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METRIC

MILITARY SPECIFICATION

# PAINT COATING SYSTEMS, STEEL SHIP TANK, FUEL AND SALT WATER BALLAST (METRIC)

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

## 1. SCOPE

1.1 Scope. This specification covers paint coating systems for application on steel surfaces subjected to fuel and salt water, such as in shipboard fuel and salt water ballast tanks.

1.2 Classification. Coating systems shall be of the following types and classes, as specified (see 6.2.1):

Type I - General use.
Type III - Limited solvent content (for use where air pollution regulations apply).

Class 1 - Epoxy
Class 2 - Coal tar-epoxy (not for fuel tanks)
Class 3 - Silicate, phosphate, or silicone zinc
Class 4 - Urethane

## 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

TT-N-95 - Naphtha, Aliphatic.
TT-T-548 - Toluene; Technical.
TT-X-916 - Xylene (For Use in Organic Coatings).
PPP-P-1892 - Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing, and Marking of.

MILITARY

MIL-G-5572 - Gasoline, Aviation: Grades 80/87, 100/130, 115/145.
MIL-T-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5.
MIL-I-45208 - Inspection System Requirements.

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.

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.

(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 shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 93 - Flash Point by Pensky-Martens Closed Tester.
D 130 - Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test.
D 156 - Saybolt Color of Petroleum Products (Saybolt Chromometer Method).
D 381 - Existent Gum in Fuels by Jet Evaporation.
D 522 - Elongation of Attached Organic Coatings with Conical Mandrel Apparatus.
D 523 - Specular Gloss.
D 562 - Consistency of Paints Using the Stormer Viscometer.
D 1208, Sec. 2 - Common Properties of Certain Pigments.
D 1210 - Fineness of Dispersion of Pigment-Vehicle Systems.
D 1296 - Odor of Volatile Solvents and Diluents.
D 1475 - Density of Paint, Varnish, Lacquer, and Related Products.
D 1729 - Visual Evaluation of Color Differences of Opaque Materials.
D 2196 - Rheological Properties of Non-Newtonian Materials.
D 2369 - Volatile Content of Paints.
E 97 - 45-deg, 0-deg Directional Reflectance of Opaque Specimens by Filter Photometry.
E 308 - Spectrophotometry and Description of Color in CIE 1931 System.

ASTM Standard on Petroleum Products and Lubricants, Committee D-2, 37th Edition, 1960.

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

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 systems 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 6.5).

3.2 Materials. The coating systems shall be composed of the following vehicles for each class, pigmented, formulated, and manufactured to produce a uniform, high quality product capable of meeting all the requirements of this specification.

3.2.1 Class 1, epoxy. Class 1 epoxy coating system shall be composed principally of an epoxy resin converted with amines or other suitable materials.

3.2.2 Class 2, coal tar-epoxy. Class 2 coal tar-epoxy coating system shall be composed principally of a refined coal tar-coal tar pitch and a minimum of 17 percent (by mass of coating) of an epoxy resin converted with amines or other suitable materials.

3.2.3 Class 3, silicate, phosphate, or silicone zinc. Class 3 zinc coating system shall be composed principally of an inorganic silicate, phosphate or silicone with zinc, which may be both free and combined.

3.2.4 Class 4, urethane. Class 4 urethane coating system shall be composed principally of a polyurethane resin converted with amine or other suitable material.

3.2.5 Solvent. The solvent portion of type III coating systems 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.
(c) A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene, or toluene: 20 percent maximum.

The contractor shall provide certification to this effect.

3.2.6 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. Class 1 and class 4 coating systems shall be composed of coats having a 45-degree directional reflectance of not less than 30 with exception of the prime coat. Succeeding coats shall be of contrasting color, and the top or finish coat shall be white or a very light pastel shade. The color of classes 2 and 3 coating systems shall be characteristic of the ingredients, lot to lot. Determination of directional reflectance and machine color values or matches (quality conformance or qualification testing) is not required for class 2 or 3 coatings systems.

3.4 Description. Where coatings are composed of components to be mixed at the time of application, the minimum proportions for any component shall be at least 5 percent by volume of the total. Classes 1, 2, and 4 coating systems shall consist of at least two coats.

