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METRIC  
 DOD-PRF-24596(SH)  
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## PERFORMANCE SPECIFICATION

### COATING COMPOUNDS, NONFLAMING, FIRE-PROTECTIVE (METRIC)

This specification is approved for use by the Naval Sea Systems Command and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers nonflaming and fire-protective coatings which are suitable for use where air pollution regulations apply for solvents in paints, and for application over certain selected surfaces.

1.2 Classification. Coating compounds covered by this specification shall be of the following types, classes, and applications, as specified (see 6.2):

Type I - Non-intumescent, nonflaming.  
 Type II - Intumescent, fire-protective.

Class 1 - Surface ship, general usage.  
 Class 2 - Submarine, general usage.  
 Class 3 - Submarine (underway use only) (see 6.1.2).

Application A - Steel.  
 Application B - Aluminum.  
 Application C - Fiber reinforced plastics (FRP).  
 Application D - Wood.  
 Application E - Elastomeric foam insulation.

#### 2. APPLICABLE DOCUMENTS

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

#### SPECIFICATIONS

##### FEDERAL

PPP-P-1892 - Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing and Marking of.

##### MILITARY

MIL-P-15280 - Plastic Material, Unicellular (Sheets and Tubes).  
 MIL-L-17970 - Enamel, Nonflaming (Dry), Chlorinated Alkyd Resin, Soft White, Semigloss, Formula No. 124/58.  
 MIL-P-24441/1 - Paint, Epoxy Polyamide, Green Primer, Formula 150.  
 MIL-I-45208 - Inspection System Requirements.

#### STANDARDS

##### FEDERAL

FED-STD-141 - Paint, Varnish, Lacquer and Related Materials: Methods for Testing of.  
 FED-STD-313 - Material Safety Data Sheets, Preparation and the Submission of.  
 FED-STD-595 - Colors.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 3112, Department of the Navy, Washington, DC 20362 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting 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 otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

- B 117 - Salt Spray (Fog) Testing.
- D 93 - Flash Point by Pensky-Martens Closed Tester.
- D 523 - Specular Gloss.
- D 562 - Consistency of Paints Using the Stormer Viscometer.
- D 610 - Rusting on Painted Steel Surfaces, Evaluating Degree of.
- D 1308 - Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
- D 1475 - Density of Paint, Varnish, Lacquer, and Related Products.
- D 1729 - Visual Evaluation of Color Differences of Opaque Materials.
- D 2197 - Adhesion of Organic Coatings.
- D 2369 - Volatile Content of Paints.
- D 2698 - Determination of Pigment Content of Solvent Type Paints by High Speed Centrifuging.
- D 2805 - Hiding Power of Paints.
- E 97 - 45-Degree, 0-Degree Directional Reflectance of Opaque Specimens by Filter Photometry.
- E 136 - Noncombustibility of Elementary Materials.
- E 162 - Surface Flammability of Materials Using a Radiant Heat Energy Source.

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

**NATIONAL BUREAU OF STANDARDS  
NBS Smoke Density Chamber Test**

(Application for copies should be addressed to the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.)

**SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT  
Rules and Regulations  
Rule 102**

(Application for copies should be addressed to the South Coast Air Quality Management District, Metropolitan Zone, 434 South San Pedro Street, Los Angeles, CA 90013.)

(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.)

**3. REQUIREMENTS**

**3.1 Qualification.** Coating compounds furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3).

**3.2 Composition.** Coating shall be furnished in accordance with the requirements of the type, class, and application specified (see 6.2).

**3.2.1 Recovered materials.** Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and shall be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

**3.3 Color.** Coating shall be furnished in a color number selected from FED-STD-595, specified in the contract (see 6.2) and shall match the standard color chip of FED-STD-595, when tested as specified in 4.6.

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3.3.1 **Pigment.** Any combination of the pigments listed for any specific color shall make up the basic hiding pigmentation for that color. Hiding pigments shall be chemically pure and free from extenders. Small amounts of other shading pigments may be used when necessary to match the color chips, provided these additional pigments have good color permanence.

