

O-F-555C
January 3, 1969
 SUPERSEDING
 Fed. Spec. O-F-555B
 March 11, 1964

FEDERAL SPECIFICATION
 FOAM LIQUID, FIRE EXTINGUISHING,
 MECHANICAL

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE

1.1 This specification covers one type of foam liquid for use in mechanical foam generating equipment for extinguishment of fires in flammable liquids such as gasoline and oils.

1.1.1 Federal specification coverage. Federal specifications do not include all varieties of the commodity as indicated by the title of the specification, or which are commercially available, but are intended to cover only those generally used by the Federal Government.

2. APPLICABLE DOCUMENTS

2.1 Specifications and standards. The following specifications and standards, of the issues in effect on date of invitation for bids, or request for proposal, form a part of the specification to the extent specified herein:

Federal Specifications:

| | |
|------------|--|
| L-P-390 | - Plastic Molding Material, Polyethylene, Low and Medium Density. |
| QQ-A-250/2 | - Aluminum Alloy 3003, Plate and Sheet. |
| QQ-S-700 | - Steel, Sheet and Strip, Medium and High Carbon. |
| TT-E-489 | - Enamel, Alkyd, Gloss (For Exterior and Interior Surfaces). |
| VV-G-76 | - Gasoline, Automotive. |
| PPP-B-601 | - Boxes, Wood, Cleated-Plywood. |
| PPP-B-621 | - Boxes, Wood, Nailed and Lock-Corner. |
| PPP-B-636 | - Box, Fiberboard. |
| PPP-C-96 | - Cans, Metal, 28 Gage and Lighter. |
| PPP-D-723 | - Drums, Fiber. |
| PPP-D-729 | - Drums: Metal, 55-Gallon (For Shipment of Noncorrosive Material). |
| PPP-P-704 | - Pails, Metal: (Shipping, Steel, 1-through 12-Gallon). |
| PPP-T-66 | - Tape: Pressure-Sensitive Adhesive, Vinyl Plastic Film. |

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Federal Standards:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies).
Fed. Std. No. 595 - Colors.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index: The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, D.C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, Wash.)

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specification:

MIL-I-22023 - Insulation Felt, Thermal and Sound Absorbing Felt,
Fibrous Glass, Flexible.

Military Standards:

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" by 48" 4-Way
(Partial) Pallet Skids, Runners, or Pallet-Type Base.

(Copies of Military Specification and Standards required by contractors 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 a specific issue is identified, the issues in effect on date of invitation for bids, or request for proposal shall apply:

Uniform Classification Committee:

Uniform Freight Classification Rule.

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

American Society for Testing and Materials (ASTM) Standard:

- D-96 - Method of Test for Water and Sediment in Crude Oils.
- D-97 - Method of Test for Cloud and Pour Points.
- D-445 - Method of Test for Viscosity of Transparent and Opaque Liquids (Kinematic and Dynamic Viscosities).
- D-1298 - Method Test for Specific Gravity of Petroleum Liquids, Hydrometer Method.
- E 11 - Specifications for Sieves, for Testing Purposes (Wire Cloth Sieves, Round-Hole and Square-Hole Screens or Sieves).

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

REQUIREMENTS

3.1 Qualification. Foam liquid furnished under this specification shall be products which are approved for listing on the applicable qualified products list at the time set for opening of bids (see 4.2 and 6.3).

3.2 Material. The foam liquid shall be essentially a concentrated homogeneous colloidal suspension of hydrolyzed proteins, foam stabilizers and metallic salts and other material as required to conform to the requirements as specified herein.

3.3 Compatibility (for qualification testing only). The foam liquid shall be compatible with other liquids approved under this specification in that a mixture with any approved foam liquid in all proportions shall conform to the requirements of 3.13 when tested as specified in 4.7.11. Also, when tested as specified in 4.7.7.2, the sedimentation of the mixture shall be not greater than 0.25 percent by volume.

3.4 Specific gravity. The foam liquid shall have a minimum specific gravity of 1.12 at 60°/60°Fahrenheit (F.) when tested, as specified in 4.7.1. The specific gravity shall be not greater or less than 0.02 from that established for the qualified material, except that it shall be not less than 1.12.

3.5 Viscosity. The foam liquid shall have a maximum kinematic viscosity of 110 centistokes at 32°F. and a minimum kinematic viscosity of 15 centistokes at 68°F. (20°C.), when tested, as specified in 4.7.2. The kinematic viscosity of the liquid at 32°F. (0°C.) shall be not greater or less than 20 centistokes from the value established for the qualified material, except that it shall not be greater than 110 centistokes.

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3.6 pH value. The foam liquid shall have a pH value between 6 and 7.5 at 68°F. when tested, as specified in 4.7.3. The pH shall not vary from this range in 6-percent solutions of foam liquid in synthetic sea water prepared using distilled water. The pH value at 68°F. shall not be greater or less than 0.4 units of the value established for the qualified material, except that the value shall stay within the range of 6 to 7.5. Also, after the high temperature (149°F.) stability test specified in 4.7.7.2, the pH value of the foam liquid shall be not greater or less than 0.6 units of the value established for the qualified material, except that the value shall stay within the range of 6 to 7.5.

3.7 Pour point. The foam liquid shall have a maximum pour point of 14°F., when tested as specified in 4.7.4, and shall be not greater or less than 5°F. of the value established for the qualified material, except that the pour point shall not exceed 14°F.

3.8 Sedimentation. The foam liquid as supplied shall have a sedimentation value not greater than 0.1 percent by volume, when tested as specified in 4.7.5. Sedimentation, if present, shall be completely dispersible on mild shaking, and shall all readily pass through an 80-mesh screen when tested, as specified in 4.7.5.

