MIL-V-173C
5 November 1969
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MILITARY SPECIFICATION

VARNISH, MOISTURE-AND-FUNGUS-RESISTANT (FOR TREATMENT OF COMMUNICATIONS, ELECTRONIC, AND ASSOCIATED EQUIPMENT)

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers one type of moisture-and-fungus-resistant varnish consisting of a para-phenyl phenol-formaldehyde resin in combination with tung oil and suitable solvents which has been made fungistatic by the addition of 7.0 ± 1.0 percent salicylanilide or one percent copper 8-quinolinolate, for the treatment of assembled communications, electronic, and associated electrical equipment.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Federal

L-P-513	Plastic Sheet, Laminated, Thermosetting, Paper-Base Phenolic Resin
TT-P-143	Paint, Varnish, Lacquer, and Related Materials, Packaging, Packing, and Marking Of
TT-R-271	Resin, Phenol-Formaldehyde, Para-Phenyl
TT-T-306	Thinner, Synthetic-Enamel
TT-T-548	Toluene, Technical
TT-T-775	Tung Oil, Raw (China Wood) (For Use in Organic Coating)
TT-X-916	Xylene, (For Use in Organic Coating)

STANDARDS

Federal

Fed. Test Method Std Nr. 141	Paint, Varnish, Lacquer, and Related Materials; Methods of Inspection, Sampling, and Testing

Military

MIL-STD-129 Marking for Shipment and Storage Palletized Unit Loads (40" X 48" 4-way Partial and 4-way Pallets)

(Copies of specifications and standards required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

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

Official Classification Committee

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Official Classification Committee, One Park Avenue, at 33rd Street, New York, N.Y. 10016.)

American Society for Testing Materials (ASTM)

D295-58 Testing Varnished Cotton Fabrics and Varnished Cotton Fabric Tapes Used for Electrical Insulation

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

Air Pollution Control District-County of Los Angeles, Calif, Rule 66

(Copies of the document may be obtained from Air Pollution Control District, County of Los Angeles, 434 San Pedro Street, Los Angeles, Calif 90013.)

3. REQUIREMENTS

3.1 Material (See Table II).

3.1.1 Volatile content. The volatile portion of the varnish shall be any suitable solvent or solvents: however, methanol (wood alcohol), benzene (benzol), chlorinated hydrocarbons, or other highly toxic solvents shall not be used. The solvent shall be of such nature that it will not constitute a hazard to personnel applying the varnish.

3.1.2 Oil. The oil shall be tung oil conforming to Specification TT-T-775.

3.1.3 Resin. The resin shall be para-phenyl phenol-formaldehyde resin conforming to Specification TT-R-271.

3.1.4 Fungistatic agent. The varnish shall be made fungistatic by the addition of salicylanilide, or, when specified, copper 8-quinolinolate.

3.2 Formulation and characteristics of the liquid varnish. The formulation and characteristics of the liquid varnish shall be as specified in Table I.

3.2.1 Low-temperature stability. When tested as specified in 4.5.1.4, the varnish shall remain clear, except when the fungistatic agent is copper 8-quinolinolate.

3.2.2 Storage stability. When tested as specified in 4.5.1.5, the varnish shall be no darker than Gardner Color Standard Number 16, shall not increase more than one letter (0.20 poise) in viscosity, and shall not corrode the container. The Gardner Color Standard Number does not apply when the fungistatic agent is copper 8-quinolinolate. There shall be no sedimentation and separation which cannot be redispersed by stirring, and which will not remain dispersed after standing 30 minutes.

3.3 Application and film characteristics (See Table II). The varnish shall be suitable for application by spraying, dipping, or brushing. When thinned to suitable spray consistency, the varnish shall spray in such a manner that the dried film will have a smooth, clear finish, (for salicylanilide varnish only) free from defects such as bubbles or filaments. The dry film shall form a continuous, homogeneous, transparent coating (for salicylanilide varnish only).

3.3.1 Dielectric strength. When tested as specified in 4.5.2.1, the dielectric strength of the film shall be not less than 750 volts root mean square per mil.

3.3.2 Resistance to thermal shock and bending. When tested as specified in 4.5.2.2, the film shall show no evidence of cracking, splintering, or tackiness.

3.3.3 Insulation resistance. When tested as specified in 4.5.2.3, the insulation resistance of the set of coated specimens shall be at least ten times that of the uncoated specimens.