3.4 **Identification characteristics.** Values for identification characteristics shall be provided by individual contractors for characteristics as indicated by "X" in table I. The values shall be established for each coating system prior to qualification testing. The purpose of these values is to serve as a basis for determining that the material being offered is essentially the same as that which was approved under qualification testing. Subject to acceptance by the Naval Sea Systems Command, alternative means of identification (for example, infrared spectrographic examination, and chemical analysis) may be substituted for the characteristics in table I, provided appropriate data are submitted by the contractor.

TABLE I. Identification characteristics values.

Characteristic	Coating component <sup>1/</sup> (Part A or B)	Coating <sup>2/</sup> (Parts A and B, mixed)	Coating system <sup>3/</sup> (multiple coats in accordance with contractor's instructions)
Chemical nature	X		
Percent of principal constituents (15 percent or more of total)	X		
Percent pigment	X		
Percent nonvolatile vehicle	X		
Total solids	X		
Percent volatile	X		
Mass per unit volume	X	X	
Color	X	X	X
Viscosity	X	X	
Flash point (Pensky-Martin Closed Cup)	X	X	
Fineness of grind	X	X	
Pot life		X	
Drying or curing time		X	
Specular gloss and appearance			X
Recoatability			X
Hiding power (contrast ratio)			X
Adhesion			X
Directional reflectance			X
Flexibility			X
Resistance to water immersion			X
Resistance to hydrocarbons			X
Mixing instructions	X	X	
Application instructions		X	

<sup>1/</sup> Coating components are individually packaged components such as base component (Part A), converter component or hardener (Part B), or liquid portion, powder portion and curing solution. Indicate only applicable characteristics. For example, percent pigment is not applicable to curing solutions.

<sup>2/</sup> Coatings are the coating components as mixed for application.

<sup>3/</sup> Coating system is total system (number and type of coats and approximately dry film thickness as tested for qualification approval).

3.5 **Solvent.** The solvent portion of the formulation shall conform to requirements specified herein.

- (a) A combination of hydrocarbons, alcohols, aldehydes, ethers, esters, or ketones having an olefinic or cycloolefinic type of unsaturation except perchloroethylene: 5 percent maximum.
- (b) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene, methyl benzoate, and phenyl acetate: 8 percent maximum.

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- (c) A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene, or toluene: 20 percent maximum.

The contractor shall provide certification to this effect.

### 3.6 Qualitative requirements.

3.6.1 Condition in container. Components of the coating system shall be free from grit, seeds, skins, abnormal thickening, or livering in a freshly opened container, and shall show no more pigment settling or caking than can be easily and completely reincorporated to a smooth, uniform state (see 4.6.3).

3.6.2 Mixing properties. The coating shall be free from grit, seeds, skins, or lumps, and shall result in a smooth, uniform mixture, when tested as specified in 4.6.4. After aging, the coating shall show no signs of gelation.

3.6.3 Spraying properties. The coating shall spray satisfactorily in all respects, and shall show no running, sagging, or streaking, when tested as specified in 4.6.5. The dried film shall show no dusting, mottling, or color separation and shall present a smooth finish.

3.6.4 Brushing properties. The coating shall brush satisfactorily in all respects when tested as specified in 4.6.6, and shall dry to a smooth, uniform film, free from seeds, runs, or sags.

3.6.5 Flexibility. A film of coating shall show no checking, cracking, or flaking, when tested as specified in 4.6.7. Two test panels shall be prepared and tested for flexibility. The panels shall be retained for use in 3.6.6 and 3.6.6.1 (one panel for each).

3.6.6 Knife test. A film of coating, prepared and tested as specified in 4.6.8, shall adhere tightly to the test panel. It shall be difficult to furrow off with the knife and shall not flake, chip, or powder. The knife cut shall show beveled edges.

3.6.6.1 Adhesion. The film of coating, prepared for 4.6.7, and tested as specified in 4.6.8.1, shall show no loss of inner coat adhesion, nor loss of adhesion to the surface of the substrate.

3.6.7 Fluid resistance. When tested as specified in 4.6.9, the coatings, with the exception of those offered for application E, shall meet the requirements of 3.6.7.1, 3.6.7.2, and 3.6.7.3.