3.9 Precipitation. The foam liquid as supplied shall be readily miscible with synthetic sea water and shall show a precipitation of not more than 0.05 percent by volume when tested, as specified in 4.7.6.

3.10 Stability.

3.10.1 Low temperature stability, -85°F. (-65°C.). When tested, as specified in 4.7.7.1, the sedimentation shall not exceed 0.2 percent by volume. The sedimentation shall be completely dispersible on mild shaking and shall all readily pass through an 80-mesh screen specified in 4.7.5.

3.10.2 High temperature stability, 149°F. (65°C.). The foam liquid shall not show any physical, chemical, or performance changes beyond the limits specified in 3.4, 3.5, 3.6, 3.7, 3.8 (except that the liquid shall have a sedimentation value not greater than 0.2 percent by volume), 3.9, 3.11, 3.12, and 3.13 when tested, as specified in 4.7.7.2. Also, any sedimentation present shall be completely dispersible on mild shaking, and shall all readily pass through the 80-mesh screen specified in 4.7.5.

3.11 Foam stabilizer salts. When metal foam stabilizers are required, the foam liquid shall show a metal foam stabilizer salt content calculated for the metal, which shall not vary from the optimum content for the particular formulation of liquid by more than the numerical value of 0.05 percent. The metal salt and the optimum metal salt content shall be those proposed by the particular manufacturer and approved as a result of the qualification tests of the particular formation of liquid. The test for iron salts is specified in 4.7.8. The required test for determining the concentration of other salts shall be approved at the time of qualification.

3.12 Foam characteristics.

3.12.1 Drainage. The foam generated from a 5-percent premixed solution of the foam liquid in fresh water at 68°F. (20°C.) shall show a 25-percent drainage time between 95 and 140 seconds when tested, as specified in 4.7.9.

3.12.2 Foam expansion. The foam generated from a 5-percent premixed solution of the foam liquid in fresh water shall be above the following minimum expansion values when tested, as specified in 4.7.9:

| Temperature °F. | Expansion value, minimum |
|-----------------|--------------------------|
| 68 | 7.5 |
| 41 | 6.5 |

3.12.3 Resistance to dry powder attack. The foam generated from a 6-percent premixed solution of the foam liquid in synthetic sea water shall contain the fire during a 5-minute burnback period to a maximum area of 2-square feet, when tested, as specified in 4.7.10.

3.13 Fire requirements.

3.13.1 Fire performance. The foam liquid as received and after treating at 149°F., as specified in 4.7.7.2, shall have a time of coverage of not more than 2 minutes, control in not more than 4 minutes, and shall completely extinguish the fire in not more than 5 minutes, when tested, as specified in 4.7.11.1.

3.13.2 Fluidity. The foam shall extinguish the fire in a positive and progressive manner after start of foam application. The foam produced shall form a continuous blanket over the gasoline, shall flow readily into corners of the tank, shall not break up into separate masses or form voids in the foam blanket. The foam blanket shall average not less than 2 inches in thickness after the 5-minute period of application.

3.13.3 Sealability. The foam blanket shall protect the fuel from reignition by a lighted torch for a period of not less than 15 minutes after the 5-minute period of foam application when foam is tested, as specified in 4.7.11.2.

3.13.4 Burnback. The foam blanket shall prevent spread of the fire beyond an area approximately 20-inches square, when tested, as specified in 4.7.11.3.

3.14 Corrosion.

3.14.1 Corrosion to steel. The foam liquid shall not cause a loss of weight exceeding 15 milligrams per square decimeter per day (24 hours) or any evidence of pitting of an uncoated steel sample conforming to QQ-S-700 (cold rolled sheet, annealed last, dull finish), when tested, as specified in 4.7.12.1.

3.14.2 Corrosion to aluminum. The foam liquid shall not cause a loss of weight exceeding 15 milligrams per square decimeter per day (24 hours) or any evidence of pitting of an uncoated aluminum sample conforming to QQ-A-250/2, when tested, as specified in 4.7.12.2.

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3.15 Marking.

3.15.1 Identification marking shall be in accordance with MIL-STD-130. Marking shall include a seven digit identifying number to specify the date of manufacture and the batch number. The first two digits shall indicate the year of manufacture (for example 68 for 1968), the next two digits shall indicate the month of manufacture (for example 08 for August), the next two digits shall indicate the day of the month of manufacture and the last digit shall identify the batch number for the specific manufacturing date. For example, number 68-08-31-3 indicates that the item was the third batch manufactured on 31 August 1968. In addition, the marking on the containers (see 5.4), shall be in black characters against a red background.

3.15.2 Two identical markings conforming to figure 1 shall be applied to the 5-gallon 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.

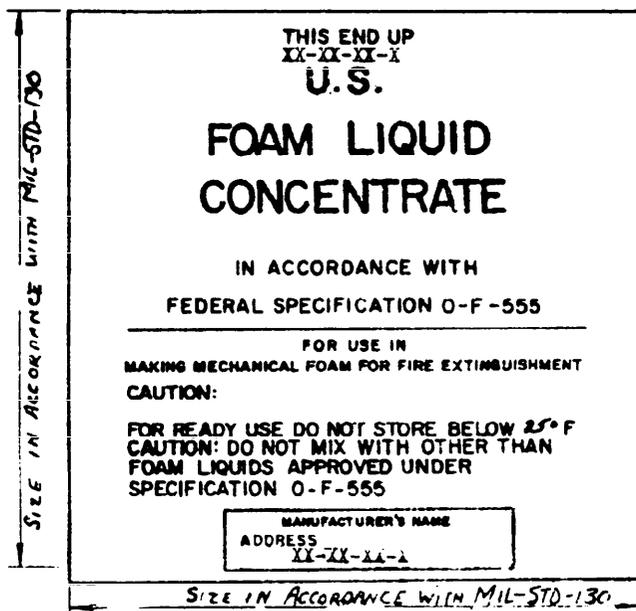


FIGURE 1.—Container markings.

