

JAN-S-732  
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SUPERSEDING  
U.S. Army  
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20 Nov. 1947  
Picatinny Arsenal  
Tentative Specification  
PXS-1186  
21 May 1945

## NATIONAL MILITARY ESTABLISHMENT SPECIFICATION

### SHELLAC SOLUTIONS (FOR USE IN AMMUNITION)

This specification was approved by the Departments of the Army, the Navy, and the Air Force for the procurement services of the respective Departments.

#### 1. SCOPE AND CLASSIFICATION

1.1 Scope. - This specification covers solutions of orange shellac suitable for use in ammunition.

#### 1.2 Classification.-

1.2.1 Types.- This specification covers two types of shellac solution, as specified (see 6.2):

- Type I - Dyed.
- Type II - Undyed.

1.2.2 Classes.- Type I shellac solution shall be furnished in two classes, as specified (see 6.2):

- Class 1 - For application by spraying.
- Class 2 - For application by swabbing.

#### 2. APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

2.1 Specifications. - The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification:

##### FEDERAL SPECIFICATIONS:

- TT-S-271 - Shellac (Orange) and Other Lacs.
- VV-L-791 - Lubricants, Liquid Fuels, and Related Products, Methods for Sampling and Testing.

##### JOINT ARMY-NAVY SPECIFICATION:

- JAN-A-463 - Alcohol, Ethyl (For Ordnance Use).

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U.S. ARMY SPECIFICATIONS:

- 50-0-1 - General Specification for Ammunition Except Small Arms Ammunition.<sup>1</sup>
- 100-2 - Standard Specification for Marking Shipments by Contractors.<sup>1</sup>

NAVY DEPARTMENT SPECIFICATION:

- General Specifications for Inspection of Material.<sup>2</sup>

(Army.- Copies of specifications should be obtained from the procuring agency or as directed by that agency. Both the title and identifying number or symbol should be stipulated when requesting copies.)

(Navy.- Copies of Federal specifications, National Military Establishment specifications, Joint Army-Navy specifications, and Navy Department specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington 25, D.C., except that activities of the Armed Forces should make application to the Supply Officer in Command, Naval Supply Center, Norfolk 11, Va. Both the title and identifying number or symbol should be stipulated when requesting copies.)

2.2 Other publications.- The following publications, of the issue in effect on date of invitation for bids, form a part of this specification:

BUREAU OF SUPPLIES AND ACCOUNTS PUBLICATIONS:

- Navy Shipment Marking Handbook.<sup>2</sup>

(Copies of the Navy Shipment Marking Handbook may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington 25, D.C., except that activities of the Armed Forces should make application to the Supply Officer in Command, Naval Supply Center, Norfolk 11, Va.)

INTERSTATE COMMERCE COMMISSION REGULATION:

- Regulations for Transportation of Explosives and Other Dangerous Articles, etc.

(Information as to the availability of Interstate Commerce Commission Regulations for Transportation of Explosives and Other Dangerous Articles, etc., may be obtained from the Interstate Commerce Commission, Washington 25, D.C.)

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<sup>1</sup>Applicable only to Army purchases.

<sup>2</sup>Applicable only to Navy purchases.

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## 3. REQUIREMENTS

3.1 Material.--The material used in the manufacture of shellac solutions shall conform to the applicable specifications listed in 2.1. In addition, the following materials shall be of the type or grade specified:

- Alcohol, ethyl - Joint Army-Navy Specification JAN-A-463, grade 5.
- Shellac, orange - Federal Specification TT-S-271, type I, grade A, B, or C.
- Aniline dye - A commercial grade of purple dye in powdered form.

3.2 Chemical and physical requirements.-- The shellac solutions shall conform to the chemical and physical requirements shown in Table I.