3.6.7.1 Water resistance. A film of coating, prepared and tested as specified in 4.6.9.1, shall show no wrinkling or blistering immediately after removal of the panel from the water. The coating shall be no more than slightly affected when examined 2 hours after removal. After 24 hours of air drying, the portion of the panel which was immersed shall be almost indistinguishable with regard to hardness and adhesion from the portion which was not immersed. A slight discoloration of the immersed portion shall be permitted.

3.6.7.2 Hydrocarbon fluid resistance. A film of coating, prepared and tested as specified in 4.6.9.2, shall show no blistering or wrinkling and no more than a slight whitening or softening upon removal from the fluid. After 2 hours of air drying, the portion of the panel that was immersed shall be almost indistinguishable with regard to hardness, color, and gloss from a panel prepared at the same time but not immersed.

3.6.7.3 Salt spray resistance. A film of coating, prepared and tested as specified in 4.6.9.3, and examined immediately after removal from the test, shall show no more than a trace of rusting when tested in accordance with ASTM D 610 and no more than five scattered blisters no larger than 1 mm in diameter.

### 3.7 Thermal properties.

3.7.1 Type I coating systems. The type I coating systems, when used for applications A, B, C, and D, shall show performance equal to or superior to that of enamel manufactured in accordance with MIL-E-17970, when tested concurrently for flaming, flame spread, softening, and smoke generation.

3.7.2 Types I and II coating systems, application E. Types I and II coating systems, when used for application E, shall prevent exposure of the elastomeric substrate for flaming, flame spread, softening, and smoke generation (see 4.6.10).

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3.7.3 Type II coating systems. Type II coating systems shall demonstrate intumescence when tested as specified in 4.6.10.2. In addition, type II, applications C, D, and E coatings shall prevent flashover from occurring for a minimum of 10 minutes, when defined and tested in accordance with 4.6.10.6.

3.7.3.1 The following maximum flame spread indices shall be allowed for applications A, B, C, D, and E, respectively when tested in accordance with 4.6.10.2: 5, 2, 15, 10, and 25.

3.7.3.2 The following maximum smoke generation shall be allowed for applications A, B, C, D, and E, respectively, when tested in accordance with 4.6.10.3: 15, 15, 20, 30, and 40.

3.7.3.3 Coating shall not exhibit flaming, sparking, or burning drops, when tested in accordance with 4.6.10.5.

3.7.4 Flash point. No coating system to be supplied under this specification shall have a flash point of less than 38°C when tested in accordance with 4.6.10.6.

3.8 Toxicity. The material shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency (see 4.7).

3.9 Material safety data sheet. The contracting activity shall be provided a Material Safety Data Sheet (MSDS) at the time of contract award. The MSDS is DD Form 1813 and is found in FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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.

4.1.1 Inspection system. The contractor shall provide and maintain an inspection system acceptable to the Government for supplies and services covered by the specification. The inspection system shall be in accordance with MIL-I-45208.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- (a) Qualification inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

4.3 Qualification tests. Qualification tests shall be conducted at a laboratory satisfactory to the Naval Sea Systems Command. Qualification tests shall consist of the tests specified in 4.6 and 4.7.

4.3.1 Products to be tested shall be qualified as to the applicable service application determined by the substrate(s) the coatings are designed to protect. The applicable service application is supplied by the contractor and becomes a part of the application for qualification testing (see 6.3). Qualification approval for one type, class, or application of coating compound does not constitute approval of the other types, classes, and applications.

4.3.2 Ingredient samples. The contractor shall submit 4 liters (L) (1 gallon (gal)) each of Parts A and B components, (see footnote 1, table I), or a 4-L (1-gal) sample of a one-component coating.

4.4 Quality conformance tests. Quality conformance inspection shall consist of all tests in 4.6 and 4.7 with the exception of water resistance (see 4.6.9.1), hydrocarbon fluid resistance (see 4.6.9.2), salt spray resistance (see 4.6.9.3), and thermal properties (see 4.6.10).

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4.5 Test conditions.

4.5.1 Routine testing. Routine testing shall be conducted at 21°C to 28°C at a relative humidity of 50 ± 5 percent.

4.5.2 Referee testing. Referee testing shall be conducted at a temperature of 23°C ± 1°C, and a relative humidity of 50 ± 4 percent.