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 facilities or any commercial laboratory acceptable to 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 that supplies and services conform to prescribed requirements.

4.2 Qualification tests. Qualification tests shall be conducted at a laboratory satisfactory to the Naval Ship Engineering Center. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.3 and 6.4). Qualification tests shall consist of the tests specified in 4.7.

4.3 Sampling.

4.3.1 Lot. For purposes of sampling, a lot shall consist of not more than 5000 gallons of foam liquid.

4.3.2 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 and acceptable quality level - 2.5 percent defective to verify compliance with all requirements regarding fill, closure, marking and other requirements not requiring tests.

4.3.3 Sampling for quality conformance tests. Two filled 5-gallon containers five filled 2-gallon containers or forty filled 1-quart containers shall be selected at random from each lot for the tests specified in 4.5 or, if the lot is a single homogeneous batch of not over 5000 gallons, sampling for quality conformance tests may be made from the batch tank prior to packaging.

4.3.4 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 by an inspector and forwarded to a laboratory designated by the command or agency concerned for the tests specified in 4.6. The contractor shall submit in addition to the above samples the results of tests required by 4.3.3.

4.4 Examination of filled containers. Each sample filled container shall be examined for defects for 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.

4.5 Quality conformance tests. The samples selected in accordance with 4.3.3 shall be subjected to the tests specified in 4.7.1, 4.7.3, 4.7.5, 4.7.6, and 4.7.9.

4.5.1 Action in case of failure. If any one of the samples tested is found to be not in conformance with this specification, this shall be cause for rejection of the lot represented by the sample.

4.6 Production check tests. The samples selected, as specified in 4.3.4, shall be separately subjected to such chemical, physical, and performance tests as are necessary to determine that the sample is essentially identical to the material upon which qualification approval has been granted.

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4.6.1 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 production check test sample. Thenceforth, except as herein-after specified, acceptance and rejection of lots shall normally be on the basis of the sampling, examination and tests specified in 4.3, 4.4 and 4.5 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 bureau or agency concerned and shall there be subjected to the tests specified in 4.6. 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 4.3.4) in the event of failure.

4.7 Test procedures.

4.7.1 Specific gravity. Specific gravity shall be determined by ASTM D-1298.

4.7.2 Viscosity. Viscosity shall be determined by ASTM D-445 using the Canon-Fenske Viscometer.

4.7.3 pH value. pH value of the foam liquid or of 6-percent solutions in synthetic sea water shall be determined by means of a standard pH electrometer using the glass electrode. Report the pH value to the nearest 0.1. Synthetic sea water of the following composition shall be used:

| | Percent by weight |
|--|----------------------|
| Magnesium chloride ($\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$).... | 0.10 |
| Calcium Chloride ($\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$)..... | 0.16 |
| Anhydrous sodium sulfate (Na_2SO_4).. | 0.40 |
| Sodium chloride, C. P. (NaCl)..... | 2.50 |
| Distilled water | 95.84 |

4.7.4 Pour point. Pour point shall be determined by ASTM D97 and the following: The temperature of the cooling bath shall be maintained between -40° and -50°F . The jacket containing the test jar shall be supported in a vertical position in the cooling bath so that not more than 1 inch of the jacket projects out of the cooling medium. Beginning at a foam liquid temperature of 15°F . and continuing at decreasing 1°F . intervals, the test jar shall be removed from the jacket and shall be tilted just enough to determine whether there is any movement of the foam liquid in the jar. The complete operation of removal and replacement shall not require more than 3 seconds. As soon as the foam liquid does not flow when the jar is tilted, the jar shall be held in a horizontal position for exactly 5 seconds. If the foam liquid shows any movement under these conditions, the jar shall be immediately replaced in the jacket and the test shall be repeated at the next temperature 1°F . lower. The test shall be continued in this manner until a point is reached at which the foam liquid in the jar shows no movement when the jar is held in a horizontal position for exactly 5-seconds. The temperature of the foam liquid at this point shall be noted and the pour point shall be recorded as the temperature 5°F . above this point.

4.7.5 Sedimentation. A representative sample shall be taken from the container after thoroughly mixing the contents. Sedimentation shall be determined by ASTM D 96 using the cone-shaped tube, except that the solvent and emulsifier shall not be added and the tests shall be conducted at $68^{\circ} \pm 2^{\circ}\text{F.}$ ($20^{\circ} \pm 1.1^{\circ}\text{C.}$). One pint of the thoroughly stirred foam liquid shall be filtered through an 80-mesh screen filter conforming to ASTM E-11. The screen shall be 1-inch in diameter and mounted in a brass or stainless steel frame 10 inches long.

4.7.6 Precipitation. A portion of the supernatant liquid obtained after the sedimentation test (see 4.7.5) shall be used in preparing a 6 percent solution of the liquid in synthetic sea water (see 4.7.3) at a temperature of $68^{\circ} \pm 2^{\circ}\text{F.}$ ($20^{\circ} \pm 1.1^{\circ}\text{C.}$). Determine presence of precipitation using type method specified in 4.7.5.

