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**Center for Corrosion  
Science and Engineering**

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**USS THEODORE ROOSEVELT CVN-71  
One-Year Follow-up Report on the Installation of Cote-L  
Distribution Company Durabak Polyurethane Coating on the deck  
of a wet space/washroom 03-88-3-L**

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## Executive Summary

This one-year follow-up report covers the installation of Cote-L Distribution Company Durabak Polyurethane Coating on the deck of a wet space/washroom 03-88-3-L on USS THEODORE ROOSEVELT CVN-71

## Results

Two NAVSEA/NRL authorized Coatings Inspectors surveyed the deck of the wet space/washroom 03-88-3-L on USS THEODORE ROOSEVELT CVN-71 at Naval Station Norfolk in Norfolk, Virginia. The Cote-L Distribution Company Durabak Polyurethane Coating had been in service for one year. The coating system was to be evaluated by determining:

1. Extent of corrosion
2. Extent of blistering
3. Extent of edge breakdown
4. Coating overall condition

The deck in this washroom was found to be in “like new” condition with no defects, blisters, delamination or corrosion noted.

1. The Cote-L Distribution Company Durabak Polyurethane Coating seemed to have held up since it was installed on 27 Feb 2007.
2. There was not rust around pipe hangers or drains.
3. No rust visible on any deck surfaces.
4. The deck coating did not appear to be lifted or delaminated in corners, angles, transition areas between deck and bulkheads or the deck itself.
5. The deck appeared to mop clean with minimum effort. This washroom is used by the catapult crew and is subjected to heavy use by hard working, dirty personnel.

The extent of corrosion was to be determined using methods described in ASTM D 610-01, “Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces”. Extent of blistering was to be determined using methods described in ASTM D 714-02, “Standard Method of Evaluating Degree of Blistering of Paints”. Both ASTM methods consist of a series of reference photographs showing various extents of coating failure. The coating inspector visually identifies the reference photograph that most closely matches the pattern of coating failure on the surface being inspected.

The wet space deck demonstration coating was also inspected in accordance with Corrosion Control Information Management System (CCIMS) and Ship’s Engineering Maintenance Assistance Team (SEMAT) Navy Inspection Criteria. Under both inspection criteria, the deck assessment after the one year in-service evaluation inspection was Condition 1 rating, passing the inspection criteria listed in the two guidelines. ABS document *Guidance Notes on the Inspection, Maintenance and Application of Marine Coatings Systems (Third Edition, 2007)* is referenced during coatings inspection periods for detailed descriptions of

critical area assessments. A comprehensive list of inspection criteria guideline's used is listed below:

1. Corrosion Control Information Management System (CCIMS), Inspection results were; Condition 1 assessment
2. Ship's Engineering Maintenance Assistance Team (SEMAT), Supervisor of Shipbuilding. Assessment Condition 1
3. ASTM D 610-01, "Standard Method of Evaluating Degree of Rusting on Painted Steel Surfaces"
4. ASTM D 714-02, "Standard Method of Evaluating Degree of Blistering of Paints"
5. SSPC-VIS 2, Pub Number 00.08, "Standard method of Evaluating Degrees of Rusting on Painted Steel Surfaces"
6. ABS document Guidance Notes on the Inspection, Maintenance and Application of Marine Coatings Systems (Third Edition, 2007). Reference standards: ISO 4628/2:2003. Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 2. ISO 4628:2003. Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of common types of defect – Part 3: Designation of degree of rusting

## **Conclusions**

After one year service the Cote-L Distribution Company Durabak Polyurethane Coating covered by this report was found to be in excellent condition, "like new" with no deterioration of any kind noted. Ship's Force noted that they had not had any problems or concerns with this deck coating.

The coatings inspectors were unable to locate any data concerning the flash point of this material or any data covering safety concerns since this is a polyurethane coating being used in interior service. It is assumed that the flash point is above 100F and that this is not one of the polyurethane coatings that have special safety concerns.

The coating appeared to meet the serviceability requirements of the performance specification and is recommended for inclusion on QPL-32171.

## Pictorial Report



Bullet identifying the washroom



The washroom receives heavy use by the catapult crew who bring much grime and grease with them. The deck mops clean with minimum effort.



The interface between deck drains and deck coating is often a problem area but in this space all interface areas are in excellent condition with no deterioration.



All interfaces with pipe brackets, pipes, supports and foundations are in excellent condition. The texture of the deck coating aids personnel in greasy shoes with maintaining traction.