TABLE I. -- Chemical and physical requirements

	Type I		Type II
	Class 1	Class 2	
Color (max.)-----	Purple (see 4.4.1.1)		ASTM 5
Specific gravity 20°/4°C-----	0.860±0.005	0.925±0.005	-----
Nonvolatile matter, percent---	17.8±1.6	39.2±1.6	8.7±1.0
Wax in nonvolatile portion, percent (max.)-----	3.0	3.0	3.0
Ash in nonvolatile portion, percent (max.)-----	0.3	0.3	0.3
Iodine number of nonvolatile matter (max.)	18	18	18
Material insoluble in 98 to 99 percent normal butyl alcohol or ethylene glycol monoethyl ether, percent (max.)-----	1.0	1.0	1.0
Drying time:			
Set to touch, minutes(max)--	5	5	1
Dry hard, minutes (max.) ---	30	1,080	5
Appearance of dried film-----	Uniform and homogeneous		
Nature of volatile matter-----	Shall conform to the ethyl alcohol content requirement for grade 5 of Joint Army-Navy Specification JAN-A-463		

3.3 Workmanship.--

3.3.1 Type I.-- The dyed shellac solution shall be prepared as follows: Dissolve (cut) 10 parts by weight of shellac and 0.1 part by weight of dye in 68 parts by weight of alcohol. Filter the solution, or, allow the insoluble material to settle out and decant the supernatant liquid. To prepare class 1 solution, evaporate the clear solution until it has a specific gravity of 0.860 ±0.005 at 20°C.

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To prepare class 2 solution, evaporate the clear solution until it has a specific gravity of  $0.925 \pm 0.005$  at 20°C.

3.3.2 Type II.- The undyed shellac solution shall be prepared as follows: Dissolve (cut) 8 gm. of the shellac in each 100 ml. of alcohol allowing the insoluble material to settle out for at least 48 hours. Decant the supernatant liquid.

#### 4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Size of lots.- Maximum 1,000 gallons.

4.2 Sampling.- Take, at random, a single container representative of the lot. Label the container to show the name of the material, plant, purchase order, and number of gallons in the lot. Make all acceptance tests on this sample.

4.3 Inspection.- Inspection shall be made in accordance with the requirements of U.S. Army Specification 50-0-1 and shall be made at the point of delivery unless otherwise specified in the contract or purchase order.

4.4 Tests.- Tests shall be made in accordance with the following:

4.4.1 Color.-

4.4.1.1 Type I.-

4.4.1.1.1 Preparation of color standards.- Prepare standard A by diluting a mixture of 10 ml. of 0.10 N potassium permanganate solution and 10 ml. of a saturated solution of ferric ammonium sulfate to 50 ml. with distilled water and mixing thoroughly. Prepare standard B by diluting a mixture of 4 ml. of 0.10 N potassium permanganate solution and 10 ml. of a saturated solution of ferric ammonium sulfate to 50 ml. with distilled water and mixing thoroughly.

4.4.1.1.2 Procedure.-Transfer a weighed portion of approximately 1.0 gm. of class 1 or 0.5 gm. of class 2 material to a 100-ml., glass-stoppered graduated cylinder. Dilute the sample in the graduate with 95-percent ethyl alcohol so that the diluted solution contains 0.33 gm. of nonvolatile matter per 100 ml. of solution. The volume to which the sample shall be diluted may be calculated by multiplying the weight of sample by the percent nonvolatile matter as determined in 4.4.3, and dividing the product by 0.33. Mix the dilute solution thoroughly and transfer a 50-ml. portion to a 50-ml. Nessler tube. Compare the color of the dilute solution, when viewed by transmitted diffuse white light, with the colors of standards A and B (see 4.4.1.1.1) which are contained in similar 50-ml. Nessler tubes. To pass

the comparison test, the solutions shall be approximately the same shade of purple as the color standards, but lighter than standard A and darker than standard B.

4.4.1.2 Type II.- Determine the color of the undyed shellac solution in accordance with method 10.2 of Federal Specification VV-L-791.

4.4.2 Specific gravity.- Determine the specific gravity of the sample of the dyed shellac solution at 20°/4° C. by means of a Westphal balance or pycnometer.

4.4.3 Nonvolatile matter.-By means of a weighing pipet, transfer a weighed portion of approximately 2.5 gm. of the sample for type I, class 1 material, 1.2 gm. for type I, class 2 material, and approximately 5 gm. for type II material to a tared flat-bottomed metal dish approximately 8 cm. in diameter. Heat the dish and contents at 105° + 2°C. for 3 hours, cool in a desiccator and weigh. Calculate the increase in weight as percent nonvolatile matter.

4.4.4 Wax.-

4.4.4.1 Reagents.-

4.4.4.1.1 Ninety-five percent alcohol.- Either 95 percent ethyl alcohol or specially denatured alcohol formulas SD-1 or SD-30 shall be used. (See 6.3).