4.7.7 Stability.

4.7.7.1 Low temperature stability, -85°F. (-65°C.). Representative foam liquid samples shall be taken from a previously unopened container after thoroughly mixing the contents. A sample shall be placed in a sealed polyethylene container and rapidly solidified by exposure to a temperature of not higher than -85°F. for 24 hours. The container shall be hammered with a mallet to break up the solidified liquid into small pieces which shall be transferred to a 100 ml. centrifuge tube and a 1-pint wide mouth bottle, both of which shall then be capped. The centrifuge tube and bottle shall be exposed to a temperature of $23^{\circ} \pm 2^{\circ} - 0^{\circ}\text{F.}$ ($-5^{\circ} \pm 1.1^{\circ}\text{C.}$) for 1 week and then brought to room temperature. Sedimentation in

the centrifuge tube shall be determined as specified in 4.7.5. Also, the 1-pint sample shall be filtered through the 8-mesh screen specified in 4.7.5.

4.7.7.2 High temperature stability 149°F. (65°C.). The foam liquid in an unopened container shall be brought to a temperature of $149^{\circ} \pm 2^{\circ}\text{F.}$ within 4 hours, maintained at $149^{\circ} \pm 2^{\circ}\text{F.}$ for 24 hours, and then brought to room temperature. The contents shall then be thoroughly mixed after which the foam liquid shall be tested for conformity with the requirements of 3.10.2. The foam liquid in the container may be brought to 149°F. by immersion of the container in an upright position to within 1 inch of the top of the container in a water bath maintained at 149°F. The container may then remain immersed in the 149°F. bath for an additional 24 hours or else transferred to an air oven which will maintain the liquid at 149°F. for the 24-hour storage period. In addition to the above, a 100 ml. sample of the thoroughly mixed foam liquid in a centrifuge tube and a 1-pint sample in a 1-pint wide mouth bottle shall be similarly stored at 149°F. The sedimentation in the container, the centrifuge tube and the 1-pint bottle shall be determined as specified in 4.7.5.

4.7.8 Foam stabilizer salts. To test for iron salts, accurately weigh approximately 1.000 ± 0.0001 gram (g.) of the foam liquid into a 50-milliliter (ml.) beaker. Add 5 ml. of concentrated nitric acid, cover the beaker with a watchglass and boil down to about 2 ml. on a hot plate. Add another 5 ml. of concentrated nitric acid and again boil down to 2ml. Remove from the hot plate, cool and then wash down the watchglass and the sides of the beaker with about 5 ml. of distilled water. Add 2 ml. of perchloric acid (70 percent) and complete destruction of the organic matter by slowly boiling the solution to strong fumes of perchloric acid, keeping the beaker covered with a watchglass to avoid loss by spattering. Cool the solution, wash down the watchglass and beaker

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with about 25 ml. of distilled water, warm gently if necessary until a clear solution is obtained. Transfer the solution to a 100 ml. volumetric flask, cool and dilute to the 100 ml. mark. Add in sequence to another 100 ml. volumetric flask 40 ml. of 0.2M ammonium persulphate, 10 ml. potassium thiocyanate (40 percent), 4 ml. 4N nitric acid and a 10 ml. aliquot from the sample liquid. Dilute with distilled water to the 100 ml. mark. Mix thoroughly and immediately thereafter transfer a portion of this solution to a cuvette or sample tube of a photoelectric colorimeter and read the light transmission in the colorimeter using a 420 millimicron blue filter. Color comparison may also be made with Nessler tubes in the absence of a photoelectric colorimeter. Interpolate the results from a recent calibration curve prepared with standard concentrations of iron prepared in the same manner. Run a blank, using all the reagents and water in the volumes indicated in the foregoing procedure, deducting the value thus obtained from that of the sample figures.

4.7.9 Drainage and expansion. The drainage and expansion shall be determined using the equipment shown on figure 2 and the 6-GPM mechanical foam nozzle shown on figure 3 with the foam being generated at 100 p.s.i.g. The foam collector shall be placed with the backboard vertical. The base of the 6 GPM nozzle shall be about 3 inches above the top of the sieve with the tip of the nozzle 10 feet from the backboard of foam collector. Two pans shall be used to collect the draining liquid. The standard sieve receiving pan shall be used to collect the liquid draining during the foam application and prior to the weighing operation; the drainage pan, a metal pan at least 9 inches in diameter and 1-inch high, shall be used to collect the liquid draining during the weighing operation. Prior to test, (1) the total weight (W_1) of the sieve plus drainage pan shall be determined, (2) the weight of the receiving pan (W_3) shall be determined and (3) the drainage pan shall be positioned on the laboratory balance and the balance weights then set to indicate the weight of the drainage pan. Before the foam application, the sieve shall be wetted with water and then shaken to remove excess water. The sieve shall be nested in the receiving pan and both placed in the sieve retainer. Foam generation shall be started and after steady flow has been obtained, the foam stream shall be directed against the central portion of the backboard. Foam flow to the sieve shall be cut off by means of a swivel cover as soon as the sieve has been filled. Timing shall be started at this point. The sieve and the receiving pan shall be removed from the sieve retainer and any foam clinging to the outside of the combination shall be wiped off. The sieve and receiving pan shall then be separated. The receiving pan shall be placed aside for later weighing, and the sieve shall be supported above the drainage pan which was previously positioned on the balance. The sliding weight of the balance shall be advanced in 10-gram increments and the times noted at which the beam balances. The weighing shall continue until the total weight of drained liquid, in the drainage and receiving pans, shall be at least 25 percent of the total weight of the foam sample. Calculate the total weight of the foam sample (W_F) as follows:

$$W_F = (W_2 - W_1) + (W_4 - W_3)$$

where: W_1 = weight of sieve plus drainage pan, g.

W_2 = weight of sieve with foam plus drainage pan with drained liquid, g.

W_3 = weight of receiving pan, g.

