NOTE: The document identifier and heading has been changed on this page to reflect that this is a performance specification. There are no other changes to this document. The document identifier on subsequent pages has not been changed, but will be changed the next time this document is revised.

METRIC
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SUPERSEDING
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(See 6.8)

PERFORMANCE SPECIFICATION

PAINT COATING SYSTEMS, FUEL AND SALT WATER BALLAST TANKS (METRIC)

This specification is approved for use within 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 surfaces subjected to fuel and salt water in shipboard fuel and salt water ballast tanks. These coatings are not applicable to fresh or potable water tanks.

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

Type I - General use. May be used in areas where air pollution regulations do not apply.
Type III - Limited solvent content for use where air pollution regulations apply (see 3.2.1).
Type IV - A coating system with a solvent content of 340 grams per liter of paint (2.8 pounds of solvent per gallon of paint) or 290 grams of solvent per liter of paint (2.4 pounds per gallon) for use where air pollution regulations apply.
Class 1 - A coating system where the first coat is a shop primer or preconstruction primer.
Class 2 - A coating system with or without shop primer which will be used exclusively in dedicated seawater ballast tanks. No exposure to fuel, other hydrocarbons, or fresh water is permitted.
Grade A - A coating system which is able to be stored, applied and cured at a temperature range of minus 7 to 10 degrees Celsius (°C) (20 to 50 degrees Fahrenheit (°F)).

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 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 8030

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

TT-N-95 - Naphtha; Aliphatic.
TT-T-548 - Toluene, Technical.
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.

STANDARDS

FEDERAL

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

(Copies of specifications, standards, and other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Tester. (DoD adopted)
D 130 - Standard Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test. (DoD adopted)
D 156 - Standard Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method). (DoD adopted)
D 381 - Standard Test Method for Existent Gum in Fuels by Jet Evaporation. (DoD adopted)
D 522 - Standard Test Method for Elongation of Attached Organic Coatings with Conical Mandrel Apparatus. (DoD adopted)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) - Continued

D 523 - Standard Test Method for Specular Gloss. (DoD adopted)
D 562 - Standard Test Method for Consistency of Paints Using the Stormer Viscometer. (DoD adopted)
D 846 - Standard Specification for Ten-Degree Xylene. (DoD adopted)
D 910 - Standard Specification for Aviation Gasolines. (DoD adopted)
D 1208 - Standard Test Methods for Common Properties of Certain Pigments. (DoD adopted)
D 1210 - Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems. (DoD adopted)
D 1296 - Standard Test Method for Odor of Volatile Solvents and Diluents. (DoD adopted)
D 1475 - Standard Test Method for Density of Paint, Varnish, Lacquer, and Related Products. (DoD adopted)
D 1729 - Standard Practice for Visual Evaluation of Color Differences of Opaque Materials. (DoD adopted)
D 2196 - Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer. (DoD adopted)
D 2369 - Standard Test Method for Volatile Content of Coatings. (DoD adopted)
D 3359 - Standard Method for Measuring Adhesion by Tape Test. (DoD adopted)
E 308 - Standard Method for Computing the Colors of Objects by Using the CIE System. (DoD adopted)
F 718 - Shipbuilders and Marine Paints and Coatings; Product/Procedure Data Sheet. (DoD adopted)

ASTM and other Specifications and Classifications for Petroleum Products and Lubricants, Committee D-2, 4th Edition, 1985.

(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 and Rule 107

(Application for copies should be addressed to the South Coast Air Quality Management District, 9150 Flair Drive, El Monte, CA 91731.)

STEEL STRUCTURES PAINTING COUNCIL (SSPC)
Surface Preparation Specifications

(Requests for copies should be addressed to the Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, PA 15213.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Coating systems furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.4).

3.2 Materials. The coating systems shall be composed of the following vehicles for each class, pigmented, formulated, and manufactured to produce a uniform product meeting the requirements of this specification. The coating systems shall be composed of two component, chemically cured, epoxy resins converted with amines. Materials (types, classes and grades) provided in accordance with this specification shall contain no asbestos or lead.