3.3.4 Fungus resistance. When tested as specified in 4.5.2.4, the dried film shall resist the growth of fungi.

3.4 Rule 66. The varnish shall comply with the applicable provisions of Air Pollution Control District-County of Los Angeles, California, Rule 66 (see 4.6).

TABLE I. Formulation and Characteristics of the Liquid Varnish

Formulation and Characteristics	Requirements	Method (Table or Para)
Formulation:	3.2	Table II and 4.5.1
Nonvolatile content, calculated on total weight of varnish exclusive of fungistatic agents by weight, minimum, percent:	50	
Oil, percentage of nonvolatiles, by weight, percent.	55 ± 2	
Resin, percentage of nonvolatiles, by weight, percent	Balance	
Salicylanilide content, percent[1]	7.0 ± 1.0	4.5.1.1
Copper 8-quinolinolate, percent[1]	1.0 + .25 -0	4.5.1.2
Characteristics:	3.2	
Viscosity at 23° ± 1.1°C (73.4° ± 2°F):		
Gardner tubes[2]		
Poises	0.85 to 1.25, incl	Table II and 4.5.1
Skinning:		
As received	Negligible	
After 48 hours in sealed container	Negligible	
Ash, maximum, percent	0.25	
Drying time:		4.5.1.3
Set-to-touch, maximum, minutes	60	
Free from after-tack, maximum, hours	5	
Rosin and rosin derivatives	Negative	Table II and 4.5.1
Color (as received)[3,4]	No darker than 12	
Low-temperature stability	(See 3.2.1)	4.5.1.4
Storage stability	(See 3.2.2)	4.5.1.5

[1]Both salicylanilide and copper 8-quinolinolate content are calculated by weight on nonvolatile portion exclusive of fungistatic content.

[2]Procedure Band Gardner Tubes C to E, inclusive, shall be used.

[3]Does not apply when copper 8-quinolinolate is present.

[4]Gardner color standard.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.

4.1.1 Supplier. 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 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 supplies and services conform to prescribed requirements.

4.2 Classification of inspection. The examination and testing of varnish shall be classified as follows:

a. Quality conformance inspection (see 4.4.1).

b. Inspection of preparation for delivery (see 4.7).

4.3 Inspection conditions and methods.

4.3.1 Conditions. Unless otherwise specified herein, all inspection shall be made in a laboratory maintained at 23° ± 1,1°C (73.4° ± 2°F) and 50 ± 4 percent relative humidity. All samples of varnish or varnish film shall be conditioned for not less than three hours at these conditions before inspection is begun.

4.3.1.1 Preparation of panels. Unless otherwise specified herein and 6.2, panels shall be prepared as follows: Panels shall be pieces of thoroughly cleaned, smooth sheet copper approximately 3.5 inches wide, 8.0 inches long, and 0.005 inch thick. The consistency of the varnish may be changed by addition of thinner conforming to Specification TT-T-306, but not by evaporation. Each panel shall be dipped into the varnish twice, once in the reverse direction so as to give a more uniform thickness of coating, and shall be withdrawn at a uniform rate by mechanical means. The consistency and the withdrawal rate of the panels shall be adjusted so that the final film thickness on one side of the panel shall be not less than 0.0015 and not more than 0.0020 inch. Thickness measurements shall be made on each panel by means of a dial-type micrometer graduated to 0.0001 inch. Care shall be taken, before dipping the panels, that the varnish has been in the dipping tank for a sufficient length of time to be free from air bubbles. Between dippings, panels shall be dried or partially dried for any suitable period (usually about 15 minutes but not to exceed one hour) which will result in a smooth, clear film (for salicylanilide varnish only) upon multiple coating. The final coat shall be dried for 48 hours. The panels shall be dried in the same vertical position in which they were dipped, in an essentially dust-free chamber maintained as specified in 4.3.1.

4.4 Quality conformance inspection.

4.4.1 Sampling and inspection. Sampling and inspection shall be in accordance with Method 1031.2 of Fed. Test Method Std. Nr. 141.

4.4.2 Test procedures. The varnish shall be tested in accordance with the following applicable methods of Fed. Test Method Std. Nr. 141, as indicated in Table II, and as hereinafter specified.