4.6 Test procedures. Tests shall be conducted in accordance with table II. For all tests requiring the use of mixed coating, Parts A and B shall be mixed in the proportions specified in 4.6.4 and allowed to stand for the appropriate temperature dependent induction time before using, as recommended by the contractor.

TABLE II. Test procedures.

Item	FED-STD-141	Test paragraph	ASTM method	Requirement
Color			D 1729	3.3
Total solids			D 2369	Table I
Vehicle solids			D 2698	Table I
Viscosity (Krebs-Stormer)				
Mass per unit volume			D 962	Table I
Flash point			D 1475	Table I
Specular gloss			D 93	Table I
Directional reflectance			D 523	Table I
Drying time		4.6.1	E 97	Table I
Set to touch	4061			
Dry hard	4061			
Full hardness	4061	4.6.1.1		
Hiding power (contrast ratio)		4.6.2	D 2805	Table I
Condition in container	3011	4.6.3	D 2805	3.6.1
Mixing properties		4.6.4		3.6.2
Spraying properties	2131	4.6.5		3.6.3
Brushing properties	4321	4.6.6		3.6.4
Flexibility	6221	4.6.7		3.6.5
Knife test	6304	4.6.8		3.6.6
Adhesion	6301	4.6.8.1	D 2197	3.6.6.1
Fluid resistance		4.6.9		3.6.7
Water resistance		4.6.9.1	D 1308	3.6.7.1
Hydrocarbon fluid resistance		4.6.9.2	D 1308	3.6.7.2
Salt spray resistance		4.6.9.3	B 117	3.6.7.3
Thermal properties		4.6.10		3.7
Radiant panel test		4.6.10.2	E 162	3.7
NBS smoke density chamber - flaming and nonflaming mode		4.6.10.3		3.7
Setchkin test		4.6.10.4	E 136	3.7
Resistance to ignition test		4.6.10.5		3.7
NBS quarter scale flashover test		4.6.10.6 and appendix 4.7		3.7
Toxicity of and quantity of emitted volatiles				3.8

4.6.1 Drying time. Draw down a film of the coating compound with 38 µm (75 µm gap clearance) film applicator and determine drying time in accordance with method 4061 of FED-STD-141 under referee conditions for compliance with table I.

4.6.1.1 Full hardness. The film shall be considered to have reached full hardness when it is very difficult to remove with a knife blade.

4.6.2 Hiding power (contrast ratio). Determine the contrast ratio in accordance with ASTM D 2805. Calculate the contrast ratio and check for compliance with table I.

4.6.3 Condition in container. Determine package condition in accordance with method 3011 of FED-STD-141 and observe for compliance with 3.6.1.



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**4.6.4 Mixing properties.** Thoroughly mix by hand (do not use paint shaker) in accordance with contractor's instructions. Place 130 grams (g) of the material in a 225-g glass jar and do not agitate or disturb for 2 hours. At the end of this period, examine for compliance with 3.6.2.

**4.6.5 Spraying properties.** Mix the coating as specified in 4.6.4. Spray on a test panel to a dry film thickness between 50  $\mu\text{m}$  and 75  $\mu\text{m}$  and observe for spraying properties in accordance with method 4131 of FED-STD-141 for compliance with 3.6.3. For referee test, use automatic application in accordance with method 2131 of FED-STD-141.

**4.6.6 Brushing properties.** Apply the coating to a 100-by 300-mm steel panel, using a 40-mm brush, and observe for brushing properties in accordance with method 4321 of FED-STD-141 for compliance with 3.6.4.

**4.6.7 Flexibility.** Determine flexibility on two test panels in accordance with method 6221 of FED-STD-141. Examine the panel for compliance with 3.6.5.

**4.6.8 Knife test.** Perform the knife test in accordance with method 6304 of FED-STD-141 using a flat portion of one panel from the flexibility test. Observe for compliance with 3.6.6.

**4.6.8.1 Adhesion.** The adhesion test shall be performed in accordance with method 6301 of FED-STD-141 on a flat portion of the remaining panel from the flexibility test. Observe for compliance with 3.6.6.1.

