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MILITARY SPECIFICATION  
FIRE EXTINGUISHING AGENT, AQUEOUS FILM FORMING  
FOAM (AFFF) LIQUID CONCENTRATE, SIX PERCENT,  
FOR FRESH AND SEA WATER

This specification has been concurred in by interested commands of the Navy Department and the Marine Corps.

1. SCOPE

1.1 This specification covers the requirements for aqueous film forming foam (AFFF) liquid concentrate fire extinguishing agent consisting of fluorocarbon surfactants and foam stabilizers. The liquid concentrate will be diluted for use in concentrations of six parts concentrate to ninety-four parts fresh or sea water by volume.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

TT-E-489 - Enamel, Alkyd, Gloss (For Exterior and Interior Surfaces).  
PPP-D-700 - Drums: Metal, 55-Gallon, (For Acid and Corrosive Liquids).  
PPP-D-729 - Drums: Metal, 55-Gallon, (For Shipment of Noncorrosive Material).  
PPP-D-1152 - Drum, Steel, 55-Gallon (24-Gage) Reinforced.  
PPP-P-704 - Pails, Metal: Shipping Steel, (1 through 12 Gallon).

MILITARY

MIL-P-116 - Preservation, Methods of.  
MIL-G-5572 - Gasoline, Aviation, Grades 80/87, 100/130, 115/145.

STANDARDS

FEDERAL

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 U.S. Military Property.  
MIL-STD-147 - Palletized and Containerized Unit Loads, 40" x 48" Pallets, Skids, Runners, or Pallet-Type Base.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM A279-63 - Total Immersion Corrosion Test of Stainless Steels.  
ASTM D445-65 - Test for Viscosity of Transparent and Opaque Liquids (Kinematic Viscosities).  
ASTM D1141-52 (1965) - Substitute Ocean Water, Specification for.  
ASTM D1298-67 - Test for Specific Gravity of Petroleum Liquids, Hydrometer Method.  
ASTM D1331-56 - Tests for Surface and Interfacial Tension of Solutions of Surface Active Agents.

FSC 4210

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

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 West Jackson Blvd., Chicago, Illinois 60606.)

NATIONAL CLASSIFICATION BOARD

National Motor Freight Classification Rules.

(Application for copies should be addressed to National Motor Freight Traffic Association, Inc., 1616 P Street, N.W., Washington, D.C. 20036.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA No. 412 - Suggested Standard Test Procedures for Aircraft Rescue and Fire Fighting Vehicles Utilizing Foam (1969 Edition)

(Application for copies should be addressed to National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. 02110).

3. REQUIREMENTS

3.1 Qualification. Liquid concentrate fire extinguishing agents furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.3 and 6.3).

3.2 Material. The concentrate shall consist of fluorocarbon surfactants plus other compounds as required to conform to the requirements specified hereinafter. The material shall have no adverse effect on the health of personnel when used for its intended purpose.

3.3 Compatibility. The concentrate of one manufacturer shall be compatible with the concentrate furnished by the other manufacturers listed on the qualified products list for this specification. An admixture shall conform to 3.10, 3.11, and 3.13, when tested as specified in 4.7.7, 4.7.8, and 4.7.12. The percentages of the components in the admixture shall be determined by the testing activity.

3.4 Specific gravity. The specific gravity shall be determined as specified in 4.7.1. Samples tested subsequent to qualification shall deviate not more than 0.01 from the specific gravity value determined during qualification testing.

3.5 Viscosity. The concentrate shall have a maximum kinematic viscosity of 300 centistokes (cs) at  $40^{\circ} \pm 0.1^{\circ}\text{F}$ ., when tested as specified in 4.7.2.

3.6 pH value. The concentrate shall have a pH value between 4.0 and 8.0 at  $77^{\circ} \pm 1^{\circ}\text{F}$ ., when tested as specified in 4.7.3. Samples tested subsequent to qualification shall deviate not more than 0.5 from the pH value determined during qualification testing, but in no case shall be less than 4.0 or greater than 8.0 at  $77^{\circ} \pm 1^{\circ}\text{F}$ ..

3.7 Surface tension. The solution shall have a maximum surface tension of 18 dynes per centimeter at  $77^{\circ} \pm 1^{\circ}\text{F}$ ., when tested as specified in 4.7.4.