4.5 Methods of examination and test.

4.5.1 Formulation and characteristics of liquid varnish (see 3.2).

4.5.1.1 Salicylanilide content. Salicylanilide content shall be calculated as follows:

Table II. Index

Examination or Test	Requirement Paragraph or Table	Method Nr of Federal Test Method Standard Nr 141 or Para
Material	3.1 to 3.1.4, incl	
Formulation:		4.5.1
Nonvolatile content		[1]4041
Salicylanilide content		4.5.1.1
Copper 8-quinolinolate		4.5.1.2
Characteristics:		4.5.1
Viscosity	Table I	4271
Skinning	and 3.2	4141
Ash		5262
Drying time		[2]4061
Rosin and rosin derivatives		5031 and 5032
Color (as received)		4248
Low-temperature stability	(See 3.2.1)	4.5.1.4
Application and film characteristics:	3.3	4331
Dielectric strength	3.3.1	4.5.2.1
Resistance to thermal shock and bending	3.3.2	4.5.2.2
Insulation resistance	3.3.3	4.5.2.3
Fungus resistance	3.3.4	4.5.2.4

[1]For Clear liquids.

[2]See 4.5.1.3.

4.5.1.1.1 Procedure. From a dropping bottle, transfer a sample of the varnish weighing 2.3 to 2.7 grams to a 250-milliliter (ml) pearshaped separatory funnel containing 40 ml of ethyl ether. Mix by swirling and add 20 ml of 2.5 percent aqueous sodium hydroxide. Shake vigorously, and allow complete separation of layers. Draw off the aqueous lower layer into a second separatory funnel containing 40 ml of benzene, shake, and allow complete separation. A total of three such extractions shall be made with 20 ml portions of sodium hydroxide. Each aqueous layer from the second funnel shall be drawn off and filtered through paper, that has been dampened with water, into a 400 ml beaker. Wash the paper thoroughly with 100 ml of water used in small portions. Place the beaker in a water bath at 80° to 85°C, inclusive (176° to 185°F, inclusive), for at least one hour. Cool to room temperature and dilute to 250 ml with water in a volumetric flask. After thorough mixing, filter approximately 100 ml. Withdraw by means of a pipette, a 5 ml aliquot of the filtered sample into another 250 ml volumetric flask and dilute to volume with water. Mix thoroughly.

4.5.1.1.2 Determination. Determine the absorbence of this solution at 336 millimicrons in a silica or quartz cell in a spectrophotometer[1]. Use water in the blank cell, and a slit width of 0.4 millimeter (mm). Apply cell corrections if necessary or reverse the position of the cells and average the absorbences obtained. The percent of salicylanilide (on a varnish basis) shall be calculated as follows:

$$\text{Percent salicylanilide} = \frac{A \times 6250}{41.2 \times b \times sw \times al}$$

Where:

A = Absorbance at 336 millimicrons after cell correction.

b = Cell length in centimeters (cm).

sw = Sample weight.

al = Size of aliquot taken in ml (5 ml for this test).

41.2 = The absorptivity obtained by calibration with pure salicylanilide.

6250 = The factor for the two 250 ml dilutions made.

4.5.1.1.3 Calculation. To calculate the percent of salicylanilide on a nonvolatile basis, the following two formulas shall apply:

1. Nonvolatile content, calculated on total weight of varnish exclusive of salicylanilide, by weight = $\frac{A - B}{100 - F} \times 100$.

[1] Beckman Model Du or Equivalent

2. Salicylanilide content, calculated on nonvolatile portion exclusive of fungistatic content, by weight = $\frac{B}{A - B}$ x 100.

Where:

A = Percent nonvolatile content, calculated on total weight of varnish including salicylanilide, by weight.

4.5.1.2 Copper 8-quinolinolate content shall be determined as follows:

4.5.1.2.1 Procedure. Accurately weight 2.0000 grams (± .1 mg) of sample. Quantitatively transfer the weighed material to a 250 ml separatory funnel containing about 10 ml of ethyl ether. Rinse the walls of the weighing vessel with aliquots of ethyl ether totaling 30 ml and transfer all to the separatory funnel.

Extract the copper 8-quinolinolate with 10 percent sulfuric acid solution. First use 20 ml of acid solution and a two minute agitation time. Draw off the acidic solution of copper 8-quinolonolate into a 250 ml beaker. Repeat twice using the same amount of acid but only one minute agitation.

