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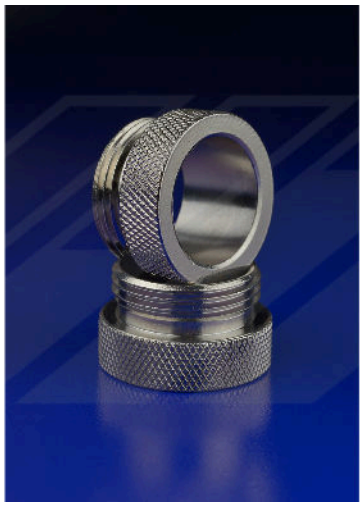

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METRIC
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21 February 1989
(See 6.10)

MILITARY SPECIFICATION

COATINGS, POWDER (METRIC)

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

1. SCOPE

1.1 Scope. This specification covers powder coatings for interior steel, aluminum, copper-nickel and bronze equipment, furniture, and electrical box surfaces and on exterior steel, aluminum, copper-nickel, and bronze surfaces exposed to marine atmosphere, high humidity, seawater, and weathering.

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

1.2.1 Types. The types of powder coatings are designated as follows:

Type I - Epoxy
Type II - Epoxy polyester hybrid
Type III - Polyester
Type IV - Polyester triglycedial isocyanurate (TGIC)
Type V - Polyester urethane hybrid
Type VI - Acrylic
Type VII - Acrylic polyester hybrid
Type VIII - Acrylic urethane hybrid
Type XI - Urethane
Type X - Polyurethane
Type XI - Vinyl
Type XII - Nylon

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, SEA 03R42, Naval Sea Systems Command, 2531 Jefferson Davis Hwy, Arlington, VA 22242-5160 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 8010

2.1.2 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.

DEPARTMENT OF LABOR (DOL)

Code of Federal Regulations, Title 29, Part 1910, 1915, 1917, 1918, 1926, and 1928 - Hazard Communication Act, Final Rule.

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

ENVIRONMENTAL PROTECTION AGENCY (EPA)

SW 846, Chapter 3.3, method 7471 - Test Methods for Evaluating Solid Waste; Physical/Chemical Methods.

(Application for copies should be addressed to National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 366M - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality. (Metric)(DoD adopted)
B 103 - Standard Specification for Phosphor Bronze Plate, Sheet, Strip, and Rolled Bar. (DoD adopted)
B 117 - Standard Test Methods of Salt Spray (Fog) Testing. (DoD adopted)
B 122 - Standard Specification for Copper-Nickel-Tin Alloy, Copper-Nickel-Zinc Alloy (Nickel-Silver), and Copper-Nickel Alloy Plate, Sheet, Strip, and Rolled Bar.
B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate. (Metric)
D 149 - Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
D 235 - Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent).
D 522 - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
D 523 - Standard Test Method for Specular Gloss. (DoD adopted)
D 740 - Standard Specification for Methyl Ethyl Ketone.
D 1193 - Standard Specification for Reagent Water (Federal Test Method Standard No. 7916).
D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes. (DoD adopted)
D 1729 - Standard Practice for Visual Evaluation of Color Differences of Opaque Materials.

ASTM (Continued)

D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity. (DoD adopted)

D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

D 3359 - Standard Methods for Measuring Adhesion by Tape Test.

D 3363 - Standard Test Method for Film Hardness by Pencil Test.

D 3924 - Standard Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials. (DoD adopted)

D 3951 - Standard Practice for Commercial Packaging. (DoD adopted)

D 4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

D 4217 - Standard Test Method for Gel Time of Thermosetting Coating Powder.

E 662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

E 800 - Standard Guide for Measurement of Gasses Present or Generated During Fires.

G 53 - Standard Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV - Condensation Type) for Exposure of Nonmetallic Materials.

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

STATE OF CALIFORNIA DEPARTMENT OF HEALTH SERVICES

California Administrative Code Title 22, Division 4.5, Environmental Health Standards for the Management of Hazardous Waste, Article 3, Characteristics of Hazardous Waste, Section 66261.24, Characteristic of Toxicity, Table II, Pg. 655 (Register 91, Nos. 22; 5-31-91).

(Application for copies should be addressed to the Hazardous Material Laboratory, State of California, Dept of Health Services, 2151 Berkeley Way, Berkeley, CA 94704.)

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SP 10 - Near-White Blast Cleaning. (DoD adopted)

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

UNITED NATIONS (UN)

UN - Performance Oriented Packaging.

(Application for copies should be addressed to: Labelmaster, 5724 North Pulaski Road, Chicago, IL 60646)

(Non-Government standards and other publications are normally available from the organizations that prepare or 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 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 powder coatings 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 of award of contract (see 4.3 and 6.4).

3.2 Materials. The material shall be a finely ground free flowing powder of a one-component material consisting of a resin and curing agent system, as specified (see 1.2.2 and 6.2), catalysts, fillers, colorants, and flow control agents in order to form a powder formulation capable of being electrostatically applied and conforming to the requirements of this specification.

3.2.1 Workmanship. The powder shall be uniform, free from grit, and free of solvent, abrasives, water, chlorides, or other impurities.

3.2.2 Hydrogen cyanide. When specified (see 6.2), the combustion products of the coating in an as applied form, shall not contain detectable concentrations of hydrogen cyanide (see 4.8.19). Monitoring for hydrogen cyanide shall be performed in accordance with the guidance provided in ASTM E 800. (Note: Important aspects of selecting a valid test method for sampling and analysis of hydrogen cyanide include sample compatibility with other materials present in the combustion products, sample stability, sample collection efficiency, positive and negative chemical interferences, selectivity and specificity of the method, extent to which sample is representative of the environment sampled, sensitivity of the method, ease of monitoring, use of "state-of-the-art" methods, reproducibility of data, existence of a comprehensive quality control program which addresses all aspects of the sampling and analysis program, and the time/cost of sample collection and analysis. Most errors in analytical measurements are due to poor sampling techniques. Use the following analytical methods, in decreasing order of preference, for hydrogen cyanide. Ion chromatography, ion specific electrode (National Institute for Occupational Safety and Health (NIOSH) Method #7904), gas chromatography, infrared analysis, spectrophotometric (colorimetric) methods in accordance with NIOSH Method #6010, and direct reading instrumentation/indicator tubes. Use an American Industrial Hygiene Association accredited laboratory wherever possible. The laboratory used must have an established, comprehensive quality control program which includes the analysis of "blanks," "blind samples," duplicate samples, and proficiency testing samples via multiple-laboratory sample analysis program. Where possible, samples should be collected by or under the direct supervision of an industrial hygienist certified by the American Board of Industrial Hygiene.)

