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Superseding

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MILITARY SPECIFICATION

FIRE EXTINGUISHING AGENT, "LIGHT WATER" LIQUID CONCENTRATE, (6 PERCENT)

This specification has been approved
by the Naval Air Systems Command,
Department of the Navy

1. SCOPE.

1.1 This specification covers the requirements for one type and grade of "Light Water" liquid concentrate fire extinguishing agent consisting of non-toxic fluorocarbon surfactants and appropriate foam stabilizers. The material shall be suitable for use in conjunction with potassium dry chemical fire extinguishing agent in suitably designed "twinning" equipment and in suitably designed foam-forming devices. The liquid concentrate shall be diluted or proportioned by suitably designed equipment for use in concentrations of six parts concentrate to ninety-four parts 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 this specification to the extent specified herein.

SPECIFICATIONS

Federal

PPP-B-601	Box, Wood, Cleated-Plywood
PPP-B-621	Box, Wood, Nailed and Lock-Corner
PPP-P-704	Pails, Shipping, One through Twelve Gallons

FSC 4210

Military

MIL-F-22287 Fire Extinguishing Agent, Potassium
Dry Chemical

STANDARDS

Military

MIL-STD-105 Sampling Procedures and Tables for
Inspection by Attributes

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-147 Palletized Unit Loads, 40" x 48" 4-Way
Partial and 4-Way Pallets

(When requesting specifications, standards and publications refer to both the title and number. Copies of this specification and applicable specifications may be obtained upon application to the Commanding Officer, Naval Supply Depot (CDI), 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120).

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.

Americal Society for Testing and Materials

ASTM-D445-61 Test for Kinematic Viscosity

ASTM-D-1298-55 Test for Specific Gravity of Petroleum
Liquids, Hydrometer Method

ASTM-D1331-56 Tests for Surface and Interfacial Tension
of Solutions of Surface Active Agents

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

3. REQUIREMENTS

3.1 Preproduction - The fire extinguishing agent, "Light Water" liquid concentrate furnished under this specification shall be a product which has been inspected and passed the preproduction inspection specified herein.

3.2 Data requirements - No data is required by this specification (other than reports accompanying samples submitted for preproduction testing), or by applicable documents referenced in Section 2, unless specified in the contract or order. (see 6.2).

3.3 Chemical and physical requirements - The "Light Water" liquid concentrate shall conform to the requirements of Table 1 when tested as specified therein. The material shall consist of non-toxic fluorocarbon surfactants, and shall not give off toxic vapors when subjected to intense heat.

3.4 Performance requirements -

3.4.1 Foamability - The solution of "Light Water" concentrate in water (six parts concentrate to ninety-four parts water by volume) shall produce a foam possessing an expansion with a limit of 7.0 minimum and a 25 percent drainage time of 2-1/2 minutes minimum value when tested as specified in 4.5.7.

3.4.2 Film formation and sealability - The foam produced by the sample shall spread over the surface of the fuel when tested as specified in 4.5.8 and result in a surface from which no sustained ignition of fuel vapors can be detected.

TABLE I
CHEMICAL AND PHYSICAL REQUIREMENTS

Requirement	Limits/Value	Test Paragraph
Specific Gravity at 25° ± 3°C (77 ± 5°F), minimum	1.075	4.5.1
Viscosity in centistokes at 25 ± 0.5°C (77 ± 1°F)	50-150	4.5.2
Viscosity in centistokes at 4.4 ± 0.5°C (40 ± 1°F) maximum	300	4.5.2
Refractive Index (n _{25/D})	1.3750 - 1.3850	4.5.3
pH value 25 ± 3°C (77 ± 5°F), minimum	4.2	4.5.4
Surface tension, dynes per centimeter at 25 ± 3°C (77 ± 5°F), maximum	20.0	4.5.5

TABLE I (Continued)
CHEMICAL AND PHYSICAL REQUIREMENTS

<u>Requirement</u>	<u>Limits/Value</u>	<u>Test Paragraph</u>
Nitrogen Content, percent	0.30 - 0.40	4.5.6
Color Identification, maximum	light amber	visual
Foamability:		
Expansion, minimum	7.	4.5.7
Drainage time, minimum minutes	2.5	4.5.7

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, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specifications where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Classification of inspection - The inspection of the fire extinguishing agent shall be classified as follows:

- (a) Preproduction Inspection (4.3)
- (b) Quality Conformance Inspection (4.4)

4.3 Preproduction inspection - Preproduction inspection shall consist of all the inspection of this specification.

4.3.1 Sampling for preproduction inspection -

4.3.1.1 Unless otherwise specified, as soon as practicable after award of a contract or order, the contractor shall furnish preproduction samples for inspection to determine conformance with this specification. Quantity production shall be withheld until the preproduction sample has been pronounced satisfactory by the Government. When a contractor is in continuous production of these items from contract to contract, submission of further preproduction samples may be waived at the discretion of the Contracting Officer. The approval of preproduction samples or the waiving of the preproduction inspection shall not relieve the contractor of his obligation to submit samples for quality conformance inspection.