3.5 Pot life. The pot life of the coatings of the coating systems, mixed and ready for application, shall be a minimum of four hours at 21°C (70°F), and 80 percent relative humidity, when tested in accordance with 4.5.1.

3.6 Drying or curing time. All coatings of the coating systems shall require no more than 24 hours between coats when applied at a temperature of 10°C (50°F) and shall be ready for service within 7 days after the application of the last coat (see 4.5).

3.7 Flash point. Coatings shall not flash at temperatures lower than 38°C (100°F) when tested in accordance with 4.5.

3.8 Application characteristics. All coatings of the coating systems shall be readily applied by brush and spray, using commercially available equipment. The coatings shall exhibit reasonable leveling without excessive sagging when applied at proper film thickness as recommended by the manufacturer. Adhesion between coats shall be adequate for performance in service without undue restrictions concerning timing, temperature or other conditions associated with application.

3.9 Immersion resistance. The coating systems when tested in accordance with 4.5.2 shall show no film failure other than moderate change in appearance and a maximum failure of 3 percent of the total area. Coatings shall show no pinhole rusting, loss of adhesion, or blisters larger than 1.5 millimeters (mm) (1/16 inch). Very fine blisters or surface imperfections that may appear during the first 10 cycles of the test whose rate of growth is negligible or very slow, shall not be counted.

3.10 Service performance. The coating systems shall continue to provide excellent protection against corrosion with a total of 10 percent maximum touch-up for a minimum period of three years (see 4.7).

3.11 Condition in container. The coatings of the coating systems shall be usable, shall be readily broken up with a paddle to a smooth uniform consistency, and shall not liver. The coatings of the coating systems shall not increase more than one-third in viscosity, or alternately shall have no viscosity increase which cannot be compensated for by addition of a maximum of 5 percent of thinner similar to that used in the coating, or increase more than one-fifth in time of dry, nor show any other objectionable properties for at least one year.

3.12 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 service medical department which will act as advisor to the contracting activity (see 4.7).

3.13 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, alternate means of identification (for example, infra-red 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 1/ | Coating 2/ | Coating system 3/ | Quality conformance | QPL |
|---|---|---|---|---|---|
| Chemical nature | X | | | | X |
| Percent of principal constituents (15 percent or more of total) | X | | | X | X |
| Percent pigment | X | | | X | X |
| Percent nonvolatile vehicle | X | | | X | X |
| Percent volatile | X | | | X | X |
| Mass per liter (L), gallon (gal) | X | X | | X | X |
| Color | X | X | | X | X |
| Viscosity | X | X | | X | X |
| Flash point | X | X | | X | X |
| Fineness of grind | X 6/ | X | | X | X |
| Odor | X | X | | X | X |
| Pot life | | X | | X | X |
| Drying or curing time | | X | X | X | X |
| Gloss and appearance | | X | X | X | X |
| Recoatability 8/ | | X 4/ | X 4/ | | X |
| Adhesion | | X 4/ | X 4/ | | X |
| Flexibility | | X | X | X | X |
| Resistance to boiling water immersion (identification standard) | | | X 4/ | | X |
| Resistance to fuel and water at 32°C (90°F) (accelerated performance test) | | | X 4/ | | X |
| Mixing instructions | | X 5/ | | | X |
| Application instructions | | | X 5/ | | X |
| Ash | | X 7/ | | X 7/ | X |

1/ 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.

2/ Coatings for classes 1, 2, and 4 are the resin base and converter as mixed for application. Coating for class 3 is powder portion mixed with liquid portion.

3/ Coating system is total system (number and type of coats and approximately dry film thickness as tested for qualification approval). Class 3, self-curing single coat applications shall be considered both as a coating and coating system. Other class 3 coating systems shall consist of the "powder and liquid" coat followed by a curing coat.

4/ Not required for each lot. Shall be run at least once every six months.

5/ Required once only. Shall be furnished with request for test.

6/ For zinc dust component of class 3 systems and coal tar pitch components of class 2 coatings, report percent retained on U.S. Standard No. 325 sieve.

7/ For coal tar pitch components of class 2 coatings. Not required for each lot. Shall be run at least every six months.

8/ Recoatability not required for class 3 coatings.