4.4.4.1.2 Chloroform.- Use redistilled chloroform in order that the solvent shall not leave a nonvolatile residue.

4.4.4.1.3 Filter cel.- Extract the filter cel with chloroform before using.

4.4.4.2 Procedure.- Transfer weighed portions of approximately 56 gm. of type I, class 1, approximately 25 gm. of type I, class 2, and approximately 115 gm. of type II material, to 200-ml. tall-form beakers. Evaporate the solutions in the beakers. Evaporate the solutions in the beakers to volumes of approximately 25 ml., conducting the evaporation on a steam bath. Add 2.5 gm. of sodium carbonate and 150 ml. of hot distilled water. Immerse the beaker in a steam or boiling-water bath, and stir the contents of the beaker until the shellac is in solution. Cover the beaker with a watch glass and allow to remain in the bath for 2 to 3 hours more without agitation. Remove the beaker from the bath and place it in cold water. The wax will come to the surface of the liquid in the beaker where it will solidify as a layer or float as small hard particles according to the amount of wax present. Prepare a Buchner

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funnel, which shall have an inside diameter of 2.25 to 3.5 inches, as follows: Cover the bottom of the Buchner funnel with a disk of filter paper; mix 1 gm. of filter cel (see 4.4.4.1.3) with water and pour the mixture onto the filter paper, applying suction to remove the water. Add 0.5 gm. of filter cel to the shellac solution and filter the solution through the prepared Buchner funnel with the aid of suction. Transfer any insoluble matter in the beaker to the funnel and wash the insoluble matter thoroughly with water. Pour a few ml. of alcohol (see 4.4.4.1.1) on the filter containing the insoluble matter in order to facilitate drying. Dry the filter at  $40^{\circ} \pm 2^{\circ}\text{C.}$ , fold and wrap in another filter paper, tie or bind with thin copper wire and then extract with chloroform (see 4.4.4.1.2) for 2 hours in a suitable continuous extraction apparatus. Transfer the chloroform extract to a tared evaporating dish, rinsing the extraction flask with several small portions of chloroform. Evaporate the chloroform with the combined chloroform extract and rinsings on a steam bath. Dry the dish and wax residue at  $105^{\circ}$  to  $110^{\circ}\text{C.}$  for 1 hour, cool in a desiccator and weigh, repeating these operations until a weight constant to within 10 mg. is obtained. Calculate the increase in weight as percent wax in the nonvolatile portion as follows:

$$\text{Percent wax in the nonvolatile portion} = \frac{100A}{0.01BW}$$

where

A = gm. increase in weight

W = gm. of sample

B = percent nonvolatile matter as determined in 4.4.3.

4.4.5 Ash.- Transfer an accurately weighed portion of the sample, containing approximately 5 gm. of nonvolatile matter to a tared porcelain or silica crucible. Evaporate most of the alcohol on a steam bath. Ignite the residue at a low heat, not exceeding dull redness, using a muffle furnace if available, until the ash is free from carbon. If a carbon-free ash cannot be obtained in this manner, extract the charred mass with hot water, collect the insoluble residue on an ashless filter paper, ignite the filter paper and contents in the crucible previously used until all carbon is consumed. Add the water extract, evaporate the solution to dryness and heat the crucible and residue to dull redness. Cool the crucible and contents in a desiccator and weigh. Calculate the increase in weight as percent ash in the nonvolatile portion as follows:

$$\text{Percent ash in the nonvolatile portion} = \frac{100A}{0.01BW}$$

where

A = gm. increase in weight

W = gm. of sample

B = percent nonvolatile matter as determined in 4.4.3

#### 4.4.6 Iodine number of nonvolatile matter.-

##### 4.4.6.1 Reagents.-

4.4.6.1.1 Acetic acid.-The glacial acetic acid used in determination of iodine number shall be checked for freedom from reducing impurities and for a minimum melting point of 14.8°C. (equivalent to an assay of 99-percent acetic acid). Should the melting point be higher than 14.8°C., it shall be reduced to 14.8° C. by the addition of small quantities of water with subsequent determination of the melting point to insure a final melting point of 14.8°C. (See 6.4.) The following check test methods shall be used:

4.4.6.1.1.1 Reducing impurities.- Dilute 2 ml. of the acetic acid with 10 ml. of distilled water. Add 0.1 ml. of N/10 potassium permanganate solution and maintain at a temperature  $24^{\circ} \pm 3^{\circ}\text{C}$ . Note whether the acetic acid passes the test as evidenced by the pink color in the solution not being discharged in 2 hours.