4.3.1.2 The preproduction sample shall consist of 5-gallons of the material furnished in a sealed container. The sample shall be inspected as specified herein and in accordance with the contract or order. Each sample shall be accompanied by the results of all specification tests (see 6.2).

4.4 Quality conformance inspection - Quality conformance inspection shall consist of all the tests of this specification as described under "Test Methods" (4.5), and the examination of filled containers (4.4.2).

4.4.1 Sampling -

4.4.1.1 Inspection Lot - All material manufactured as one batch and offered for delivery at one time shall be considered a lot for purposes of quality conformance inspection.

4.4.1.2 Lot acceptance test samples - From each lot of material offered for acceptance under contract, four filled 5-gallon containers shall be selected at random. A composite sample, sufficient in size for test purposes, shall be made up by drawing equal portions from the containers and immediately placed in a dry, air and water tight container and forwarded to a testing laboratory satisfactory to the procuring agency. The composite sample shall be subjected to all the tests as described under "Test Methods". (4.5).

4.4.2 Examination of filled containers - A random sample of filled containers shall be selected from each lot in accordance with MIL-STD-105 at inspection level I, and acceptable quality level (AQL) equal to 2.5 percent defective to verify compliance with all stipulations of this specification regarding fill, closure, packaging, packing, marking and other requirements not involving tests. Containers shall be examined for defects of the container and the closure, for evidence of leakage, and for unsatisfactory markings; each sample filled container shall also be weighed to determine the amount of the contents. Any container in the sample having one or more defects or under required fill shall be rejected, and if the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, the lot represented by the sample shall be rejected.

4.5 Test Methods -

4.5.1 Specific Gravity - The specific gravity of the liquid concentrate shall be determined in accordance with ASTM Method D-1298-55.

4.5.2 Viscosity - The viscosity of the liquid concentrate shall be determined in accordance with ASTM Method D-445-61 using a capillary viscometer of appropriate size number at 25°C. (77 ± 1°F.) and at 4.4°C. (40 ± 1°F.).

4.5.3 Refractive Index - An Abbe refractometer shall be used to determine the refractive index of the sample. Standard testing procedures for this instrument shall apply.

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

4.5.5 Surface tension - The surface tension of a solution of 1cc of the liquid concentrate in 370cc of distilled water shall be determined in a Cenco DuNuoy tensiometer in accordance with ASTM Method 1331-56 and until the readings come to an equilibrium (approximately 30 minutes).

4.5.6 Nitrogen Content - A modified sealed tube Kjeldahl digestion and titration method shall be used to determine the nitrogen content of the liquid concentrate. (Reference Analytical Chemistry, Volume 23, pp 363, 1951).

4.5.7 Foamability - An Ansul Company (Marinette, Wisconsin) portable extinguisher, Model WF-2-1/2, (or similar) of the stored pressure type is modified for this test. The discharge hose and nozzle are replaced by the following assembly in 1/4" pipe size: A nipple 2-1/2" in length, a tee fitted with a calibrated 200 psi gage, a 1/4" to 3/4" bushing, and finally a special foam-producing nozzle. This air-aspirating nozzle (or similar), available as a laboratory testing item from National Foam System, Inc., West Chester, Pennsylvania, should have a flow rated at 2.00 gpm ± .10 gpm at 100 psig delivery pressure.

First, in the procedure to test foam concentrates for expansion and drainage, the extinguisher container is charged with one gallon of premixed solution at 70°F. in the required quantities. The discharge assembly is then coupled to the extinguisher. Using compressed air or nitrogen, the unit is pressurized to 110 psig.

The unit is held with the nozzle 3 ft. from the ground and at a distance of 10 ft. from a foam collecting board. The latter is constructed at an angle of 45° to the horizontal and has a V-shaped trough to direct the run-off foam into a standard 1-liter glass graduate centered below the trough exit.

The discharge valve is depressed and the foam stream directed to one side of the collector. When the installed discharge gage registers 105 psi the foam stream is directed to impinge on the stand backboard at its center point. Discharge is continued in this manner until the foam fills the cylinder. The protruding top of the foam column in the graduate is then struck off level and a stopwatch is started.

The expansion value is defined as the ratio of the final foam volume to original foam solution volume before air addition. The foam filled graduate is weighed to the nearest gram and the expansion calculated from the following expression.

$$\text{Expansion} = \frac{(\text{graduate total volume in ml.})}{(\text{Full weight minus empty weight in grams})}$$

At one minute intervals from the stopwatch starting point, the total volume of solution drained from the foam column is recorded. Sufficient readings should be taken to insure that more than one-fourth of the solution in the foam sample has drained. The 25% drainage volume is calculated from:

$$25\% \text{ Volume} = \frac{(\text{Full weight minus empty weight in grams})}{4}$$

The time required to collect this drainage volume shall be reported as the 25% drainage time.