3.14 Aviation fuel compatibility (not required for class 2). Coating systems shall not contribute particulate or chemical contamination which is detrimental to subsequent logistics or aircraft operation when tested in accordance with 4.5.7. Particulate contamination occurs when solids, color bodies and fuel reaction bodies are leached from the coating, whereas chemical contamination evidences itself when the fuel becomes corrosive, shows increased existent gum or suffers a loss in diethylene bromide.

3.14.1 Color. Effect of coating systems on color of fuel shall be negligible when tested in accordance with 4.5.7.2. For JP-5 fuel, Saybolt color difference shall not exceed 2. For aviation gas, there shall be no perceptible difference in color, turbidity or precipitation.

3.14.2 Corrosion. JP-5 fuel and aviation gas shall not become corrosive after contact with coating systems, when tested in accordance with 4.5.7.3.

3.14.3 Existent gum. Effect of coating systems on existent gum shall be negligible when tested in accordance with 4.5.7.4. The difference in existent gum (unwashed) shall not exceed 4 milligrams (mg)/100 milliliters (mL). The difference in existent gum (washed) shall not exceed 2 mg/100 mL.

3.14.4 Solids (total sediment). The effect of coating systems on total sediment shall be negligible, when tested in accordance with 4.5.7.5. The difference in total sediment shall not exceed 7 mg/L.

3.14.5 Bromine. The effect of coating systems on ethylene dibromide content of aviation gas shall be negligible when tested in accordance with 4.5.7.6. The difference in bromine content shall not exceed 10 percent.

3.15 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 this 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 all tests specified in 4.5, 4.6, and 4.7. Qualification approval for type III coating systems shall also constitute qualification approval for type I coating systems.

4.3.1 Ingredient samples. The contractor shall submit to the designated laboratory 4 L (1 gal) each of Parts A and B components, or a 4-L (1-gal) sample of a one-component coating.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the quality conformance tests required for identity in table I.

4.4.1 Panel preparation. Test plates of the nature and size specified in the applicable test method shall be coated in accordance with the contractor's application instructions. The individual coatings shall be mixed in accordance with the contractor's mixing instructions.

4.5 Test procedures. Tests shall be conducted in accordance with table II.

TABLE II. Test procedures.

| Characteristic | Applicable test method FED-STD-141 | Applicable ASTM test method |
|---|---|---|
| Pigment | 4021 (using suitable extraction mixture) | ------ |
| Volatiles | | D 2369 |
| Nonvolatile vehicle (calculated by difference) | 4053 | ------ |
| Viscosity | | (Krebs - Stormer) D 562 or (Brookfield) D 2196 |
| Mass per L (gal) | | D 1475 |
| Fineness of grind | | D 1210 |
| Flash point | | D 93 |
| Odor | | D 1296 |
| Color (quality conformance inspection) | | D 1729 |
| Color (qualification) | | E 308 |
| Color (JP-5 fuel) | | D 156 |
| Directional reflectance (green filter) | | E 97 |
| Drying (curing) time | 4061 | ------ |
| Flexibility (conical mandrel) | | D 522 |
| Application (as modified by contractor's instruction) | 2131 or 2141 | ------ |
| Condition in container | 3011 | ------ |
| Gloss[1/] | | D 523 |
| Ash | | D 1208, sec 2 |

[1/] The panel prepared for gloss shall also be visually examined for surface smoothness, irregularities, and appearance.

4.5.1 Pot life. The coatings of the coating systems shall be mixed from the components, in accordance with the contractor's instructions, in a suitable container so as to result in approximately 1 L ((1 quart (qt)) of finished material. For routine testing, ambient conditions above 21°C (70°F) and 50 percent relative humidity shall be satisfactory. For referee tests, 21°C ± 3°C (70°F ± 5°F) and 80 ± 10 percent relative humidity shall prevail. The time between mixing and the loss of adequate brushing and spraying properties shall be determined. Report up to a 48-hour period the actual temperature, humidity and the time of loss of adequate brushing and spraying properties.

4.5.2 Immersion resistance. The coating systems shall be applied in accordance with the contractor's instructions, and consonant with 3.4, so as to coat completely two 150 by 300 by 3 mm (6 by 12 by 1/8 inch) blasted hot rolled mild steel plates. The blast pattern shall approximate 0.08 mm (3-mils) depth for coating systems of at least 0.13-mm (5-mils) thickness and 0.04-mm (1.5-mils) for systems less than 0.13-mm (5-mils) thick, have completely removed all mill scale, rust and rough edges and be similar to the average areas encountered in blasted tanks prior to coating. Unless otherwise specified (see 6.2.1), 24 hours dry time shall be allowed between coats and one week at 21°C (70°F) or equivalent between the last coat and first immersion.

