg/L, max	-	1,000,000	-	1,000,000	APHA	4.7.10.2
BOD <sub>20</sub> /COD, min		0.75		0.75	Standard Methods	4.7.10.3
Aquatic Toxicity LD50 for rainbow trout (ppm max)	1400	8	450	6	ASTM E729	4.7.10.1
Inorganic Sulfates maximum	-	1.6	-	1.6	ASTM D3673	4.7.9

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Table II. Performance Requirements for Propellant Foams - Quality Control Laboratory Tests

Requirement	<u>Foam System Evaluated</u>	
	Types F1 + F2 over $\text{NH}_4\text{OH}$	Types 01 + 02 over $\text{HNO}_3$
Expansion ratio		
minimum	4.0	2.5
maximum	5.0	3.5
25% drainage time		
minimum	24 hours	10 minutes
Collapse % in 24 hours maximum	15	--
50% collapse time, minutes, minimum	--	50

1. Substitute propellant substrates are undiluted, reagent grade ammonium hydroxide and nitric acid over which foams are applied as specified in 4.7.1.14.

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Table III. Fire performance.

	<u>Hypergolic fuel foams</u>			<u>Test paragraphs</u>
	<u>Type F Low expansion</u>	<u>Type F high expansion</u>	<u>Type O high expansion</u>	
<u>50 ft<sup>2</sup> fire (see 4.7.13)</u>				
Foam application time to extinguish, seconds, max	240	150	75	4.7.14.1.5 4.7.14.2.5 4.7.14.3.5
Burnback time of resulting foam cover, minutes, min	5	N/A	N/A	4.7.14.1.6 4.7.14.2.6 4.7.14.3.6
Vapor securing ability, post-fire, concentration ppm maximum	1 ppm N <sub>2</sub> H <sub>4</sub>	1 ppm N <sub>2</sub> H <sub>4</sub>	100 ppm NO <sub>x</sub>	4.7.14.1.7 4.7.14.2.7 4.7.14.3.7
Foamability:				
Foam expansion, minimum	6	200	200	4.7.14.4
Foam 25% drainage time, minutes, minimum	12	5	4	4.7.14.4
Wand Test	Pass	Pass	Pass	4.7.14.1.6 4.7.14.2.6 4.7.14.3.6



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4.3.1 Samples for Qualification Inspection. One 55 gallon drum of each component is required for the qualification inspection.

4.4 Sampling for Quality Conformance Inspection.

4.4.1 Inspection Lot. A lot shall consist of each component manufactured as one batch and transferred from one mixing tank to the shipping container.

4.4.2 Sampling for Examination of Filled Containers. A random sample of filled containers shall be inspected from each lot in accordance with MIL-STD-105 at inspection level I. The acceptable quality level (AQL) of 2.5 percent defective shall be used to verify compliance with all requirements regarding fill, closure, marking, and other requirements not requiring tests (see 4.6, 5.1.1.1, and 5.1.1.2).

4.4.3 Sampling for Quality Conformance Inspection. Three filled 55-gallon containers of each concentrate shall be selected at random from each lot and used as one composite sample for the tests specified in 4.6. For purposes of the tests required by 4.5 one of the 55-gallon containers selected at random may be used or a 55 gallon sample of the product shall be withdrawn from an agitated mixing tank prior to packaging. The results of the tests required by 4.5 shall be submitted to the Air Force Systems Command, Space Division (CEPE), Los Angeles, CA, 90009-2960 or the designated laboratory.

4.5 Quality Conformance Inspection. The samples selected in accordance with 4.4.3 shall be subjected to the quality conformance inspection of table IV. If the sample tested is found to be not in conformance with any of the quality conformance tests, the lot represented by the sample shall be rejected.

4.5.1 Quality Conformance Inspection Report. The contractor shall prepare test reports in accordance with the data ordering document included in the contract (see 6.2.2).

4.6 Examination of Filled Containers. Each sample filled container shall be examined for defects of construction of the container, and the closure, for evidence of leakage, and for unsatisfactory markings. Each filled container shall also be weighed to determine the amount of contents. Any container in the sample having one or more defects or less than required fill, shall not be offered for delivery, and if the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, this shall be cause for rejection of the lot represented by the sample.

4.7 Test Procedures.

NOTE: Temperatures are recored to the nearest degree, pH to the nearest 0.1 unit, density to the nearest 0.001 g/cc, viscosity to the nearest 0.0-1 cp and refractive index to the nearest 0.0001 unit.

4.7.1 Refractive Index. Measure the refractive index at a temperature of 20°C in accordance with ASTM 1218. Record refractive index temperature.

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Table IV. Qualification and quality conformance inspections.

<u>Examination or Test</u>	<u>Reference paragraph</u>		<u>Qualification</u>	<u>Quality Conformance</u>
	<u>Requirement</u>	<u>Test</u>		
Refractive index	3.3	4.7.1	x	x
Viscosity	3.3	4.7.2	x	x
pH value	3.3	4.7.3	x	x
General Corrosion	3.3	4.7.5.1	x	
Localized Corrosion	3.3	4.7.5.2	x	
Density	3.3	4.7.4	x	x
Percent solids	3.3	4.7.6	x	x
Fraction gelled	3.3	4.7.7	x	x
Inorganic sulfates	3.3	4.7.9	x	x
Iron content	3.3	4.7.8	x	x
Foamability	3.4	4.7.13	x	x
Performance with simulated propellants	3.4	4.7.17	x	x
Environmental impact	3.3	4.7.10	x	
50 ft <sup>2</sup> fire test	3.5	4.7.14	x	
Examination of filled containers	4.6	4.6		x
Stability	3.3.1 & 3.4.2	4.7.11	x	
Compatibility	3.3.2 & 3.4.2	4.7.12	x	
Stratification	3.3.1 & 3.4.1	4.7.15		x
Precipitation	3.3.2 & 3.4.2	4.7.16		x

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4.7.2 Viscosity.

