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MILITARY SPECIFICATION

COATING, EPOXY, FOR STEEL STRUCTURES

1. SCOPE

1.1 Scope - This specification covers both epoxy primer and epoxy enamel air dry epoxy coatings for spray or brush application to exterior or interior steel surfaces exposed in a marine environment. The primer and epoxy enamel shall be used as a system as specified herein.

1.2 Classification - Epoxy coating covered by this specification shall be of the following classes as specified, (See 6.5):

CLASS A. - Epoxy primer
CLASS B. - Epoxy enamel

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Federal

TT-P-143 - Paint, Varnish, Lacquer and Related Materials; Packaging, Packing and Marking.
TT-P-442 - Pigment, Titanium-Dioxide (for Protective Coatings)

STANDARDS

Federal

Federal Test Method Standard No. 141 - Paint, Varnish, Lacquer and Related Materials; Method of Inspection, Sampling and Testing.

Federal Standard No. 595 - Colors

2.2 Other publications - The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposals shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

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ASTM D1310-67-Flash Point of Volatile Flammable Materials by Tag Open Cup Apparatus

(Application for copies of this test method should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.)

STEEL STRUCTURES PAINTING COUNCIL

SSPC - Vis 1-67T Pictorial Surface Preparation Standards for Painting Steel Structures.

(Application for copies of this specification should be addressed to the Steel Structures Painting Council, 4400 Fifth Ave., Pittsburgh, Pa. 15213) Price $22.00 per copy.

3. REQUIREMENTS

3.1 Material shall comply with specific requirements contained herein. Material not definitely specified shall be of the quality regularly used for the purpose in the commercial market. The use of supplier's specifications will not constitute waiver of Government inspection.

3.2 Color - The color of the enamel (CLASS B) specified in the contract or order (see 6.2) shall match that of the standard color chip in FED. STD. 595 or Coast Guard Standard as specified.

3.3 Components - The epoxy primer and the epoxy enamel shall each consist of a pigmented epoxy resin base and a converter (hardener) formulated with either an amine adduct or a polyamide. These shall be packaged separately and furnished in kit form both for CLASS A, Epoxy primer and CLASS B, Epoxy enamel. The components shall conform to the requirements in TABLE I as applicable.

3.4 Composition

3.4.1 Pigment

3.4.1.1 For CLASS A, epoxy primer, the pigments selected shall be at the discretion of the manufacturer using high quality rust inhibitive pigments (zinc chromate, red lead, basic lead silico chromate) together with suitable extender pigment and others, in order that the resultant primer meets the requirements of this specification.

3.4.1.2 For CLASS B, epoxy enamel topcoat, the major pigment shall be rutile titanium dioxide (TT-P-422, Type III) with tinting color pigments added where necessary to achieve the specified color.

3.4.2 Vehicle - The vehicle in both CLASS A and CLASS B shall be of the epichlorhydrin/bisphenol A resin, reacted with either an amine adduct or polyamide, to produce a suitable coating.

3.4.3 Quantitative Requirements.

3.4.3.1 Components - The epoxy and hardener components of the CLASS A primer and CLASS B epoxy enamel shall conform to the requirements in Table I.

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TABLE I

Requirement	CLASS A Primer Epoxy	CLASS A Primer Hardener	CLASS B Enamel Epoxy	CLASS B Enamel Hardener
Epoxy value (on solids) (equiv./100 gms. of resin)	0.14-0.18	-	0.10-0.14	
Amine Nitrogen, % (on solids)	-	4.0-6.0	-	4.0-8.0
Flash Point °F (Tag Open Cup) not under	80	80	80	80
Coarse Particles % (maximum)	0.5	0.5	0.5	0.5

3.5. Physical Properties of Admixed Paints

The physical properties of the epoxy primer and epoxy enamel, after combining the pigmented portion with the hardener, shall conform to the requirements listed in Table II.

3.6. Qualitative requirements

3.6.1 Class A., Epoxy primer, Class B, Epoxy enamel

3.6.1.1 Condition in container - The pigmented components of both the primer and enamel, in a freshly opened container, shall show no caking, settling, skinning, livering or pigment flotation. The non-pigmented components shall be homogeneous and transparent, shall not exhibit any curdling and be free of lumps or gelled particles.

3.6.1.2 Mixing properties - The admixed primer and enamel shall be smooth and free of grit, seeds, skins or lumps.

3.6.1.3 Brushing and spraying properties - The primer and enamel shall be readily applied by brush or spray using commercially available spray equipment. Brushed films shall possess good leveling and exhibit no sag. Sprayed films shall be smooth, uniform and free of bubbles, pinholes, cracks and other film irregularities.

