

MIL-F-23905A(WP)

26 March 1965

Superseding

MIL-F-23905(Wep)

1 November 1963

MILITARY SPECIFICATION

FIRE EXTINGUISHING AGENT, "LIGHT WATER" LIQUID CONCENTRATE

This specification has been approved by
the Bureau of Naval Weapons, 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 perfluorocarbon surfactants. The material shall be suitable for use in conjunction with potassium dry chemical fire extinguishing agent in suitably designed "twinned" equipment. The liquid concentrate shall be diluted for use in such equipment in concentrations of one part concentrate to three parts potable tap water by volume. This diluted material shall be known as "Active Solution."

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

RR-S-366 Sieves, Standard for Testing Purposes

PPP-B-601 Boxes, Wood, Cleated-Plywood

FSC 4210

Federal (Cont'd)

PPP-B-621	Boxes, Wood, Nailed and Lock-Corner
PPP-D-760	Drums and Pails, Metal (5 and 16.64 Gallon)

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 and Containerized Unit Loads, 40" x 48" 4-way (Partial) Pallet Skids, Runners, or Pallet-Type Base

(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.

"American Society for Testing and Materials

ASTM - D445-61	Test for Kinematic Viscosity
ASTM - D1298-55	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).

National Fire Protection Association

NFPA Standard No. 11 - "Standard for Foam Extinguishing Systems." (1963)

(Application for copies of Standard No. 11, "Standard for Foam Extinguishing Systems," should be addressed to: National Fire Protection Association, Boston, Massachusetts.)

American Chemical Society

Analytical Chemistry - Volume 23, No. 6, pp 363, June 1951
"Kjeldahl digestion and titration method for nitrogen content."

(Application for copies of Analytical Chemistry should be addressed to: American Chemical Society, Special Issues Sales Dept., 1155 Sixteenth Street, N.W. Washington, D. C. 20036).

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 I when tested as specified therein. The material shall consist of non-toxic perfluorocarbon surfactants, and shall not give off toxic vapors when subjected to intense heat.

3.4 Performance Requirements -

3.4.1 Foamability - The "Active Solution" (one part concentrate to three parts water by volume) shall produce a foam possessing an expansion between limits of 3.8 and 4.1 when tested as specified in 4.5.9.

3.4.2 Foam fluidity - The foam produced by the sample shall spread over the surface of the fuel completely to the edge of the test pan within a maximum time period of 30 seconds after removal of the centered foam retaining ring when tested as specified in 4.5.9.

TABLE I

Chemical and Physical Requirements

REQUIREMENT	LIMIT	TEST PARAGRAPH
Specific Gravity at 25 $\pm$ 3 $^{\circ}$ C (77 $\pm$ 5 $^{\circ}$ F)	1.011 $\pm$.009	4.5.1
Viscosity in centistokes at 25 $\pm$ 3 $^{\circ}$ C (77 $\pm$ 5 $^{\circ}$ F)	21.0 $\pm$ 7.0	4.5.2
Refractive Index (n ₂₅ /D)	1.3350 to 1.3375	4.5.3
pH value 25 $\pm$ 3 $^{\circ}$ C (77 $\pm$ 5 $^{\circ}$ F)	5.0 to 6.5	4.5.4
Solids Content, percent minimum by weight	3.70	4.5.5
Surface tension, dynes per centimeter at 25 $\pm$ 3 $^{\circ}$ C (77 $\pm$ 5 $^{\circ}$ F)	18.0 $\pm$ 4.0	4.5.6
Iodine Content, percent range	0.145 to 0.210	4.5.7
Nitrogen Content, percent range	0.080 to 0.105	4.5.8
Color Identification, maximum	slightly hazy amber	visual

3.4.3 Fuel Vapor Sealability: When tested as specified in 4.5.9, the foam produced by the sample shall show no penetration of fuel vapor at 2 minutes elapsed time. Ignition of any sort shall not occur when the surface is probed 1/2 inch above the surface with the flame from a burning wax taper. After 30 minutes elapsed time (from removal of foam retaining ring) the same foam covering shall show only momentary flash ignition of vapor-filled bubbles on the surface when similarly probed with the flaming taper. No self-sustaining fuel ignition

shall occur upon further exploration with the flaming taper, even at apparently open and non-foam covered surface patches on the fuel.

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 clean, 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 Cannon-Fenske viscometer size number 200 at 25°C.

4.5.3 Refractive Index - An Abbé 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 Solids Content - Accurately weigh 10 grams of liquid concentrate in an evaporating dish and dry to constant weight, ± 3 milligrams in a circulating oven at 40°C (104°F).

4.5.6 Surface tension - The surface tension of a solution of lcc 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).

4.5.7 Iodine Content - Standard methods of silver nitrate potentiometric titration shall be used to determine the iodine content of the sample.

4.5.8 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).