4.5.2.1 The coated panels shall be subjected to 20 cycles (or to prior failure) of the following test cycle:

(a) Test cycle for evaluating tank coating. The cycle comprises three operations carried out in the order specified:
   (1) Salt water immersion for one week. Immerse panels totally for one week in 3 percent salt water solution comprised of commercial table salt dissolved in distilled water, at a temperature of 27°C ± 6°C (80°F ± 10°F).
   (2) Aromatic fuel immersion for one week. Following salt water immersion, immerse panels totally for one week in a 40-percent aromatic synthetic gasoline comprising a blend of 60 volumes aliphatic petroleum naphtha conforming to TT-N-95, 25 volumes toluene conforming to TT-T-548 and 15 volumes xylene conforming to TT-X-916, at a temperature of 27°C ± 6°C (80°F ± 10°F).
   (3) Hot sea water immersion for two hours. This operation is intended to simulate conditions encountered in the use of tank cleaning equipment. Following fuel immersion, immerse panels totally in hot synthetic sea water for two hours at 80°C (175°F).

Note: Operations (1) to (3) constitute one complete test cycle. This cycle is repeated and coating deterioration reported after each complete cycle. If coating is still satisfactory after 20 cycles, wipe lightly with a soft cloth and fresh water, allow 48 hours to thoroughly dry and recoat the central upper third of one side of each panel, masking the portion from the edge to 13-mm (1/2 inch) inward, with one coat of the finish coating of the coating systems (or primer and finish coat if appropriate). Allow one week dry time, and complete immersion test with five additional test cycles. On the recoated area, adhesion of the added coating readily discerned to be less than half the adhesion between the original coats, shall be considered failure. Inspect for compliance to 3.9.

4.5.3 Resistance to boiling water. A panel, prepared in accordance with 4.5.2 shall be immersed to 150 mm (6 inches) of the 300-mm (12-inch) length in boiling distilled water in a beaker for 500 hours or to prior failure. The extent, nature and time of failure shall be reported.

4.5.4 Resistance to fuel and water at 32°C (90°F). A panel prepared in accordance with 4.5.2, except for size, approximately 60 by 120 mm (2-1/2 by 5 inches) shall be immersed in 50 mm (2 inches) of 3 percent salt solution covered by 50 mm (2 inches) of the synthetic fuel of 4.5.2 in a Mason jar, closed and sealed. The jar shall be kept at 32°C ± 3°C (90°F ± 5°F) by partial immersion in a water bath or other suitable means for 240 hours. The panel shall be removed and immediately examined and reported for any change in appearance, film failure or loss of apparent hardness and adhesion of the coating by visual observation and knife test.

4.5.5 Recoatability. Recoatability for qualification of the coating systems shall be determined by 3.9 and 4.5.2. For identification characteristics in connection with acceptance of individual lots, after 24 hours dry time, the panel of 4.5.4 shall be recoated on

one side with the finish coat of the coating systems, (or primer and finish coat if appropriate) allowed 72 hours dry time and then be immersed in the same media of 4.5.4 for 24 hours, examined and reported as in 4.5.4. Recoatability shall not be required to be determined for class 3 coatings.

4.5.6 Adhesion. A separate panel similar to the panel tested under 4.5.5 shall be prepared at the same time. Adhesion of each coat shall be tested by knife just prior to application of the next coat and of the coating systems just prior to the time of immersion of the panel of 4.5.5. After the immersion periods for the panel of 4.5.5, the adhesion between the immersed and the retained panel shall be compared.

4.5.7 Tests for aviation fuel compatibility. The effect of coating systems on fuel degradation shall be measured by comparison of test results obtained on fuel in contact with the coating system with the same age unexposed fuel. Results of tests shall be forwarded to Commander, Naval Sea Systems Command, Materials Engineering, Washington, DC 20362. The format shown in 6.3 is suggested for use in reporting test results.