**4.6.9 Fluid resistance.**

**4.6.9.1 Water resistance.** Degrease two 100-by 300-mm test panels. Spray a coat of epoxy primer conforming to MIL-P-24441/1 to a dry film thickness between 18 and 25  $\mu\text{m}$  and air dry for 1 to 4 hours. Then spray the coating to a wet film thickness specified by the contractor, and allow the coating to air dry 48 hours. After the final coat of the system has been applied, air dry 30 days. Coat all exposed, uncoated surfaces with wax or other suitable coating, and immerse the panel in distilled water at  $23^{\circ}\text{C} \pm 1^{\circ}\text{C}$  for 14 days in accordance with ASTM D 1308. On removal, observe the panel for compliance with 3.6.7.1. Scrape the wax off the panel gently and wipe the panel clean with an aromatic solvent. Condition the panel under referee conditions for 48 hours, and test for thermal insulating properties (see 4.6.10).

**4.6.9.2 Hydrocarbon fluid resistance.** Prepare a film of coating as in 4.6.9.1 and air dry 30 days. Immerse in a hydrocarbon fluid mixture consisting of 70 percent isooctane and 30 percent toluene for 14 days at  $23^{\circ}\text{C} \pm 1^{\circ}\text{C}$  in accordance with ASTM D 1308. At the end of the test period, remove and examine for compliance with 3.6.7.2.

**4.6.9.3 Salt spray resistance.** Prepare three 100-by 300-mm test panels as in 4.6.9.1, and air dry for 30 days. Expose the unscored panels to 5 percent salt spray for 14 days in accordance with ASTM B 117. Upon removal, wash the panels gently in warm running water not more than  $38^{\circ}\text{C}$  until free from any visible salt deposits and examine immediately for compliance with 3.6.7.3.

**4.6.10 Thermal properties.**

**4.6.10.1 Painting of test specimens.** Test specimens shall be painted to either 150  $\mu\text{m}$  dry film thickness in at least two, but not more than four coats to achieve 150  $\mu\text{m}$  or to that thickness which the contractor recommends. Coating thickness tested shall be at whichever of these values is greater. If multiple coats are required to achieve the test thickness, at least 24 hours, but no more than 48 hours, shall lapse between coats. Fully coated test specimens shall be aged no less than 7 days nor more than 14 days before testing. Application of test coatings shall be by brush, roller, or spray. Test specimens, unless otherwise specified in the specific test method, shall be of material corresponding to the classification desired.

**4.6.10.1.1** Test samples prepared in accordance with 4.6.10.1 shall be immersed in distilled water, as specified in 4.6.9.1. After drying, test samples in accordance with 4.6.10.2 through 4.6.10.6. Coatings shall meet the requirements of 3.7.

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4.6.10.2 Radiant panel test. The radiant panel test shall be conducted in accordance with ASTM E 162. In addition, intumescent paints shall be observed for the degree of intumescence expressed as a percent of the original dry film thickness. Performance of non-intumescent paint shall be compared to the performance of MIL-E-17970 enamel, when tested concurrently, and intumescent paint for coating elastomeric (MIL-P-15280) insulating foam. The non-intumescent paint compared to MIL-E-17970 paint shall be applied at 125  $\mu$ m dry film thickness and the intumescent paint applied at contractor's recommended dry film thickness.

4.6.10.3 NBS smoke density chamber test. This test shall be conducted in accordance with the NBS Smoke Density Chamber Test in both burning and non-burning modes. The test sample shall be prepared in accordance with 4.6.10.1 on an applicable substrate. The performance of the test paint shall be compared to the performance of MIL-E-17970, when tested concurrently at 150  $\mu$ m thickness, when prepared and tested under identical conditions.

4.6.10.4 Noncombustibility test. The noncombustibility test shall be conducted in accordance with ASTM E 136. Test specimens shall be prepared by painting fiber glass insect screening of approximately 18 by 16 mesh. The fiber glass insect screening shall not have a flammable finish (such finish shall be removed by autoclaving prior to sample preparation). Paint and dry as specified; cut the painted screening into 38 by 50-mm pieces; stack the pieces to form the 38 by 38 by 50-mm test specimens. Fine wire may be used to bind the cube tightly together. The performance of the test paint shall be compared to the performance of MIL-E-17970, tested at 150  $\mu$ m thickness when prepared and tested under identical conditions. The test report shall include the time factors of thermocouples  $T_3$  and  $T_4$ .