3.2.3 Toxic products. When evaluated as specified in 4.9, the materials used in the powder coating shall not contain known or potentially carcinogenic materials, as identified by: (1) the Occupational Safety and Health Administration (regulated carcinogens), (2) International Agency for Research on Cancer (IARC) (latest monographs), and (3) National Toxicology Program (latest annual

report). The manufacturer is responsible for maintaining "carcinogen free" materials. For the purposes of this specification, "carcinogen free" is defined as follows:

(a) Known or potential carcinogens, identified by the three agencies defined earlier in this paragraph shall not be intentionally added to any formulation.
(b) Where these materials may find their way into formulations, as a result of being an impurity or trace constituent in an ingredient, the levels shall be maintained as low as feasible.
(c) Under no circumstances shall the level of known or potential carcinogen be present in the final product, as supplied, at levels in excess of 0.06 percent by weight.

In addition, the powder coating, as supplied, shall not contain the following materials in excess of 0.06 percent by weight (see 6.3): asbestos or any asbestos-form materials, benzene, toluene, chlorinated solvents, hydrolyzable chlorine derivatives, lead, chromium, cadmium, mercury (see 4.8.22), and nitrosamines. (Note: Use of abrasive techniques to remove cured powder coatings from substrates containing compliant levels of lead and other materials, could still result in the creation of a potentially hazardous condition. Consult the local cognizant industrial hygienist for detailed health hazard control guidance prior to proceeding).

3.2.3.1 Toxicity. The powder coating shall have no adverse effect on the health of personnel when used for its intended purpose in accordance with the precautions delineated on the Material Safety Data Sheet and Hazardous Chemical Warning Label. Questions related to health effects associated with use of powder coatings will be referred by the contracting activity to the qualifying activity. The qualifying activity will act as an advisor to the contracting activity. The qualifying activity will arrange for review of questions by the appropriate departmental medical service. The contracting activity will be provided with a copy of the Navy Environmental Health Center (NAVENVIRHLTHCEN) findings.

3.2.4 Material safety data sheet (MSDS). The contracting activity shall be provided a material safety data sheet at the time of 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 (see 5.5 and 6.5).

3.2.5 Disposal requirement. Waste powder and removed coating shall be disposed of in an ordinary landfill. To minimize dusting at landfills the powder coating shall be sintered (solidified) before disposal. All disposal shall be in accordance with both the state and federally imposed Environmental Protection Agency (EPA) regulations. For Navy activities contact the Naval Facilities Engineering Command for guidance regrading any special considerations for powder coatings and waste materials.

3.2.6 Metal content. The content of each soluble metals and total content of each metal of the powder coating shall be not greater than the values listed in tables I and II when tested as specified in 4.10.

TABLE I. Soluble metals content. 1/

Soluble metal and/or its compound	Maximum, mg/L
Antimony and/or its compounds	15
Arsenic and/or is compounds	5
Barium and/or its compounds (excluding barite)	100
Beryllium and/or its compounds	0.75
Cadmium and/or its compounds	1
Chromium (VI) compounds	5
Chromium and/or chromium (III) compounds	560
Cobalt and/or its compounds	10
Copper and/or its compounds	25
Fluoride salts	180
Lead and/or its compounds	0.5
Mercury and/or its compounds	0.2
Molybdenum and/or its compounds	350
Nickel and/or its compounds	10
Selenium and/or its compounds	1
Silver and/or its compounds	5
Tantalum and/or its compounds	800
Thallium and/or its compounds	7
Tungsten and/or its compounds	800
Vanadium and/or its compounds	24
Zinc and/or its compounds	250

1/ The values in table I are instantaneous values for toxic materials and are not time weighted averages.

TABLE II. Total metals content. 1/

Metal	Maximum, %WT
Antimony and/or its compounds	0.015
Arsenic and/or is compounds	0.001
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	0.0005
Chromium and/or chromium (III) compounds	0. 56
Cobalt and/or its compounds	0.005
Copper and/or its compounds	0.01
Fluoride salts	0.18
Lead and/or its compounds	0.005
Mercury and/or its compounds	0.0002
Molybdenum and/or its compounds	0.35
Nickel and/or its compounds	0.02
Selenium and/or its compounds	0.001
Silver and/or its compounds	0.001
Tantalum and/or its compounds	0.8
Thallium and/or its compounds	0.007
Tungsten and/or its compounds	0.8
Vanadium and/or its compounds	0.01
Zinc and/or its compounds	0.25

1/ The values in table II are instantaneous values for toxic materials and are not time weighted averages.

3.3 Coating characteristics. When applied to a substrate and subjected to a heating cycle, as required by the contractor, the material shall melt, fuse, and subsequently cure to form a coating which conforms to all the requirements of this specification. The contractor shall specify the application procedure and shall provide detailed health and safety information, by means of Material Safety Data Sheets, Product Specification/Data Sheets, and Hazardous Chemical Warning Labels, needed to ensure; (1) optimum performance of the powder coating and (2) all procedures are performed safely.

3.4 Film properties. The powder coating shall be applied by established commercial powder coating methods over abrasive blasted steel, aluminum, copper-nickel, or bronze surfaces, as applicable. Coatings shall have a total dry film thickness for interior, dry service surfaces, and exterior and interior wet spaces immersion service surfaces, aluminum, copper-nickel, or bronze surfaces of 51 to 102 micrometers (μm) (2 to 4 mils) and 102 to 152 μm (4 to 6 mils), respectively. The cured coating shall be uniform, smooth, even, and free of runs, sags, and streaks. The coating shall be not less than 0.05 mm (2.0 mils) above the blasted profile (see 4.8.1).

3.5 Cure time. The powder shall have a cure cycle (time and temperature) of less than 30 minutes at a temperature of less than 204.44 ± 5 degrees Celsius (°C) (400 ± 10 degrees Fahrenheit (°F)) and meet the cure test specified in 4.8.18. At

176.67 ± 5°C (350 ± 10°F), the powder shall have an overbake stability of at least 100 percent of the recommended cure time. The temperature and time duration of the powder coating cure cycle shall not effect the material properties of the coated substrate.

3.6 Gel time. Epoxy gel time of a film of applied powdered materials shall be not less than 20 seconds nor greater than 60 seconds when tested as specified in 4.8.2. Other powders gel time of the film of the applied powdered materials shall be not greater than 125 seconds when tested as specified in 4.8.2. The gel time for class 2 powdered materials shall not be less than 4 seconds nor greater than 60 seconds when tested as specified in 4.8.2. Types XI and XII are not required to meet this requirement.

3.7 Weathering properties (for class 3 only). The weathering properties for class 3 only shall be as follows:

(a) Accelerated weathering. The cured film of applied powder coating shall show no cracking, a loss of not greater than 30 percent of the gloss measured before exposure, no color change, blistering, wrinkling, or loss of adhesion of the coating nor evidence of substrate corrosion after 1,000 hours exposure to accelerated weathering (see 4.8.15.1).

(b) Humidity resistance. The cured film of applied powder coating shall show no corrosion, blistering, wrinkling, or loss of adhesion (see 4.8.15.2).

3.8 Color. Color of the cured film of applied powder coatings shall be as specified and in accordance with FED-STD-595 color chip (see 6.2 and 6.7).

3.9 Flexibility (for classes 1 and 3 only). When specified (see 6.2), the cured film of applied powder coating shall show no cracking or loss of adhesion in the bend area (see 4.8.5).