Adjust the pH of the acidic extracts to 6.5 to 7.0 with concentrated NH_4OH. (A green suspension forms) Quantitatively transfer the contents of the beaker to a 250 ml separatory funnel containing a few ml of chloroform. Thoroughly rinse the beaker with 20 ml of chloroform, placing the rinse in the separatory funnel. Stopper the funnel and agitate for two minutes. Collect the lower chloroform extract in a 250 ml beaker. Repeat twice using the same amount of chloroform with one minute of agitation.

Filter the chloroform extract of copper 8-quinolinolate through a Whatman Number 40 filter paper into a 250 ml volumetric flask and dilute to volume with chloroform. Transfer 50 ml of this solution to a 250 ml volumetric flask and dilute to volume with chloroform. The concentration of this solution is approximately 0.8 mg copper 8-quinolinolate/100 ml solution.

Measure the absorbence of the samples and standards against a chloroform blank at 410 millimicrons wavelength in a spectrophotometer (Beckman Model B, Du, DK-2 or equivalent). Use a 1 cm standard silica cell. Determine concentration of copper 8-quinolinolate by reference to a plot of absorbence vs concentration prepared from the standards data.

4.5.1.2.2 Preparation of standard solutions. Accurately weigh 0.20000 gram Nuodex[2] and carefully transfer it to a 250 ml separatory funnel containing a few ml of ethyl ether. Rinse the walls of the weighing vessel with aliquots of ethyl

[2] 10% Copper 8-Quinolinolate
Source: Tenneco Chemicals Inc, Nuodex Div, P.O. Box 2, Piscataway, NJ 08854

ether totaling 30 ml and transfer all to the separatory funnel. Extract copper 8-quinolinolate exactly as described in the procedure and filter through a number 40 Whatman paper into a 250 ml volumetric flask. Dilute to volume. The concentration of this stock solution is 0.08 mg copper 8-quinolinolate per ml. Prepare standard solutions from the stock solution according to the chart below. Transfer the number of mls stock solution indicated to a 100 ml volumetric flask and make to volume with chloroform to prepare the corresponding standard.

STANDARD SOLUTIONS CHART

Ml Stock Solution	% Copper 8-Quinolinolate
20	2.0
15	1.5
12.5	1.25
10	1.0
7.5	0.75
5	0.5

4.5.1.3 Drying time.

4.5.1.3.1 Preparation of panels. Six panels shall be prepared as specified in 4.5.1.1, except for the following:

a. Panels 1.25 inches wide will be satisfactory.

b. Only one dip, to within one inch of the top, shall be made.

c. The consistency of the varnish shall be adjusted by addition, but not by evaporation of thinner, so that the final thickness of the dry film on each side of the panel shall be not less than 0.0010 and not more than 0.0013 inch.

4.5.1.3.2 Method of test. Drying time shall be determined as specified in method 4061 of Federal Test Method Standard Nr. 141, except that the cylindrical weight in the referee method shall be one pound in weight and one inch in diameter.

4.5.1.4 Low-temperature stability. Varnish shall be poured into an eight ounce covered jar and stored for 24 hours at 0°C (32°F). It shall then be brought to room temperature and kept there for at least one hour, after which it shall be stirred and examined for clarity and sedimentation (see 3.2.1).

4.5.1.5 Storage stability. A one gallon sample in an original unopened container shall be stored for one year at approximately 20° to 30°C (68° to 86°F). The varnish shall then be transferred to a glass container, stirred and after 30 minutes, examined for color, viscosity change, and signs of sediment and separation. The original container shall also be examined for signs of corrosion (see 3.2.2).

4.5.2 Application and film characteristics (see 3.3 to 3.3.4, inclusive).

4.5.2.1 Dielectric strength (see 3.3.1).

4.5.2.1.1 Panels. Four test panels of the size and material specified in 4.3.1.1 shall be thoroughly washed with soap and water, rubbed dry with clean cheesecloth, then cleaned with xylol-alcohol solvent (1:1) and rubbed dry with clean cheesecloth. The cleaned panels shall be thoroughly examined for dust or lint particles; contact of the surface to be coated, with the hands or any other contaminating object, shall be avoided. A total of ten thickness measurements shall be made on the panels before coating, starting one inch from one end and making measurements 1-3/4 inches apart along lines 3/4 inch each side of the center line of the panel. The average of these shall be taken as the average copper thickness. Thickness shall be measured with a dial-type micrometer calibrated to 0.0001 inch having a two-inch-diameter anvil and a $\frac{1}{4}$-inch-diameter presser foot with a deadweight load of three ounces. Two panels shall then be placed together and sealed at the edges with masking tape so that only one side of each panel will be coated when double-dipped, as specified in 4.3.1.1. After drying under conditions as specified in 4.3.1.1, the panels shall be separated without bending and cut into strips along the center line.