The deck surface mops clean with minimum effort



The shower stall decks are in excellent condition



Shower stall deck close-up



Catapult maintenance is hard, dirty work. The mild texture of this deck coating aids traction with greasy soled work boots

## **Durabak Installation Instructions**

### References:

1. 009-26 Standard Items
2. Durabak Application Tips

### Installation Instructions:

1. Submit MSDS, technical data sheets and ASTM 718 prior to start of work.
2. Ventilate space where work is being performed. Comply with NAVSEA Standards for Health and Safety.
3. Accomplish free flow test of drains. Blank or plug to prevent contaminants.
4. Accomplish removal of existing deck covering including cove base.
5. Accomplish requirement of 009-32 (Standard Items) for surface prep and primer. Scale or sand floor and 6" up perimeter to SSPC-11
6. Install new deck rings if necessary.
7. Solvent wipe and vacuum prior to priming.
8. Prime IAW manufacturer instructions and 009-32 using International 998 or equivalent.
9.
  - a) Install epoxy underlayment and cove base where applicable using 1 lb./sf or less Epmar 1290 Ultra Lightweight underlayment or equivalent.
  - b) If required install a waterproof membrane Epmar SS2102 or equivalent.
  - c) Lightly abrade membrane with 80 grit sandpaper and solvent wipe prior to installation of Durabak.
10. Apply Durabak with special open foam rollers (available through Cote-L Industries). Use only a Durabak special stipple roller—other rollers will not pick up and spread Durabak evenly. Rollers are available in 9" and 4" sizes.
11. Mix Durabak thoroughly with electric drill to keep rubber in suspension. Remix periodically.
12. Add accelerator if you would like to increase drying time (normal drying time between coat is approximately 1-2 hours depending on weather.
13. Product applies in two coats. Brush in areas inaccessible to rollers. (Weld seams, I beams, cove etc.) Brush in one direction. Do not apply too thick. Apply in two thin coats. Final dry film thickness 22-24 mils.
14. Apply second coat when first coat is dry to touch. Coverage is approximately 60 square feet per gallon.
15. Follow manufacturer's instructions for cleaning.
16. Use only xylene for cleaning or to thin product.

PERFORMANCE SPECIFICATION  
DECK COATINGS, HIGH DURABILITY

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

1. SCOPE

1.1 Scope. This specification establishes the requirements for high durability, wear resistant deck coatings for use in high traffic areas, with minimal maintenance.

1.2 Classification. Coatings covered by this specification are of the following types and classes, as specified (see 6.2):

1.2.1 Types. The types of deck coating systems are as follows:

Type I - Interior deck coating system for general use.

Type II - Interior deck coating system for submarine use.

Type III - Weather deck coating system (excluding MIL-PRF-24667 nonskid products).

Type IV - AFFF station deck coating system.

1.2.2 Classes. The classes of deck coatings are as follows:

Class 1 - Semi-gloss.

Class 2 - High gloss.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

## 2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

### FEDERAL STANDARDS

FED-STD-141 - Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing

### DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-24441 - Paint, Epoxy-Polyamide, General Specification for

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch> or <http://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

### CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.1000 - Subpart Z, Toxic and Hazardous Substances  
29 CFR 1990 - Identification, Classification, and Regulation of Potential Occupational Carcinogens  
40 CFR 60, Ch.1, Appendix A, Method 24 - Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings  
40 CFR 63 - National Emission Standards for Hazardous Air Pollutants for Source Categories  
40 CFR 82 - Protection of Stratospheric Ozone  
40 CFR 302 - Designation, Reportable Quantities, and Notification  
40 CFR 355, Appendices A and B - The List of Extremely Hazardous Substances and Their Threshold Planning Quantities  
40 CFR 372.65 - Specified Toxic Chemical Listings

(Copies of these documents are available online at [www.gpoaccess.gov/index.html](http://www.gpoaccess.gov/index.html) or from the Superintendent of Documents, U.S. Government Printing Office, North Capitol & "H" Streets, N.W., Washington, DC 20402-0002.)

### NAVAL SEA SYSTEMS COMMAND (NAVSEA)

S9510-AB-ATM-010 - Nuclear Powered Submarine Atmosphere Control Manual, Chapter 7

(Copies of this document are available from Commander, Naval Sea Systems Command, Code SEA 05Z9, 1333 Isaac Hull Ave., SE, Stop 5122, Washington Navy Yard, DC 20376-5122.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

- ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus (DoD adopted)  
**ASTM D 523 - Standard Test Method for Specular Gloss (DoD adopted)**
- ASTM D 610 - Standard Test Method for Evaluating Degree of Rusting on Painted Steel (DoD adopted)**
- ASTM D 714 - Standard Test Method for Evaluating Degree of Blistering of Paints (DoD adopted)**
- ASTM D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes (DoD adopted)**
- ASTM D 1849 - Standard Test Method for Package Stability of Paint (DoD adopted)  
ASTM D 2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
- ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity (DoD adopted)
- ASTM D 2697 - Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings (DoD adopted)
- ASTM D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact) (DoD adopted)
- ASTM D 3278 - Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus (DoD adopted)**
- ASTM D 3363 - Standard Test Method for Film Hardness by Pencil Test (DoD adopted)  
ASTM D 4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser (DoD adopted)
- ASTM D 6037 - Standard Test Methods for Dry Abrasion Mar Resistance of High Gloss Coatings
- ASTM D 6905 - Standard Test Method for Impact Flexibility of Organic Coatings  
ASTM E 260 - Standard Practice for Packed Column Gas Chromatography  
ASTM E 1252 - Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis

(Copies of these documents are available from [www.astm.org](http://www.astm.org) or ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

(Copies of this document are available from SSPC Publication Sales, 40 24<sup>th</sup> Street, 6<sup>th</sup> floor, Pittsburgh, PA 15222-4656 or [www.sspc.org](http://www.sspc.org).)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Qualification. The coating furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3). Qualification inspection shall consist of compliance with Table I, Table II, and all other applicable requirements of this specification.

3.1.1 Materials. For two component systems, the allowed proportions for the ratio of resin component to hardener shall be limited to 4:1, 3:1, 2:1 or 1:1 by volume. When mixed and applied in accordance with the manufacturer's instructions, the final coating system shall be in accordance with all requirements of this specification.

3.2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Ozone-depleting substances (ODS). The use of any ODS in the composition of the coating under this specification, directly or referenced in any test method, is prohibited. Class I or Class II ozone-depleting chemicals are defined by 40 CFR 82.

3.4 Toxicity. The coating shall have no adverse effect on the health of personnel when used for its intended purpose, and shall not cause any environmental problems during waste disposal (see 6.6). Unless otherwise specified herein, the material used in the coating shall have no known carcinogenic or potentially carcinogenic materials identified by the Occupational Safety and Health Administration (OSHA) (29 CFR 1990) as regulated carcinogens, or the International Agency for Research on Cancer (IARC) latest monographs, or the latest annual report of the National Toxicity Program (NTP); and shall have no extremely hazardous substances (EHS) or toxic chemicals identified in 29 CFR 1910.1000, 40 CFR 302, 355 and 372, respectively. The manufacturer is responsible for maintaining carcinogenic free, extremely hazardous substance free and toxic chemical free materials. The manufacturer shall not, unless specific material maximum levels are cited herein, allow the addition of any of these prohibited materials to the formulation; and when any of these prohibited materials are/may be present, as a result of being present as a trace or impurity in other ingredient(s), the concentration of the prohibited material shall not equal or exceed 0.01 percent by weight of the coating.

3.4.1 Asbestos content. The asbestos content may not exceed 5% by weight of the dry coating film.

3.4.2 Metal content. The content of each soluble metal and total content of each metal of the coating shall be not greater than the values listed in Tables I and II when tested as specified in 4.5.1.2.

TABLE I. Soluble metals content.

Soluble Metal and/or its Compounds	Maximum, mg/L
Antimony and/or its compounds	15.0
Arsenic and/or its compounds	5.0
Barium and/or its compounds (excluding barite)	100.0

Beryllium and/or its compounds	0.75
Cadmium and/or its compounds	1.0
Chromium (VI) compounds	5.0
Chromium and/or its chromium (III) compounds	560.0
Cobalt and/or its compounds	50.0
Copper and/or its compounds	25.0
Fluoride salts	180.0
Lead and/or its compounds	5.0
Mercury and/or its compounds	0.20
Molybdenum and/or its compounds	350.0
Nickel and/or its compounds	20.0
Selenium and/or its compounds	1.0
Silver and/or its compounds	5.0

TABLE I. Soluble metals content -continued.

Soluble Metal and/or its Compounds	Maximum, mg/L
Tantalum and/or its compounds	100.0
Thallium and/or its compounds	7.0
Tungsten and/or its compounds	100.0
Vanadium and/or its compounds	24.0
Zinc and/or its compounds	250.0

TABLE II. Total metals content.