3.10 Adhesion. The cured film of applied powder coating shall have a minimum classification of 5B (see 4.8.6).

3.11 Specular gloss. Initially, the 60-degree specular gloss of the cured film of applied powder coating (for all colors except Navy haze-gray) shall have a minimum requirement of 45 and a maximum requirement of 85. The 60-degree specular gloss requirement for Navy haze-gray shall have a minimum requirement of 45 and a maximum requirement of 60 (see 4.8.7).

3.12 Dielectric strength. When specified (see 6.2), the cured film of applied powder coating shall have an average dielectric strength greater than 30 volts per micrometer (762 volts per mil) (see 4.8.8).

3.13 Thermal shock resistance (for class 3 only). The cured film of applied powder coating shall withstand 10 cycles between 74 ± 2°C (165 ± 4°F) and minus 54 ± 2°C (minus 65 ± 4°F) without cracking, checking, or disbonding (see 4.8.9).

3.14 Impact resistance. The cured film of applied powder coating shall provide a coating that will have a direct and reverse impact resistance of not less than 18 newton meters (160 inch pounds) and 2.8 newton meters (25 inch pounds), respectively, without forming a holiday when inspected with a 67.5 volt

detector (see 4.8.10). Except type XII shall have a direct and reverse impact resistance of not less than 14 newton meters (125 inch pounds), without forming a holiday when inspected with a 67.5 volt detector (see 4.8.10).

3.15 Abrasion resistance. Weight loss from the cured film of applied epoxy powder coating shall be not greater than 60 milligrams (mg) (0.0001 pound) and all other powder coatings not greater than 100 mg (see 4.8.11).

3.16 Salt spray resistance (for classes 2 and 3). A cured film of applied powder coating shall show undercutting of not greater than 6 millimeters (mm) (1/4 inch) from the score lines. There shall also be no blistering, wrinkling, or loss of adhesion of the coating or any general surface corrosion or pitting (see 4.8.12).

3.17 Fluid resistance properties (for class 2 only). The fluid resistance properties for class 2 shall be as follows:

(a) Boiling water immersion. The cured film of applied powder coating shall show no wrinkling, blistering, or loss of adhesion (see 4.8.13.1).
(b) Hydrocarbon immersion. A cured film of applied powder coating shall show no softening, blistering, rusting, or other visible defects (see 4.8.13.2).
(c) Hydraulic fluid immersion. A cured film of applied powder coating shall show no softening, blistering, rusting, or other visible defects (see 4.8.13.3).

3.18 Chemical resistance. The cured film of applied powder coating shall not blister, soften, lose bond, discolor, change greater than 50 percent in gloss, nor develop holidays and intentionally made holes shall exhibit no undercutting during the 45-day test period (see 4.8.14).

3.19 Weathering properties (for class 2 only). The weathering properties for class 2 only shall be as follows:

(a) Humidity resistance. The cured film of applied powder coating shall show no corrosion, blistering, wrinkling, or loss of adhesion (see 4.8.15.2).

3.20 Hardness. The cured film of applied powder coating shall have a pencil hardness of not less than 2H (see 4.8.16).

3.21 Holiday. The cured film of applied powder coating shall be free of holidays (see 4.8.17).

3.22 Shelf life. Powder coating materials shall meet the requirements of this specification for 1 year from the date of manufacture when stored unopened in the original container at or below 22°C (72°F) and at a relative humidity less than 50 percent (see 4.8.3).

3.23 Outgassing (for classes 1 and 2). Outgassing when conducted as specified in 4.8.20, the outgassing of the powder coatings shall not contaminate a ship or submarine atmosphere.

3.24 Touchup. The cured powder coating, when touched up with silicone alkyd copolymer enamel conforming to MIL-E-24635, type II, class 2, shall exhibit good adhesion. For type I powder coatings, touchup cured powder coatings with epoxy-polyamide, exterior topcoat conforming to MIL-P-24441 and Formula 151, type I of MIL-P-24441/2 (see 4.8.21).

3.25 Label. Manufacturer's container label instructions for the powder coating shall be in accordance with the requirements of 29 CFR 1910, 1915, 1917, 1918, 1926, and 1928 (see 5.4.1.1).

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 (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept 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).

4.2.1 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the applicable test methods specified herein.

4.3 Qualification inspection. Qualification inspection shall be conducted at a laboratory satisfactory to the Government. Qualification inspection shall consist of the tests specified in 4.8.1 through 4.8.22.

4.3.1 Loss of qualification. After qualified product list (QPL) approval, any subsequent change in product composition will result in cancellation of QPL listing and the necessity for the manufacturer to apply for re-qualification.

4.3.2 Identification characteristic. When specified in the contract or order, an identification characteristic values report shall be prepared (see 6.3 and appendix A).

4.4 Quality conformance inspection.

4.4.1 Lot. For the purpose of quality conformance inspection and test sampling, a lot is defined as all the powdered material of the same type and class, from a single, uniform batch, produced and offered for delivery at one time (see 6.3). The addition of any substance to a batch shall constitute a new lot. All necessary reports must be presented before the quality conformance inspection begins.

4.4.2 Sampling for quality conformance tests. As a minimum, the contractor shall randomly select two samples from each lot of completed powdered material. One sample shall be taken from the first 10 percent of production from the lot. The other sample shall be taken from the last 10 percent of production from the lot. The samples shall be subjected to the tests as specified in 4.8.1 through 4.8.7, 4.8.10, 4.8.16, and 4.8.18 (see 6.6). In addition, the periodic long-term tests shall be conducted as shown in table III.

TABLE III. Periodic quality conformance testing.

Test	Test method	Frequency of testing intervals (min months)
Dielectric strength	4.8.8	12
Thermal shock	2/ 4.8.9	12
Abrasion resistance	4.8.11	12
Salt spray resistance	1/2/ 4.8.12	24
Boiling water immersion	1/ 4.8.13.1	12
Hydrocarbon immersion	1/ 4.8.13.2	18
Hydraulic fluid immersion	1/ 4.8.13.3	18
Chemical resistance	4.8.14	24
Accelerated weathering	3/ 4.8.15.1	24
Humidity resistance	1/2/ 4.8.15.2	18
Holiday test	4.8.17	18
Touch-up	4.8.21	6

1/ For class 2.
2/ For class 3.

4.5 Test procedures. Unless otherwise specified (see 6.2), tests shall be performed on duplicate panels of each material.

4.6 Test panels. The test panel material, the surface preparation and test panel coating application shall be as specified (see 4.6.1 through 4.6.4).

4.6.1 Material. Unless otherwise specified (see 6.2), test panels shall be prepared from sheet steel conforming to ASTM A 366M, cold rolled, sheet aluminum conforming to ASTM B 209M, alloy 5086, ASTM B 103 for phosphor bronze plate, and ASTM B 122 for copper-nickel-tin alloy, copper-nickel-zinc alloy, and copper-nickel alloy, and shall be of any convenient size and thickness subject to the following limitations. Unless otherwise specified (see 6.2), panels shall be not less than 100 by 150 by 3 mm (4 by 6 by 0.125 inches). Panels for the flexibility test shall be 25 by 150 by 0.75 mm (1 by 6 by 0.03 inches).