3.8 Interfacial tension. A 6-percent solution shall have a maximum interfacial tension of 5.0 dynes per centimeter at  $77^{\circ} \pm 1^{\circ}\text{F}$ ., when tested as specified in 4.7.5.

3.9 Foamability. The solution of AFFF concentrate in water (six parts concentrate to ninety-four parts water by volume) shall produce a foam possessing an expansion of 7.0 minimum and a 25-percent drainage time of 3 minutes minimum value, when tested as specified in 4.7.6 with both fresh (tap) water and synthetic sea water.

3.10 Film formation and sealability. When tested as specified in 4.7.7, the film produced by the sample shall spread over the surface of the fuel, and shall result in a surface from which no sustained ignition of fuel vapors can be detected.

3.11 Fire performance.

3.11.1 Twenty-eight square-foot test. When tested for fire performance as specified in 4.7.8, the fire shall be completely extinguished with an application density of 0.10 gal/ft<sup>2</sup> (84-second application time) or less, and shall exhibit a 25-percent burnback time of at least 240 seconds.

3.11.2 Four-hundred square-foot test. When tested for fire performance as specified in 4.7.9, at least 85 percent of the fire shall be extinguished within 30 seconds and the total of the "percent of fire extinguished" values recorded at 10, 20, 30, and 40 seconds shall be 285 or greater.

3.11.3 Twelve-hundred sixty square-foot test. When tested for fire performance as specified in 4.7.10, at least 85 percent of the fire shall be extinguished within 30 seconds, and the total of the "percent of fire extinguished" values recorded at 10, 20, 30, and 40 seconds shall be 285 or greater.

3.12 Corrosion. When tested as specified in 4.7.11, the corrosion rate of the concentrate shall not exceed 25 milligrams per square decimeter per day (mdd) for cold rolled steel, 0.5 mdd for 6061T6 aluminum alloy, and corrosion-resistant steel (GRES 304). The corrosion rate of a 6-percent sea water solution shall not exceed 10 mdd for cupro-nickel (90 percent Cu-10 percent Ni).

3.13 Stability. The concentrate and solution in fresh water shall be tested as specified in 4.7.12. At the end of the required storage period, the concentrate samples shall show no evidence of precipitation or stratification. The diluted solution samples shall show no evidence of stratification, and precipitate formation shall not exceed 1 percent by volume. In addition, stored samples shall conform to the limits specified herein, except that foam expansion shall be no less than 6.0 (after storage), when tested as specified in 4.7.1, 4.7.5, 4.7.6, and 4.7.7.

#### 3.14 Marking.

3.14.1 Identification marking shall be in accordance with MIL-STD-130. In addition, the marking on the containers (see 5.3) shall be in white characters against a blue background (see 5.1.1.3).

3.14.2 Two identical markings conforming to figure 1 shall be applied to containers 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. No paper labels shall be used.

### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of 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 tests. The inspection of the fire extinguishing agent shall be classified as follows:

- (a) Qualification tests.
- (b) Quality conformance inspection.
  - (1) Examination of filled containers.
  - (2) Quality conformance tests.
  - (3) Production check tests.

4.3 Qualification tests. <sup>1/</sup>Qualification tests shall be conducted at a laboratory satisfactory to the Naval Ship Engineering Center. Qualification tests shall consist of examination and qualification tests shown in table I.

4.3.1 Samples for qualification tests. Five filled 5-gallon containers are required for the qualification tests.

<sup>1/</sup> Application for qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.3 and 6.3.1).

MIL-F-24385(NAVY)

THIS END UP

U.S.

AQUEOUS FILM FORMING FOAM (AFFF) LIQUID CONCENTRATE

In accordance with

MILITARY SPECIFICATION MIL-F-24385

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THIS FIRE EXTINGUISHING CONCENTRATE IS FOR USE BY DILUTION WITH WATER IN FIXED OR MOBILE SYSTEMS. IT MAY BE USED ALONE OR IN COMBINATION WITH "TWINNED" DRY CHEMICAL EQUIPMENT. THE CONCENTRATE MAY BE DILUTED FOR USE IN FLOW PROPORTIONING EQUIPMENT WITH SEA WATER OR FRESH WATER AT VOLUME PROPORTIONS OF SIX GALLONS CONCENTRATE TO 94 GALLONS WATER. IT MAY ALSO BE DILUTED FOR READY-USE STORAGE AS A SIX-PERCENT PREMIX SOLUTION WITH FRESH WATER ONLY.