3.2.1 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.

Solvents shall not exceed 20 percent by volume of the coating material. The contractor shall provide certification of compliance to the above requirements. The volatile thinner shall be in accordance with any solvent system in accordance with Rule 102 of the South Coast Air Quality Management District. When specified in contract or order, the contractor shall provide certification to this effect (see 4.8).

3.2.1.1 Type IV. The solvent content (more accurately termed volatile organic content (VOC)) of type IV coating systems is limited to either 340 or 290 grams of solvent per liter of coating minus water (water must be excluded before calculating the VOC) (see 4.5.7.7).

3.3 Color. Coating systems shall be composed of coats having a 60-degree specular gloss 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.

[illegible] preparing not as specified.

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. The coating system shall consist of at least two full coats as specified by the manufacturer (excluding shop or preconstruction primer) (see 6.7).

3.5 Pot life. The pot life of the coatings of the coating systems, mixed and ready for application, shall be a minimum of 4 hours at 21°C (70°F) and 80 percent relative humidity (see 4.5.1). The pot life of the coatings of the reduced temperature coatings system, mixed and ready for application, shall be a minimum of 3 hours (see 4.5.1).

3.6 Drying or curing time. Coatings of the coating systems shall require not more than 24 hours between coats for full cure and shall be ready for service within seven (7) days after the application of the last coat. Application and cure shall be at the temperature specified by the manufacturer. In the absence of manufacturer's guidance, the temperature selected shall be at the low end of the temperature range (see 4.5).

3.7 Flash point. Coatings shall not flash at temperatures lower than 38°C (100°F) except shop primers which shall not flash at a temperature lower than 20°C (68°F) (see 4.5). Preconstruction primers (shop primers, after blast primers, after pickling primers) shall have a minimum flash point of 20°C (68°F) (see 4.5).

3.8 Application characteristics. The coating systems shall be readily applied by brush (touch up areas only) and spray, using commercially available equipment (see 4.5.8 and 4.5.9). The coatings shall exhibit reasonable leveling without excessive sagging when applied at proper film thickness as recommended by the manufacturer.

3.9 Immersion resistance. Coatings shall show no pinhole rusting, loss of adhesion either between coats or to the substrate or blisters larger than 1.5 millimeters (mm) (1/16 inch) in diameter when tested in accordance with 4.5.2. Blisters smaller than 1.5 mm and surface imperfections neither of which increase in size after the tenth cycle and constitute no more than 3 percent of the test panel surface area shall not be considered failure.

3.9.1 Adhesion. Adhesion of the recoated area of the test panel shall be at least 50 percent of the originally applied and immersed coating system (see 4.5.2.1). For adhesion of the test panels compared to the control panel see 4.5.6.

3.10 Service performance. The coating systems shall continue to provide protection against corrosion with a total of 10 percent maximum touch-up for a minimum period of 3 years (see 4.6).

3.11 Condition in container. The coating components of the coating systems shall be usable; that is, shall be readily broken up with a paddle or mechanical stirring 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

usually causes a malfunction of the equipment. [illegible]

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, increase more than one-fifth in time of dry, nor show any other objectionable properties for at least 1 year.

3.12 Toxicity. The material shall have no adverse effect on the health of personnel when properly used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the Naval Medical Command (NAVMEDCOM) which will act as advisor to the contracting activity (see 4.7).

3.13 Identification characteristics. Values for identification characteristics shall be those established for the product at the time submitted for qualification (see table I). 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. Identification characteristics for reduced temperature materials shall be at the low end of the temperature range. The qualification testing shall be conducted at the low temperature in the range.

TABLE I. Identification characteristics values.