4.6.2 Surface preparation. Unless otherwise specified (see 6.2), the panels shall be cleaned in solvent (xylene and isopropanol, one to one ratio by volume), rinsed in clean solvent, and dried. The entire panel shall be abrasive blasted using any suitable equipment and abrasive blasting material. The abrasive materials shall be free from oil, grease, dirt, water, or other contaminants that would impair the coatability of the panel surface. The panels shall be blasted clean to a near-white metal in accordance with SSPC SP 10. After blasting, the panels shall be cleaned by using clean, dry compressed air or a vacuum. (Note: Minimum panel thickness which can be blasted effectively without deformation is 16 gauge.) Anchor pattern for interior and exterior aluminum, copper-nickel, and bronze surfaces shall be 0.025 to 0.0375 mm (1.0 to 1.5 mils) and 0.050 to 0.075 mm (2.0 to 3.0 mils), for steel surfaces.

4.6.3 Application methods. After proper surface preparation (see 4.6.2), the panels shall be kept free from fingerprints and rust. Application of the powder coating shall be accomplished not greater than 2 hours after cleaning, or the cleaned panels may be stored in clean mineral spirits or a desiccator for not greater than 72 hours before coating. Steel panels shall be treated with non-aqueous iron phosphate conforming to TT-C-490, type IV. Unless otherwise specified (see 6.2), the coating shall be applied and cured in accordance with the contractor's instructions. A dry film thickness of not less than 0.102 to 0.152 mm (4 to 6 mils) is required for exterior and interior wet spaces, immersion service surfaces, aluminum, copper-nickel and bronze test surfaces, and a dry film thickness of 0.051 to 0.102 mm (5 to 7 mils) is required for interior dry service, aluminum, copper-nickel, and bronze test surfaces (see 6.2). Coatings for the flexibility test shall be 0.076 $\pm$ 0.013 mm (3 $\pm$ 0.5 mils) thick. The powder coatings final dry film thickness shall be at the manufacturer recommended thickness.

4.6.4 Cure method. The powder coating shall be cured at the manufacturer recommended cure temperature.

4.7 Test conditions. Unless otherwise specified (see 6.2), the testing conditions shall be in accordance with ASTM D 3924. The dry film thickness shall be measured after the coated panel has been postheated in accordance with contractor's instructions.

4.8 Test methods. The coating test methods shall be as specified (see 4.8.1 through 4.8.22).

4.8.1 Coating. Panels shall be prepared, cleaned, and coated as specified in 4.6.2, 4.6.3 and 4.6.4. The coated panels shall be examined for conformance to the requirements specified in 3.4.

4.8.2 Gel time. The gel time for the powder coating shall be determined in accordance with ASTM D 4217 (see 3.6).

4.8.3 Shelf life. Two unopened containers of powder coating shall be stored in a room maintained at or below 27°C (80°F) and at a relative humidity less than 50 percent for 1 year from the date of manufacture. Both containers shall be tested for all of the requirements of this specification and checked for compliance with 3.22.

4.8.4 Panels. Panels shall be prepared and coated as specified in 4.6. The color shall meet the requirements specified in 3.8. Color shall be a general color match as tested in accordance with ASTM D 1729.

4.8.5 Flexibility (for classes 1 and 3 only). Three panels prepared and coated as specified in 4.6 and cured. The panels shall be bent 180 degrees over a 12.5-mm (1/2-inch) mandrel in accordance with ASTM D 522. The panels shall be visually examined immediately to determine conformance to the requirements specified in 3.9.

4.8.6 Adhesion. Panels shall be prepared and coated as specified in 4.6.2. Adhesion shall be determined in accordance with ASTM D 3359, method B. The coating shall be examined for conformance to the requirements specified in 3.10.

4.8.7 Specular gloss. Panels shall be prepared and coated as specified in 4.6. The 60-degree specular gloss of the powder coating shall be determined in accordance with ASTM D 523 for conformance to the requirements specified in 3.11.

4.8.8 Dielectric strength. Five panels shall be prepared and coated as specified in 4.6. The dielectric strength of the powder coating material shall be in accordance with ASTM D 149 using a type 3 electrode. The dielectric strength shall be determined for panels in oil. Oil shall be used as a dielectric to prevent flashover and shall have no effect on the properties of the coating. The average dielectric strength of five panels shall conform to the requirements specified in 3.12.

4.8.9 Thermal shock (for class 3 only). Panels shall be prepared and coated as specified in 4.6. Test panels shall be placed in an oven maintained at 74 ± 2°C (165 ± 4°F) for 30 ± 0.5 minutes, then removed and quenched in cold tap water. The samples shall then be wiped dry and immediately plunged into a suitable low temperature environment held at minus 54 ± 2°C (minus 65 ± 4°F) for 10 ± 0.5 minutes. After each cycle, the panels shall be inspected for conformance to 3.13. Cycling shall be continued until the panel fails or until 10 cycles have passed.

4.8.10 Impact resistance. Panels 150 by 300 by 3 mm (6 by 12 by 0.125 inches) shall be prepared and coated as specified in 4.6. Test panels shall be impact (both direct and reverse) tested in accordance with ASTM D 2794 using a 1.8-kilogram (4-pound) weight. The impact cup shall terminate in a hemispherical,

15.875-mm (5/8-inch) diameter nose. Backing plates shall not be used. The impact resistance shall be determined for conformance to the requirements specified in 3.14.

4.8.11 Abrasion resistance. Steel panels, 100 by 100 by 3 mm (4 by 4 by 0.125 inches) shall be prepared and coated as specified in 4.6. The panels shall be tested using a Taber Abraser apparatus using CS-17 wheels, 1000-gram (2.2-pound) weights for 1000 cycles, in accordance with ASTM D 4060. Weight loss shall be used as the evaluation criteria rather than optical clarity. The weight loss shall be determined immediately to three decimal places for conformance to the requirements specified in 3.15.

4.8.12 Salt spray resistance (for classes 2 and 3 only). Panels shall be prepared, cleaned, and coated as specified in 4.6. Test panels shall be exposed in accordance with ASTM B 117. Exposure time shall be not less than 500 hours for steel substrates and not less than 250 hours for aluminum, copper-nickel, and bronze substrates. The panels shall be examined for conformance to the requirements specified in 3.16.

4.8.13 Fluid resistance properties (for class 2 only). The fluid resistance properties for class 2 only shall be as specified in 4.8.13.1 through 4.8.13.3.

4.8.13.1 Boiling water immersion test. Panels shall be prepared and coated as specified in 4.6 and conditioned as specified in 4.7, except condition panels for 24 hours. Half of each panel shall then be immersed in reagent water conforming to ASTM D 1193, type IV at a temperature of 100 $\pm$ 2°C (212 $\pm$ 4°F) for 1000 hours. After removal from the water, each panel shall then be examined immediately for blistering, and adhesion, to verify conformance to 3.17(a).