FOR READY USE DO NOT STORE BELOW 32°F. AVOID PROLONGED STORAGE ABOVE 120°F. DO NOT MIX WITH OTHER THAN LIQUID CONCENTRATE APPROVED UNDER SPECIFICATION MIL-F-24385 OR WATER.

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MANUFACTURER'S NAME  
ADDRESS  
BATCH NO.  
DATE OF MANUFACTURE.

Figure 1 - Container markings.

4.4 The examination and tests applicable to each classification shall be as shown in table I:

Table I - Categories of inspection

Reference	Title	Qualification	Quality conformance	Production check <u>2/</u>
4.5.2	Examination of filled containers	X	X	X
3.3, 4.7.7, 4.7.8, 4.7.12	Compatibility	X		
3.4, 4.7.1	Specific gravity	X	X	
3.5, 4.7.2	Viscosity	X	X	
3.6, 4.7.3	pH value	X	X	
3.7, 4.7.4	Surface tension	X	X	
3.8, 4.7.5	Interfacial tension	X	X	
3.9, 4.7.6	Foamability	X	X	
3.10, 4.7.7	Film formation	X	X	
3.11.1, 4.7.8	Fire performance (28 sq. ft.)	X	X	X
3.11.2, 4.7.9	Fire performance (400 sq. ft.)	X	X	
3.11.3, 4.7.10	Fire performance (1260 sq. ft.)	X	<u>1/</u>	
3.12, 4.7.11	Corrosion	X		
3.14, 4.7.12	Stability	X		

1/ Either the 400-square foot or 1260-foot fire test may be performed for quality conformance testing at the discretion of the supplier.

2/ Tests of this specification, in addition to the fire performance test, will be performed as necessary to insure that the sample is essentially identical to the product upon which qualification approval has been granted.

#### 4.5 Sampling for quality conformance inspection.

4.5.1 Inspection lot. For purposes of sampling, a lot shall consist of all material manufactured as one batch and transferred from one mixing tank to the shipping container.

4.5.2 Sampling for examination of filled containers. A random sample of filled containers shall be selected in accordance with MIL-STD-105 at inspection level I. The acceptable quality level = 2.5 percent defective to verify compliance with all requirements regarding fill, closure, marking, and other requirements not requiring tests, as specified in 4.6.1, 5.1.1.1, and 5.1.1.2.

4.5.3 Sampling for quality conformance tests. Three filled 5-gallon containers shall be selected at random from each lot and used as one composite sample for the tests specified in 4.6.2, or three 5-gallon containers of the product shall be withdrawn from an agitated mixing tank prior to packaging. The results of the tests required by 4.6.2 shall be submitted to the Naval Ship Engineering Center or the designated Laboratory.

4.5.4 Sampling for production check tests. In addition to the sample selected for quality conformance tests, four additional 5-gallon containers from the first lot offered for delivery under a contract or order, and thereafter from any one lot in each group of ten successive lots shall be selected and forwarded to a laboratory designated by the Naval Ship Engineering Center for the tests specified in 4.6.3.

#### 4.6 Quality conformance inspection.

4.6.1 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.

4.6.2 Quality conformance tests. The samples selected in accordance with 4.5.3 shall be subjected to the tests of table I, as applicable.

4.6.2.1 Action in case of failure. If the sample tested is found to be not in conformance with any requirement of this specification, the lot represented by the sample shall be rejected.

4.6.3 Production check tests. The samples selected as specified in 4.5.4 shall be composited by the designated testing laboratory, and the composite sample shall be subjected to the fire performance test specified in 4.7.8. In addition, the sample shall be subjected to such other tests of this specification as are necessary to determine that the sample is essentially identical to the product upon which qualification approval has been granted.

4.6.3.1 Action in case of failure. Acceptance of the first lot offered for delivery under a contract or order shall be withheld until a satisfactory report is received on the composite production check test sample. Thenceforth, except as hereinafter specified, acceptance and rejection of lots shall normally be on the basis of the sampling, examination, and tests specified in 4.5, 4.6, and 4.7 and acceptance shall not be withheld pending receipt of test reports on production check test samples. However, upon receipt of an unsatisfactory test report on a production check test sample, additional samples shall be selected from every subsequent lot offered for delivery. The samples so selected shall be submitted to a laboratory designated by the Naval Ship Engineering Center and shall there be subjected to the examination and tests specified in 4.6 and 4.7. Lots shall then be accepted only upon receipt of a satisfactory test report on the samples so selected. Additional testing shall be discontinued and lot acceptance returned to the normal basis when two successive lots have been accepted. The contractor shall not be permitted to submit more than three separate samples for production check tests (see 4.6.3) in the event of failure.