4.6.10.5 Resistance to ignition (for steel substrates only).<sup>1/</sup> This test determines whether a paint will ignite into flames when the sole ignition source is the metallic substrate to which the paint adheres. The conditions of the test are standardized so that paints passing this test may be safely used on ships' bulkheads where nonflaming paints are required to prevent fires from spreading from one sealed compartment to the next during a severe shipboard fire.

4.6.10.5.1 Apparatus. The apparatus consists of a high asperage direct current (d.c.) generator, electrodes for holding the test specimen, an ammeter, a voltmeter, and a switch capable of handling the currents involved. The wiring diagram is shown on figure 1. The current from the d.c. generator is shunted directly through the test specimen to cause rapid heating. Using a test specimen made of mild steel as shown on figure 2, the apparatus is calibrated to give a temperature rise in the test specimen of 1000°C within 60 seconds of the start of the test. Test specimens shall be coated to either 150- $\mu$ m dry film thickness in as many coats as necessary to achieve 150- $\mu$ m or to that thickness at which the contractor recommends his material be used. Coating thickness tested shall be at whichever of these two values is greater. If multiple coats are required to achieve the test thickness, at least 24 hours, but no more than 48 hours shall lapse between coats. Fully coated test specimens shall be aged no less than seven days nor more than 14 days before being tested. When tested as described above (ambient to 1000°C heat rise in 60 seconds), flaming of the paint or fumes from the paint, volume of smoke, and other characteristics, such as sloughing, dripping, softening, or color changes shall be recorded and reported. The performance of the test paint is then compared to the performance of MIL-E-17970 tested at 150- $\mu$ m thickness when prepared and tested under identical conditions. Air moving past the specimen shall be regulated to that caused by convection heating due only to heating of the test specimen.

4.6.10.6 Flashover determination. The occurrence and time of flashover shall be determined in accordance with the criteria and method found in the appendix.

4.7 Toxicity and quantity of emitted volatiles. The toxicity of and quantity of emitted volatiles from the coating compound being qualified shall be determined by the David W. Taylor Naval Ship Research and Development Center, Annapolis, MD 21402, or by any other testing facility approved by the Naval Sea Systems Command, Washington, DC 20362. Data from this test will be reviewed by the Navy Bureau of Medicine, and by the Naval Sea Systems Command. Based on the data and review of the hazards presented by the volatiles, a determination of acceptability will be made by the Naval Sea Systems Command. This paragraph is applicable only to types I and II, class 3 qualifications.

4.8 Inspection of packaging. Sample packages and packs and the inspection of the packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

<sup>1/</sup>This test is essentially the same as described by Birnbaw and Markowitz in Industrial and Engineering Chemistry, March 1948, pages 400 thru 405.



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## 5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisitions.)

5.1 Packaging, packing, and marking. The coating shall be delivered in 4-L (1-gal) cans or 20-L (5-gal) pails, as specified (see 6.2). Two-part systems (for example, Parts A and B) shall be delivered in 4-L (1-gal) or 20-L (5-gal) amounts in suitable unitized packaging. Containers for the coating system shall conform to, and shall be packaged and packed level A, B, or C as specified (see 6.2 and 6.6) and marked in accordance with PPP-P-1892, including hazardous markings as applicable.

### 5.2 Special marking.

5.2.1 In addition to marking required in the contract (see 6.2), each container, interior and exterior, shall be marked with the following:

"The volatile content of the material in this container is not photochemically reactive as defined by Rule 102 of the South Coast Air Quality Management District" (see 6.5).

## 6. NOTES

6.1 Intended use. These coatings are intended for application as a fire-protective coating for steel, aluminum, and nonmetallic substrates. Wherever possible, the coating should be applied over a surface that has been degreased, sandblasted, and primed to promote adhesion.

6.1.1 Type I, classes 1 and 2. Type I, classes 1 and 2 material are intended for use where it is desired to use a coating material which will not become actively involved in a fire, nor contribute to fire propagation.

6.1.2 Type I, class 3. Type I, class 3 material shall be compatible with the operation of the atmosphere control system (emission of volatiles and thermal degradation products).

6.1.3 Type II, classes 1, 2, and 3. Type II, classes 1, 2, and 3 materials are intended to be used where it is desired to actively protect a substrate in a fire environment.