4.8.13.2 Hydrocarbon immersion. Panels, 150 by 300 by 3 mm (6 by 12 by 0.125 inches), shall be prepared and coated as specified in 4.6. Half of each panel shall be immersed in mineral spirits conforming to TT-T-291, type I at the conditions specified in 4.7. The panels shall be examined after 3, 10, and 30 days for conformance to 3.17(b).

4.8.13.3 Hydraulic fluid immersion test. Panels, 150 by 300 by 3 mm (6 by 12 by 0.125 inches), shall be prepared and coated as specified in 4.6. Half of the coated panels shall be immersed in hydraulic fluid conforming to MIL-H-5606 and conditioned as specified in 4.7. The panels shall be examined after 3, 10, and 30 days for conformance to 3.17(c).

4.8.14 Chemical resistance. Panels, 150 by 300 by 3 mm (6 by 12 by 0.125 inches), shall be prepared and coated as specified in 4.6 for each of the following chemical solutions: reagent grade water conforming to ASTM D 1193 type IV, a 3M aqueous solution of $CaCl_2$, a 3M aqueous solution of NaOH, and a saturated aqueous solution of $Ca(OH)_2$. The panels shall be free of holidays and have a hole drilled through the coating 6.25 mm (1/4 inch) in diameter, 25.4 mm (1 inch) from the bottom. The aluminum panels prepared for the 3M NaOH and $Ca(OH)_2$ solutions shall not have a hole. The panels shall be tested in accordance with ASTM D 1308 for each of the solutions specified above. The panel holes shall be completely immersed in the solutions during the test. The test shall be conducted at 74 $\pm$ 1°C (165 $\pm$ 2°F) for 45 days. Panels shall be examined after 3, 10, 30, and 45 days and checked for conformance to 3.18.

4.8.15 Weathering properties (for classes 2 and 3 only). Weathering properties for classes 2 and 3 only shall be as specified in 4.8.15.1 and 4.8.15.2.

4.8.15.1 Accelerated weathering (for class 3). Panels shall be prepared and coated as specified in 4.6. Panels shall be conditioned for 24 hours in accordance with 4.7, then subjected to accelerated weathering for 1,000 hours in accordance with ASTM G 53. The equipment cam shall be set for 6 hours condensation at 50 ± 1°C (122 ± 2°F) and at 60 ± 1°C (140 ± 2°F) and alternating with 6 hours of ultra-violet light at 50 ± 1°C (122 ± 2°F) and at 60 ± 1°C (140 ± 2°F) and at a peak wave length of 315 nanometers. Panels shall be removed and examined for conformance to the requirements specified in 3.7(a).

4.8.15.2 Humidity resistance (for classes 2 and 3 only). Panels shall be prepared and coated as specified in 4.6. They shall be conditioned for 24 hours in accordance with 4.7. The panels shall be exposed in a humidity cabinet in accordance with ASTM D 2247 and operated at 49 ± 1°C (120 ± 2°F) and 100 percent humidity. The powder coating shall be exposed for 30 days. After exposure, the panels shall be examined for conformance to 3.7(b) and 3.19(a).

4.8.16 Hardness. Panels shall be prepared and coated as specified in 4.6. The scratch hardness of the powder coating shall be determined in accordance with ASTM D 3363 for conformance to 3.20. The average of the five hardness readings shall conform to the requirements specified in 3.20.

4.8.17 Holiday test. Panels shall be prepared and coated as specified in 4.6. Holiday detection shall be performed with a 67.5 voltage direct current detector on the whole panel. Examine panels for conformance to 3.21.

4.8.18 Cure time.

4.8.18.1 Scope. This method describes two procedures for the determination of cure in powder coatings:

1) Reagent A is recommended for epoxy powder coatings which exhibit a high degree of solvent resistance and are relatively unaffected by strong solvents such as MEK (methyl ethyl ketone).
2) Reagent B is recommended for other powder coatings, including hybrids (epoxy cured polyesters), polyester urethanes, TGIC (triglycidyl isocyanurate) cured polyesters, and so forth. This procedure uses a blend of MEK and mineral spirits (1) in a ratio suitable to discern cure.
3) This test method can be tailored to more clearly define "cure" in particular powder coating formulation by either increasing or decreasing the concentration of MEK in the solvent blend.

4.8.18.2 Apparatus.

1) Reagents: MEK (methyl ethyl ketone), conforming to ASTM D 740 and mineral spirits conforming to ASTM D 235.
2) Containers (squeeze bottles) to hold mixed or single reagents.
3) A 2-pound ball peen hammer.
4) Soft cloth or soft paper towel folded into a 3- by 3-inch pad approximately 1/2 inch thick.

5) Length of copper wire to attach pad to ball end of a 2-pound ball peen hammer.
6) Panels prepared and coated as specified in 4.6.

4.8.18.3 Procedure.

1) Mix MEK and mineral spirits in ratios of:

Reagent A. 100 percent MEK
Reagent B. 10 percent MEK/90 percent mineral spirits by volume

Mixing of other ratios can be used to more clearly discern "cure" in certain instances.

2) Fill squeeze bottles with reagent blends. Be sure to properly label each container.
3) Fold a soft cloth, such as cheese cloth, or cotton into a 3- by 3-inch square approximately 1/2 inch thick.
4) Attach the 3- by 3-inch pad to the ball end of a 2-pound ball peen hammer with No. 18 copper wire, for example (the 2-pound hammer provides a constant force on the test panel and helps eliminate operator dependence).
5) Saturate pad with appropriate solvent blend.

Caution: Provide adequate ventilation, consistent with accepted lab practice, to prevent solvent vapors from accumulating to dangerous levels.

6) Use reagent A as described in item 1 of 4.8.18.1.
Use reagent B as described in item 2 of 4.8.18.1.

7) Stroke/slide pad on the test panel while looking for obvious signs of powder coating failure.

4.8.18.4 Interpretation of tests:

1) This test should always be compared with known cured panels representing the same system under evaluation.
2) (Examples of degree of apparent cure:)

	Rating
Dissolving to bare metal	No cure (usually less than 25 double rubs)
Some film removal and softening	Partial cure (100 double rubs)
No effect on film appearance or gloss	Cured coating (100 double rubs)

3) The number of double rubs to bare metal or failure if applicable shall be used in the test comparison.
4) Examples for coating that has been overbaked and is easily disboned:

Visual
- Brittle appearance.
- Flaky or chalky.
- Carbonized

5) Examples of coating that starts to burn.

- Initial white color turns to a yellow color.
- Initial yellow or red color turns to a brown color.
- Initial blue color turns to a gray color.

4.8.19 Hydrogen cyanide. If required (see 3.2.2 and 6.2), powder coatings shall be tested for the presence of hydrogen cyanide during combustion in accordance with ASTM E 800. Using a one time-integrated sampling technique, the chamber described in ASTM E 662, and an analytical method capable of determining 0.1 parts per million (ppm) concentration of hydrogen cyanide. Check for compliance with 3.2.2.