4.7.2.1 Viscosity of Acrylate Emulsions and Surfactants. The viscosity shall be determined at temperature of  $25^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$  in accordance with ASTM D 3716. Viscosity measurements of surfactants are determined on concentrated samples which have been thoroughly agitated assuring a uniform mixture before sampling and after temperature equilibration. The viscosity of acrylates is measured on a neutralized 1% copolymer solution after treating the original sample shown in 4.7.2.1.1. The viscosity shall be recorded in centipoise.

4.7.2.1.1 Thickened Viscosity of a 1% Copolymer Solution of Type F1 and Type O1. Using a platform balance, accurately weigh (X) g of sample into a 16-ounce, wide-mouth jar. Add (W) g of distilled water and (V) ml of 1N NaOH, in that order. Use a buret calibrated to the nearest 0.1 ml to add the NaOH. Mix carefully with a spatula. Avoid aeration. Label this solution "A".

Using a platform balance, weigh specified amounts of solution "A" and distilled water (both from Table V under "Final Dilution") into a 16 ounce jar. Mix carefully with a spatula. Avoid aeration. Determine the pH of the solution in accordance with ASTM E70.

Use the following equation to calculate the weight of sample, volume of 1N NaOH and weight of water required to prepare an initial neutralized copolymer solution.

$$X = \text{grams of sample} = \frac{R^*}{\% \text{ gelled}^*}$$

$$V = \text{ml of NaOH} = \frac{(X) \times \text{Acid Number}^*}{56.1 \times N (\text{NaOH})}$$

$$W = \text{grams of water} = S^* - X - 1.04 V$$

\*R, B, and S are constants from Table V. Acid Number is considered a constant, unless otherwise indicated. % gelled is determined in accordance with 4.7.7. Determine the viscosity of the solution at  $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . Use the Brookfield, Model LVF Viscometer and #3 spindle at 12 RPM.

4.7.3 pH Value.

4.7.3.1 pH of Acrylate Emulsions. The pH value of the acrylate emulsions shall be determined on the neat material at  $25^{\circ}\text{C} \pm 1.0^{\circ}\text{C}$  in accordance with ASTM E70. Care must be taken to rinse electrodes thoroughly with distilled or deionized water immediately after determining the pH value.

4.7.3.2 pH of Surfactants. The pH value of a 10% (by volume) solution of surfactant in distilled or deionized water shall be determined at  $25^{\circ}\text{C} \pm 1.0^{\circ}\text{C}$  in accordance with ASTM E70. The pH may change slowly with time; therefore, the relatively steady reading after several minutes of stirring is recorded.

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TABLE V. Constant Values and Ranges

<u>Type</u>	<u>Final Dilution</u>					<u>Allowable pH range</u>	<u>Acid Number</u>
	<u>R</u>	<u>B</u>	<u>S</u>	<u>g Solution "A"</u>	<u>g Water</u>		
F1	689	2	400.0	125.0	125.0	7.5-9.0	87.0
O1	1842	3	400.0	50.0	200.0	7.5-8.5	72.3

4.7.4 Density. Weigh a clean, dry 10 cc volumetric flask. Fill to mark with sample and reweigh. Adjust temperature to  $25^{\circ}\text{C} + 2^{\circ}\text{C}$  in a constant temperature bath. Record density in g/cc and actual sample temperature.

4.7.5 Corrosion. The liquid for immersion of the metal specimens for general corrosion and localized corrosion tests shall consist of the concentrate of each of Types F1, F2, O1 and O2.

#### 4.7.5.1 General Corrosion.

4.7.5.1.1 Test Specimens. The test specimen shall consist of UNS 30400 in accordance with UNS designations (see ASTM E527). All specimens shall be milled to finished dimensions of approximately 1/16 inch thick, 1/2 inch wide, and 3 inches long. All specimens shall be degreased in acetone, rinsed with distilled water and air dried before exposure. (Prepared metal specimens may be obtained from the Metaspec Company, Box 6715, San Antonio, Texas 78209).

4.7.5.1.2 Test Procedures. Five weighed specimens shall be fully immersed in the test medium in a separate 600 mL beaker and held at  $25^{\circ}\text{C} + 5^{\circ}\text{C}$  for a period of 60 days. A watch-glass cover shall be used to retard evaporation. At the end of the exposure period, the weight-loss shall be determined and the corrosion rate calculated as required.

#### 4.7.5.2 Localized Corrosion.

4.7.5.2.1 Test Specimens. The test specimens shall consist of UNS 30400 CRES milled to finished dimensions of approximately 1/16 inch thick, 1/2 inch wide, and 3 inches long. After degreasing with acetone, rinsing with distilled water, and air drying before exposure, the specimens shall be pretreated by immersion in a 1:9 concentrated nitric acid-water solution for a period of 5 minutes and then rinsed again with distilled water.