4.4.6.1.1.2 Melting point.- Fill a 6-inch test tube about two-thirds full of the acetic acid and insert an accurately calibrated thermometer to the test tube by means of a cork stopper. An engraved stem thermometer calibrated between 10° and 65°C. in 0.2°C. intervals and with the 0°C. point marked on the stem is recommended; the thermometer should have an auxiliary reservoir at the upper end, a length of about 39 cm. and a diameter of about 6 mm., and should be certified by the National Bureau of Standards (See 6.5.) The amount of acid in the test tube should be at least double the quantity required to cover the bulb of the thermometer when the bottom of the latter is 0.5 inch from the bottom of the test tube. Suspend the test tube within a larger test tube by means of a cork. Cool the acid by immersing the assembly in ice water until the temperature of the acid is 10°C. Withdraw the assembly from the ice bath and stir the acid rather vigorously for a few moments in order to cause the supercooled liquid to partially crystallize and give a mixture of liquid and solid acid. Allow the mixture to warm, taking thermometer readings every 15 seconds. Note the temperature at which the thermometer readings remain constant for at least 2 minutes. Make any necessary stem and bore corrections and take this corrected temperature as the melting point of the acetic acid.

4.4.6.1.2 Chloroform.- Use U.S.P. grade, acetone-free, chloroform.

4.4.6.1.3 N/10 sodium thiosulfate solution.- Dissolve pure sodium thiosulfate in distilled water that has been well boiled to free it from carbon dioxide, using 24.83 gm. of crystallized sodium thiosulfate per 1,000 ml. of solution. Add 0.1 gm. of sodium carbonate per 1,000 ml. of solution to stand overnight before standardization. Standardize the solution, preferably with resublimed iodine or potassium iodate. (See 6.6.) Keep the solution in a stock bottle provided with a guard tube filled with soda lime.

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4.4.6.1.4 Starch solution.- Make a paste of 0.2 gm. of soluble (potato) starch in cold water and pour into 100 ml. of boiling water. Boil the mixture for 5 minutes, cool and bottle.

4.4.6.1.5 Potassium iodide solution.- Dissolve potassium iodide, free from iodates, in distilled water, using 10 gm. of potassium iodide per 90 ml. of water.

4.4.6.1.6 Wijs solution.- Dissolve 13 gm. of resublimed iodine in one liter of acetic acid (see 4.4.6.1.1), heating gently if necessary. Cool the solution and determine its strength by titration with N/10 sodium thiosulfate solution (see 4.4.6.1.3) as follows: Transfer an accurately measured portion of 20 ml. of the iodine-acetic acid solution to a 300-ml. Erlenmeyer flask, add quickly 15 ml. of potassium iodide solution (see 4.4.6.1.5) and titrate immediately with N/10 sodium thiosulfate solution, allowing the solution to run in rapidly while shaking the flask vigorously until the solution in the flask assumes a straw color; add 15 ml. of freshly prepared starch solution (see 4.4.6.1.4) and slowly finish the titration. Set aside 50 to 100 ml. of the iodine-acetic acid solution. Introduce dry chlorine gas into the remainder of the solution until a characteristic color change occurs, indicating that the halogen content of the solution has been approximately doubled. Determine the halogen strength of the chlorinated solution by titration with N/10 sodium thiosulfate solution in a manner similar to that described above for determining the strength of the iodine acetic acid solution. If the halogen content of the iodine-acetic acid solution has been more than doubled, reduce it by adding the requisite quantity of the iodine-acetic solution. The final solution should contain an amount of iodine and chlorine corresponding to iodine-monochloride; a slight excess of iodine does no harm, but any excess of chlorine over that required theoretically for iodine-monochloride must be avoided. As an example, if the titration of 20 ml. of the original iodine-acetic acid solution required 22 ml. of N/10 sodium thiosulfate solution, then 20 ml. of the finished Wijs solution should require between 43.5 and 44 ml. of the thiosulfate solution.