4.5.7.1 Preparation for fuel samples for test.

(a) Apply coating systems to four steel rods, 19 mm by 190 mm (3/4-inch by 7-1/2 inches), drilled, threaded and fitted with a 3-mm by 19-mm (1/8-inch by 3/4-inch) all thread bolt for suspension. Allow 7 days drying time at ambient laboratory temperature after application of last coat, prior to immersion in fuel.

(b) Prepare approximately 5 L each of particle-free aviation gas and JP-5 fuels by repeated filtration through a type AA millipore filter as specified in Appendix X of ASTM Standard on Petroleum Products and Lubricants, using 100/130 aviation gas conforming to MIL-G-5572, and JP-5 fuel conforming to MIL-T-5624.

(c) Wash coated test rods thoroughly with hot water at 82°C ± 6°C (180°F ± 10°F) for 15 to 30 minutes, drain and dry. Mount test rod on a 6-mm by 180-mm (1/4-inch by 7-inches) square plastic beaker cover (for 2-L beaker), center drilled for mounting test rod.

(d) Into four clean 2-L beakers, pour 1000-2000 mL of particle-free aviation gas. Into four clean 2-L beakers, pour 1000-1200 mL of particle-free JP-5 fuel. Cover two beakers of each fuel with rod-mounted cover (for "exposed fuel" samples). Cover two beakers of each fuel with 6-mm by 180-mm (1/4-inch by 7-inches) square plastic beaker covers, plain (for "unexposed fuel" samples). Store all beakers with fuel in dark and maintain at 27°C ± 6°C (80°F ± 10°F) for 30 days. Swirl fuel by rotating beakers at least three times daily.

(e) On the 31st exposure day, test "exposed" and "unexposed" aviation gas and JP-5 fuel for color, corrosion, existent gum, and solids, and "exposed" and "unexposed" aviation gas for bromine in accordance with the following test procedures.

4.5.7.2 Color. Color for JP-5 fuel shall be determined in accordance with ASTM D 156. Report difference between "exposed" and "unexposed" fuels. Colors of "exposed" and "unexposed" aviation gas shall be compared visually. Report difference as "pass" or "fail" in accordance with 3.3.

4.5.7.3 Corrosion. Corrosiveness of both "exposed" and "unexposed" fuels shall be determined in accordance with ASTM D 130.

4.5.7.4 Existent gum. Existent gum (both "washed" and "unwashed") shall be determined in accordance with ASTM D 381. Report differences between "exposed" and "unexposed" fuels.

4.5.7.5 Solids (total sediment). Solids shall be determined in accordance with Appendix X of ASTM Standard on Petroleum Products and Lubricants.

4.5.7.6 Bromine. Bromine shall be determined on both the "exposed" and "unexposed" fuels in accordance with the following procedure.

4.5.7.6.1 Apparatus.

4.5.7.6.1.1 Decomposition. The apparatus used for the decomposition of bromides by sodium in liquid ammonia shall be as shown on figure 1. The center neck of the 250-mL, 2-neck, round-bottom flask carries a teflon-sealed, corrosion-resistant, steel stirring

assembly. The side neck shall be fitted with a 2-hole rubber stopper through which pass an ammonia delivery tube and a vent protected by a drying tube containing Drierite or equal. After charging of the flask with liquid ammonia, the pictured rubber stopper shall be replaced with a 1-hole stopper fitted with a vent tube, also protected by a drying tube.

4.5.7.6.1.2 Titration. The apparatus used for following the titration of bromides shall be a continuous indicating pH meter such as the Beckman Model H-2, equipped with a glass electrode and a silver electrode (see note 1). A titration set-up shall be used, such as shown on figure 2 which shall be capable of accurate delivery of slip-drop quantities of silver nitrate.

4.5.7.6.2 Materials and reagents. The following materials and reagents shall be required:

(a) Dry ice and acetone for cooling
(b) Drierite or equal
(c) Ammonia
(d) Sodium
(e) Alcohol
(f) Sodium hydroxide pellets
(g) Ammonium persulfate
(h) Sodium arsenite, 10 percent
(i) Nitric acid, approximately 20 percent
(j) Silver nitrate, 0.05N

4.5.7.6.3 Procedure for the analyses of gasolines. The procedure for the analyses of decomposition of bromides shall be as follows:

(a) Cool the flask with a dry-ice/acetone slurry and introduce about 15 grams (g) of ammonia (see note 2). Replace the rubber stopper carrying the delivery tube by the one fitted only with a protected vent and add a cube of freshly cut sodium having an edge dimension of about 5 mm. Rotate the stirrer slowly by hand to partially dissolve the metal. Add exactly 50 mL of the gasoline under test (see notes 3 and 4), remove the cooling bath, and start the stirrer. As soon as the ammonia starts to evolve, disconnect the drying tube from the vent (see note 5). Continue the stirring until the ammonia has evaporated (about 20 minutes for a 15-g charge). If the characteristic blue color of sodium in liquid ammonia should disappear during the earlier stages of the evaporation, add another piece of sodium.