#### 4.7 Test procedures.

(NOTE: Where sea water is required for tests, synthetic sea water in accordance with ASTM D1141-52 shall be used.)

4.7.1 Specific gravity. The specific gravity of the liquid concentrate shall be determined in accordance with ASTM Method D1298-67.

4.7.2 Viscosity. The viscosity of the liquid concentrate shall be determined in accordance with ASTM Method D445-65 using a capillary viscometer of appropriate size number at  $40^{\circ} \pm 0.1^{\circ}\text{F}$ .

4.7.3 pH value. The pH value of the liquid concentrate shall be determined potentiometrically, using a pH meter equipped with a glass electrode and a reference electrode.

4.7.4 Surface tension. The surface tension of a solution of 1 cc of the liquid concentrate in 370 cc of distilled water shall be determined in a Cenco DuNuoy tensiometer, or equal, in accordance with ASTM D1331-56 and until the readings come to an equilibrium (approximately 30 minutes).

4.7.5 Interfacial tension. The interfacial tension between reagent grade cyclohexane and a 6-percent by volume solution of the liquid concentrate in distilled water shall be determined in a Cenco DuNuoy tensiometer, or equal, in accordance with ASTM D1331-56, and until the readings come to an equilibrium.

4.7.6 Foamability. Foam samples for analyses shall be taken from the same equipment as used in the fire performance test specified in 4.7.8 which shall be operated in the same manner. A 6-percent solution shall be  $70^{\circ} \pm 2^{\circ}\text{F}$ . Foam shall be discharged from the nozzle held at hip height and directed onto the collection backboard from a distance of approximately 10 feet. The methods and procedures used shall be as specified in National Fire Protection Association Publication NFPA No. 412.

4.7.7 Film formation and sealability. The test shall determine the ability of a fire-extinguishing agent of the foam-forming type to develop a vapor-sealing film on a hydrocarbon fuel surface. As the foam drains, a small percentage of the liquid drop-out remains surface-borne and spreads to provide protection against re-ignition of exposed fuel.

4.7.7.1 A corrosion-resisting steel Graduated Measure of 1000 ml capacity (4-1/2 inches in diameter, 5 inches deep) (Cole-Parmer Co., Chicago, Illinois, or similar) shall be fitted at the top edge with two small metal clips protruding 1/8 inch into the opening. They shall serve to restrain an 80-mesh conical screen of corrosion-resisting steel (5 inches in height by 4-3/4 inches in diameter) from floating out of the container during the test. A Waring Automatic Blender, or similar, shall be used as the test foam maker (at  $70^{\circ} \pm 5^{\circ}\text{F}$ ).

4.7.7.2 First, 600 ml of 98-percent cyclohexane shall be placed into the Graduated Measure. One hundred ml of the 6-percent solution to be tested shall be foamed for 10 seconds at low speed in the blender. Two hundred ml of this foam shall be poured onto the fuel surface. The screen shall then be inserted into the measure and clipped firmly into place, and a stopwatch shall be started.

4.7.7.2.1 After 1 minute of elapsed time, a small flame shall be passed six times around the fuel surface at a height of 1/2 inch ( $\pm 1/8$  inch). A small flash may occur but no sustained ignition shall result if an effective vapor-seal is present. This flame can be readily provided using a hand-held propane tank fitted with a capillary tubing outlet and adjusted with the valve to give about a 1-inch long pilot flame.

#### 4.7.8 Fire performance (28-square-foot test).

4.7.8.1 Test site. The 28-square-foot fire performance test shall be conducted in a level circular pan 6 feet in diameter (28 square feet), fabricated from 1/4-inch thick steel and having sides 5 inches high, resulting in a freeboard of approximately 2-1/2 inches during tests. The pan shall be without leaks so as to contain gasoline on a substrate of water. The water depth shall be held to a minimum, and shall be used only to ensure complete coverage of the pan with fuel.