Metal and/or its Compounds	Maximum, % wt
Antimony and/or its compounds	0.015
Arsenic and/or its compounds	0.005
Barium and/or its compounds (excluding barite)	0.10
Beryllium and/or its compounds	0.0002
Cadmium and/or its compounds	0.0005
Chromium (VI) compounds	0.001
Chromium and/or its chromium (III) compounds	0.56
Cobalt and/or its compounds*	0.005
Copper and/or its compounds	0.03
Fluoride salts	0.18
Lead and/or its compounds	0.005
Mercury and/or its compounds	0.0002
Molybdenum and/or its compounds	0.035
Nickel and/or its compounds	0.02
Selenium and/or its compounds	0.002
Silver and/or its compounds	0.0017
Tantalum and/or its compounds	0.100
Thallium and/or its compounds	0.007
Tungsten and/or its compounds	0.100
Vanadium and/or its compounds	0.01
Zinc and/or its compounds	0.25

\*Total cobalt content may exceed 0.005% wt (up to 0.2% wt) to effect proper drying. Soluble cobalt content may not exceed Table I requirements.

3.5 Off-gassing (Type II only). The coating shall be tested for off-gassing in accordance with Chapter 7 of NAVSEA Technical Manual S9510-AB-ATM-010 and shall be certified for and assigned a usage category of either "Limited" or "Permitted" (see 4.5.2 and 6.7).

3.6 Volume solids. The volume of solids of the coating shall be 65% minimum.

3.7 Volatile organic content (VOC) solvent. The VOC of all types and classes of the coating shall not exceed 250 grams per liter (g/L).

3.8 Flash point. The flash point of the coating shall be greater than 38 °C (100 °F).

3.9 Shelf life. The shelf life of the coating shall be at least 12 months, with a minimum ASTM D 1849 level of 8 reported for all qualities.

3.10 Drying or cure time. Coatings 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 lowest allowed temperature specified by the manufacturer.

3.11 Abrasion resistance.

3.11.1 All classes. The abrasion resistance of the coating shall not exceed 70 mg loss.

3.11.2 Class 2 only. The percent gloss retention must exceed 90%.

**3.12 Impact resistance. Impact resistance of the coating shall not be less than 50 inch-pounds.**

3.13 Flexibility. A film of coating shall show no checking, cracking or flaking at less than 10% elongation.

3.14 Pencil hardness. The pencil hardness of the coating shall be 2H min.

3.15 Slip resistance. The dry slip resistance of the coating shall be no less than 0.70 static coefficient of friction (COF), and the wet slip resistance shall be no less than 0.60 static COF.

3.16 Hazardous air pollutant (HAP) content. The content of the HAPs solvents in the mixed coating or its components shall not exceed the weight percent (% wt) values listed in Table III. Within these limitations and the requirement that the finished coating meet all requirements of this specification, solvent selection is the responsibility of the manufacturer. HAP materials are defined by 40 CFR 63.

TABLE III. Hazardous air pollutant solvent content limits.

Hazardous solvent in each individual total coating	Maximum, % wt
Benzene	0.05
Chlorinated solvent(s), total	0.05
Solvents containing fluorine as defined by 40 CFR 82	0.01
Ethyl benzene	0.05
Methyl, ethyl and butyl mono-ethers of ethylene glycol or the acetates thereof, total (also known as methyl, ethyl and butyl cello solves and methyl, ethyl and butyl cello solve acetates)	0.05
Methyl ethyl ketone (MEK)	0.05
Methyl isobutyl ketone (MIBK)	0.05
Toluene	0.05
Xylene (all forms), total	0.1

3.17 Condition in container. The coating shall be free from grit, seeds, skins, abnormal thickening, or living in a freshly opened container, and shall show no more pigment settling or caking than can be easily and completely reincorporated to a smooth, uniform state. Water based coatings shall also be free of rust staining, emulsion breakdown, spoilage and rancidity. Container shall be free of corrosion.

3.18 Resistance to water. When tested as specified herein, a film of coating shall show no wrinkling or blistering immediately after removal of the wetted sponges. The coating shall be no more than slightly affected when examined 2 hours after removal of the wetted sponges. After 24 hours of air drying, the portion of the panel which was covered by the wetted sponges shall be visually indistinguishable with regard to hardness and adhesion from the portion which was not immersed.

3.19 Resistance to hydrocarbon fluid. When tested as specified herein, a film of coating shall show no blistering or wrinkling and no more than a slight whitening or softening upon removal of the fluid wetted sponge. After 2 hours of air drying, the portion of the panel that was covered by fluid wetted sponge shall be visually indistinguishable with regard to hardness, color, and gloss from a panel prepared at the same time, but not immersed.

3.20 Resistance to salt spray (Type III only). When tested as specified herein, a film of coating examined immediately after removal from the test shall show no more than a trace of corrosion in accordance with ASTM D 610 and no more than five scattered blisters no larger than 1 mm in diameter.

3.21 Resistance to condensation. When tested as specified herein, a film of coating shall show a maximum ASTM D 714 blister rating of 8F or better after testing for 100 hours. The ASTM D 714 blister rating shall be 6F or better when evaluated after an additional 200 and 400 hours. Blisters within 12 mm of all edges shall be disregarded.