4.4.6.2 Procedure.- Transfer approximately 5 ml. of the sample by means of a pipet to a flat-bottomed glass or porcelain dish at least 8 cm. in diameter. Allow the sample to spread evenly over the bottom of the dish. Heat the dish and contents at 85° to 90°C, for 1-1/2 hour. Scrape the residue from the dish, using a sharp knife blade, and discard any chips or thick pieces. At the discretion of the analyst, the dry shellac may be obtained by the following alternate method: Pour a thin film of the sample on a clean glass plate approximately 6 by 10 inches and allow the material to drain for 1 hour, holding the plate in a vertical position; place the plate in a horizontal position in an air oven at 43° + 5°C. for 18 hours; cool and scrape off the dry shellac with a sharp razor blade. Transfer an accurately weighed portion of .020 + 0.01 gm. of the dry shellac to a 300-ml. dry bottle made of clear glass and provided with a ground-glass stopper. Add 20 ml. of acetic acid (see 4.4.6.1.1) and warm the mixture gently on a steam bath until all of the sample except the wax is dissolved. A pure shellac is rather difficultly soluble; solution is quicker according to the proportion of rosin present. Add 10 ml. of chloroform (see 4.4.6.1.2) and cool the solution to 21.5° to 22.5° C. Allow the bottles to stand half immersed in a shallow pan of water, well insulated or equipped with a



suitable thermostat, for at least 30 minutes at 21.5° to 22.5°C., before adding the Wijs solution. (See 4.4.6.1.6) Add 20 ml. of Wijs solution (which shall have a temperature of 21.5° to 22.5°C) from a pipet having a rather small delivery aperture (delivery time, approximately 30 seconds). Close the bottle, immerse it again in the pan of water, and note the time. Keep the bottle and contents immersed in the bath for 1 hour, swirling the contents of the bottle occasionally. After exactly 1 hour, add 10 ml. of freshly prepared potassium iodide solution (see 4.4.6.1.5) washing into the bottle any Wijs solution which may be on the stopper of the bottle. Add 120 ml. of water and 40 ml. of chloroform and titrate the solution immediately with N/10 sodium thiosulfate solution (see 4.4.6.1.3), allowing the solution to run in rapidly while shaking vigorously until the water solution assumes a light brown color. Now add 15 ml. of freshly prepared starch solution (see 4.4.6.1.4) and slowly finish the titration. The endpoint is sharp as the aniline dye and the reaction products of shellac remain dissolved in the chloroform; disregard any blue coloration which may return after 0.5 minute or so. Run a blank determination at the same time on the reagents. Calculate the iodine number of the nonvolatile matter in the shellac solution as follows:

Iodine number of nonvolatile matter =

$$\frac{12.69 (V - v)N}{W}$$

where

V = ml. of sodium thiosulfate solution required in titration of blank.

v = ml. of sodium thiosulfate solution required to titrate excess halogen in solution containing sample.

N = normality of sodium thiosulfate solution

W = gm. of nonvolatile matter taken for test

The analyst should run in parallel a sample of pure shellac of known iodine number as a check upon the reliability of the Wijs and other reagents; the iodine number thus should be within  $\pm 0.5$  of the known iodine number.

4.4.7 Material insoluble in 98 - to 99-percent normal butyl alcohol or thylene glycol monoethyl ether.-

4.4.7.1 Apparatus.- The apparatus shall consist of a crucible, a carbon filter funnel and a heating coil. (see fig. 1) The crucible shall be a Jena glass (or equal) filter crucible having a capacity of 30 ml. with a fritted-glass filter disk having a thickness of 3 mm. and a porosity of 5 to 7 (average diameter of pores 35 to 40 microns.) The carbon filter funnel shall be made of heat-resistant glass and shall fit the crucible. The heating coil shall be made of 3 mm. diameter copper tubing and shall be of such size and shape that the filter crucible and the large part of the carbon filter funnel will fit snugly within it; the outside shall be insulated with sheet asbestos.

4.4.7.2 Preparation of the filtering unit.- Cut a disk of filter paper (Whatman No. 41 or equivalent) to fit inside the crucible and then place the

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disk on top of the glass filter. Introduce upon the filter paper, in the customary manner, an asbestos mat approximately 3 mm. in thickness. Dry the prepared crucible at 105° to 110°C for 1 hour, cool in a dessicator and weigh. Reheat the crucible at 105° to 110°C for 0.5 hour, cool in a dessicator and weigh, repeating these operations if necessary until constant weight is attained. Attach the tared crucible to the filter funnel using thin rubber tubing to form an airtight connection. Place the combined filtering unit within the heating unit, attach to a suction flask and pass a current of steam through the coil of the heating unit.