4.5.2.1.2 Conditioning. Test strips shall be immersed in distilled water at a temperature of 23° ± 1.1°C (73.4° ± 2°F) for a period of 24 hours. Upon withdrawal from the water, the surface water shall be removed by blotting lightly with absorbent paper. The dielectric-strength tests shall be made immediately and completed within five minutes after removal from the water.

4.5.2.1.3 Procedure. Dielectric breakdown shall be measured at four points along the centerline of each strip at 1-3/4-inch from one end. Electrodes shall be cylindrical rods 1/4 inch in diameter with edges rounded to 1/32 inch radius, and the upper, movable electrode shall weigh 0.1 ± 0.005 pound. To prevent flashover, a "single shot" dielectric-strength tester[3] shall be used. The potential shall be applied at a low voltage and gradually raised at a rate so that puncture will occur in approximately 10 to 15 seconds. Five thickness measurements shall be made on each strip at the same points at which the original copper panel thicknesses were measured. The average volts per mil shall be determined by the following procedure: The average thickness of the panel before coating shall be subtracted from that of the panel (two strips) after coating, to give the net-average film thickness. The eight breakdown voltages obtained on each panel (two strips) shall be averaged and divided by the average film thickness for that panel. The four resulting dielectric strengths shall then be averaged and this value reported as the dielectric strength (volts per mil) of the varnish.

[3]This apparatus is referenced in Publication D295-58

4.5.2.1.4 Frequency. The frequency of the test potential shall be not greater than 100 cycles per second, and each part of the testing apparatus shall have a continuous rating of not less than two kilovolt-amperes. The waveform shall be a sine curve, and the voltage shall be measured by an approved method. The voltage may be controlled by an approved method which does not distort the wave more than 10 percent from a sinusoidal shape, and which does not subdivide the voltage in steps greater than 500 volts.

4.5.2.2 Resistance to thermal shock and bending. Two coated panels prepared as specified in 4.5.2.1.1 shall be subjected to four temperature cycles, each consisting of three hours at 85°C (185°F) followed by three hours at -55°C (-67°F). Transfer from one temperature to the other shall be effected at once. The panels shall then be conditioned from one to 24 hours at 23°C (73.4°F). The two panels shall each be cut into two strips, one by eight inches (the edges of the dielectric-strength-test panels shall not be used for these strips), and given a flexibility test by bending the strips, with the film outside, around a ½-inch mandrel through an angle of 180°. The film shall be examined for evidence of cracking, splintering, or tackiness (see 3.3.2).

4.5.2.3 Insulation resistance (see 3.3.3).

4.5.2.3.1 Apparatus. The apparatus shall consist of the following:

a. An insulation-resistance tester possessing a useful range of at least 1 to 100,000 megohms, inclusive.

b. A testing room, cabinet, or container in which an atmosphere can be maintained at 23° ± 1.1°C (73.4° ± 2°F) and 96 ± 2 percent relative humidity. Care shall be taken to prevent rapid fluctuations of temperature within the specified range and consequent condensation.

4.5.2.3.2 Specimens. The specimens shall be two-post terminal strips as shown on figure 1, made from 1/16-inch laminated plastic sheet conforming to type PBG of Specification L-P-513.

4.5.2.3.3 Mounting. Ten terminal strips shall be used. Prior to mounting, the specimens shall be conditioned for at least four days at 23° ± 5°C (73.4° ± 9°F) and 50 ± 4 percent relative humidity. Five of the strips, constituting a set, shall be mounted as shown on figure 1. The other five terminal strips shall be mounted on another metal bar in the same manner.

4.5.2.3.4 Coating. One set of mounted strips shall be dipped once, with the strips horizontal, by the method specified in 4.5.1.3.1 except that strips shall be completely dipped. There shall be no abnormal "buildup" of the film between the terminal posts on any of the terminal strips. The second set of mounted strips shall not be coated. The coated set shall be allowed to dry for 48 hours under the conditions specified in 4.5.2.3.3.