4.7.8.2 Test equipment. The nozzle used for applying agent shall be of a type available from National Foam System, Inc., West Chester, Pa., or equal, as a laboratory testing item with a flow rate of 2.0 gallons per minute (g.p.m.) at 100 pounds per square inch (p.s.i.) pressure. The outlet shall be modified by a "wing tip" spreader having a 1/8-inch wide circular arc orifice 1-7/8 inches long. (Bernz-o-matic flame spreader TX-1527, slightly pinched down.)

4.7.8.3 Test materials. The 6-percent solution in fresh water and sea water shall be  $70^{\circ} \pm 10^{\circ}\text{F}$ . The charge shall consist of 6-percent  $\pm$  0.1 percent concentrate in fresh water and sea water. The fuel shall be 10 gallons of gasoline conforming to MIL-G-5572.

4.7.8.4 Test procedure. No tests shall be conducted with wind speeds in excess of 10 miles per hour. The complete fuel charge shall be dumped into the diked area within a 60-second time period.

4.7.8.4.1 The fuel shall be ignited within 60 seconds after completion of fueling and shall be permitted to burn freely for 15 seconds before the application of the extinguishing agent.

4.7.8.4.2 The fire shall be extinguished as rapidly as possible and in the most effective and expeditious manner. This shall be achieved by maintaining the nozzle 3-1/2 to 4 feet above the ground and angled upward at a distance that permits the closest edge of the foam pattern to fall on the nearest edge of the fire. The nozzle shall be moved slowly from side to side to permit the foam pattern to fall from edge to edge of the fire. The operator shall move forward and around the area as the fire front recedes and shall always maintain the nozzle in the same attitude. When the fire is extinguished, the time-for-extinguishment shall be recorded continuing distribution of the agent over the test area until exactly 3 gallons of premix has been applied. (90-second application time.)

4.7.8.4.3 Burnback. The burnback test shall start within 30 seconds after the 90-second solution application. A weighted 1-foot diameter pan having 2-inch side walls and charged with 1 quart of gasoline shall be placed in the center of the area. (An eyebolt with an 8-inch shaft attached to the center of the pan and a 10-foot pole with a hook on the end will facilitate the placement of the pan.) The fuel in the pan shall be ignited just prior to placement. Burnback time shall commence at the time of this placement and terminate when 25 percent of the fuel area (7 square feet), (36-inch diameter), originally covered with foam is aflame. After the large test pan area will sustain burning, the small pan shall be removed.

4.7.8.4.4 A minimum of three runs each in fresh water and sea water of the 28-square foot test, including burnback, will be required for qualification. One run each in fresh water and sea water will be required for quality conformance and production check tests.

4.7.8.5 Results: The following shall be recorded:

- (a) Time for extinguishment (seconds).
- (b) Time for 25 percent area burnback (seconds).

The following shall be calculated and reported:

- (a) Application density for extinguishment (gals/ft.<sup>2</sup>) =  

$$\frac{2 \text{ gal.} \times 1}{\text{min.} \quad 28 \text{ ft.}^2} \times \frac{\text{Extinguishment time (seconds)}}{60}$$
- (b) Burnback time (seconds).

The results for each test run shall be reported.

#### 4.7.9 Fire performance (400-square-foot test).

4.7.9.1 Test site. The fire test shall be conducted in a level circular area 22.6 feet in diameter (400 square feet). The base and surrounding dike shall be of material suitable for the containment of fuel on a substrate of water. The water depth shall be the minimum required to ensure complete coverage of the diked area with fuel.

4.7.9.2 Test equipment. The nozzle used for applying the agent shall be a Rockwood FFF nozzle with stream shaper designed to discharge 16 g.p.m. at 100 pounds per square inch (p.s.i.) or equal (available from Bliss-Portland, South Portland, Maine 04106). The test shall be run with the nozzle discharging 16 g.p.m. at 100 p.s.i. pressure at the nozzle (application rate 0.04 g.p.m. per square foot).

4.7.9.3 Test materials. The solutions in fresh water and sea water shall be  $70^{\circ} \pm 10^{\circ}\text{F}$ , and shall contain  $6.0 \pm 0.1$  percent AFFF concentrate. The fuel shall be 150 gallons of gasoline conforming to MIL-G-5572.

4.7.9.4 Test procedure. No tests shall be conducted with wind speeds in excess of 10 miles per hour. The complete fuel charge shall be dumped into the diked area as rapidly as possible. Before fueling for any test run, all extinguishing agent from the previous test runs shall be removed from the diked area.