W_4 = weight of receiving pan with drained liquid, g.

The total weight of the drained liquid is equal to the sum of the weights of the liquid in the receiving pan and drainage pan. By interpolation of the weight-time data obtained, determine the time in seconds required for drainage of liquid to 25 percent of the total weight of the foam sample ($W_F/4$).

Also, calculate the expansion as follows:

$$\text{Expansion} = \frac{V}{W_F}$$

Where V = volume of foam sample collected in sieve = 1650 ml.

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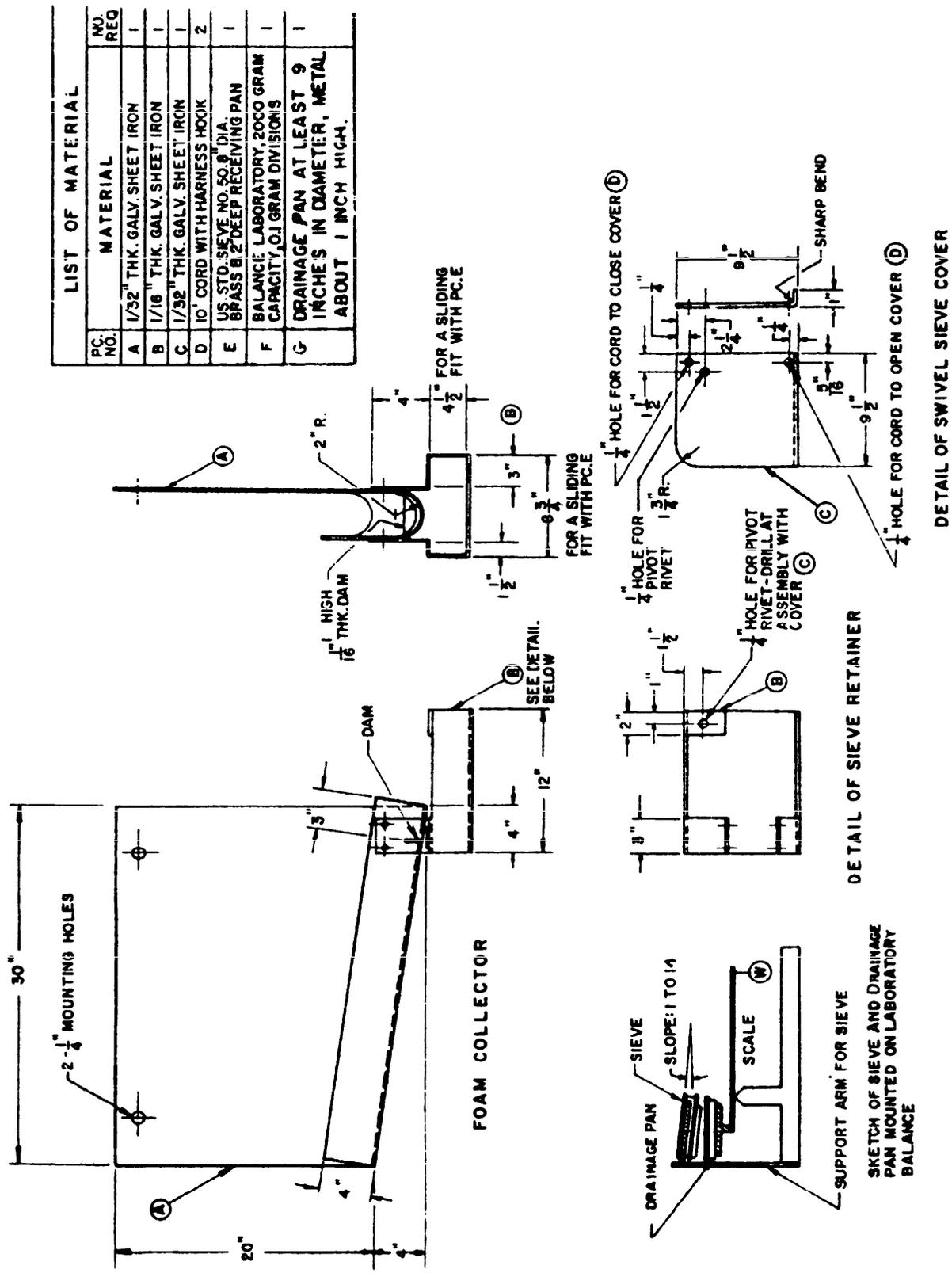


FIGURE 2. Foam drainage test apparatus.

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4.7.10 Resistance to dry powder attack. Seven gallons of regular grade of commercial gasoline conforming to VV-G-76 shall be placed in a 3-foot square by 5-inch deep open top steel tank containing a 1-inch thick fiberglass mat conforming to MIL-I-22023, type 1, class 4. The tank shall be positioned in a wind shielded area and the fuel in the tank shall be ignited. The fire shall be permitted to burn freely for 15 seconds prior to extinguishment with dry powder. The powder used for this test shall be a standard sample of potassium bicarbonate base dry chemical which shall be obtained by making application to the U. S. Naval Applied Science Laboratory (Code 938), Flushing and Washington Avenues, Brooklyn, New York 11251. The powder shall be applied from a fully charged 5-pound pressurized-cartridge type extinguisher. The extinguisher shall be operated with the discharge nozzle about 3 feet above the ground level and at a horizontal distance of 4 feet from the near edge of the test tank. The operator shall approach the fire with the nozzle directed at the base of the flames and moved from side to side as necessary to facilitate extinguishment of the fire. Powder application shall be continued, after extinguishment is effected, until complete discharge of the contents of the extinguisher. Care shall be taken to distribute powder uniformly over the entire fuel surface. One minute from the start of powder application, a premixed solution, consisting of 6 percent by volume of foam liquid in synthetic sea water (synthetic sea water for this test shall have the composition given in 4.7.3, except that fresh water may be substituted for distilled water) at 68°F. (20°C.), shall be discharged through a 6 GPM mechanical foam nozzle at 100 pounds per square inch gage (PSIG). The foam produced in this manner shall be directed against a vertical backboard which shall be positioned 10 feet from the tip of the nozzle and flush with the far edge of the test tank. The foam, upon striking the backboard, shall flow into the tank. Foam flow to the tank shall be halted after 1 minute, at which time the surface of the foam in the tank shall be leveled off. Five minutes after completion of foam application, an opening, 6-inches square, shall be made in the approximate center of the foam blanket and the exposed fuel surface shall be reignited. The reignited fire shall be permitted to burn for 5 minutes, after which the area of foam destruction or burnback shall be determined.