4.7.5.2.2 Procedure. Ten specimens shall be girdled lengthwise with a clean 1/16 to 1/8 inch wide band of a good grade of gum rubber of a size such that the band is taut during the test. Because of the poor quality of most commercial rubber bands, it is recommended that the bands for this test be cut from 1-3/4 inch flat width pure gum amber tubing. Gooch type (Preiser Scientific Rubber tubing, Pure Gum, Gooch type, 1/32 inch thin wall, pure gum amber tubing is very elastic, especially made for Gooch crucibles, Stock No.

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139080, or equal). This tubing is most easily cut with sharp shears. The specimens girdled with the rubber bands shall be placed in a 60 ml, beaker so that no contact is made between individual specimens. A 1/4-inch layer of glass beads shall be introduced into the beaker to aid in stabilizing specimen position. Enough liquid shall be added to completely immerse the specimens, and a watch-glass shall be placed over the beaker to retard evaporation (but allow air access) and act as a dust cover, and the assemblies allowed to stand at room temperature for 60 days.

**4.7.5.2.3 Results.** The specimens shall be monitored daily over the 60-day period to ascertain the presence or absence of pitting. These daily examinations shall be made without disturbing the test (other than removing the cover). Corrosion is customarily signaled by appearance of a dark spot which, if removed after sufficient exposure, discloses a corrosion pit. If the suspected area cannot be positively identified by the naked eye, it can be at a magnification of 10X. At the end of the test, each specimen shall be inspected carefully with particular attention being given to the edges of the specimens and those areas of the specimens under, or adjacent to the rubber bands. 10X magnification shall be used, if necessary. Any evidence of pitting shall constitute failure.

#### **4.7.6 Percent Solids.**

**4.7.6.1 Test Equipment.** Tared aluminum dishes with a close-fitting cover having a diameter of approximately 60mm and a height of 15 mm.

**4.7.6.2 Test Procedure.** If the temperature of the emulsion is above room temperature, allow it to cool to room temperature. Then weigh two samples of approximately 1 g each to the nearest 1.0 mg in dried tarred aluminum weighing dishes. Dry the samples for 20 min in a forced-draft oven at a temperature of  $150^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . Remove the samples from the oven, cool the container and contents to room temperature in a desiccator, and weigh them to the nearest 0.1 mg. Average the values if they are within 0.1%. If not, make additional duplicate determinations until a pair of duplicate determinations agree within 0.1%. Calculations of the percent solid content are to be conducted in accordance with ASTM D3716 paragraph 5.3.

#### **4.7.7 Fraction Gelled.**

**4.7.7.1 Test Equipment.** Sieves, Tyler or U.S.B.S. 20 and 100-mesh, diameter 8 inches, all stainless steel. Spray head with rubber hose connections. Tin can, 2-ounce, style #12, 2-3/8 X 13/16 inch, with bead and trim, body degreased, lid standard.

**4.7.7.2 Test Procedure.** Transfer one liter of the sample into a 3.8 liter jar containing one liter of clean tap water ( $25\text{--}30^{\circ}\text{C}$ ) and swirl to obtain a uniform mixture. Thoroughly wet both sides of a 20 mesh and 100-mesh sieve with tap water. Connect the sieves with 20-mesh on top, and 100-mesh on bottom. Pour the diluted sample onto the 20-mesh and swirl until most of the liquid has passed through. Using a shower head connected to a water outlet, rinse the sieves gently with clean tap water, being careful to avoid foam formation. Next, separate the sieves and gently rinse the 100-mesh sieve, again being careful to avoid foam formation. (The purpose of the 20-mesh

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sieve is to assure the obtaining of true gel particles by removing any skins.) Immediately, before the 100 mesh sieve can dry, treat the sieve as follows: Using the shower head, wash the gel particles on the sieve into as compact a mass as possible in one corner of the sieve. Place a dry paper towel on the underside of the sieve directly below the collected gel particles to dry the sieve and gel particles. Then, use a small spatula to scrape the gel particles off the screen and transfer them quantitatively into a weighed 2-ounce solids can. Place the can in a forced-draft oven at  $150^{\circ}\text{C} + 2^{\circ}\text{C}$  for 20 minutes. Remove the can from the oven, close the lid, and allow the can to cool in a desiccator to room temperature. Then, reweigh to determine the weight of dried residue. Report to the second decimal place, the weight of dried residue in grams per liter.

4.7.8 Iron Content. Accurately weigh 10 grams of sample into a clean 30 ml ceramic crucible. Place the crucible in a clay triangle and carefully burn off all organics using a laboratory burner. Burn off the remaining carbon in a muffle furnace at  $600^{\circ}\text{C}$ . Cool the crucible to near room temperature, add 1 ml of concentrated hydrochloric acid and 1 ml of concentrated nitric acid and digest on a hot plate until light boiling occurs. Cool. Dilute sample to 10.0 ml and perform the atomic absorption analysis in accordance with ASTM D1068. Use an air-acetylene flame (lean) and longest burner possible.

4.7.9 Inorganic Sulfates. The weight percent of inorganic sulfates as sodium sulfate shall be determined in accordance with ASTM D3673.

4.7.10 Environmental Impact.

4.7.10.1 Toxicity. Toxicity test shall be performed on rainbow trout in accordance with ASTM E729, using dynamic procedures. The minimum acceptable dissolved oxygen content of water used in this procedure shall be 5 ppm.