3.22 Pot life. The pot life of the coating shall be a minimum of 1/2 hour at 21 °C (70 °F) and 80 percent humidity.

3.23 Gloss. The 60-degree specular gloss of the coating shall be between 45% and 60% for Class 1 and greater than 80% for Class 2.

3.24 Resistance to aqueous film forming foam (AFFF) (Type IV only). When tested as specified herein, a film of coating examined immediately after removal from the test shall be visually indistinguishable with regard to hardness, color, and gloss from a panel prepared at the same time, but not immersed.

3.25 Serviceability. The deck coating shall show no deficiencies that would limit its serviceability when examined during and after the minimum service period specified.

#### 4. VERIFICATION

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

a. Qualification inspection (see 4.2)

**b. Conformance inspection (see 4.3)**

4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in Table IV.

4.2.1 Qualification sample. The qualification sample shall consist of enough component materials (i.e. Parts A and B if a two component system) to create 4 liters (1 gallon) of the final mixed coating.

4.3 Conformance inspection.

4.3.1 Lot. For purposes of conformance inspection, a lot shall consist of all coating of the same formula number from a single uniform batch or single uniform blend of batches (for each component) offered for delivery at one time. Two representative samples of component A and of component B from each lot of paint (total of 4 samples per lot) shall be evaluated for verification tests. The 4 samples per lot shall be packaged in separate containers. Minimum size for each sample shall be 1 liter (1 quart).

4.3.2 Conformance tests. Conformance tests for acceptance of individual lots shall consist of all tests identified in Table IV. At a minimum, the contractor shall select representative samples from the first and last containers from each lot of each component, and subject the samples to all conformance tests. Results shall meet the applicable requirements in section 3.

TABLE IV. Qualification and conformance testing.

Item	Qualification testing required	Conformance testing required	Requirement paragraph	Test method paragraph
Toxicity	Yes	No	3.4	4.5.1
Asbestos content	Yes	No	3.4.1	4.5.1.1
Total and soluble metal content	Yes	No	3.4.2	4.5.1.2
Off-gassing	Yes	No	3.5	4.5.2
Volume solids	Yes	No	3.6	4.5.3
Volatile organic content (VOC) solvent	Yes	No	3.7	4.5.4
Flash point	Yes	Yes	3.8	4.5.5
Shelf life	Yes	No	3.9	4.5.6
Drying or cure time	Yes	Yes	3.10	4.5.7
Abrasion resistance	Yes	Yes	3.11	4.5.8
Impact resistance	Yes	No	3.12	4.5.9
Flexibility	Yes	No	3.13	4.5.10
Pencil hardness	Yes	Yes	3.14	4.5.11
Slip resistance	Yes	No	3.15	4.5.12
Hazardous air pollutant (HAP) content	Yes	No	3.16	4.5.13
Condition in container	Yes	Yes	3.17	4.5.14
Resistance to water	Yes	No	3.18	4.5.15
Resistance to hydrocarbons	Yes	No	3.19	4.5.16
Resistance to salt spray (Type III only)	Yes	No	3.20	4.5.17
Condensation resistance	Yes	No	3.21	4.5.18
Pot life	Yes	No	3.22	4.5.19
Gloss	Yes	Yes	3.23	4.5.20
Resistance to AFFF (Type IV only)	Yes	No	3.24	4.5.21
Serviceability	Yes	No	3.25	4.5.22

4.4 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in section 4.

4.5 Test methods. The coating shall be tested in accordance with the applicable methods specified herein.

4.5.1 Toxicity. The material shall be evaluated by the Navy Environmental Health Center (NEHC) using the administrative Health Hazard Assessment (HHA) to determine compliance with the requirements of 3.4 (see 3.4, 6.2 and 6.6).

4.5.1.1 Asbestos content. Asbestos content shall be determined on a dry film of the coating in accordance with 29 CFR 1915.1001, Appendix K, and the results shall be recorded as a percent by weight of the dry coating film.

4.5.1.2 Soluble and total metal content. Soluble and total metal content, except tantalum and tungsten, shall be determined on a dry film of the coating in accordance with the 40 CFR 261, Appendix III and the appropriate test listed in Tables V and VI. Soluble metal content shall be analyzed as milligrams per liter (mg/L). Total metal content shall be analyzed as percent by weight of the dry coating film. Tantalum and tungsten soluble metal content and total metal content shall be analyzed as specified in 4.5.1.3.

TABLE V. Test methods for evaluating solid waste physical/chemical methods, EPA SW-846.