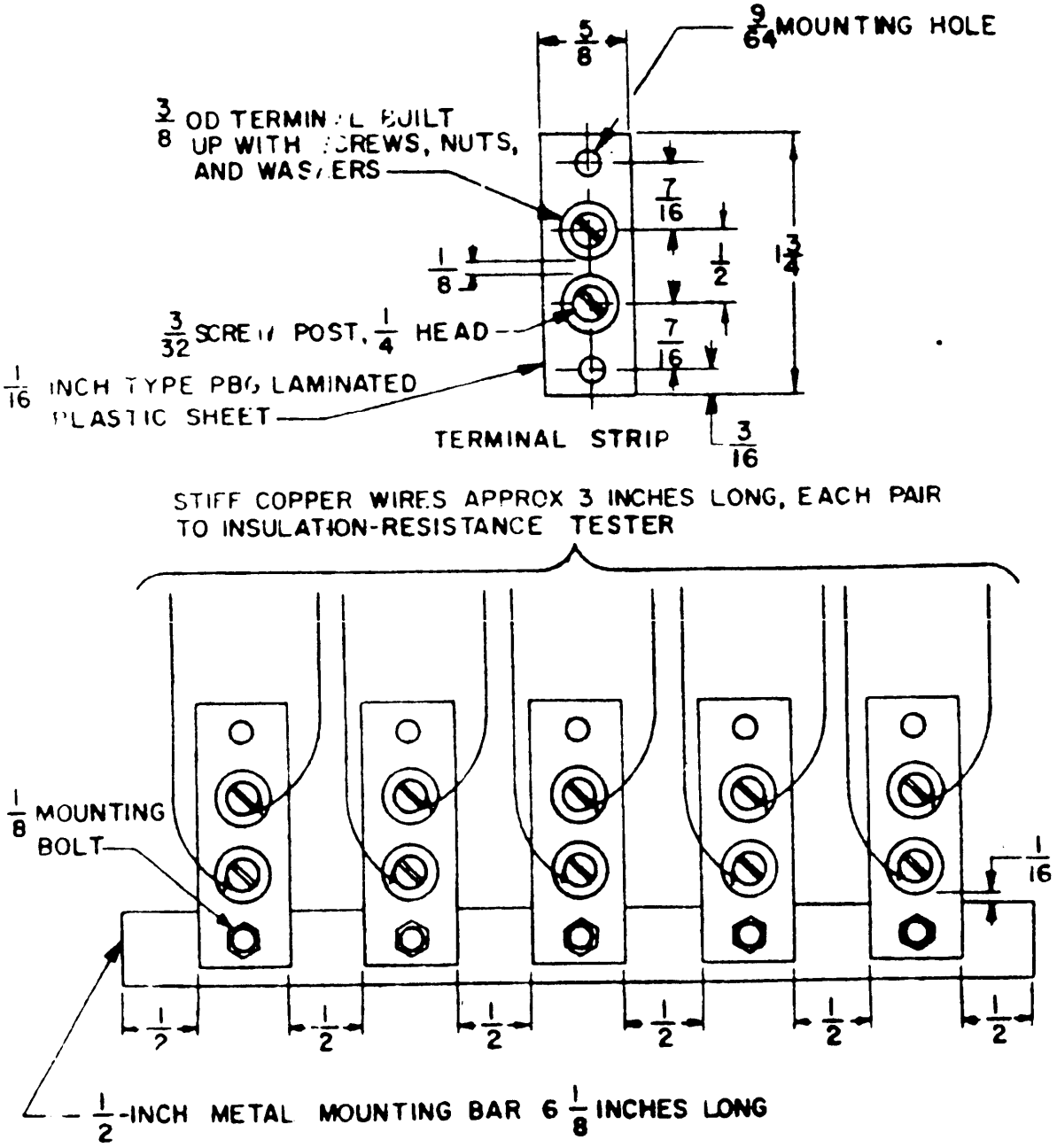

FIGURE 1. *Mounted terminal strips for insulation-resistance test.*

4.5.2.3.5 Procedure. Both the coated and uncoated set of specimens shall be exposed to the atmosphere specified in 4.5.2.3.1.b. for seven days prior to testing, and tested while still in the specified atmosphere. The ends of the copper wires shall be cleaned to the bare metal, and the electrodes of the insulation tester shall then be attached. After one minute electrification at 90 to 135 volts direct current, the resistance reading shall be taken. If the set of uncoated specimens has an average insulation resistance of more than 300 megohms and the coated specimens fail to meet 10 times the uncoated value, tests shall be repeated.