4.4.7.3 Procedure.- Transfer an accurately weighed portion of the sample, containing approximately 5 gm. of nonvolatile matter, to a 250-ml. beaker. Add 75 ml. of the solvent, heat the solution in the beaker to the boiling point on a hot plate and boil gently for 5 minutes to insure complete solution of soluble matter. Pour approximately 10 ml. of the boiling solvent from a wash bottle into the heated crucible. Apply gentle suction and immediately decant the boiling shellac solution into the crucible, retaining as much of the insoluble matter as possible in the beaker. Wash the insoluble residue successively with three 20-ml. portions of the solvent, boiling the solution on the hot plate for approximately 1 minute before each filtration. Finally, transfer the insoluble material from the beaker to the crucible with a stream of the boiling solvent from a wash bottle, using a rubber-tipped stirring rod to aid in the transfer, if necessary. Wash down the inner walls of the crucible with the boiling solvent. The total volume of the solvent used should be approximately 175 ml. It is advisable to keep the crucible covered with a small watch glass at all times, except when actually transferring the solution from the beaker to the crucible or when washing down the inside walls of the crucible; by this procedure a higher temperature is maintained within the crucible. Allow the crucible to remain within the heating coil, with the suction on, for a few minutes in order to suck it as dry as possible. Remove the crucible and wash the outside with boiling solvent. Dry the crucible and contents for one hour at 105° to 110°C., cool in a desiccator and weigh. Calculate the increase in weight as percent insoluble matter in the nonvolatile portion as follows:

$$\text{Percent insoluble matter} = \frac{100A}{0.01BW}$$

in nonvolatile portion

where

A = gm. increase in weight

B = percent nonvolatile matter as determined in 4.4.3

W = gm. of sample

4.4.8 Drying time.- Flow a portion of the sample on a clean glass plate which shall be approximately 6 by 4 inches, and place the coated plate in nearly vertical position in a well-ventilated room but not in the direct rays of the sun. The temperature of the room shall be between 21° and 32°C. Test the film on the plate at points not less than 1 inch from the top or side edges of the film. Consider the sample to have set to touch when gentle pressure of the finger on the film reveals a tacky condition but none of the film adheres to the

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finger. Consider the sample to have dried hard when the pressure that can be exerted on the film by the thumb, when the plate is pressed between the thumb and forefinger, does not move the film or leave a mark which remains noticeable after the spot is lightly polished.

4.4.8.1 Retest for drying time.-- If the sample fails to meet the set to touch and/or dry hard requirements specified in 3.2, then two additional tests shall be run on different days; and if the sample fails to meet the drying time requirements in both of these additional tests, the material shall be considered unsatisfactory. In cases where different laboratories fail to agree on the drying test, due to different atmospheric conditions, and umpire tests become necessary, such tests shall be made in a well-ventilated room maintained at a temperature of  $25^{\circ} \pm 2^{\circ}\text{C}$ . and relative humidity of  $50 \pm 4$  percent.

4.4.9 Appearance of dried film.-- Prepare a film of the sample as specified in 4.4.8 and allow the film to dry for 24 hours under the conditions specified therein. Note whether the film is uniform and homogeneous in appearance.

4.4.10 Nature of volatile matter.-- Transfer a portion of 50 to 100 ml. of the sample to a 250-300-ml. wide-neck Erlenmeyer flask and add several glass beads. Fit a two-hole rubber stopper to the flask, the stopper holding a thermometer and a short bent glass tube. Connect the bent glass tube by means of rubber tubing to a 12-inch Liebig condenser set downward for distillation (the diameter of the inner tube of the condenser shall be equal to the diameter of the ends of the condenser and to the diameter of the bent glass tube). Immerse the flask deeply in an oil or wax bath heated to  $90^{\circ}\text{C}$ . Gradually raise the temperature of the bath during the first hour to  $120^{\circ}\text{C}$ . and continue the distillation at this temperature for 2 hours. Determine the specific gravity of the distillate at  $20^{\circ}/4^{\circ}\text{C}$ . by means of a calibrated hydrometer, Westphal balance or pycnometer. Obtain the percentage by volume of ethyl alcohol, in the distillate by reference to tables. (See 6.7.) If the presence of solvents, other than grade 5 ethyl alcohol is suspected, or indicated, in the course of testing, then such tests shall be made as are considered necessary to confirm the presence of such solvents in the volatile portion of the sample.