4.7.10.2 Chemical Oxygen Demand. COD shall be determined in accordance with procedures in Standard Methods for the Examination of Water and Waste Water (latest applicable edition)

4.7.10.3 Biodegradability. Biodegradability shall be determined by dividing the value expressed in mg/l for the carbonaceous biochemical oxygen demand (CBOD) specified in Standard Methods for the Examination of Water and Waste Water (latest applicable edition) by the value expressed in mg/l, for chemical oxygen demand (COD) determined as specified in 4.7.10.2.

4.7.11 Stability.

4.7.11.1 Sample Preparation. Samples of each concentrate, and the two foam solutions, as appropriate, shall be prepared in sufficient quantity to perform the required tests. One liter (L) of each concentrate shall be placed in lightly stoppered glass cylinder. All concentrate samples shall then be stored being subjected to accelerated aging at  $65^{\circ}\text{C} + 2.0^{\circ}\text{C}$  for a period of 10 days. The concentrate samples, or solutions made from them shall then be subjected to the following tests:

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- a. Foamability 4.7.13
- b. Fire performance (50 ft<sup>2</sup>) 4.7.14
- c. Stratification 4.7.15
- d. Precipitation 4.7.16
- e. Performance with simulated propellants 4.7.17

4.7.12 Compatibility.

4.7.12.1 Sample Preparation. The Government will provide samples of appropriate qualified product to manufacturers officially authorized to submit candidate material for qualification (see 3.3.2). Mixtures of the concentrates to be tested shall be prepared in sufficient quantities to perform the required tests. (For qualification testing, the testing activity will determine the number of product mixtures to be evaluated and the ratio of products comprising these mixtures.) One L of each shall be placed in lightly stoppered glass cylinders. The concentrate samples shall be stored at 65°C  $\pm$  2.0°C for a period of 10 days. The samples and solutions made from them shall then be subjected to the following tests:

- a. Foamability 4.7.13
- b. Fire Performance (50 ft<sup>2</sup>) 4.7.14
- c. Stratification 4.7.15
- d. Precipitation 4.7.16
- e. Performance with simulated propellants 4.7.17

4.7.13 Laboratory Foamability.

4.7.13.1 Test Equipment. Blender (Citation-Walther Corporation unit or equivalent), 1000 cc graduated cylinder, balance (1000 gram capacity) normal laboratory glassware.

4.7.13.2 Procedure. The expansion ratios and drainage rates of both Type F fuel foam and Type O oxidant foams are determined over simulated propellant substrates where hydrazine fuel is replaced with ammonium hydroxide (NH<sub>4</sub>OH). Mix 1 volume of the acrylic concentrate (F1 for the fuel foam or O1 for the oxidizer-foam) with 4 volumes of water and stir. Mix 1 volume of the surfactant concentrate (F2 for the fuel foam or O2 for the oxidizer foam) with 4 volumes of water and stir thoroughly, being careful to avoid foam formation. From each of the mixtures remove equal volume aliquots. Place the F2 and O2 aliquot in the foam generator (blender). Add the F1 or O1 (make sure that F1 is combined with F2 for the fuel foam and O1 is combined with O2 for the oxidizer foam) aliquot and start agitation immediately using the #8 setting (18,500 rpm); continue for about 30 seconds. Add either 20 ml of concentrated reagent grade NH<sub>4</sub>OH or HNO<sub>3</sub> as appropriate (see Table II) to the graduated cylinder. Weigh the cylinder and substrate to the nearest gram. Transfer 980



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ml of the foam generated in the blender to the 1000 ml mark of the cylinder. Determine the 25% drainage time as specified in NFPA 412. In addition, the percent of foam collapse after 24 hours shall be determined for Type F foams only and the time, in minutes, required for 50% of the foam column to collapse shall be determined for Type O foams only.

4.7.14 Fire Test. No fire test shall be conducted when the wind speed is above 10 miles per hour (mi/hr) as measured at the test site. The fire test shall be conducted in a square metal pan with a total area of 50 ft<sup>2</sup> in accordance with U.L. 162. NOTE: The materials used in this test are extremely hazardous and must be handled in accordance with approved safety procedures. Only a few test sites in this country are approved to conduct tests with these toxic materials. In addition to their toxicity, the fuel has been known to ignite spontaneously when certain conditions of heat and oxidation exist in the fire test pan.

4.7.14.1 Type F Low Expansion Test.

4.7.14.1.1 Test Equipment. The nozzle used for the low expansion test shall be the 4 gal/min nozzle manufactured by National Foam Systems, Inc, Lionville, PA, Part No 1251-0896-8. The nozzle inlet pressure shall be a gage pressure of 100 psi. The discharge from the nozzle shall be directed against a backboard which is placed at one edge of the test pan in order to achieve the gentle application of foam described as Type II in the U.L. 162 procedure. Flame/extinguishment shall be viewed through an IR thermal imaging device (English Electric Valve Company Limited miniature thermal imaging camera Model P4428 or equal).

4.7.14.1.2 Foam Component Preparation. The two foam components, F1 and F2 shall be prepared at 20°C + 5°C. The premixed component solutions shall be 20 + 0.05 percent solutions made with fresh water. The two pre-mixed component solutions shall be prepared no more than 24 hours before the initiation of the fire test. The premixed solutions shall be stored in stainless steel containers, to prevent polymerization by iron contamination of the components, see Figure 5.