4.5.2.4 Fungus resistance (see 3.3.4 and 6.5.2). The fungus resistance of the dried film shall be determined in accordance with 4.5.2.4.1 to 4.5.2.4.4.3, inclusive.

4.5.2.4.1 Test organisms. The following fungi (see 6.5) shall be used:

	American Type Culture Collection Nr.	Quartermaster Culture Collection
Aspergillus niger	9642	QM 386
Aspergillus flavus	9643	QM 380
Penicillium Funiculosum	9644	QM 391
Trichoderma sp	9645	QM 365

4.5.2.4.2 Maintaining stock cultures. Cultures of these fungi shall be maintained separately on an appropriate medium such as potato-dextrose agar. The stock cultures may be kept for not more than four months in a refrigerator at approximately 3° to 10°C (37.4° to 50°F). Subcultures incubated at 28° to 30°C (82.4 to 86°F), for 7 to 20 days, shall be used in preparing the spore suspension.

4.5.2.4.3 Spore suspension. The spore suspension shall be prepared by pouring, into one subculture of each of the four fungi (see 4.5.2.4.1), a steril 10-ml portion of a solution containing, per liter, 0.05 gram of a wetting agent such as dioctyl sodium sulfosuccinate (see 6.5.1), and shaking to dislodge the spores. Spore suspensions from the individual fungi shall then be poured together and mixed to provide a composite spore suspension for use in the test. The spore suspension may be prepared fresh each day or may be held in the refrigerator at 3° to 10°C (37.4° to 50°F), for not more than seven days.

4.5.2.4.4 Procedure and evaluation of results.

4.5.2.4.4.1 Test medium. The test medium shall contain the following:

Distilled water	1,000 ml
Dextrose	40 grams
Peptone	10 grams
Agar	20 grams

The test medium shall be made up and autoclaved, approximately 100 ml to a flask, and then poured into petri dishes, about 25 ml per dish.

4.5.2.4.4.2 Specimens. A sheet of Whatman Nr. 2 filter paper, or equivalent, shall be dipped into the varnish and the film allowed to air-dry for 48 hours. The test may be facilitated by providing, prior to dipping the filter paper into the varnish, a thin black pencil or ink line located 2 mm within the edge of each disk, to cut later from the filter paper. (Observation as to the extent to which fungi grow upon the specimens may then be made by noting whether growth progresses beyond this line.) The viscosity of the varnish shall be adjusted if necessary, or the sheet shall be redipped to give an increase in dry weight of 80 to 120 percent to the filter paper. The dried sheet shall then be conditioned by immersing in slowly running tap water or in distilled water, using a separate container for each varnish under test, for 18 hours at room temperature, allowing to dry, and heating in a dry oven at 85°C (185°F) for two hours. Following the conditioning, four circular specimens, each three cm in diameter, shall be cut or punched from the coated filter paper for each varnish under test.

4.5.2.4.4.3 Inoculation and incubation. Each specimen shall be deposited on the center of the surface of the set agar in a petri dish. The surface, including the surface of the specimen, shall then be inoculated with the composite spore suspension, either by spraying the suspension from a sterilized atomizer in such manner that the entire surface is moistened with the spore suspension, or by distributing 0.5 to 1.0 ml of the spore suspension from a sterilized pipette and tilting the dish to moisten the entire surface with the suspension. In each daily group of tests, four dishes of set agar without specimens shall be seeded with the spore suspension to serve as controls. The petri dishes shall be incubated at 28° to 30°C (82.4° to 86°F) and shall be examined after seven days of incubation.

4.5.2.4.4.4 Evaluation of results. For the varnish to be considered fungus-resistant, the following are required.

4.5.2.4.4.4.1 Fungus growth in control dishes. There shall be copious fungus growth in all four of the control dishes. (Absence of such growth requires repetition of the test and is not to be considered as indicating failure.)

4.5.2.4.4.4.2 Contaminating growth in test dishes. Growth of bacteria, or of fungi obviously other than the test fungi, shall not occur within 1 cm of more than one specimen, nor occupy more than one-fourth of the area in more than one test dish. (Presence of such contaminating growth in more than one of the four dishes requires repetition of the test and is not to be considered an indication of failure. When such contaminating growth occurs in one dish only, that dish shall be discarded and the evaluation shall be based upon the remaining three dishes.)