## 5. PREPARATION FOR DELIVERY

5.1 Packing.-- Unless otherwise specified, the shellac solutions shall be packed in standard commercial containers of 1 gallon capacity and so constructed as to insure acceptance by common or other carriers for safe transportation, at the lowest rate, to the point of delivery. The containers shall be of such construction as to prevent contamination by foreign materials.

5.2 Marking.-- Shipments shall be marked to insure safe handling as required by Interstate Commerce Commission Regulations for Transportation

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of Explosives and Other Dangerous Articles, etc. In addition shipments for the Army shall be marked in accordance with U.S. Army Specification 100-2; for the Navy, in accordance with the requirements of the Navy Shipment Marking Handbook. Any special marking shall be as specified in the contract or order.

## 6. NOTES

6.1 Intended use.- The shellac solutions covered by this specification is intended for use in fuzes.

6.2 Ordering data.- Invitations for bids and contracts or orders should specify the title, number, and date of the specification, and the type and class of shellac solution required. (See 1.2.1 and 1.2.2.)

6.3 A description of the various specially denatured alcohol formulas is contained in Appendix to Regulations No. 3, Formulae for Completely and Specifically Denatured Alcohol issued by the U.S. Treasury Department, Bureau of Internal Revenue.

6.4 Van Nostrand's Chemical Annual, 7th Issue, 1934, page 613 presents tables of quantities of water to be added to glacial acetic acid to attain various melting points.

6.5 ASTM Thermometer 360-42, Titer test as described in ASTM designation E1-46, is suitable for the purpose intended in 4.4.6.1.1.2.

6.6 A description of the standardization of sodium thiosulfate solution with resublimed iodine or potassium iodate is contained in Treadwell-Hall's Analytical Chemistry, 9th Edition, Volume II, pages 587 and 589.

6.7 Tables giving percent by volume of ethyl alcohol in relation to specific gravity are found in the Official and Tentative Methods of Analyses of the Association of Official Agricultural Chemists, 2nd Edition, pages 464-477.

NOTICE.- When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have furnished, formulated, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian: ARMY-ORDNANCE DEPARTMENT      Other interest: NAVY-OS.

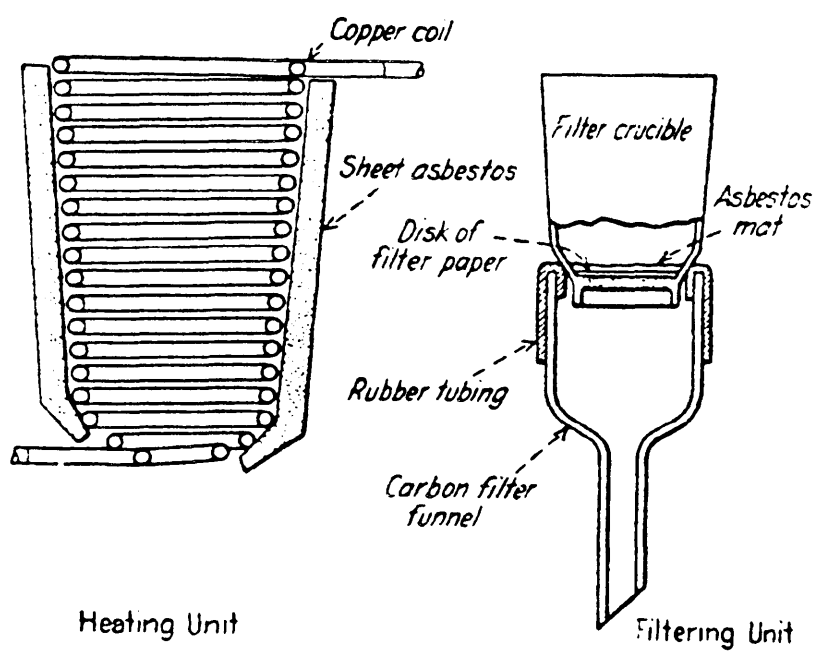


FIGURE 1.—Apparatus for insoluble matter test.

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-M004	
<b>INSTRUCTIONS</b>			
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			
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> 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?			
<input type="checkbox"/> YES <input type="checkbox"/> 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

FOLD

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DEPARTMENT OF THE NAVY

POSTAGE AND FEES PAID  
NAVY DEPARTMENT

                      
OFFICIAL BUSINESS

COMMANDING OFFICER  
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