This test shall be run three times on the one gallon charge. Repressurize unit each time to 110 psi. The reported expansion and drainage time values will be averages of the three tests.

4.5.8 Film formation and sealability - The objective is to test 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 reignition of exposed fuel.

A stainless steel Graduated Measure of 1,000 ml capacity (4-1/2" dia., 5" deep) (Cole-Parmer Co., Chicago Illinois, or similar) is fitted at the top edge with two small metal clips protruding 1/8" into the opening. They serve to restrain an 80 mesh conical screen of stainless steel (5" in height by 4-3/4" in diameter) from floating out of the container during the test. A Waring Automatic Blender, or similar, is used as the test foam maker. (at 70 ± 5°F.).

First, 600 ml of 98% cyclohexane are placed into the Graduated Measure. 100 ml of the active solution to be tested are formed for 10 seconds at low speed in the Blender. 200 ml of this foam are poured onto the fuel surface. The screen is then inserted into the Measure and clipped firmly into place, and a stopwatch is started. A small portion of foam bubbles will be forced through the screen mesh but the dominant surface area will appear bare.

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

4.6 Rejection criteria - When any lot acceptance test sample fails to meet any of the test requirements of this specification or when the number of defective filled containers exceeds the acceptance number as specified in 4.4.2, the lot represented by the sample shall be rejected.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging -

5.1.1 Level A -

5.1.1.1 Cleaning, drying and preservative application - Not applicable.

5.1.1.2 Unit packaging - Unit packaging of the liquid concentrate fire extinguishing agent shall be furnished in 5-gallon containers in accordance with specification PPP-P-704A, Type 1, Class 1 except that the interior coating shall be a uniform double coating of Bradley-Vrooman Series 46, epon-phenolic resin. The closure shall be a snap-on cap type with a protective metal band as described in paragraph 3.3 of PPP-P-7C4A.

5.1.2 Level B - Not applicable.

5.1.3 Level C -

5.1.3.1 Unit packaging - Unit packaging of the liquid concentrate fire extinguishing agent shall be in accordance with 5.1.1.2.

5.2 Packing -5.2.1 Level A -

5.2.1.1 Exterior Containers - Unless otherwise specified, material packaged in accordance with 5.1.1.2 shall be shipped without exterior packing. When specified by the procuring activity, pails shall be packed in wood boxes in accordance with specification PPP-B-601, overseas type, or PPP-B-621, Class 2 (weight limit not to exceed 200 lbs) or palletized in accordance with Specification MIL-STD-147, load type III.

5.2.2 Level B - Not applicable.

5.2.3 Level C - The liquid concentrate fire extinguishing agent packaged in accordance with 5.1.3.1 shall be packed to afford protection against damage during shipment from the supply source to the first receiving activity for immediate use. Containers shall comply with Consolidated Freight Classification Rules or other common carrier regulations applicable to the mode of transportation.

5.3 Marking -

5.3.1 Special Markings - Two identical instructions for use and caution label markings as listed below shall be applied to each container so that the markings are located diametrically opposite on the container side. The labels shall be applied in such a manner that water immersion of the container, or normal handling will not impair the legibility of the marking.

Instructions for use: Fire extinguishing agent "Light Water" liquid concentrate is a non-toxic, non-corrosive, fluorocarbon surfactant mixture for use in specially designed equipment which generates "Light Water" (Lt H₂O) foam for firefighting purposes in foam-forming devices or in conjunction with "twinned" potassium bicarbonate dry chemical equipment. This concentrate is to be diluted for use with clean fresh water in volume proportions of 6 gallons concentrate to 94 gallons water. This may be done by premix in the final storage container or by suitably designed flow proportioning equipment.

Caution: Do not store below 32°F. (0°C) for ready use. Do not mix with any other liquids except as noted in the instructions for use.

5.3.2 Normal markings - In addition to the markings required by contract or order, unit packages, and shipping containers shall be marked in accordance with the requirement of MIL-STD-129.

6. NOTES

6.1 Intended use - Foams produced from "Light Water" diluted concentrates are intended for use as fire extinguishing agents or in conjunction with dry chemical extinguishing type agents for the purpose of eliminating flashbacks and preventing reignition of flammable hydrocarbon fuels.

6.2 Ordering data - Procurement documents should specify the following:

- a. Title, number and date of this specification
- b. Quantity
- c. Level of packaging and packing required (see 5.1 and 5.2)
- d. Whether preproduction inspection is required (see 4.3.1.1)
- e. Where preproduction inspection is to be conducted when required (see 4.3.1.2).

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