4.5.2.4.4.4.3 Fungus growth in test dishes. Growth of the test fungi, as observed with the naked eye (see 4.5.2.4.4.2), shall not extend more than two mm over the edge and toward the center of any specimen. (Fungus growth may touch the specimen and grow to the designated distance over its periphery. If growth extends to a greater distance over one of the specimens, the test may be repeated. Upon such repetition, the varnish shall be considered fungus-resistant provided all specimens pass.)

4.6 Rule 66. The manufacturer shall certify the varnish complies with the provisions of Rule 66 (see 3.4).

4.7 Inspection of preparation for delivery. The packaging, packing and marking of the varnish shall be inspected to determine compliance with the requirements of Section 5 of this specification.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging and marking. Materials shall be prepared for shipment in accordance with TT-P-143 for levels A, B, or C as specified. Type and capacity of unit containers and whether drums shall be palletized shall be as specified (see 6.2).

5.2 Marking of shipments. In addition to any special markings required by contract or order, unit packages, intermediate packages and shipping containers shall be marked in compliance with TT-P-143 and MIL-STD-129. Marking shall also include the following:

Specification Number.

Manufacturer's lot or batch number.

Name of manufacturer.

Name of contractor (if other than manufacturer).

Date of manufacture (month and year).

NOTE: THIS VARNISH COMPATIBLE WITH:
XYLENE (SPEC TT-X-916)
TOLUENE (SPEC TT-T-548)
SYNTHETIC - ENAMEL THINNER (SPEC TT-T-306).

CAUTION: AVOID INHALATION OF FUMES OR EXCESSIVE SKIN CONTACT.
KEEP AWAY FROM FACE AND EYES.
WORK IN A WELL-VENTILATED AREA.

6. NOTES

6.1 Intended use. The varnish covered by this specification is intended for use, by spray, dip, or brush application, in the protection of communications, electronic, and associated electrical equipment against the effect of moisture-and-fungus attack on the performance of the equipment. It is intended that this specification be used in conjunction with supplementary specifications specifying the method of application of the varnish and the treatment of the equipment to receive it.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification.

b. Location of lot acceptance inspection (see 4.4.1).

c. Preparation of panels, if other than that specified in 4.3.1.1.

d. Level of packaging and level of packing required (see 5.1 and 5.2).

e. When copper 8-quinolinolate may be substituted for salicylanilide (see 3.1.4).

6.3 Government verification inspection. Verification inspection by the Government will be limited to the amount deemed necessary to determine compliance with the contract or order, and will be limited in severity to the definitive quality assurance provisions established in this specification and the contract or order. The amount of verification inspection by the Government will be adjusted to make maximum utilization of the supplier's quality-control system and the quality history of the product (see 4.1).

6.4 Dielectric strength. The dielectric-strength test specified in 4.5.2.1 is substantially the same as that in ASTM Publication D115-55, "Testing Varnishes Used for Electrical Insulation".

6.5 Fungus resistance. The organisms used in the fungus-resistance test specified in 4.5.2.4 may be obtained from the American Type Culture Collection, 2112 M Street, N.W., Washington, D.C. 20037, or for service use, from Quartermaster Research and Engineering Center, Natick, Massachusetts.

6.5.1 Wetting agent. Dioctyl sodium sulfosuccinate, a wetting agent, is available under the trade name "Aerosol OT".

6.5.2 Applicability of test. It is to be noted that the method of determining fungus resistance specified in 4.5.2.4 is applicable only to the specific formulation covered by this specification. It should not be used for the evaluation

of fungus resistance of other formulations, particularly those employing fungicides other than salicylanilide, or employing salicylanilide in substantially different concentrations.

6.6 Fluorescence. The varnish covered by this specification is inherently fluorescent. Advantage may be taken of this characteristic to facilitate inspection of the finished, treated equipment, by examining such equipment under ultraviolent light to determine coverage thereof.

6.7 Certain provisions of this specification are the subject of international standardization agreement ABC-NAVY-STD-17C, Electric Insulation Material, dated 21 April 1966. When amendment, revision, or cancellation of this specification is proposed which will effect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

6.8 Symbols are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

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