4.7.9.4.1 The fuel shall be ignited within 60 seconds after completion of fueling, and shall be permitted to burn freely for 15 seconds before the application of the extinguishing agent.

4.7.9.4.2 The fire shall be extinguished as rapidly as possible, and in the most effective and expeditious manner. This shall be achieved by maintaining the nozzle 3-1/2 to 4 feet above the ground and angled upward at a distance that permits the closest edge of the foam pattern to fall on the nearest edge of the fire. The nozzle shall be moved slowly from side to side to permit the foam pattern to fall from edge to edge of the fire. The operator shall move forward and around the area as the fire front recedes, and shall always maintain the nozzle in the same attitude.

4.7.9.4.3 A minimum of three runs each in fresh water and sea water of the 400-square foot fire performance test shall be required for qualification. One run each in fresh water and sea water will be required for quality conformance and production check tests.

4.7.9.5 Results. The "percentage of fire extinguished" at 10-second intervals after beginning application of the extinguishing agent shall be recorded. The values recorded at 10, 20, 30, and 40 seconds shall be summed and reported for each test run.

4.7.10 Fire performance (1260-square-foot test).

4.7.10.1 Test site. The fire test shall be conducted in a level circular area 40 feet in diameter (1260 square feet). The base and surrounding dike shall be of nonporous material for the containment of fuel on a substrate of water. The water depth shall be the minimum required to ensure complete coverage of the diked area with fuel.

4.7.10.2 Test equipment. The nozzle used for applying agent shall be a Rockwood FFF nozzle with double screen designed to discharge 50 g.p.m. at 100 p.s.i. (available from Bliss-Portland, South Portland, Maine 04106) or equal. The test shall be run with the nozzle discharging 50 g.p.m. at 100 p.s.i. pressure at the nozzle.

4.7.10.3 Test materials. The solution in fresh water and sea water shall be  $70^{\circ} \pm 10^{\circ}\text{F}$ , and shall contain  $6.0 \pm 0.1$  percent AFFF concentrate. The fuel shall be 250 gallons of gasoline conforming to MIL-G-5572.

4.7.10.4 Test procedure. No tests shall be conducted with wind speeds in excess of 10 miles per hour. The complete fuel charge shall be dumped into the diked area as rapidly as possible. Before fueling for any test run, all extinguishing agent from the previous test runs shall be removed from the diked area.

4.7.10.4.1 The fuel shall be ignited within 60 seconds after completion of fueling, and shall be permitted to burn freely for 15 seconds before the application of the extinguishing agent.

4.7.10.4.2 The fire shall be extinguished as rapidly as possible, and in the most effective and expeditious manner. This shall be achieved by maintaining the nozzle 3-1/2 to 4 feet above the ground and angled upward at a distance that permits the closest edge of the foam pattern to fall on the nearest edge of the fire. The nozzle shall be moved slowly from side to side to permit the foam pattern to fall from edge to edge of the fire. The operator shall move forward and around the area as the fire front recedes, and shall always maintain the nozzle in the same attitude.

4.7.10.4.3 A minimum of three runs each, in fresh water and sea water, of the 1260-square foot fire performance test shall be required for qualification. One run each in fresh water and sea water will be required for quality conformance and production check tests.

4.7.10.5 Results. The "percentage of fire extinguished" at 10-second intervals after beginning application of the extinguishing agent shall be recorded. The values recorded at 10, 20, 30, and 40 seconds shall be summed and reported for each test run.

4.7.11 Corrosion. The corrosion tests shall be conducted with the AFFF concentrate on cold rolled steel, corrosion-resistant steel (CRES 304), 6061T6 aluminum alloy, and with 6-percent solution prepared with synthetic sea water on cupro-nickel alloy consisting of 90 percent copper and 10 percent nickel as specified in ASTM A279-63. The metal coupons shall be approximately 1/16-inch thick and milled to a finished dimension of 1/2 inch by 3 inches. The metal coupons shall be two thirds immersed in the appropriate liquids and held for 38 days at a temperature of  $98^{\circ} \pm 2^{\circ}\text{F}$ . The container shall be capped to prevent evaporation. At the end of the exposure period, the weight loss shall be determined and calculated out on an mdd basis.