4.7.11 Fire test procedure.

4.7.11.1 Fire test. Foam liquid as received and also as treated in accordance with 4.7.7.2 shall be subjected to individual fire tests by discharging through a 6-gallon per minute mechanical foam nozzle (see fig. 3) supplied with both fresh water and synthetic sea water (synthetic sea water for this test shall have the composition given in 4.7.3, except that fresh water may be substituted for distilled water) at a line pressure of 100 pounds p.s.i.g. and at a temperature of about 68°F. (20°C.). The foam liquid shall be approximately the same temperature as the water. The tank used for the fire tests shall be of steel construction measuring 10-foot square by 3-foot deep. The nozzle shall be positioned in the middle of the windward side of the tank with the nozzle tip 16 inches directly above the top edge of the tank. The fire shall be permitted to burn freely for 60 seconds before foam application. The foam stream shall be directed across the fire to strike the approximate center of the back side of the tank, 12 inches above the fuel level, and shall be applied for a 5-minute period. Record the periods after start of foam application as required for the foam to spread over the tank, for the fire to be extinguished except for licks of flame at the edges of the foam blanket, and for complete extinguishment, as "coverage", "control", and "extinguishment", respectively. The foam liquid shall be inducted at a rate of 6.0 to 6.5 percent concentration by volume.

4.7.11.1.1 In addition to the requirements of 4.7.11.1, in testing the foam liquid concentrate, a minimum of 75 gallons of gasoline shall be floated on a sufficient quantity of water so that the fuel surface is 2 feet below the top edge of the tank. Twenty-five gallons of gasoline shall be added to the tank for each additional fire test. The gasoline used shall be a commercial grade motor fuel between 82 and 93 octane, conforming to VV-G-76.

4.7.11.1.2 The fire test shall be conducted when the wind velocity is below 10 miles per hour.

4.7.11.2 Sealability test. The lighted torch (see fig. 4) shall be passed continuously over the foam blanket starting 10 minutes after completion of foam application without touching or penetrating the foam. Fourteen minutes after completion of foam application, the lighted torch shall be applied over the foam blanket for 1 minute with the torch touching the foam blanket but not penetrating the blanket by more than 1/2 inch during the test.

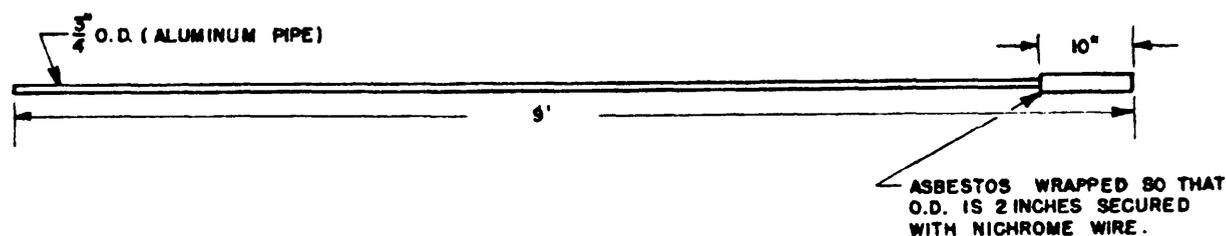


FIGURE 4.---Torch.

4.7.11.3 Burnback test. Fifteen minutes after completion of the test specified in 4.7.11.1 an opening, 6-inches square, shall be made in the approximate center of the foam blanket and the exposed fuel shall be reignited with a torch. The reignited fire shall be permitted to burn for 5-minutes. After the 5-minute burning period, the burnback area shall be determined.

4.7.12 Corrosion.

4.7.12.1 Corrosion to steel. Four uncoated steel samples, 1/2 inch by 3 inch by 1/16 inch, shall be scrubbed clean with a bristle brush under running water and dried. Weigh to an accuracy of 0.0005 grams and place cornerwise in 4-ounce capacity square sample bottles, each containing sufficient foam liquid concentrate to completely immerse each sample. Cap the bottles and keep in an oven maintained at $100 \pm 2^{\circ}\text{F}$. for 21 days. Remove samples and clean by means of scrubbing with a bristle brush. After cleaning, weigh the specimens and calculate the loss in weight as milligrams per square decimeter per day. Use the average weight loss from the four samples.

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4.7.12.2 Corrosion to aluminum. Four uncoated aluminum samples, 1/2 inch by 3 inches by 1/16 inch, shall be cleaned by immersing in nitric acid (specific gravity 1.42) for 2 minutes at room temperature. Scrub the samples with a bristle brush under running water, dry and weigh to an accuracy of 0.0005 grams. Place the sample cornerwise in 4-ounce capacity square sample bottles, each containing sufficient foam liquid concentrate to completely immerse each sample. Cap the bottles and keep in an oven maintained at $100 \pm 2^{\circ}\text{F}$. for 21 days. Remove samples and clean by means of scrubbing with a bristle brush. After cleaning, weigh the specimens and calculate the loss in weight as milligrams per square decimeter per day. Use the average weight loss from the four samples.