4.5.9 Foamability, Foam Fluidity and Fuel Vapor Sealability performance tests - Approximately 700 ml "Active Solution" at $70 \pm 2^\circ\text{F}$ shall be made up from the sample for this test. Using a kitchen mixer (Sunbeam Mixmaster, Model 12C type or equal), at room temperature $70 \pm 2^\circ\text{F}$, 100 ml of "Active Solution" shall be placed in a large mixing bowl and vigorously mixed using the eggbeater mixing blades at a shaft speed of 790 ± 10 rpm (approx. setting 10) for exactly one minute. The speed shall then be reduced to 460 ± 10 rpm (approx. setting 5) and an additional 550 ml "Active Solution" shall be added to the bowl. After a further 2 minute mixing time at this speed (total: 3 min. mixing time) the bowl shall be removed and a foam sample carefully poured and leveled off in the standard 2 inch by 7-3/8 inch (1400 ml capacity) foam sample container and the expansion of the sample determined by weighing as given in NFPA No. 11 "Standard for Foam Extinguishing Systems." The expansion shall be reported as Foamability and checked for conformance to 3.4.1.

The following equipment and materials shall be made available for subsequent testing Foam Fluidity and Fuel Vapor Sealability of the sample:

A round, all-welded or brazed double-jacketed pan or tray constructed on non-ferrous metal and suitably supported at a convenient height with an inside diameter of 23-1/2 inches (Nominal 3 ft² area) and 1 inch in depth. The pan and its contents are maintained at 70° ± 2°F by circulating water from a suitable constant temperature source through the jacket. The pan is filled to a minimum depth of approximately 1/4 inch with approximately 1/2 gallon cyclohexane fuel, (practical, B. P. 172° - 178°F). A removable pin with a flat base, approx. 3/16 inch diameter and 1 inch height (A 1 inch brass, flat-headed machine screw, 1/4-20 is suitable for this) is positioned base down in the fuel in the exact center of the inner bottom surface of the pan. (This pin serves as a foam anchor and is removable for cleaning). A metal foam-retaining ring, 4 inches ID. by 3 inches height with 1/4 inch wall thickness (A 3-in. section of 4 in. galvanized pipe may be used) is positioned in the pan concentric with the pin. A 10 gram amount of potassium dry chemical agent conforming to MIL-F-22287A(Wep) is carefully placed in an 8-inch 100 mesh screen conforming to RR-S-366 for later use. (NOTE: The tests to follow involve a flammable fuel fire hazard and should be conducted in a suitable fire-proofed area with adequate ventilation and provided with portable first aid equipment, fire extinguishers and suitable emergency equipment.)

In order to conduct the tests, 114.0 ± 2 grams of the residual foam after performing the foamability test above are weighed from the mixing bowl into a tared beaker resting on a balance. This quantity is then quickly and carefully transferred to the retaining ring in the fuel pan. Residual foam is scraped out of the beaker into the ring with a rubber kitchen spatula. The retaining ring is then carefully lifted up out of the pan, thus allowing the foam to spread uniformly over the fuel surface. (Solution application density for 3 ft² pan surface equals 0.01 gal/ft²). Foam adhering to the ring is scraped onto the center of the foam surface with the rubber spatula. A maximum time of 20 seconds is allowable for the period from weighing to foam release or a total time of 45 secs from the end of the mixing time above to removal of the ring. A stopwatch is started when the foam retaining ring is removed from the fuel pan. The extent of surface coverage by the foam after 30 seconds elapsed time shall be reported as Foam Fluidity and checked for conformance to 3.4.2.

Immediately after the 30 second elapsed time interval the dry chemical shall be sifted uniformly over the foam surface in the pan by tapping the screen gently as it is moved. After 2.0 minutes elapsed time from lifting of the ring, the flaming taper shall be passed over the fuel surface at a height of no less than 1/2 inch and probing for fuel vapor and ignitable open areas conducted and reported as Fuel Vapor Sealability.

After 30.0 minutes time has elapsed from lifting of the ring the same foam covering shall be slowly probed with the lighted taper at 1/2 inch above the surface and the observations and results shall be reported as Fuel Vapor Sealability and checked for conformance to 3.4.3. (NOTE: The entire equipment used in this test shall be emptied, washed and rinsed and new fuel used in subsequent tests.)

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-D-760, Type I, Class 1 except that the interior coating shall be a uniform double coating of Bradley-Vrooman Series 46, epon-phenolic resin.

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, perfluorocarbon surfactant mixture for use in specially designed equipment which generated "Light Water" (LT H₂O) for firefighting purposes in conjunction with "twinned" potassium bicarbonate dry chemical equipment. Dilute the 5 gallon contents of this can with 15 gallons clean fresh water for use. (One part concentrate to three parts water by volume).

Caution:

Do not store below 32°F (0°C). 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 requirements of MIL-STD-129.

6. NOTES

6.1 Intended use - "Light Water" is intended for use in conjunction with dry chemical extinguishing type agents for the purpose of eliminating flashbacks and preventing reignition of flammable hydrocarbon fuels. The "Light Water" is intended for use in fire extinguishers conforming to MIL-E-23906, latest revision.

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. Container spout or nozzle closure required as listed in PPP-D-760 (see 5.1.1.2).
- e. Whether preproduction inspection is required (see 4.3.1.1)
- f. Where preproduction inspection is to be conducted when required (see 4.3.1.2)

6.3 Changes from previous issue - The outside margins of this document have been marked "#" to indicate where changes (deletions, additions, etc.) from the previous issue have been made. This has been done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written irrespective of the marginal notations and relationship to the last previous issue.