(b) Extraction and work-up of extract. Upon evaporation of the ammonia, add 5 mL of alcohol to the mixture to decompose the excess sodium. Next, add 30 mL of water and stir to aid extraction of the inorganic salts. Remove the reaction flask from the stirrer, washing down the stirrer with water, and transfer the contents to a separatory funnel. Separate the aqueous layer and extract the organic layer with two additional 30-mL portions of water. Combine the three aqueous extracts, evaporate to about 50 mL, and cool slightly. If, at this point, the mixture is not clear and contains a precipitate, filter and wash the paper with several small portions of hot water. Evaporate the combined filtrate and washings to about 50 mL and cool slightly. Add 2 g of sodium hydroxide pellets followed by 2 g of ammonium persulfate. After the solids have dissolved, boil the solution for about 15 minutes (see notes 6 and 7). Cool the solution slightly, add 10 mL of a 10 percent solution of sodium arsenite, boil for 10 minutes, and then cool to room temperature. Make the solution acid to phenolphthalein by adding $HNO_3$ (20 percent) and determine the bromides as given below (see note 8).

(c) Titration of bromides. Immerse the titration electrodes into the solution, start the stirrer, and set the pH meter to read on the acid scale. If the pH meter shows an apparent pH reading of greater than 1.5, add more $HNO_3$, until a reading of 0 to 1.5 is obtained. Next, titrate the bromides with 0.05N $AgNO_3$, making a record of apparent pH versus mL $AgNO_3$ added. From a plot of the data, determine the appropriate inflection points and calculate the quantities of bromides present by the formulae given below.

$$g\ Br = 0.003996B$$

or

$$g\ Br/gal\ at\ 15.6°C\ (60°F) = 0.3025B\ [1 + 0.00065(t_F - 60)] = 0.3025B\ [1 + 0.00065(1.8t_C - 28)]$$

Where:

B = mL 0.05N $AgNO_3$ required to titrate bromide, and

$t_F$ = temperature (°F) of gasoline when sampled

$t_C$ = temperature (°C) of gasoline when sampled

NOTES:

1. A heavy-gage silver wire attached directly to the calomel jack of the pH meter may be used. The portion that dips into the liquid should be cleaned by rubbing lightly with fine emery paper and rinsing with distilled water.
2. It is convenient to use a lecture bottle as the source of ammonia. From such a container, the gaseous ammonia may be introduced into the flask with virtually complete condensation at rates up to 2 g/minute. The quantity of ammonia being added can be followed by periodic weighing of the lecture bottle. All steps involving the charging and evaporation of ammonia should be carried out in a hood.
3. In general, it may be advisable to precool the sample by placing it in a flask surrounded by dry ice prior to introducing it into the sodium/liquid ammonia mixture. In such cases, care should be taken to protect the sample from moisture and from dissolving carbon dioxide. After adding a precooled sample to the reaction mixture, the cooling vessel may be rinsed with about 10 mL of isooctane (at room temperature) and this rinsing may be added directly to the reaction mixture.
4. By using a slightly larger amount of ammonia (about 20 g), it has been found that precooling is not necessary. Under these conditions, a 50-mL sample of gasoline (at room temperature) may be added directly into the reaction mixture without causing excessive boiling of the ammonia, provided that the addition is as slow as from a pipet.
5. If indicating Drierite or equal is used, evolution of ammonia is evidenced by a color change.
6. During this period, it is important that the solution remain alkaline. Since sulfuric acid is one of the decomposition products of ammonium persulfate, the solution should be checked occasionally to assure alkalinity. This may be done using litmus paper as an external indicator or methyl orange as an internal indicator. In the majority of cases, the 2 g of sodium hydroxide specified will be entirely sufficient; however, should it be found that the solution is becoming acid, more sodium hydroxide should be used.
7. In some cases, a reddish solid or a dark solution may form during the oxidation step. Such behavior will not affect the analyses.
8. At this point, the solution may contain a precipitate. This is of no consequence and usually will redissolve on further acidification in the next step.