5. PREPARATION FOR DELIVERY

(Preparation for delivery requirements specified herein apply only to direct Government procurement. Preparation for delivery requirements between contractors and subcontractors shall be as specified in the individual order.)

5.1 Packaging.

5.1.1 Level A. The foam liquid shall be furnished in 5-gallon pails, 5-gallon nonmagnetic containers or 55-gallon drums as specified (see 6.2).

5.1.1.1 Five-gallon pails. The 5-gallon pails shall conform to type I, class 3 of PPP-P-704. Pails shall be provided with snap-on type closures. The pour openings shall have a minimum diameter of 1-1/2 inches. The entire exterior of the pail shall be thoroughly cleaned and shall be coated as described in 5.1.1.4. Wire handles shall be galvanized or protectively coated to resist corrosion.

5.1.1.2 Five-gallon nonmagnetic containers. When specified (see 6.2), the foam liquid shall be packaged in a nonmagnetic container consisting of a 5-gallon molded polyethylene drum with a fiber drum overpack (see figure 5).

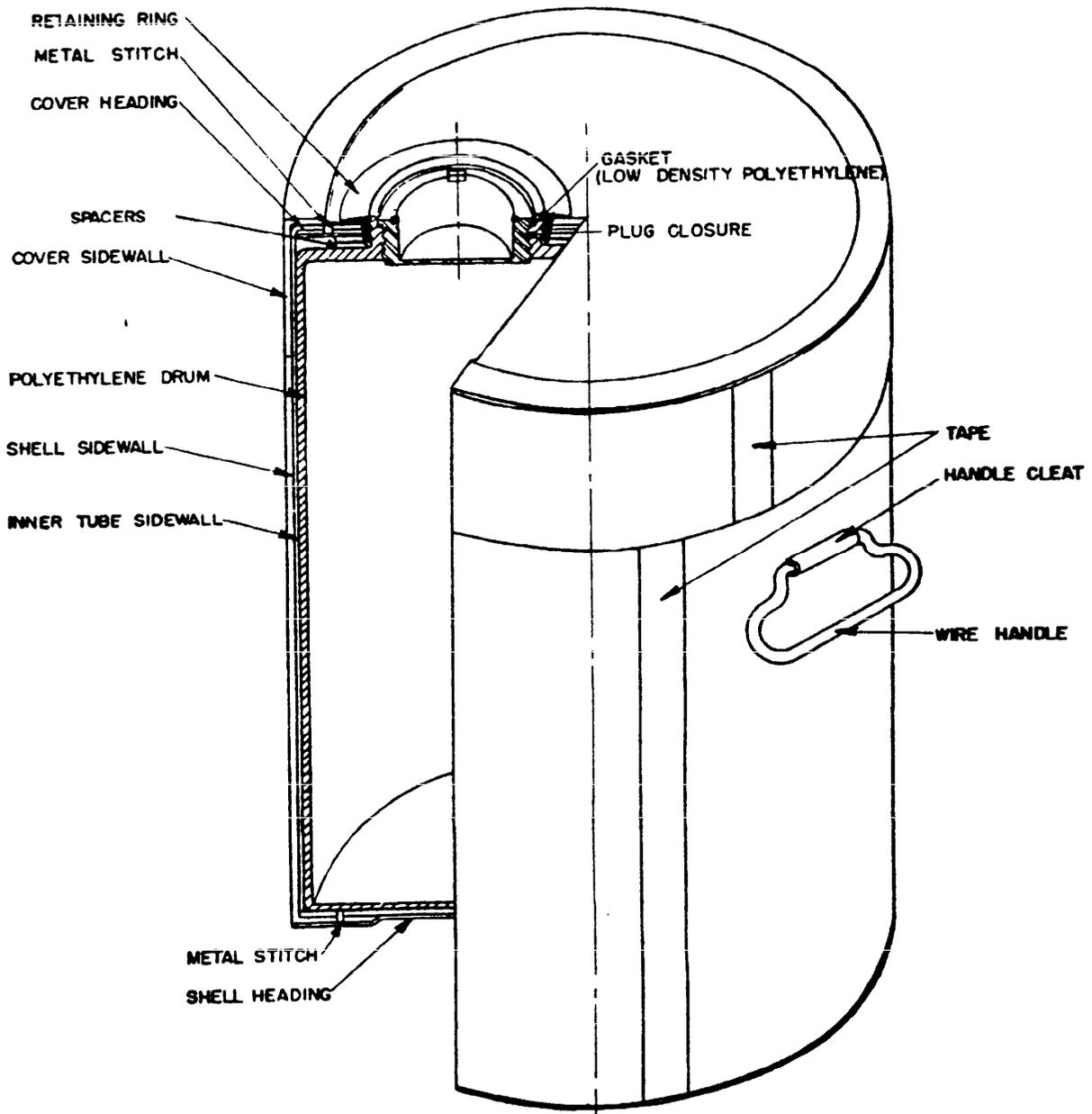


FIGURE 5. Five-gallon nonmagnetic container

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5.1.1.2.1 Polyethylene drum. The polyethylene drum shall be of one-piece seamless construction. The flange shall be molded as an integral part of the container. The polyethylene shall conform to type I, class L, grade 2 of L-P-390 to which a maximum of 5-percent polyisobutylene may be added for increased flexibility. The melt index shall not exceed 2.5 grams in 10 minutes. Dimensions shall be as follows:

| | |
|--------------------------|-----------------------------|
| Capacity | 5-gallons (+ 5 percent) |
| Height, body (overall) | 14-1/4 inches (+ 1/16 inch) |
| Diameter, body (overall) | 11 inches (+ 1/16 inch) |
| Wall thickness | 1/16 inch |