4.7.14.1.3 Fuel. Fuel for the fire test shall be 55 gal of a 50-50 mixture of hydrazine and unsymmetric dimethyl hydrazine conforming to requirements of MIL-P-27402. NOTE: As stated in 4.7.14, this fuel is highly toxic and must be handled in accordance with proper safety procedures.

4.7.14.1.4 Foam Generation. The two components shall not be mixed until immediately before being applied to the test pan. The two components shall be mixed in equal proportion at a total flow rate of 4 gal/min. No more than 20 ft of hose or piping shall be installed between the mixing point and the discharge nozzle. The recommended foam generation set-up is shown in Figure 5.

To make foam, each tank is loaded with the premix and sealed. Air pressure is applied to the tank top. When the pressure reaches 100 psi, each shutoff valve is opened individually and the pressure regulators adjusted to read 30 psi at the foam maker for high expansion foam and 100 psi for low expansion foam. Both valves are then opened to insure that good foam is being



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produced, after which both valves are closed. The system is now ready for fire testing. It is advisable not to allow the mixed foam solutions to remain in the line between the balancing valve and the foam maker for more than 5 minutes without restarting flow.

When foam is to be generated for testing, both shutoff valves are opened simultaneously. Do not make any adjustments to the pressure regulators on either line. Foam generation is stopped by closing both shutoff valves simultaneously. Within 5 minutes after testing stops, all lines should be flushed with water and drained. In cold weather, care should be taken to prevent freezing of lines and components. The nozzle shall be directed at the same metal backboard over one edge of the pan to allow gentle application of foam to the fuel surface.

4.7.14.1.5 Test Procedure. The fuel shall be dumped into the pan within 10 minutes and ignited within one minute of dumping. After allowing a preburn period of 60 seconds application of foam shall begin through the nozzle. The exact extinguishing time shall be recorded, as viewed through the IR thermal imaging device, but foam application shall continue for a total of 5 minutes.

4.7.14.1.6 Burnback Procedure. Conduct burnback and wand test in accordance with UL 162.

4.7.14.1.7 Post-Fire Vapor Securing Test. 60 seconds after successful completion of the burnback test, the atmosphere above the foam blanket shall be tested for the presence of fuel vapor. Samples shall be taken from 3 points above the foam surface, with two of the points being above the center and one of the edges of the pan, while the third point shall be above the area used for burnback test. NOTE: Appropriate detector tubes and sampling devices are available from the Mine Safety Appliance Company (MSA) and other reliable manufacturers.

#### 4.7.14.2 Type F High Expansion Test.

4.7.14.2.1 Test Equipment. The foam shall be generated by means of the 5 inch Mark IV foam generator, as made by Mine Safety Appliances Co, Inc., Evans City, Pennsylvania, (or equal) utilizing a Number 16 nozzle, adjusted to provide an expansion ratio of 230, when flowing a standard foam solution at 60 psi inlet nozzle pressure. The inlet pressure shall be a gage pressure of 30 psi. The end of the foam generator shall be placed at the edge of the test pan at a height of 1 to 2 feet above the pan. Flame extinguishment shall be determined by viewing through the IR thermal imaging device described in 4.7.14.1.1.

4.7.14.2.2 Foam Component Preparation. As specified in 4.7.14.1.2.

4.7.14.2.3 Fuel. As specified in 4.7.14.1.3.

4.7.14.2.4 Foam Generation. The two components shall not be mixed until immediately before being applied to the test pan. The two components shall be mixed in equal proportion at a total flow rate of 2.6 gal/min. The recommended foam generation set-up and procedure is discussed in 4.7.14.1.4.

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4.7.14.2.5 Test Procedure. The fuel shall be dumped into the pan within 10 minutes and ignited within one minute of dumping. After allowing a preburn period of 60 seconds, application of foam shall begin through the foam generator. The exact extinguishing time shall be recorded, as viewed through the IR thermal imaging device. Neither the wand test nor burnback test as specified in UL162 is applicable to high expansion foam.

4.7.14.2.6 Post-Fire Vapor Securing Test. As specified in 4.7.14.1.7 except that tests for the fuel vapor ( $N_2H_4$ ) shall be conducted 60 seconds after completion of foam application.

4.7.14.3 Type O High Expansion Test.

4.7.14.3.1 Test Equipment. As specified in 4.7.14.2.1.

4.7.14.3.2 Foam Component Preparation. The O2 concentrate container shall be inverted at least twice, at 24-hour intervals (minimum), in the week immediately preceding the test. The O2 concentrate shall be mechanically mixed immediately before drawing off the material which will be used to prepare the pre-mix component solutions. The two foam components, O1 and O2, shall be prepared at  $20 \pm 0.05$  percent solutions made with fresh water. The two pre-mixed component solutions shall be prepared no more than 24 hours before the initiation of the fire test. The premixed solutions shall be stored in stainless steel containers, see Figure 5.

4.7.14.3.3 Fuel. Fuel for the fire test shall be a mixture of 30 gal of nitrogen tetroxide ( $N_2O_4$ ) complying with MIL-P-26539, and 30 gal of diesel fuel complying with FED SPEC VV-F-800 (grade DF-2). WARNING: The fumes from  $N_2O_4$  are extremely corrosive and toxic and extreme care must be utilized in handling this material.