4.8.20 Outgassing. Determination of offgassed constituents and assessment of potential health hazards shall be performed in accordance with procedures set forth by the Naval Sea Systems Command (SEA 03V22). Contact Commander, Naval Sea Systems Command (SEA 03V22) Department of the Navy, 2531 Jefferson Davis Hwy, Arlington, VA 22242-5160 for specific guidance.

4.8.21 Touchup. The cured powder coating shall be overcoated with a brush coat of silicone alkyd copolymer enamel conforming to MIL-E-24635, type II, class 2, and allowed to air dry at ambient conditions for 7 days. For type I epoxy powder coatings, the cured powder coating shall also be overcoated with a brush coat of epoxy paint, conforming to MIL-P-24441/21, type III, formula 151 and allowed to air dry at ambient conditions for 7 days. The adhesion of the brush coat to the underlying powder coating shall be determined using ASTM D 3359, method B, for compliance with 3.24.

4.8.22 Mercury. The test for total mercury shall be conducted in accordance with EPA's test method 7471 (see 3.2.3).

4.9 Toxicity. To determine conformance to requirements of 3.2.3, the manufacturer of the material shall disclose the formulation of his product to the Navy Environmental Health Center, Code 34, 2510 Walmer Avenue, Norfolk, VA 23513-2617. The disclosure of proprietary information, which shall be held in confidence shall include: the name, formula, CAS number, and approximate percentage by weight and volume of each ingredient in the product (totalling 100 percent); the results of any toxicological testing of the product; identification of its pyrolysis products; and any other information as may be needed to permit an accurate appraisal of any toxicity problem or issues associated with the handling, storage, application, use, removal, disposal, or combustion of the material. In addition, the manufacturer shall provide a current MSDS for each ingredient used

in the formulation. Within 30 days prior to data submission, the manufacturer shall contact the supplier of each ingredient, and confirm each MSDS submitted is current. Information submitted shall be clearly marked or identified to show it is being provided in connection with qualification under with MIL-C-24712.

4.10 Metal content. The manufacturer shall certify that each individual coating of the powderized powder coating system meets the soluble and total metal content requirements of the California Administrative Code, Title 22, the waste extracting test. The soluble metal content, and the total metal content powderized powder shall not exceed values which would cause the material to be classified as a hazardous waste (see tables I and II). The soluble and total metal content of each cured powder coating shall be in accordance with the requirements of 3.2.6.

4.11 Inspection of packaging. Sample packages, and the inspection of packaging (preservation, 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 acquisition.)

5.1 General.

5.1.1 Performance oriented packaging (POP). In addition to the packaging requirements specified herein, and unless otherwise specified (see 6.2), all packaging shall comply with the United Nations POP criteria as detailed in performance oriented packaging documents.

5.1.2 Navy fire-retardant requirements.

(a) Treated lumber and plywood. Unless otherwise specified (see 6.2), all lumber and plywood including laminated veneer materials used in shipping container and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Levels A and B - Type II - weather resistant.
Category 1 - general use.

Level C - Type I - non-weather resistant.
Category 1 - general use.

(b) Fiberboard. Fiberboard used in the construction of interior (unit and intermediate) and exterior containers including interior packaging forms shall conform to the class-domestic/fire retardant or class-weather resistant/fire-retardant materials requirement as specified (see 6.2), of PPP-F-320 and amendments thereto.

5.2 Preservation. Preservation shall be level A, C, or commercial as specified (see 6.2).

5.2.1 Unit pack quantity. Unless otherwise specified (see 6.2), the powdered coating shall be furnished in 23 to 25 kg (50- to 55-pound) unit packs as specified for the required level of preservation (see 5.2).

5.2.2 Level A. Unit packs shall consist of a plastic bag with a fiberboard box overpack as follows:

(a) Plastic bag. The plastic bag shall be constructed of material conforming to L-P-378, type I, class 1, with thickness grade and finish at the contractor's option. Final bag closure shall be accomplished by twisting and securing with a reusable lock type plastic tie.

(b) Fiberboard box. The fiberboard box shall conform to PPP-B-636, class weather-resistant with variety, grade, and style at the contractor's option. Box closure shall use method V for closure and be reinforced with tape or nonmetallic stripping in accordance with the appendix to PPP-B-636.

5.2.3 Level C. The unit pack shall be as specified for level A except that the fiberboard box shall conform to class domestic with variety, grade, and style at the contractor's option. Box closure shall be in accordance with method I using pressure-sensitive adhesive tape.

5.2.4 Commercial. Commercial packaging shall be in accordance with ASTM D 3951.

5.2.5 Military. Military packaging shall be in accordance with MIL-STD-2073-1.

5.3 Packing. Packing shall be level A, B, C, or commercial as specified (see 6.2).

5.3.1 General requirements for levels A, B, and C. Containers selected (see 5.3.1.1) shall be of the minimum weight and cube consistent with the protection required, of uniform size, and contain identical quantities of identical material.

5.3.1.1 Levels A, B, and C. Coating preserved as specified (see 5.1) shall be packed in exterior shipping containers in accordance with MIL-STD-2073-1, and herein. Unless otherwise specified (see 6.2), container selection shall be at the contractor's option.

5.3.1.1.1 Caseliners, closure, and gross weight.

5.3.1.1.1.1 Caseliners. Unless otherwise specified (see 6.2), level A shipping containers containing coating preserved level C or commercial shall be provided with waterproof caseliners in accordance with MIL-STD-2073-1.

5.3.1.1.1.2 Closure. Container closure, reinforcing, or banding shall be in accordance with the applicable container specification or appendix thereto except that weather-resistant fiberboard boxes shall be closed in accordance with method V and reinforced with non-metallic or tape banding and domestic boxes shall be closed in accordance with method I using pressure sensitive tape.

5.3.1.1.1.3 Weight. Wood, plywood, and cleated type containers exceeding 91 kg (200 pounds) gross weight shall be modified by the addition of skids in accordance with MIL-STD-2073-1 and the applicable container specification or appendix thereto.

5.3.1.2 Commercial. Coating preserved as specified (see 5.1) shall be packed for shipment in accordance with ASTM D 3951.

5.3.2 Container modification. Shipping containers exceeding 91 kg (200 pounds) gross weight shall have not less than two, 2.62 cm by 10.16 cm (3-inch by 4-inch) nominal wood skids laid flat, or a skid or sill type base which will support the material and facilitate handling by mechanical handling equipment during shipment, stowage, and storage.

5.4 Marking. In addition to any special marking required (see 6.2) and herein, interior (unit packs), shipping containers, and palletized unit loads shall be marked for shipment and storage in accordance with MIL-STD-2073-1.

5.4.1 Special marking.

5.4.1.1 Special marking for use. Special marking for use shall be in accordance with the requirements of 3.3, 3.25, and 4.9 as applicable, including health and safety information.