Characteristic	Coating component 1/	Coating 2/	Coating system 3/
Chemical nature	X		
Percent of principal constituents (15 percent or more of total)	X		
Percent nonvolatile vehicle	X		
Percent volatile	X		
Mass per liter (L), gallon (gal)	X	X	
Color	X	X	
Viscosity	X	X	
Flash point	X	X	
Fineness of grind	X	X	
Odor	X	X	
Pot life		X	
Drying or curing time		X	X
Gloss and appearance		X	X
Recoatability		X 4/	X 4/
Adhesion		X 4/	X 4/
Flexibility		X	X
Resistance to boiling water immersion (identification standard)			X 4/

See footnotes at end of table.

TABLE I. Identification characteristics values. - Continued

Characteristic	Coating component 1/	Coating 2/	Coating system 3/
Resistance to fuel and water at 32°C (90°F) (accelerated performance test)			X 4/
Mixing instructions		X 5/	
Application instructions			X 5/
Ash		X	
Aviation fuel compatibility			X

1/ Coating components are individually packaged components such as base component (part A) and converter component or hardener (part B). Indicate only applicable characteristics.
2/ Coating is the resin base and converter as mixed for application.
3/ Coating system is total system (number and type of coats and approximately dry film thickness as tested for qualification approval).
4/ Not required for each lot. Shall be run at least once every 6 months.
5/ Required once only. Shall be furnished with request for test.

3.14 Aviation fuel compatibility. Coating systems shall not contribute particulate or chemical contamination that is detrimental to subsequent logistics or aircraft operation as specified in 4.5.7. Particulate contamination occurs when solids, color bodies, and fuel reaction bodies are leached from the coating. Chemical contamination evidences itself when the fuel becomes corrosive, shows increased existent gum, or suffers a loss in diethylene bromide.

3.14.1 Fuel color. The effect of coating systems on color of fuel shall be as follows (see 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 (see 4.5.7.3).

3.14.3 Existent gum. The effect of coating systems on existent gum shall be as follows (see 4.5.7.4). The difference in existent gum (unwashed) shall not exceed 4 milligrams (mg) per 100 milliliters (mL). The difference in existent gum (washed) shall not exceed 2 mg per 100 mL.

3.14.4 Solids (total sediment). The effect of coating systems on total sediment shall be as follows (see 4.5.7.5). The difference in total sediment shall not exceed 2 mg per liter (L).

3.14.5 Bromine. The effect of coating systems on ethylene dibromide content of aviation gas shall be as follows (see 4.5.7.6). The difference in bromine content shall not exceed 10 percent.

3.15 Shop primer (class 1). If the total paint system includes, as a first coat, a shop primer or preconstruction primer, the following requirements for exposure and immersion resistance shall apply:

(a) The shop primer shall protect a steel substrate for a period of up to 1 year (see 4.6.1). After 1 year of atmospheric exposure, the test panel shall be free of all corrosion products (see 4.6.1(a)).
(b) The test panel with shop primer shall be cleaned according to paint manufacturer's instructions and recoated according to manufacturer's instructions with the finish paint system which shall then be subject to the requirements of immersion resistance (see 3.9 and 4.6.1(b)).

3.16 Ballast tank coatings (class 2). Coating systems for use solely in dedicated salt water ballast tanks shall meet the requirements of 3.9. When used with a shop primer, ballast tank coating systems shall meet the requirements of 3.15.

3.17 Product/procedure data sheet. Manufacturers of coatings shall provide the ASTM F 718 forms to the qualifying activity. The product/procedure data sheet shall also be included with each shipment of the material covered by this specification.

3.18 Physical properties during storage. The physical properties of the coating shall not degrade through the shelf life period when stored in accordance with the storage temperature constraints as documented by 3.17.

3.19 Material safety data sheet. The contracting activity shall be provided a material safety data sheet (MSDS) at the time of the contract award. The MSDS shall be provided in accordance with the requirements of 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 or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities 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 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

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 inspection. Qualification inspection shall be conducted at a laboratory satisfactory to the Naval Sea Systems Command. Qualification tests shall consist of all tests specified in table II and 4.7. Qualification approval for type III and type IV coating systems shall also constitute qualification approval for type I coating systems.

TABLE II. Test procedures.