4.7.14.3.4 Foam Generation. As specified in 4.7.14.2.4.

4.7.14.3.5 Test Procedure. As specified in 4.7.14.2.5, except preburn time is reduced to 30 seconds. Neither the wand test nor burnback test as specified in UL162 is applicable to these high expansion foams.

4.7.14.3.6 Post-Fire Vapor Securing Test. As specified in 4.7.14.1.7 except that tests for oxidant vapor ( $NO_x$ ) shall be conducted 60 seconds after completion of foam application.

4.7.14.4 Foamability. The foams shall be generated by means of the equipment described previously for the 50ft<sup>2</sup> fire test. Foam samples shall be collected immediately after the cessation of foam application to the test pan. The nozzles shall be held at hip height and directed onto the backboard from the distances specified below. The method and procedure shall be in accordance with NFPA Standard No. 412. The expansion ratio and 25% drainage time shall be determined in accordance with this procedure.

4.7.14.4.1 Low Expansion. The foam shall be generated by means of the 4 gallons per minute (gal/min) test nozzle described in 4.7.14.1.1. During sample collection the nozzle inlet pressure shall be maintained at a gage pressure of 100 pounds per square inch (psi), and the solution directed onto

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the backboard from a distance of 4 to 6 feet.

4.7.14.4.2 High Expansion. The nozzle used for the high expansion test shall be the foam generator specification 4.7.14.2.1. During sample collection the nozzle inlet pressure shall be maintained at a gage pressure of 30 psi and the solution shall be directed onto the backboard from a distance of 2-3 feet.

4.7.15 Stratification. The presence of stratification shall be determined by visual examination of the samples contained in the glass cylinders.

4.7.16 Precipitation. The amount of precipitation shall be determined by centrifuging to a 100 mL sample withdrawn from the 1 L sample after thorough agitation in accordance with the primary method of ASTM D96-73.

4.7.17 Packaging Inspection. Sample packages and packs and the inspection of preservation, packaging, packing, and marking for shipment and storage shall be in accordance with the requirements of 4.6, section 5 and the documents specified therein.

## 5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisitions. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.4.)

5.1 Preservation-Packaging. Preservation-packaging for level A shall be as specified hereinafter.

5.1.1 The four liquid concentrate components shall be furnished in 55 gallon composite containers as specified (see 6.2.1).

5.1.1.1 Fifty-Five Gallon Container. The 55 gallon container shall be a composite comprised of a plastic insert and a steel drum overpack. The composite container shall conform to the requirements of type II, class 4 of PPP-C-1337, and the following:

a. Insert. The insert shall contain two protruding openings in the top head - one 3/4 inch and one 2-inch. Openings shall be so designed that when positioned in the steel drum cover there will be no strain on the protruding openings. The protruding plastic openings shall be secured to the drum cover by means of lock or retaining rings and gaskets. Openings shall be closed by use of NPT threaded plastic plugs.

b. Covers. The steel drum cover shall be provided with two openings to accommodate the protruding insert openings. Covers shall be fully removable. Cover gaskets are not required. Covers shall be secured to the steel drum with minimum 16-gage bolt or lever lock type locking rings.

5.1.1.2 Exterior Color and Coatings. The red color shall be an approximate match to color number 11105 of FED-STD-595. The orange color shall be an approximate match to color number 12246 of FED-STD-595. Exterior

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coating for such drum overpacks shall conform to TT-E-489.

5.2 Packing. For level A no further packing is required.

5.2.1 Method of shipment shall comply with Uniform Freight Classification Ratings, Rules, and Regulations or other carrier rules as applicable to the mode of transportation.

5.3 Marking

5.3.1 Identification marking shall be in accordance with MIL-STD-129. In addition, the marking on the containers shall be in white characters against an orange background for Types 01 and 02, a red background for Types F1 and F2.

5.3.2 Two identical markings conforming to figures 1, 2, 3, and 4 shall be applied to containers, as appropriate, so that the markings are located diametrically opposite. The markings shall be applied on the containers in such a manner that water immersion contact with the contents of the containers, or normal handling will not impair the legibility of the marking. Paper labels shall not be used.

## 6. NOTES

6.1 Intended Use. The foam concentrates defined in this specification are intended for use in controlling the vapor hazard from spills of hypergolic propellants, hydrazine and nitrogen tetroxide. The foams also have ancillary application for use as a fire extinguishing agent on fires fueled by hydrazine, or its methyl derivatives, alone or on Class A or B hydrocarbon fuel fires in which combustion is supported by nitrogen tetroxide. They are not effective in extinguishing fires involving hypergolic mixtures of hydrazines and nitrogen tetroxide but their use is recommended to control the release of toxic vapors and to mitigate combustion during those fires.

### 6.2 Ordering Data.

6.2.1 Acquisition Requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type of concentrate(s) required (see 1.2).
- c. Special marking, if required (see 5.3).

6.2.2. Data Requirements. When this specification is used in a contract which invokes the provision of the "Requirements for Data" of the Defense Acquisition Regulation (DAR), the data identified below, which are required to be developed by the contractor, as specified on an approved Data Item Description (DD Form 1664), and which are required to be delivered to the Government, should be selected and specified on the approved Contract Data Requirements List (DD Form 1423) and incorporated in the contract. When the provisions of the "Requirements for Data" of the DAR are not invoked in a

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contract, the data required to be developed by the contractor and required to be delivered to the Government should be selected from the list below and specified in the contract.