4.7.12 Stability. Three samples each of the concentrate and 6-percent solution in fresh water shall be placed in cylindrical glass containers of 1000 ml. capacity (approximately 2 inches in diameter and 19 inches high). The containers shall be stoppered to prevent evaporation and stored in an oven maintained at  $135^{\circ} \pm 5^{\circ}\text{F}$ . for 10 days. Additional samples of both concentrate and dilute solution stored shall be of sufficient quantity to perform the test specified in 4.7.6 after storage.

4.7.12.1 At the end of the exposure period, the concentrate samples shall show no evidence of precipitation or stratification. The diluted solution samples shall show no evidence of stratification, and precipitate formation shall not exceed 1 percent by volume. Precipitation shall be determined visually in the glass storage containers. Stratification shall be determined by visual examination and by subjecting specimens drawn from the top and bottom of the glass storage containers to the tests specified in 4.7.1, 4.7.5, and 4.7.7.

4.8 Inspection for preparation for delivery. Samples items and packages shall be selected in accordance with MIL-P-116 and inspected to verify conformance with the requirements of section 5.

## 5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in Section 2, see 6.4.)

5.1 Preservation and packaging. Preservation and packaging for levels A and C shall be as specified hereinafter.

5.1.1 The foam-forming liquid shall be furnished in 5-gallon pails or 55-gallon drums as specified (see 6.2).

5.1.1.1 Five-gallon pails. The five-gallon pails shall conform to type I, class 3 of PPP-P-704 and as follows:

- (a) The interior of the pails shall have a coating system approved by Naval Ship Engineering Center which has demonstrated satisfactory resistance to the liquid concentrate. The supplier shall furnish appropriate data prior to qualification. Application of the coating shall ensure the packaged product from making contact with any metal part of the container.
- (b) Pour openings shall have a minimum diameter of 1-1/4 inches.
- (c) Wire handles shall be galvanized or protectively coated to resist corrosion.

5.1.1.2 Fifty-five gallon drums. Fifty-five gallon drums shall conform to type I of PPP-D-729, type I or III of PPP-D-700, or PPP-D-1152 at the option of the supplier.

5.1.1.2.1 Lining. Fifty-five-gallon drums shall be lined on all interior surfaces as specified for pails.

5.1.1.3 Exterior coating. Pails and drums shall have a bright blue exterior coating conforming to TT-E-489, color number 15123 of Federal Standard No. 595.

5.2 Packing. For levels A, B, and C, no further packing required.

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

5.2.2 Pallets. When specified (see 6.2), five-gallon pails shall be palletized in accordance with load type III of MIL-STD-147.

5.3 Marking. In addition to the marking specified in 3.14 and any special marking required in the contract or order, containers and palletized unit loads shall be marked in accordance with MIL-STD-129.

## 6. NOTES

6.1 Intended use. The concentrate is intended for use in mechanical foam generating equipment such as fire-fighting trucks or foam sprinkler systems for extinguishing fires in flammable liquids such as gasoline or fuel oils.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Level of packaging and packing required (5.1 and 5.2).
- (c) Size of container required (5.1.1).
- (d) Whether palletizing is required (5.2.2).

6.3 With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in Qualified Products List QPL-24385 whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, 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 the Naval Ship Engineering Center, Department of the Navy, Center Building, Prince Georges Center, Hyattsville, Maryland, 20782 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 Governing Qualification" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

6.4 Sub-contracted material and parts. The preparation for delivery requirements of referenced documents listed in section 2 do not apply when material and parts are procured by the supplier for incorporation into the equipment and lose their separate identity when the equipment is shipped.

Review activities:  
AS

User activities:  
OS, YD, MC

Preparing activity:  
Navy - SH  
(Project 4210-M051)

**SPECIFICATION ANALYSIS SHEET**

Form Approved  
Budget Bureau No. 119-R004

**INSTRUCTIONS**

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).

**SPECIFICATION**

ORGANIZATION (of submitter)

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

**MATERIAL PROCURED UNDER A**

DIRECT GOVERNMENT CONTRACT

SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

YES

NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)

DATE

DD FORM 1426  
1 APR 63

REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE

0101-807-2000

**FOLD**

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**DEPARTMENT OF THE NAVY**  
Naval Ship Engineering Center  
Center Building  
Prince George's Center  
Hyattsville, Maryland 20782

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Commander, Naval Ship Engineering Center  
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