Characteristics	Requirements	Test paragraph	Applicable Federal standard test method FED-STD-141	Applicable ASTM test	Quality conformance	Qualification
Chemical nature	3.2	---	----	------	---	X
Volatiles	3.2.1	---	----	D 2369	X	X
Nonvolatile vehicle		---	----	------	X	X
Viscosity	3.11	---	----	(Krebs - Stormer) D 562 or (Brookfield) D 2196	X	X
Mass per L (gallon)	---	---	----	D 1475	X	X
Fineness of grind	---	---	----	D 1210	X	X
Flash point	3.7	---	----	D 93	X	X
Odor	---	---	----	D 1296	X	X
Color	3.3	---	----	------	---	---
Quality conformance				D 1729	X	---
Qualification				E 308	---	X
Fuel (JP-5)				D 156	X	X
Specular gloss	3.3	---	----	D 523	X	X
Drying (curing) time	3.6	---	4061	------	X	X
Flexibility	---	---	----	D 522	X	X
Application	3.8	---	4321.2 and 4331.1	------	---	X
Immersion resistance	3.9	4.5.2	----	------	---	X
Resistance to fuel and water	3.9	4.5.4	----	------	---	X
Condition in container	3.11	---	3011	------	X	X
Ash	---	---	----	D 1208	X	X
Aviation fuel compatibility	3.14	4.5.7	----	------	---	X
Pot life	3.5	4.5.1	----	------	X	X
Service performance	3.10	4.6	----	------	---	X
Shop primer	3.15	4.6.1	----	------	---	X

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

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the quality conformance tests as specified in table II.

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. The temperatures at which tests are conducted are specified in the applicable FED-STD-141 and ASTM test methods identified in table II. For reduced temperature materials, the tests shall be conducted at the low end of the temperature range.

4.5.1 Pot life. The coatings of the coating system shall be mixed from the components, in accordance with the contractor's instructions, in a container so as to result in approximately 1 L (1 quart) 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 ± 3°C (70 ± 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. For the reduced temperature coatings' systems, pot life shall be determined at the lower end of the temperature range or as directed by the paint manufacturer.

4.5.2 Immersion resistance. The coating systems shall be applied in accordance with the contractor's instructions and shall be consonant with 3.9 in order 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 prepared to surface profile SSPC-SP10 as defined by the Steel Structures Painting Council before coating. Unless otherwise specified (see 6.2.1), 24 hours dry time shall be allowed between coats and 1 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 25 cycles (or to prior failure) of the following test cycle.

(a) Test cycle for evaluating tank coatings does not apply to class 2 coatings. The cycle comprises three operations carried out in the order specified:

(1) Salt water immersion for 1 week: immerse panels totally for 1 week in 3 percent salt water solution comprised of commercial table salt dissolved in distilled water, at a temperature of 27 ± 6°C (80 ± 10°F).

(2) Aromatic fuel immersion for 1 week: following salt water immersion, immerse panels totally for 1 week in a 40-percent aromatic synthetic gasoline comprising a blend of 60 volumes aliphatic petroleum naphtha conforming to TT-N-95, 25 volumes ASTM D 846 toluene conforming to TT-T-548, and 15 volumes xylene conforming to ASTM D 846 at a temperature of 27 ± 6°C (80 ± 10°F).

(3) Hot seawater immersion for 2 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 seawater for 2 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 1 week dry time and complete immersion test with five additional test cycles. On the recoated area, adhesion determined in accordance with ASTM D 3359 of the added coating less than half the adhesion between the original coats shall be considered failure. Inspect for conformance to 3.9.1.

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 breaker 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 specified in 4.5.2 in a clear glass jar, closed and sealed. The jar shall be kept at 32 ± 3°C (90 ± 5°F) by partial immersion in a water bath or other means for 240 hours. The panel shall be removed, immediately examined, and reported for any change in appearance, such as chalking or color change, 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 as specified in 3.9 and 4.5.2. For identification characteristics in connection with acceptance of individual lots, after 24 hours dry time, the panel specified in 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 as specified in 4.5.4 for 24 hours, examined, and reported as specified in 4.5.4.