Flange:

| | |
|--------------------------|--|
| Height | 7/8 inch |
| Diameter (outside) | 3.280 inches |
| Threads-internal | Buttress type, 5 threads per inch |
| Threads-external | Glass Container Manufacturers Institute, type number 400 finish |
| Gasket | Low-density polyethylene |

5.1.1.2.2 Internal plug. The polyethylene plug shall be one-piece molded of high density polyethylene having a maximum melt index of 0.2 grams per 10 minutes. The plug shall fit the polyethylene flange snugly to insure a leakproof seal when subjected to the test specified in 5.1.1.2.3. The plug shall have a minimum 1-1/2-inch diameter center opening with a membrane seal capable of withstanding the leakage test specified in 5.1.1.2.3, yet be of wall thickness enabling quick puncture. The seal shall be designed not to break clean but to remain hinged after puncture. Closing and opening of plug shall be effected by a standard plug wrench.

5.1.1.2.3 Fiber drum. The fiber drum shall be snug fitting and shall be constructed of two convolutely wound units (outer unit water-resistant fiberboard) conforming to type I, grade A drums for 200-pound weight of contents of PPP-D-723 with heads (top and bottom) made of fiberboard. The drum shall be capable of passing the drop test specified for type III, grade A drums conforming to PPP-D-723. The drums shall be furnished with a polyethylene duplex barrier to the outside of the drum sidewall and to be outside of the cover sidewall and top heading. The outside lap seam of the drum and the cover sidewall shall be covered with a minimum 2-inch wide tape conforming to type I of PPP-T-66. The drum bottom shall be dipped in a water resistant molten resin and paraffin solution to a minimum depth of 1/2 inch. Water resistant adhesive shall be used in the construction of the sidewalls and top and bottom headings. Metal stitches for top and bottom headings shall be electrogalvanized, size 0.023-inch by 0.103-inch and spaced not to exceed 2-1/4-inch centers. A low-density polyethylene retaining ring shall be provided and made so as to fit the external threads of the flange snugly. The top or flange portion of the retaining ring shall be of a thickness so that a permanent heat seal to the top heading of the fiber drum cover can be performed. Spacers, fabricated of solid fiber and of sufficient thickness, shall be utilized for spacing the polyethylene drum insert and cover to give proper fit.

5.1.1.2.3.1 Cover. The cover shall be of the telescopic type. The top heading shall have a cutout of sufficient diameter to permit fitting and heat sealing of the retaining ring.

5.1.1.2.3.2 Handles. The drum shall be furnished with two, 3/16-inch diameter galvanized steel wire handles. The handles shall be placed on two sides of the drum at approximately 1/3 of its height from the top. The outer shell side-wall may be slotted to secure the handles.

5.1.1.2.3.3 Fifty-five gallon drums. The 55-gallon drum shall conform to type I of PPP-D-729. With cap seal applied to the bung openings, seals shall conform to paragraph 3.12.2 of PPP-D-729. Exterior coating of drums shall be as described in 5.1.1.2.3.4.

5.1.1.2.3.4 Exterior coating. Red enamel, color 11105 conforming to TT-E-489 shall be applied to exterior surfaces of pails or drums.

5.1.2 Level C. The foam liquid, in the quantity specified (see 6.2), shall be packaged in accordance with the supplier's standard practice.

5.2 Packing.

5.2.1 Level A. Unless otherwise specified (see 6.2), foam liquid packaged in 5, and 55-gallon containers, will require no overpacking.

5.2.2 Level B. Unless otherwise specified (see 6.2), foam liquid packaged in 5, and 55-gallon containers, will require no overpacking.

5.2.3 Level C. Foam liquid shall be packed for shipment in a manner which will insure acceptance by common carrier at the lowest rates and insure safe delivery to destination. Shipping containers shall comply to the Uniform Freight Classification Rules and regulations of other carriers as applicable to the mode of transportation.

5.3 Pallets. When specified (see 6.2), containers shall be palletized in accordance with MIL-STD-147.

5.4 Marking.

5.4.1 Military agencies. In addition to the marking specified in 3.15 and any special marking required by the contract or order, containers and palletized unit loads shall be marked in accordance with MIL-STD-129.

5.4.2 Civil agencies. Marking for shipment shall be in accordance with FED-STD-123.

6. NOTES

6.1 Intended use. The foam liquid is intended for use in mechanical foam generating equipment such as high capacity fog foam systems, fire fighting trucks or foam sprinkler systems for extinguishing fires in flammable liquids such as gasoline and oils.

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6.2 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Levels of packaging and packing required (see 5.1 and 5.2).
- (c) Size of container required (5.1.1 and 5.1.2).
- (d) When nonmagnetic container is required (5.1.1.2).
- (e) Whether overpacking is required (5.2.1 and 5.2.2).
- (f) Whether palletizing is required (5.3).

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 applicable Qualified Products List QPL-O-F-555 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 Engineering Center, Department of the Navy, Washington, D. C. 20360, 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 6.4).

6.4 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pa. 19120.

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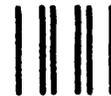
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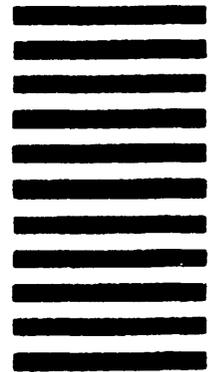


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