4.6 Service performance. Service performance shall meet the requirements of 3.10, based on durability data from tank preservation records.

4.7 Toxicity. A manufacturer of material shall disclose the formulation of his product to the Navy Bureau of Medicine and Surgery, Navy Department, Washington, DC 20372. The disclosure of proprietary information, which shall be held in confidence by the Bureau of Medicine and Surgery, shall include the name, formula, and approximate percentage by weight and volume of each ingredient in the product; the results of any toxicological testing of the product; and any such other information as may be needed to permit an accurate appraisal of any toxicity problem associated with the handling, storage, application, use or disposal of the material.

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.

5. PACKAGING

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

5.1 Packaging, packing, and marking. Unless otherwise specified (see 6.2.1), the coating of the coating systems for class 3 shall be delivered in 4-L (1-gal) cans or 20-L (5-gal) pails. Classes 1, 2, and 4 shall be delivered in 4-L or 20-L (1 or 5-gal) amounts in suitable unitized packaging. Coating of the coating systems shall be packaged level A, B, or C; packed level A, B, or C, as specified (see 6.2.1), and marked in accordance with PPP-P-1892.

5.2 Marking. In addition to any special marking specified (see 6.2.1), mixing and use instructions as applicable and hazardous markings, such as flash point or identification of ingredients considered toxic (such as leaded pigments contained therein) shall be marked on each interior or exterior container.

5.2.1 Special marking. In addition to the markings required by the contract or order (see 6.2.1), each container containing type III material (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 6.4)

6. NOTES

6.1 Intended use. Although the different classes of coating systems of this specification afford superior protection for various shipboard tanks, the coating systems are not necessarily interchangeable or of equal merit for all types of tanks and conditions of application. None of the coating systems covered herein are suitable for use in fresh or potable water tanks except by conformance to additional requirements. Class 2 coating systems may discolor fuel in clean fuel tank service. Class 3 coating systems may be unsuitable for acidic or alkaline cargos.

6.1.1 Coatings selection.

6.1.1.1 Type I. Type I coatings are acceptable in geographic areas where their volatile composition is compatible with any existing air pollution control regulations.

6.1.1.2 Type III. Type III coatings are acceptable for use in Los Angeles County and other areas where the rules cited in 6.4 apply.

6.1.1.3 Depending on local application conditions, the acquisition guidance in 6.2.1.2 may also apply to selection of specific proprietary products within each type and class.

6.1.2 Coatings applications.

6.1.2.1 New applications. Coatings in accordance with this specification should be applied as specified in the contractor's instructions. For Naval ship applications, Naval Sea Systems Command instructions govern when they conflict with, strengthen, or otherwise elaborate on contractor's instructions.

6.1.2.2 Touch-up applications. Since the type II coating systems have been deleted from DOD-P-23236A(SH), type I coating systems should be maintained using type I material, and type III coatings maintained with type III material. In each instance, touch-up material should be obtained from the same contractor and applied in accordance with the contractor's instructions.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

(a) Title, number, and date of this specification.
(b) Type and class required (see 1.2).
(c) If dry time is other than specified (see 4.5.2).
(d) When class 3 coating system to be delivered in unit quantities other than specified (see 5.1).

(e) Level of packaging and packing required (see 5.1).
(f) Special marking required (see 5.2).

6.2.1.1 Level B packaging. Level B packaging is intended to provide economical but limited protection and should be specified only when it is determined that the coating systems will be held in covered storage no more than one year from date of initial packaging.

6.2.1.2 Acquisition guidance. Coatings in accordance with this specification vary to some extent in surface preparation required, and effect of high humidity, slight surface moisture, and temperature during applications. Requirements for specific products can be found in contractor's instructions. Many factors affect the total overall cost per square foot per year for tank application, possibly the least of which is the cost of the coating systems which average about 10 percent of the total cost. The number of coats per coating systems and square foot coverage per L or per gal further complicate the equity of purchase solely on the basis of lowest cost per L or cost per gal. Contracting officers therefore should fully consider such factors.