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 determined in accordance with ASTM D 3359 just before application of the next coat and of the coating systems just before the time of immersion of the panel specified in 4.5.5. After the immersion periods for the panel specified in 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.

4.5.7.1 Preparation for fuel samples for test.

(a) Apply coating systems to four steel rods, 19 by 190 mm (3/4 by 7-1/2 inches), drilled, threaded and fitted with a 3 by 19-mm (1/8 by 3/4-inch) all thread bolt for suspension. Allow 7 days drying time at ambient laboratory temperature after application of last coat, before 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, or commercial 100LL aviation gasoline, and JP-5 fuel conforming to MIL-T-5624.

(c) Wash coated test rods thoroughly with hot water at 82 ± 6°C (180 ± 10°F) for 15 to 30 minutes, drain, and dry. Mount test rod on a 6 by 180-mm (1/4 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 by 180-mm (1/4 by 7-inches) square plastic beaker covers, plain (for unexposed fuel samples). Store all beakers with fuel in dark and maintain at 27 ± 6°C (80 ± 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. Test exposed and unexposed aviation gas for bromine in accordance with the following test procedures.

4.5.7.2 Fuel 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 3.14.1.

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 ASTM D 910 and ASTM Specifications and Classifications for 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 or equal, equipped with a glass electrode and a silver electrode (see note 1 of 4.5.7.6.3(c)). A titration set-up shall be used, such as shown on figure 2 which shall accurately deliver 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 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-grams 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 grams of sodium hydroxide pellets followed by 2 grams 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

$$g\ Br/gal\ at\ 15.6°C\ (60°F) = 0.3025B\ [1 + 0.00065(t_F - 60)]$$
$$= 0.3025B\ [1 + 0.00065\ (1.8t_C - 281)]$$

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-gauge 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 grams per 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 pre-cool the sample by placing it in a flask surrounded by dry ice before 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 pre-cooled 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 grams), it has been found that pre-cooling 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 grams 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.

4.5.7.7 Volatile organic content. Volatile organic content shall be determined by the applicable method of Rule 107 of the South Coast Air Quality Management District.

4.5.8 Brushing properties. Coatings shall be prepared according to the manufacturer's directions. Coatings shall be applied without further reduction in accordance with method 4321.2 of FED-STD-141 and observed for compliance with 3.8.

4.5.9 Spraying properties. Prepare the coating according to the manufacturer's directions. Without further reduction, spray on a sandblasted steel panel to the recommended wet film thickness. Observe for spraying properties in accordance with method 4331.1 of FED-STD-141 and for compliance with 3.8.

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

4.6.1 Shop primers (class 1). Coating systems with a shop primer or preconstruction primer as part of the system shall be applied in accordance with the manufacturers application instructions at the manufacturer's designated dry film thickness for exposure and immersion testing as specified in 4.5.2.

(a) Exposure testing. The steel test panel coated with shop primer shall be exposed for 1 year in an outdoor steel storage area. The severity of the test panel exposure shall be equivalent to that of steel stored for construction purposes.
(b) Immersion testing. Immersion resistance shall be determined in accordance with 4.5.2.
(c) The Navy test facility for exposure and immersion testing is the Navy Coatings Productivity Evaluation Center (CPEC), Norfolk Naval Shipyard.

4.6.2 Ballast tank coating (class 2). Coatings created for use in dedicated salt water ballast tanks shall be tested as specified in 4.5.2 with the following exceptions:

(a) One cycle shall be 5 days salt water immersion followed by 2 days dry-out time to simulate a ballast and de-ballast operation.
(b) There shall be no fuel or hydrocarbon exposure.
(c) Total test time shall be 50 cycles.

4.7 Toxicity. The contractor shall have the toxicological formulations and associated information available for review by the contracting activity to evaluate the safety of the material for the proposed use.

4.8 Certification data/report. When specified in the contract or order, a certification data/report shall be prepared (see 6.2.2).