<u>Paragraph</u>	<u>Data Requirement</u>	<u>Applicable DID</u>
4.5.1	Test Reports	DI-T-2072

(Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply).

6.2.2.1 The data requirements of 6.2.2 and any task in section 3, 4, or 5 of the specification required to be performed to meet a data requirement may be waived by the contracting/acquisition activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

6.3 With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Product List QPL-87939 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is AFESC Tyndall AFB, Air Force Engineering Services Command, Fire Technology Branch, Tyndall Air Force Base, FL, 32403, and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.3.1).

6.3.1 Copies of "Provisions Government Qualification SD-6" may be obtained upon application to Commanding officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 Sub-Contracted Material and Parts. The packaging requirements of referenced documents listed in section 2 do not apply when material is acquired by the contractor for incorporation into the concentrate and lose separate identity when the concentrate is shipped.

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6.5 Part or Identifying Number (PIN) An example of a PIN is provided:

M	87939	F-1	55 Gallon
Specification Prefix	Specification Number	Type Number	Container Size

Custodians  
Air Force - 50

Preparing Activity  
Air Force - 50

Review Activities  
Air Force - 68  
Air Force - 19

(Project 6850-F828)

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THIS END UP

U.S.

HYPERGOLIC PROPELLANT FOAMS LIQUID CONCENTRATE

In accordance with

MILITARY SPECIFICATION MIL-V-87939

TYPE F1 - FUEL FOAM GELLING AGENT

THIS VAPOR SUPPRESSING/FIRE EXTINGUISHING CONCENTRATE IS FOR USE BY DILUTION WITH WATER IN FIXED OR MOBILE SYSTEMS. IT MUST BE USED IN COMBINATION WITH THE TYPE F2 SURFACTANT. THE CONCENTRATE MAY BE DILUTED FOR USE IN FLOW PROPORTIONING EQUIPMENT WITH FRESH WATER AT VOLUME PROPORTIONS OF ONE GALLON EACH OF THE F1 AND F2 CONCENTRATES TO 8 GALLONS WATER.

FOR READY USE DO NOT STORE BELOW 32°F. AVOID PROLONGED STORAGE ABOVE 120°F. DO NOT MIX WITH OTHER THAN TYPE F2 LIQUID CONCENTRATE IN ACCORDANCE WITH MIL-V-87939 AND WATER.

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MANUFACTURER'S NAME  
ADDRESS  
BATCH NO.  
DATE OF MANUFACTURE

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FIGURE 1. Type F1 Container Markings.

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THIS END UP

U.S.

HYPERGOLIC PROPELLANT FOAMS LIQUID CONCENTRATE

In accordance with

MILITARY SPECIFICATION MIL-V-87939

TYPE F2 - FUEL FOAM SURFACTANT

THIS VAPOR SUPPRESSING/FIRE EXTINGUISHING CONCENTRATE IS FOR USE BY DILUTION WITH WATER IN FIXED OR MOBILE SYSTEMS. IT MUST BE USED IN COMBINATION WITH THE TYPE F1 GELLING AGENT. THE CONCENTRATE MAY BE DILUTED FOR USE IN FLOW PROPORTIONING EQUIPMENT WITH FRESH WATER AT VOLUME PROPORTIONS OF ONE GALLON EACH OF THE F1 AND F2 CONCENTRATES TO 8 GALLONS WATER. FOR READY USE DO NOT STORE BELOW 32°F, AVOID PROLONGED STORAGE ABOVE 120°F. DO NOT MIX WITH OTHER THAN TYPE F1 LIQUID CONCENTRATE IN ACCORDANCE WITH MIL-V-87939 AND WATER.

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MANUFACTURER'S NAME  
ADDRESS  
BATCH NO  
DATE OF MANUFACTURE

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FIGURE 2. Type F2 Container Markings.



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THIS END UP

U.S.

HYPERGOLIC PROPELLANT FOAMS LIQUID CONCENTRATE

In accordance with

MILITARY SPECIFICATION MIL-V-87939

TYPE 01 - OXIDIZER FOAM GELLING AGENT

THIS VAPOR SUPPRESSING/FIRE EXTINGUISHING CONCENTRATE IS FOR USE BY DILUTION WITH WATER IN FIXED OR MOBILE SYSTEMS. IT MUST BE USED IN COMBINATION WITH THE TYPE 02 SURFACTANT. THE CONCENTRATE MAY BE DILUTED FOR USE IN FLOW PROPORTIONING EQUIPMENT WITH FRESH WATER AT VOLUME PROPORTIONS OF ONE GALLON EACH OF THE 01 AND 02 CONCENTRATES TO 8 GALLONS WATER.

FOR READY USE DO NOT STORE BELOW 32°F. AVOID PROLONGED STORAGE ABOVE 120°F. DO NOT MIX WITH OTHER THAN TYPE 02 LIQUID CONCENTRATE IN ACCORDANCE WITH MIL-V-87939 AND WATER.

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MANUFACTURER'S NAME  
ADDRESS  
BATCH NO.  
DATE OF MANUFACTURE

---

FIGURE 3. Type 01 Container Markings.

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THIS END UP

U.S.