Metal/Material	Digestion Test Method
All metals, except chromium (VI)	3050
Chromium (VI)	3060
Antimony	7040 or 7041
Arsenic	7060 or 7061
Barium	7080 or 7081
Cadmium	7131
Total chromium	7190
Chromium (VI)	7195, 7196 or 7197
Lead	7421
Mercury	7470 or 7471
Nickel	7520 or 7521
Selenium	7740 or 7741
Silver	7760 or 7761

TABLE VI. Methods for chemical analysis of water and waste, EPA 600/4-020.

Metal/Material	Test Method
Beryllium	210.1 or 210.2
Cobalt	219.1 or 219.2
Copper	220.1 or 220.2
Fluoride	340.1, 340.2 or 340.3
Molybdenum	246.1 or 246.2
Thallium	279.1 or 279.2
Vanadium	286.1 or 286.2
Zinc	289.1 or 289.2

4.5.1.3 Tantalum and tungsten content. Determine the tantalum and tungsten content of the coating using any appropriate spectroscopy test method. Conduct the tests in accordance with the equipment manufacturer's directions for the use of the instrument. Paint manufacturer is responsible for justifying the test method choice and analytical accuracy.

4.5.2 Off-gassing (Type II only). The coating shall be tested in accordance with Chapter 7 of NAVSEA Technical Manual S9510-AB-ATM-010/(U), by a Government approved testing facility. The results shall be submitted to the Government for evaluation and approval for use (see 3.5 and 6.7).

4.5.3 Volume solids. Volume solids shall be tested in accordance with ASTM D 2697.

4.5.4 Volatile organic content (VOC) solvent. VOC shall be determined in accordance with 40 CFR 60 Ch.1, Appendix A, Method 24, allowing the sample to reside at  $22 \pm 1$  °C ( $72 \pm 2$  °F) for 24 hours prior to conducting the analysis. No oven heating is allowed.

4.5.5 Flash point. Flash point shall be tested in accordance with ASTM D 3278.

4.5.6 Shelf life. Shelf life shall be tested in accordance with ASTM D 1849. Storage temperature shall be  $25 \pm 2$  °C.

4.5.7 Drying or cure time. The coating shall be tested for cure time in accordance with FED-STD-141, Method 4061.

4.5.8 Abrasion resistance.

4.5.8.1 All classes. Abrasion resistance shall be tested in accordance with ASTM D 4060 using the CS 17 wheel, 1000 cycles and a 1Kg load.

4.5.8.2 Class 2 only. Percent gloss retention shall be tested in accordance with ASTM D 6037 using 20 cycles and a 500g load (Method A), or 20 double-strokes with a 500g load (Method B).

**4.5.9 Impact resistance. Impact resistance shall be tested in accordance with ASTM D 2794.**

4.5.10 Flexibility. Prepare one steel test panel to SSPC-SP-3, and coat with an epoxy primer meeting MIL-DTL-24441 or listed on QPL-23236, applied and cured per manufacturer's instructions. Prepare a second steel test panel to SSPC-SP-3 and apply the primer specified by the manufacturer for the system being tested, per manufacturer's instructions. For systems not requiring a prime coat, prepare steel panel to SSPC-SP-3 degree of surface cleanliness, and apply the coating system. Apply each coat to the minimum DFT allowed, and allow to fully cure per manufacturer's instructions. Impact flexibility shall be tested in accordance with ASTM D 6905. A minimum of 10X magnification shall be used during inspection of the tested panel for cracking.

4.5.11 Pencil hardness. Pencil hardness shall be tested in accordance with ASTM D 3363.

4.5.12 Slip resistance. Dry slip resistance shall be tested in accordance with ASTM D 2047. Wet slip resistance shall also be tested per ASTM D 2047, with the exception that the test panels shall be sprayed with a potable water mist until the entire surface is visibly coated with water immediately prior to testing.

4.5.13 Hazardous air pollutant (HAP) content. Hazardous solvent content of each coating shall be determined in accordance with ASTM E 260 or Methods 7356 and 7360 of FED-STD-141, as applicable. Solvent fractions shall be identified in accordance with ASTM E 1252 with the results recorded as the percent weight of the total paint. Alternate methods of analysis must be reviewed and approved by NAVSEA. Formulation data may be used by manufacturers in lieu of testing to demonstrate compliance with hazardous air pollutant requirements of this specification. The manufacturer's formulation data must have a consistent and quantitatively known relationship to the testing required. Calculation of individual HAP contents can be based on either manufacturer evaluation of batches or supplier data for raw materials used in the product.