6.3 The following format is suggested for reporting test results required by 4.5.7.2 to 4.5.7.6 inclusive:

Filtered JP-5 (MIL-T-5624)

| | Saybolt color | Corrosion | Existent gum Unwashed | Existent gum Washed | Solids |
|---|---|---|---|---|---|
| Exposed fuel | | | | | |
| Unexposed fuel | | | | | |
| Difference | | | | | |
| Requirements | 2 (max) | None | 4 mg/100 mL (max) | 2 mg/100 mL (max) | 2 mg/L (max) |

Filtered 100/130 Aviation Gas (MIL-G-5572)

| | Color | Corrosion | Existent gum Unwashed | Existent gum Washed | Solids | Bromine |
|---|---|---|---|---|---|---|
| Exposed fuel | | | | | | |
| Unexposed fuel | | | | | | |
| Difference | | | | | | |
| Requirements | To pass | None | 4 mg/100 mL (max) | 2 mg/100 mL (max) | 2 mg/100 mL (max) | 10 percent (max) |

Test Report No. _____
Name and Location of Testing Lab. _____
Date of Report _____

6.4 Volatile content. Although the type III container marking refers to the South Coast Air Quality Management District, the paint may be used anywhere else a paint complying with 3.2.5 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.

6.5 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 QPL 23236 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 6.5.1).

6.5.1 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.

6.6 Comparability. The comparability of types and classes of MIL-P-23236(SHIPS) and DOD-P-23236A(SH) is shown in table III.

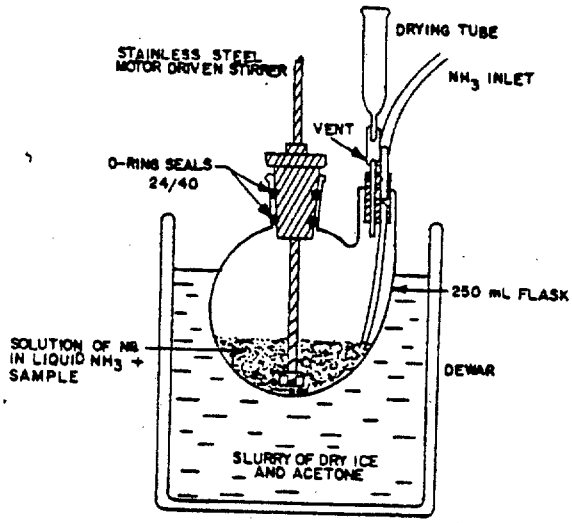
TABLE III. Comparability data.

| Coating system | MIL-P-23236(SHIPS) | DOD-P-23236A(SH) |
|---|---|---|
| Type I | X | X |
| Type II | X | 1/ |
| Type III | | X |
| Class 1 | X | X |
| Class 2 | X | X |
| Class 3 | X | X |
| Class 4 | X | X |

1/ Deleted (see 6.1.2.2).

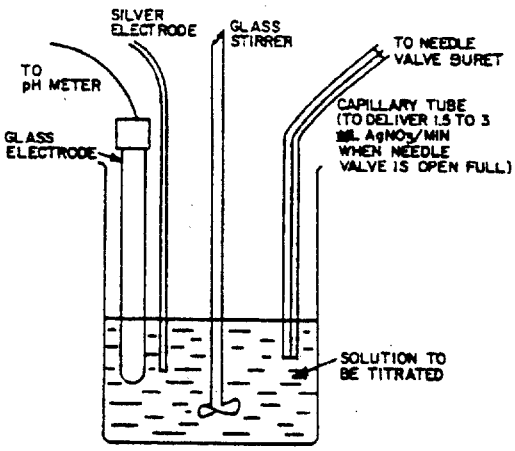
6.7 Changes from previous issue. Asterisks (*) are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Preparing activity:
Navy - SH
(Project 8030-N063)




SH 7092

FIGURE 1. Apparatus for the decomposition of organic halides.




SH 7093

FIGURE 2. Potentiometric titration assembly.

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

*(See Instructions – Reverse Side)*

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

b. ADDRESS *(Street, City, State, ZIP Code)*

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional

b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional

c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional

8. DATE OF SUBMISSION *(YYMMDD)*

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