4.9 Inspection of packaging. Sample packages and packs, and the inspection of the preservation-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), class 1 coatings and coating systems shall be delivered in 4-L or 20-L (1 or 5-gallon) amounts in unitized packaging. Coating of the coating system 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 6.3.)

6. NOTES

6.1 Intended use. Although the different types 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 kinds 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. The coating systems qualified to types I, III, grade A and class 2, grade A may be used when the application and cure temperatures are between minus 7 to 10°C (20 to 50°F). For conditions of use, see 1.2.

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 6.3 apply.

6.1.1.3 Type IV. Type IV coatings are acceptable for use where volatile organic content regulations are limited to either 340 or 290 grams of solvent per liter of coating as stated in 3.2.1.1.

6.1.1.4 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 Coating 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. Original coating applications should be maintained by using only materials of the same type. In each instance, touch-up material should be obtained from the same contractor as the original paint 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 1 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 and 5.2.1).

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 1 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 the effects 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 gallon further complicate the equity of purchase solely on the basis of lowest cost per L or cost per gallon. Contracting officers therefore should fully consider such factors.

6.2.2 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DoD FAR Supplement, Part 27, Sub-Part 27.475-1 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification are cited in the following paragraph.

Paragraph no.	Data requirement title	Applicable DID no.	Option
4.8 and appendix	Certification data/report	UDI-A-23264	----

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5010.12-L., AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.2.2.1 The data requirements of 6.2.2 and any task in sections 3, 4, or 5 of this specification required to be performed to meet a data requirement may be waived by the contracting/acquisition activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

6.3 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 conforming to 3.2.1 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 Rule 102, may be obtained from: South Coast Air Quality Management District, 9150 Flair Drive, El Monte, CA 91731.

6.4 Qualification. 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, SEA 5523, Department of the Navy, Washington, DC 20362-5101 and information pertaining to qualification of products may be obtained from that activity. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.4.1).

6.4.1 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.

6.5 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets (MSDS) prepared in accordance with FED-STD-313. Additional required government information is contained in FED-STD-313. In order to obtain the MSDS, federal acquisition regulation (FAR) clause 52.223-3 must be in the contract.

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

TABLE III. Comparability data.

Coating system	MIL-P-23236(SHIPS)	DOD-P-23236A(SH)	MIL-P-23236B(SH)
Type I	X	X	X
Type Ia			
Type II	X	Deleted	Deleted
Type III		X	X
Type IIIa		X	Deleted
Type IIIb		X	Deleted
Type IV			X
Class 1	X	X	X
Class 2	X	Deleted	X
Class 3	X	Deleted	Deleted
Class 4	X	Deleted	Deleted
Grade A			X

6.7 Definitions.

6.7.1 Coating components. Coating components are individually packaged components such as base component (part A) and converter component or hardner (part B).