5.4.1.2 Precautionary marking. Precautionary markings shall include statements that material is free of all prohibited materials (see 3.2.1 and 3.2.3), disposal guidance for all waste powder and removed coatings, and shelf life (see 3.22) marking as follows:

"DO NOT STORE AT TEMPERATURES ABOVE 27°C
(80°F) AND RELATIVE HUMIDITY ABOVE 50%"

5.4.1.3 Colors of labels. The major bold lettering on all labels which shall be brown on a white background for class 1, and green on a white background for class 2, except for exterior coatings labels which shall be purple on a white background for class 3.

5.4.2 General marking. Each component container shall be marked with the following additional information:

(a) Number and date of this specification.
(b) Type and class of powder coating.
(c) Manufacturer's name and the address of the manufacturing location.
(d) Manufacturer's QPL designation, lot number, and date of manufacture.
(e) Contract number.
(f) Color name and number from FED-STD-595.
(g) Special acquisition requirements (see 6.2(e), (k), (m), (g), and (h).

5.5 Material safety data sheet. A copy of the material safety data sheet shall be attached to the shipping document for each destination (see 3.2.4).

5.6 Toxicity. A copy of Navy Environmental Health Center findings shall be attached to the shipping document for each destination and a copy of the certificate of compliance shall be provided with each lot shipped (see 3.2.3 and 4.4.1).

6. NOTES

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

6.1 Intended use. This specification is for powder intended for use as a high-grade, durable coating to protect interior and exterior steel, copper-nickel, and bronze components. Interior dry service equipment, furniture, and electric box surfaces are subject to severe wear such as impact and abrasion. Interior immersion service components are exposed to corrosive environments, but not ultraviolet light. Exterior items receive severe exposure to adverse weather, condensing moisture, corrosive atmospheres, and marine environments.

6.1.1 Coating applications. Coating application and touchup should be as specified in 6.1.1.1 and 6.1.1.2.

6.1.1.1 New applications. Powder coatings in accordance with this specification should be applied as specified in the manufacturer's instructions or technical data sheet.

6.1.1.2 Touchup applications. Coatings should be maintained by using a compatible patch compound.

6.1.1.3 Electrostatic spray. Electrostatic spray application is the most common form of powder application.

6.2 Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number, and date of this specification.
(b) Type and class as required (see 1.2).
(c) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
(d) Resin and curing agent system required (see 3.2).
(e) When products must be free from hydrogen cyanide during combustion (see 3.2.2 and 4.8.19).
(f) Color, class, and number of powder coatings recommended (see 3.8 and 6.7).
(g) When products must be flexible (see 3.9).
(h) When products must have dielectric strength (see 3.12).
(i) When duplicate test is not required (see 4.5).
(j) Dimensions and material of test panels, if other than as specified (see 4.6.1).
(k) Surface preparation if other than as specified (see 4.6.2).
(l) If coating application is other than the contractor's instructions (see 4.6.3).
(m) Which materials the coating shall be applied to: steel, aluminum, copper-nickel or bronze (see 4.6.3).

(n) Routine and referee testing conditions if required (see 4.7).
(o) When POP criteria is not required (see 5.1.1).
(p) When fire-retardant lumber and plywood is not required (see 5.1.2(a)).
(q) Class of fire-retardant fiberboard required (see 5.1.2(b)).
(r) Level of preservation and packing required (see 5.2 and 5.3).
(s) Unit pack quantity, if other than as specified (see 5.2.1).
(t) Container selection, if other than contractor's option (see 5.3.1.1).
(u) When caseliners are not required (see 5.3.1.1.1.1).
(v) Special marking required (see 5.4).

6.3 Consideration of data requirements. The following Data Item Descriptions (DIDs) must be listed, as applicable, on the Contract Data Requirements List (DD 1432) when this specification is applied on a contract, in order to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirements for a DD 1423.

Reference paragraph	DID number	DID title	Suggested tailoring
3.2.3, 4.3.2 and appendix A	DI-MISC-80653	Test reports	-----
4.4.1 and appendix B	DI-MISC-80678	Certification/ data report	10.3.2 does not apply

The above DIDs were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD 1423.

6.4 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 No. 24712 whether or not such products have actually been so listed by the 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 purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Sea Systems Command, SEA 03R42, Department of Navy, 2531 Jefferson Davis Hwy, Arlington, VA 22242-5160 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 Standardization Documents Order Desk, Bldg 4D, 700 Robbins Ave, Philadelphia, PA 19111-5094.

6.5 Material Safety Data Sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.6 Lot acceptance and rejection criteria. If one or more defects are found in any sample (see 4.4.2), the entire lot represented by the sample should be rejected. If a lot is rejected, the contractor has the option of screening 100 percent of the lot for the defective characteristic(s) or providing a new lot which shall be tested in accordance with the sampling plan contained herein. The contractor should maintain for a period of 3 years after contract completion all records of inspection, tests, or any resulting rejections.

6.7 Colors. Commonly specified colors (see 6.2) are listed in table IV.

TABLE IV. FED-STD-595 color numbers and descriptions. 1/2/3/

Gloss	Semigloss	Low gloss lusterless	Word description
---	*20109	30109	Brown (20109 for replacement of DOD-E-18210, formula 23)
---	20117	30117	Brown
10080	---	---	Brown (piping and valve marking)
10324	---	---	Tan (piping and valve marking)
10371	---	---	Spar (U.S. Coast Guard)
11105	---	---	Red (piping and valve marking)
11120	---	---	Red (OSHA safety color)
11136	21136	31136	Red (insignia red)
12197	---	---	International orange
12199	---	---	Red (U.S. Coast Guard)
12246	---	---	Orange (piping and valve marking)
12300	---	---	Orange (OSHA safety color)
13538	---	---	Yellow (piping and valve marking)
13655	23655	33655	Yellow
13591	---	---	Yellow (OSHA safety color)
14062	---	---	Dark green (piping and valve marking)
14097	24097	*34097	Dark green (34097 for replacement of DOD-E-18214, formula 19)
14120	---	---	Green (OSHA safety color)
14449	---	---	Light green (piping and valve marking)
15042	25042	35042	Blue (sea blue)
15044	---	---	Dark blue (piping and valve marking)
15048	25048	35048	Blue (insignia blue)
15092	---	---	Blue (OSHA safety color)

See footnotes at end of table.

1/ See FED-STD-595 for color cards.
2/ *Mark Navy colors.
3/ Table IV provides FED-STD-595 color numbers and descriptions for commonly specified colors. To order colors not listed, contracting officer will provide FED-STD-595 color number or other information necessary to identify the product desired.