4.5.14 Condition in container. Condition in contain shall be tested in accordance with method 3011.2 of FED-STD 141.

4.5.15 Resistance to water. Prepare a test panel per SSPC-SP-3, and apply each coat of the coating system to the minimum wet film thickness specified by the manufacturer. Allow each intermediate coat to cure at room temperature per manufacturer's instructions prior to applying the next coat. After the final coat of the system has been applied, air dry at room temperature for 7 days, or until full cure-to-service time per manufacturer's instructions is reached, whichever is shorter. Coat all exposed surfaces. The panel shall be laid flat and sponges wet with distilled water shall be laid on the panel in a manner to cover the full face of the test panel. The sponges shall be kept wet for a period of 7 days at ambient laboratory conditions. The sponges may be covered, but such covering shall not restrict all evaporation. Evaporation will leach water soluble materials from the paint into the sponge. After the 7 days have passed, remove the sponges, observe the panel for ASTM D 1308 effects after 2 and 24 hours.

4.5.16 Resistance to hydrocarbon fluid. Prepare a test panel per SSPC-SP-3, and apply each coat of the coating system to the minimum wet film thickness specified by the manufacturer. Allow each intermediate coat to cure per manufacturer's instructions prior to applying the next coat. After the final coat of the system has been applied, air dry at room temperature for 7 days, or until the full cure-to-service time per manufacturer's instructions is reached, whichever is shorter. Coat all exposed surfaces. The test panels shall be laid flat and sponges wet with commercial kerosene or jet fuel shall be laid on the panel in a manner to cover the full face of the test panel. The sponges shall be kept wet for a period of 24 hours at ambient laboratory conditions. The sponges may be covered to restrict evaporation, but such covering shall not restrict all evaporation. Evaporation will leach fuel soluble materials from the paint into the sponge. After the 24-hour period is complete, remove the sponges, and observe the panel for ASTM D 1308 effects.

4.5.17 Resistance to salt spray (Type III only). Prepare one steel test panel to SSPC-SP-3, and coat with an epoxy primer meeting MIL-DTL-24441 or listed on QPL-23236, applied and cured per manufacturer's instructions. Prepare a second steel test panel to SSPC-SP-3 and apply the primer specified by the manufacturer for the system being tested, per manufacturer's instructions. For systems not requiring a prime coat, prepare steel panel to SSPC-SP-3 degree of surface cleanliness, and apply the coating system. Apply each coat to the minimum DFT allowed per manufacturer's instructions. Allow each intermediate coat to cure per manufacturer's instructions prior to applying the next coat. After the final coat of the system has been applied to each panel, air dry at room temperature for 7 days, or until the full cure-to-service time per manufacturer's instructions is reached, whichever is shorter. Coat all exposed surfaces. Expose the panels to 5 percent salt spray for 14 days in accordance with ASTM B 117. Upon removal, wash the panels gently in warm running water (not more than 38 °C) until free from any visible salt deposits and examine immediately in accordance with ASTM D 610.

4.5.18 Resistance to condensation. Prepare one steel test panel to SSPC-SP-3, and coat with an epoxy primer meeting MIL-DTL-24441 or listed on QPL-23236, applied and cured per manufacturer's instructions. Prepare a second steel test panel to SSPC-SP-3 and apply the primer specified by the manufacturer for the system being tested, per manufacturer's instructions. For systems not requiring a prime coat, prepare steel panel to SSPC-SP-3 degree of surface cleanliness, and apply the coating system. Apply each coat to the minimum DFT allowed per manufacturer's instructions. Allow each coat to cure per manufacturer's instructions prior to applying the next coat. After the final coat of the system has been applied, air dry at room temperature for 7 days, or until the full cure-to-service time per manufacturer's instructions is reached, whichever is shorter. Coat all exposed surfaces. The test shall be conducted in accordance with ASTM D 2247 for 100, 300 and 500 hours. Evaluation will be conducted and blisters rated in accordance with ASTM D 714.

4.5.19 Pot life. Two component coatings shall be mixed from the components, in accordance with the manufacturer's instructions, in a container so as to result in approximately 1 liter (1 quart) of finished material. For single component coatings, 1 liter (1 quart) of the coating shall be poured into a separate container. For routine testing, ambient conditions above 21 °C (70 °F) and 50 percent relative humidity shall be satisfactory. For referee tests,  $21 \pm 3$  °C ( $70 \pm 5$  °F) and  $80 \pm 10$  percent humidity shall prevail. The time between mixing and/or pouring and the loss of adequate brushing and spraying properties shall be determined. Report up to a 12-hour period the actual temperature, humidity and the time of loss of adequate brushing and spraying properties.