HYPERGOLIC PROPELLANT FOAMS LIQUID CONCENTRATE

In accordance with

MILITARY SPECIFICATION MIL-V-87939

TYPE 02 - OXIDIZER FOAM SURFACTANT

THIS FIRE VAPOR SUPPRESSING/EXTINGUISHING CONCENTRATE IS FOR USE BY DILUTION WITH WATER IN FIXED OR MOBILE SYSTEMS. IT MUST BE USED IN COMBINATION WITH THE TYPE 01 GELLING AGENT. THE CONCENTRATE MAY BE DILUTED FOR USE IN FLOW PROPORTIONING EQUIPMENT WITH FRESH WATER AT VOLUME PROPORTIONS OF ONE GALLON EACH OF THE 01 AND 02 CONCENTRATES TO 8 GALLONS WATER. FOR READY USE DO NOT STORE BELOW 32°F. AVOID PROLONGED STORAGE ABOVE 120°F. DO NOT MIX WITH OTHER THAN TYPE 01 LIQUID CONCENTRATE IN ACCORDANCE WITH MIL-V-87939 AND WATER.

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MANUFACTURER'S NAME  
ADDRESS  
BATCH NO.  
DATE OF MANUFACTURE

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FIGURE 4. Type 02 Container Markings.

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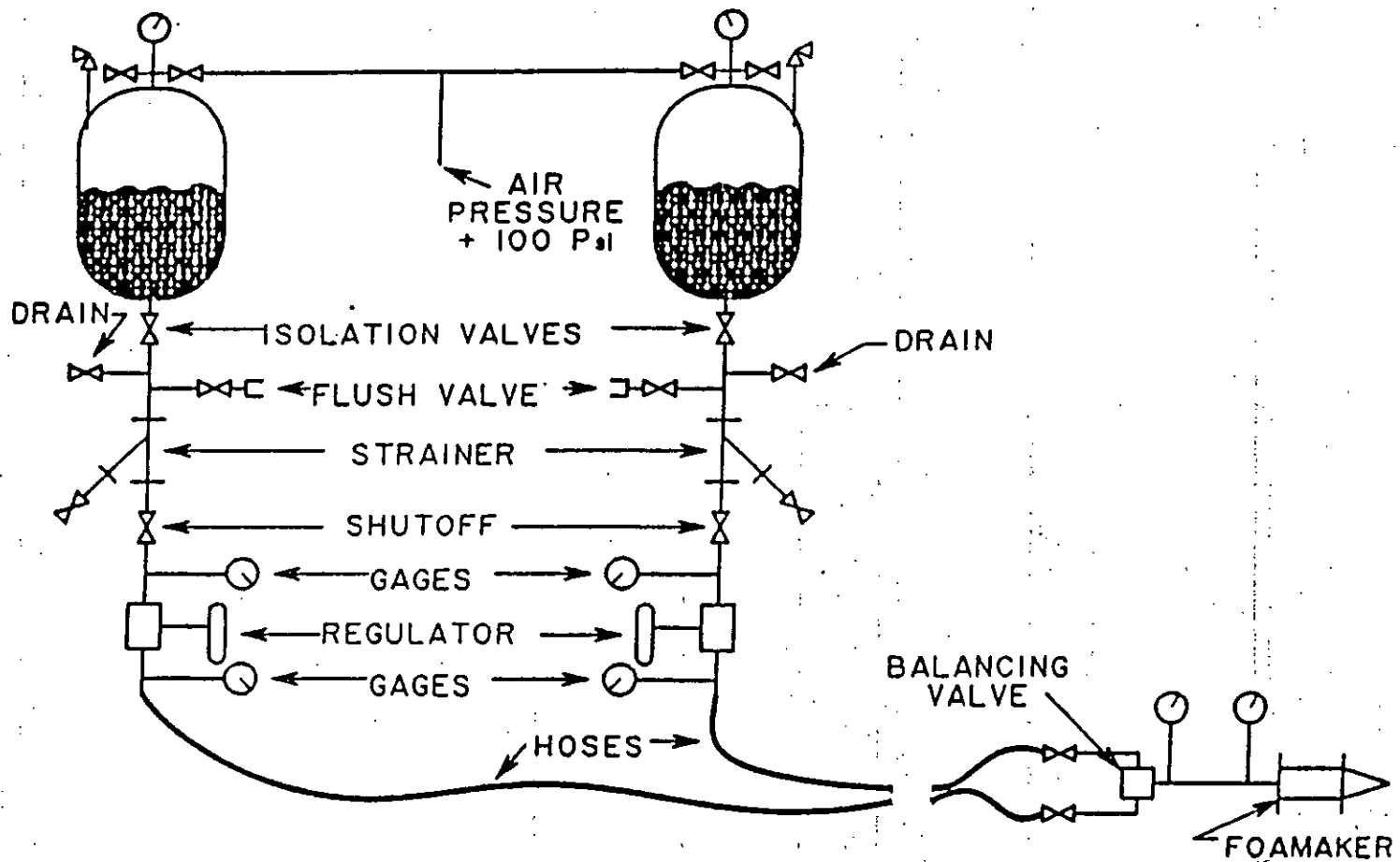


FIGURE 5  
FIRE TEST FOAM SYSTEM

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE					
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)					
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR					
		<input type="checkbox"/> USER					
		<input type="checkbox"/> MANUFACTURER					
		<input type="checkbox"/> OTHER (Specify): _____					
5. PROBLEM AREAS							
a. Paragraph Number and Wording:							
				b. Recommended Wording:			
				c. Reason/Rationale for Recommendation:			
6. REMARKS							
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Area Code) - Optional					
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)					

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)