6.2 Ordering data. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type, class, and application (see 1.2 and 3.2).
- (c) Color required (see 3.3).
- (d) Size of container required (see 5.1).
- (e) Level of packaging and packing required (see 5.1).
- (f) Special marking required (see 5.2).

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 the applicable Qualified Products List OPL 24596 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, 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 Naval Sea Systems Command, Department of the Navy, Washington, DC 20362, 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 6.3.1).

6.3.1 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.

6.4 The coating covered by this specification should be purchased by volume, the unit being 4 L or one U.S. liquid gallon (231 cubic inches) at 20°C.

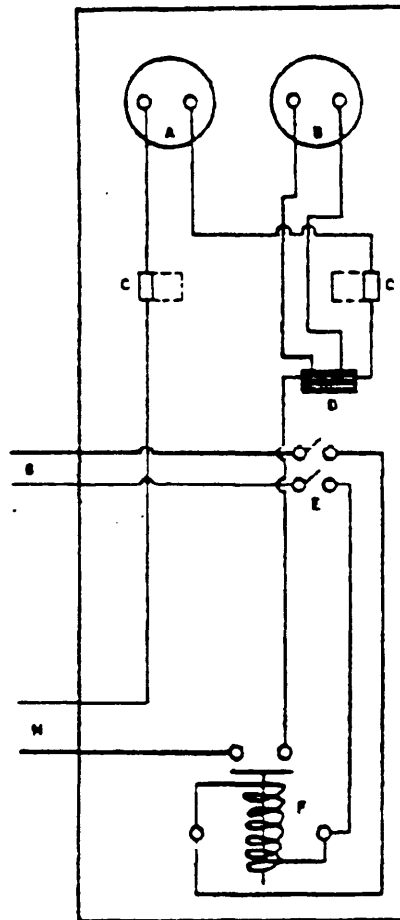
DOD-C-24596(SH)

6.5 Volatile content. Although the container marking specifically refers to the South Coast Air Quality Management District, the coating compound may be used anywhere else a coating compound complying with 3.5 is allowed. This includes other air pollution control districts or similar areas controlling the emission of solvents into the atmosphere. Information regarding Los Angeles County Air Pollution Rules 102, 442, and 443 may be obtained from: South Coast Air Quality Management District, Metropolitan Zone, 434 South San Pedro Street, Los Angeles, CA 90013.

6.6 Level B packaging. Level D packaging is intended to provide economic but limited protection and should be specified only when it is determined that the paint will be held in covered storage no more than 1 year from date of initial packaging.

Preparing activity:  
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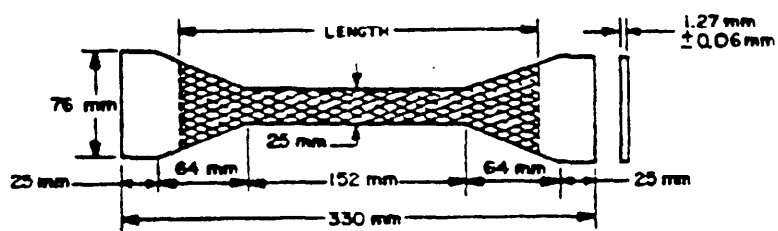


SH11436

FIGURE 1. Wiring diagram for thermoelectric tester.

- A. Voltmeter, range 0-100 volts (V), direct current (d.c.)
- B. Ammeter, range 0-100 amperes (A), d.c.
- C. Specimen holder electrodes.
- D. Shunt 400 A, 50 millivolts (mV).
- E. Snap switch, two-pole single throw.
- F. D.C. contactor 100 A, and coil 110 V, alternating current (a.c.) or d.c.
- G. Source of power, 110 V, a.c. or d.c.
- H. Conductors to holding generator 1/0 stranded

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FIGURE 2. Diagram of test panel used in resistance to ignition test.

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APPENDIX

APPENDIX

DETERMINATION OF THE FLASHOVER POTENTIAL OF A  
LINING MATERIAL USING A QUARTER-SCALE ROOM FIRE TEST

10. SCOPE

10.1 Scope. This method describes a procedure to determine the flashover potential of materials in a room when subjected to a fire exposure.