4.5.20 Gloss. 60-degree specular gloss shall be tested in accordance with ASTM D 523.

4.5.21 Resistance to AFFF (Type IV only). Prepare one steel test panel to SSPC-SP-3, and coat with an epoxy primer meeting MIL-DTL-24441 or listed on QPL-23236, applied and cured per manufacturer's instructions. Prepare a second steel test panel to SSPC-SP-3 and apply the primer specified by the manufacturer for the system being tested, per manufacturer's instructions. For systems not requiring a prime coat, prepare steel panel to SSPC-SP-3 degree of surface cleanliness, and apply the coating system. Apply each coat to the minimum DFT allowed per manufacturer's instructions. Allow each coat to cure per manufacturer's instructions prior to applying the next coat. After the final coat of the system has been applied, air dry at room temperature for 7 days, or until the final cure-to-service time per manufacturer's instructions is reached, whichever is shorter. Coat all exposed surfaces. The test panels will be suspended in covered containers of 6 percent AFFF diluted with natural sea water, 35 percent AFFF diluted with natural sea water, and 100 percent AFFF for 30 days. On removal from the container, observe the panel for ASTM D 1308 effects.

4.5.22 Serviceability. The deck coating shall be applied in NAVSEA designated or approved representative areas aboard a U.S. naval vessel for a minimum service period of 6 months.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The material covered by the specification is intended for use as high durability, wear resistant deck coating for use in high traffic areas, with minimal maintenance. The coating may be supplied with or without aggregate.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type and class (see 1.2).
- c. Manufacturer's certificate of compliance stating no ozone-depleting substances (ODS) used (see 3.3).
- d. Toxicity conformance (see 3.4 and 6.6).
- e. Off-gassing conformance, when required (see 3.5 and 6.7).
- f. Packaging requirements (see 5.1).
- g. Material Safety Data Sheet, when required (see 6.4).**

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-32171, 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. Information pertaining to qualification of products may be obtained from Commander, Naval Sea Systems Command, SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160.

6.4 Material safety data sheets. When required, contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. In order to obtain the MSDS, FAR clause 52.223-3 must be in the contract.

6.5 Product/procedure data sheet. Manufacturers of coatings will be required to provide ASTM F 718 forms for the product being qualified to the qualifying activity as part of the final qualification package. No other versions or changes to the ASTM F 718 sheets will be allowed to be used by any contractor involved in work onboard Naval vessels. The product/procedure data sheet will also be required to be included with each shipment of the material covered by this specification.

6.6 Toxicity evaluation. The NEHC requires sufficient information to permit a Health Hazard Assessment (HHA) of the product. Any questions concerning toxicity, information required to conduct an HHA, and requests for HHAs should be addressed to the Commanding Officer, Navy Environmental Health Center, ATTN: Hazardous Materials Department, Industrial Hygiene Directorate, 620 John Paul Jones Circle, Suite 1100, Portsmouth, VA

20378-2103. Upon receipt of the HHA, a copy should be provided to Commander, Naval Sea Systems Command, SEA 05M1, 1333 Isaac Hull Ave., SE, Stop 5133, Washington Navy Yard DC 20376-5133.

6.7 Off-gassing. Type II materials to be installed in submarines are to be controlled to prevent off-gassing, which contaminates the atmosphere and results in health hazards to personnel or deleterious effects on machinery. These controls are accomplished through the Submarine Material Control Program, which is described in Chapter 7 of NAVSEA Technical Manual S9510-AB-ATM-010. Under the Submarine Material Control Program, all materials considered for use on submarines require certification and assignment of a usage category. Under the certification process, candidate materials are selected by Navy activities or contractors, and a request for certification is submitted to Commander, Naval Sea Systems Command, SEA 05Z9, 1333 Isaac Hull Ave., SE, Stop 5122, Washington Navy Yard DC 20376-5122. The certification request is accompanied by detailed information, including descriptions of the material, method of application, usage, and storage. A chemical analysis is conducted, which is normally accomplished through off-gas testing. The off-gas test is required to be conducted in a Government approved laboratory designated by the preparing activity. Information pertaining to this test requirement may be obtained from this same address. Based on the chemical analysis results, a usage category is assigned to the material defining whether, and to what extent, the material may be used on submarines.

6.8 Shelf life. This specification covers items where shelf life is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order. The shelf-life codes are contained in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from DoD 4140.27-M, Shelf-life Management Manual, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points (ICPs), and (2) the DoD Service and Agency administrators for the DoD Shelf-life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: <http://www.shelflife.hq.dla.mil/>.

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

6.10 Subject term (key word) listing.

AFFF stations  
Deck coverings  
Deck paint  
Paint

Custodians:  
Army - MI  
Navy - SH  
Air Force - 11

Preparing Activity:  
Navy - SH  
(Project 8010-2005-001)

Review activities:  
Army - MR  
Navy - AS, CG  
Air Force - 84, 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil>.