6.7.2 Coating. A coating is the resin component (base) and converter mixed and ready for application.

6.7.3 Coat. A coat is a single application of the coating.

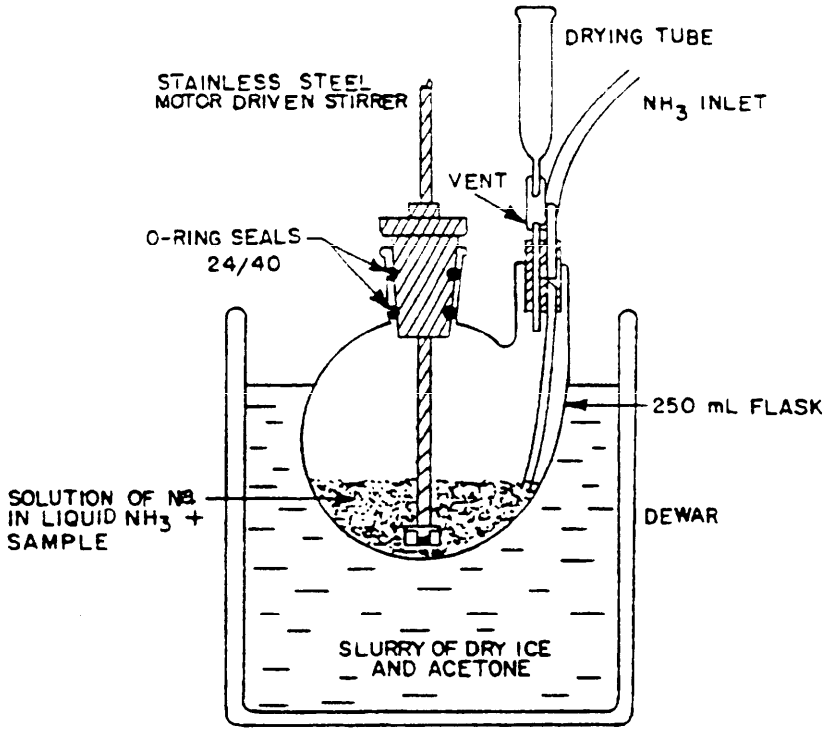
6.7.4 Coating system. A coating system is the total number of coats as specified by the manufacturer at the time of qualification testing and at the dry film thickness per coat as specified by the manufacturer at the time of qualification testing.

6.8 Subject term (key word) listing.

Curing time
Flash point
Immersion resistance
Pot life
Viscosity
Volatile organic content

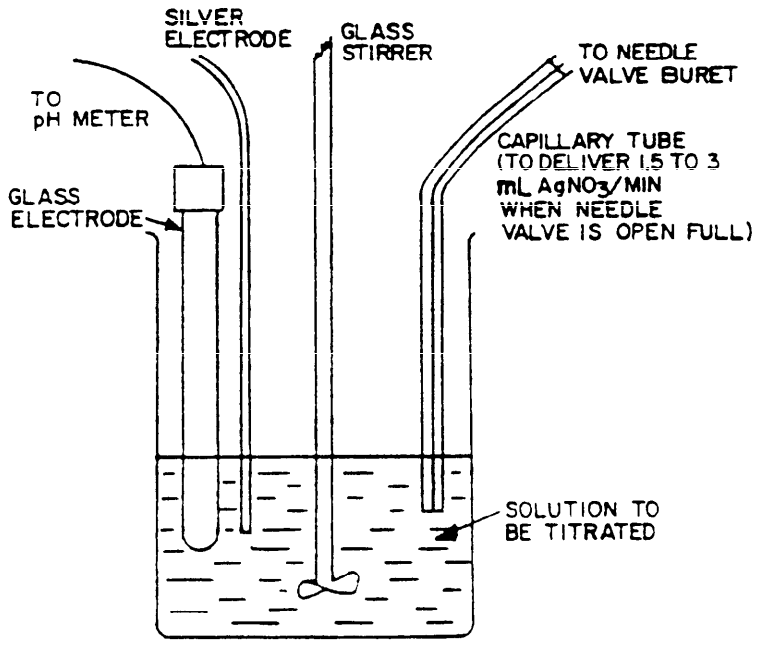
6.9 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Preparing activity:
Navy - SH
(Project 8030-N088)



SH 7092

FIGURE 1. Apparatus for the decomposition of organic halides.



SH 7093

FIGURE 2. Potentiometric titration assembly.

APPENDIX

REPORTS TECHNICAL REQUIREMENTS

10. SCOPE

10.1 Scope. This appendix covers the technical requirements that shall be included in the certification data/reports when required by the contract or purchase order. This appendix is mandatory only when data item description UDI-A-23264 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. REPORT

30.1 Certification data/report. When required by the contract or order, the following information shall be included on the certification data/report:

(a) Toxicological data and formulations to evaluate the safety of the material for the proposed use (see 3.12).
(b) Certification that volatility requirements are met (see 3.2.1).
(c) Conformance of each lot of ingredient raw material, stating test results and source, as applicable (see 4.5).

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-P-23236B(SH)	PAINT COATING SYSTEMS, FUEL AND SALT WATER BALLAST TANKS (METRIC)

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

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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