6.8 Part or Identifying Number (PIN). The PIN to be used for powder coating coatings acquired to this specification are created as follows:

Type	Class	Container size	FED-STD-595 color
I - Epoxy II - Epoxy polyester hybrid III - Polyester IV - Polyester triglycedial isocyanurate (TGIC) V - Polyester urethane hybrid VI - Acrylic VII - Acrylic polyester hybrid VIII - Acrylic urethane hybrid IX - Urethane X - Polyurethane XI - Vinyl XII - Nylon	1 - Interior, dry service 2 - Interior, wet spaces, immersion service 3 - Exterior	A 50 pounds B 100 pounds C 150 pounds	

Example: D24712-I 1 A 17038

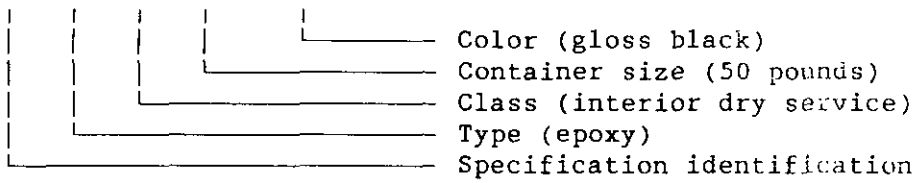

TABLE IV. FED-STD-595 color numbers and descriptions 1/2/3/ - Continued.

Gloss	Semigloss	Low gloss lusterless	Word description
15102	25102	---	Blue (light blue)
15182	---	---	Blue (U.S. Coast Guard)
15200	---	---	Light blue (piping and valve marking)
---	*26008	---	Gray (26008 for replacement of DOD-E-699, formula 20)
16081	---	---	Dark gray (piping and valve marking)
16099	---	---	Deck gray (U.S. Coast Guard)
---	26118	*36118	Gray #11 (36118 for replacement of DOD-P-15183, formula 109)
---	*26173	36173	Gray #17 (ocean gray)
16187	---	---	Gray (piping and valve marking)
---	26231	*36231	Gray #23 (36231 for replacement of DOD-E-700, formula 20L)
---	---	36270	Lusterless gray #27 (haze gray)
16307	*26307	36307	Gray #30 (bulkhead gray)
---	*26373	36273	Gray #37
16376	---	---	Light gray (piping and valve marking)
16492	*26492	36492	Gray #49 (gull or pearl gray)
17038	*27038	37038	Black (27038 for replacement of DOD-E-698, formula 24; 37038 for replacement of DOD-P-15146, formula 104; 17038-U.S. Coast Guard)
17043	---	---	Gold (piping and valve marking)
17100	---	---	Dark purple (piping and valve marking)
17142	---	---	Light purple (piping and valve marking)
17155	---	---	Purple (OSHA safety color)
17875	*27875	37875	White (insignia white - 27875 matches color of DOD-E-1115, formula 30)
17886	27886	37886	White (bone white)
23814	---	---	Chartreuse (piping and valve marking)

See footnotes at top of next page.

D	24712	XXXX	X	XXX	XXXXX
Prefix to indicate an item defined by metric units	Specification number	Type number (see 1.2)	Class (see 1.2)	Container size	Color

6.9 Subject term (key word) listing.

Adhesion
Application instruction
Color
Dielectric strength
Flexibility
Gel time
Marine environment
Material safety data sheets
Toxicity
Waste powder

Custodians:
Army - ME
Navy - SH
AF - Code, 99

Review activities:
Army - MR
Navy - AS, MC, CG
AF - Code, 84

Preparing activity:
Navy - SH
(Project 8010-0770)

APPENDIX A

TEST REPORT TECHNICAL CONTENT REQUIREMENTS

10. SCOPE

10.1 Scope. This appendix covers technical content requirements that should be included in the technical reports when required by the contract or order. This appendix is mandatory only when data item description DI-MISC-80653 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. TEST REPORT

30.1 Content and format. The identification characteristics values report shall be on metric size A4 (8-1/2 x 11-inch) paper in contractor format and contain the following information:

(a) Color.
(b) Hardness.
(c) Shelf life.
(d) Gel time.
(e) Gloss.
(f) Adhesion.
(g) Flexibility.
(h) Application and safety instructions.
(i) Commercial name or coded designation.

APPENDIX B

CERTIFICATION/DATA REPORT TECHNICAL CONTENT REQUIREMENTS

10. SCOPE

10.1 Scope. This appendix covers information that shall be included in the certification/data report when specified in the contract or order. This appendix is mandatory only when data item description DI-MISC-80678 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. CERTIFICATION CONTENT

30.1 Additional requirements. In addition to the requirements specified in 6.3, the certification/data report shall include the following information:

(a) Certification that the submitted powder coating does not contain known or potentially carcinogenic materials, as identified by: (1) the Occupational Safety and Health Administration (regulated carcinogens), (2) International Agency for Research on Cancer (latest monographs), and (3) National Toxicology Program (latest annual report). The manufacturer is responsible for maintaining "carcinogen free" materials. For the purposes of this specification, "carcinogen free" is defined as follows:

(1) Known or potential carcinogens, identified by the three agencies defined earlier in this paragraph shall not be intentionally added to any formulation.

(2) Where these materials may find their way into formulations, as a result of being an impurity or trace constituent in an ingredient, the levels shall be maintained as low as feasible.

(3) Under no circumstances shall the level of a known or potential carcinogen be present in the powder coating at levels in excess of 0.06 percent by weight. Substances regarded as Navy Occupational Chemical Reproductive Hazards shall not be purposely added to formulations. Where present, as a result of being an impurity or trace constituent, the levels shall be maintained as low as feasible. Under no circumstances shall levels of these materials in the final product as supplied for use equal or exceed 0.1 percent by weight. In addition, the manufacturer shall certify the powder coating, as supplied for use, does not contain the following materials in excess of 0.06 percent by weight: asbestos or any asbestos-form materials, benzene, toluene, chlorinated solvents, hydrolyzable chlorine derivatives, lead, chromium, cadmium, mercury (see 4.8.22), and nitrosamines as specified in 3.2.3.

(b) Certification that the submitted powder coating will not emit hydrogen cyanide as a product of combustion, if so specified (see 3.2.2).
(c) Certification that the submitted powder coating has 1 year storage stability at the time of delivery to the contracting officer as specified in 3.22.
(d) Test report showing that the submitted material conforms to all requirements of this specification (see 4.8.1 through 4.8.22).
(e) Directions for applying the system as specified (see 3.3).
(f) Material safety data sheet as specified in 3.2.4.
(g) A copy of the NEHC findings in 3.2.3.1.
(h) Certification that the submitted powder coating does not exceed the metal content levels in excess of what is specified in tables I and II. (See 3.2.6).

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the comment number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of this form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-C-24712A(SH)	2. DOCUMENT DATE (YYMMDD) 950525

3. DOCUMENT TITLE
COATINGS, POWDER (METRIC)

4. NATURE OF CHANGE (identity paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) DSN (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Technical Point of Contact (TPOC) MR. DALE A. SOWELL, NAVSEA 03M1 ADDRESS ALL CORRESPONDENCE AS FOLLOWS:	b. TELEPHONE (Include Area Code) (1) Commercial: DSN: TPOC: 703-602-0213 8-332-0213
c. ADDRESS (Include Zip Code) COMMANDER, NAVAL SEA SYSTEMS COMMAND ATTN: SEA 03R42 2531 JEFFERSON DAVIS HIGHWAY ARLINGTON, VA 22242-5160	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403 Falls Church, VA 22041-3466 Telephone 703-756-2340 DSN 289-2340