10.2 The method described will yield a time from the introduction of the fire exposure until the moment of flashover.

20. JUSTIFICATION

20.1 In the interest of reducing both the setup time and cost associated with fire testing in a full size room, herein defined as a 3 by 3 by 2.4 m high room having a 750 mm by 2.03 m high doorway, a one-quarter scale room fire test was devised to predict flashover potential of lining materials exposed to fire.

30. EQUIPMENT

30.1 The quarter-scale room shall be constructed from a suitable ceramic insulation board and shall form an airtight box having a ceiling and four sides. The box shall sit on a floor fabricated with the same material. The interior dimensions of the fully lined quarter-scale room are 750 by 750 by 500 mm high. The doorway is located at the center of one wall and shall be 495 mm wide and 425 mm high to secure the proper ventilation and fire development. The height between the finished ceiling and the top of the doorway shall be 175 mm. The floor of the model room shall extend at least 300 mm outside of the doorway. The box shall be removable to allow for application of paint and ceiling and wall covering. The entire base of the box in contact with the floor shall be made airtight.

30.2 A porous plate diffusion flame burner shall be used as the fire source. The burner shall be 90 by 90 by 75 mm high, consisting of a horizontal porous plate area of 75 by 75 mm with a 6-mm wide steel plate perimeter and steel plate sides and bottom.

30.3 Four 250  $\mu$ m chromel-alumel thermocouples shall be used, 25 mm and 75 mm below the center of the overhead and 25 mm and 50 mm below the top of the doorway.

40. PROCEDURE

40.1 The test material shall fully line the walls and ceiling.

40.2 Prior to testing, the fully-lined test room shall be conditioned for at least 24 hours at a relative humidity between 20 and 60 percent, and a temperature of  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

40.3 The fire source shall be positioned on the floor snugly against one rear corner of the test room. A flow rate of  $0.0091 \text{ m}^3/\text{min}$  of methane shall be used to produce a constant heat input of approximately 336 joules per minute (336 J/min) for the duration of the test.

40.4 The test data from the four thermocouples shall be recorded as a continuous function of time.

40.5 The primary data generated by this test will be the time to flashover if it occurs, and the maximum temperature if it is not reached. Flashover is characterized by thermal flux levels equal to or greater than 2 watts per square centimeter ( $\text{W}/\text{cm}^2$ ) at the floor level. This corresponds to interior temperatures of  $600^{\circ}\text{C}$  and higher, and doorway temperatures of  $500^{\circ}\text{C}$  and higher. For the purpose of qualification acceptance, flashover is defined as the fire condition where one of the interior thermocouple measurements reach  $600^{\circ}\text{C}$  or one of the doorway measurements reach  $500^{\circ}\text{C}$ , whichever occurs first. For qualification acceptance of the material, flashover shall not occur within 10 minutes.

40.6 The evolution of toxic gases shall be detected and reported using appropriate air sampling techniques. The presence of HCN, HCl,  $\text{CO}_2$ , and CO shall be reported, if detected, in parts per million (p/m).

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APPENDIX

40.7 Color slides shall be taken before the test, at the point of maximum involvement, and after the fire has been extinguished.

50. DATA VERIFICATION

50.1 Hard copy results of data generated including the slides shall be submitted to the Commander, Naval Sea Systems Command, Materials Engineering, Washington, DC 20362.

50.2 Materials offered for use under this specification shall have been tested by this quarter-scale test. The procedure and results shall be verified by the appropriate Defense Contract Administration Services (DCAS) and the resulting DCAS verification shall be available to the contracting officer.

60. SUMMARY

60.1 This quarter-scale room test procedure provides a relatively simple, straight forward and reproducible method to determine the flashover potential of materials used to line the interior surfaces of a compartment. The lining materials may be insulation, paint (used over lining materials), sheathing, acoustic panels or the like. In addition, important data on the generation of toxic gasses and the suppression of toxic gasses can be derived. The fact that the data is of a "go" or "no-go" form makes the error of operation relatively small.



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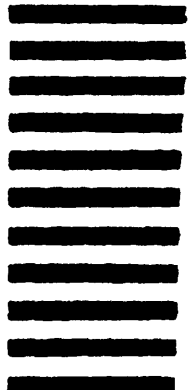
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