3.6.1.4 Storage stability - The packaged components shall remain stable and exhibit no change other than a 20% viscosity increase after six months storage and shall meet all applicable requirements of the specification.

3.6.2 Coating system (Physical Properties)

3.6.2.1 Impact resistance - The coating system, when tested as specified in 4.4.2.6, shall withstand a direct impact of 40 inch pounds without failure.

3.6.2.2 Fresh water resistance - The coating system, when applied as specified in 4.4.2.7, shall exhibit no blistering, gloss change after three months immersion in fresh, circulating tap water at ambient temperatures.

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3.6.2.3 Salt water resistance - The coating system, when applied as specified in 4.4.2.8, shall exhibit no blistering, gloss change or color change after three months immersion at ambient temperature circulating 3% salt water composed of commercial table salt dissolved in fresh tap water.

3.6.2.4 Salt spray resistance - The coating system, when applied as specified in 4.4.2.9, shall exhibit no blistering or underfilm rusting after 500 hours of exposure to a 5% salt spray.

3.6.2.5 Accelerated weathering - The coating system when applied as specified in 4.4.2.10, shall exhibit no checking, cracking or film failure other than slight chalking or a moderate loss of gloss after 500 hours of exposure.

4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

4.2 Sampling, inspection and testing - Unless otherwise specified, sampling, inspection and testing shall be in accordance with Method 1031 of Federal Standard 141.

4.3 Testing - Testing under this specification shall be for acceptance of individual lots. The right is reserved to make any additional tests deemed necessary to determine that the coating meets the requirements of this specification.

4.4 Test methods

4.4.1 Test conditions - The routine and referee testing conditions shall be in accordance with section 7, Federal Test Method Standard 141 except as otherwise specified herein.

4.4.1.1 Acceptance testing of individual lots shall consist of all tests in section 4 with the exception of the storage stability test.

4.4.2 Test methods - Tests shall be conducted in accordance with the specified methods of Federal Test Method Standard No. 141 and as specified in Table III.

4.4.2.1 Pot life - Mix Part A and Part B in a one pint container in the proper proportions to produce a one pound sample. Seal the container, allow to stand for 30 minutes at 75°F ± 5°F, remove seal and determine the initial viscosity. Reseal container, allowing to stand for additional 7 1/2 hours and again determine the viscosity. Calculate the increase to determine compliance with Table II.

4.4.2.2 Drying time - Determine the drying time in accordance with method 4061.1 of Federal Test Method Standard (FTMS) No. 141 and determine compliance with Table II both at 75°F ± 5°F and at 40°F ± 5°F.

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TABLE II

Admixed Paints

		CLASS A (Primer)		CLASS B Epoxy Enamel Topcoat	
		Min	Max	Min	Max
Non-volatile	%	65	-	65	-
Fineness of grind, Hegman Std.		3	-	7	-
Weight per gallon	lbs	10.5	11.5	10.0	11.0
Consistency, Krebs-Stormer,	grams	100	150	100	150
shearing rate of 200 RPM	KU	65	85	65	85
Pot Life					
Consistency increase-7 1/2 hrs.	%	-	20	-	20
Drying time (75°F)					
Tack free	hrs	-	1.0	-	1.0
Dry hard	hrs	-	3.0	-	3.0
Dry thru	hrs	-	5.0	-	5.0
Drying time (40°F)					
Tack free	hrs	-	4.0	-	8.0
Dry hard	hrs	-	8.0	-	16.0
Dry thru	hrs	-	16.0	-	24.0
Adhesion - cross hatch, retained	%	100	-	100	-
Flexibility-mandrel diam.	in.	-	1/4	-	1/4
Hardness (pencil)		-	-	HB	-
Hiding Power -					
White	%	-	-	95	-
Tints	%	-	-	98	-
Yellowness index (white only)		-	-	-	0.03
Gloss (60° Specular)		-	-	90	-
Abrasion resistance	(l/mil)	-	-	40	-

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TABLE III
Tests and Methods

Test	Applicable method in Fed Std 141	Paragraph of this specification giving further references	Paragraph of this specification giving requirements
Epoxy value	7403		Table I
Amine Nitrogen	7391		Table I
Flash point, (Tag Open Cup)	(a)		Table I
Non-Volatile	4041.1		Table II
Fineness of grind, Hegman Std.	4411.1		Table II
Weight per gallon	4184.1		Table II
Consistency	4281		Table II
Pot Life		4.4.2.1	Table II
Drying time	4061.1	4.4.2.2	Table II
Adhesion		4.4.2.3	Table II
Flexibility	6221		Table II
Pencil hardness		4.4.2.4	Table II
Hiding power	4122.1		Table II
Yellowness index (white)	6131		Table II
Gloss-60° Specular	6101		Table II
Abrasion resistence	6191 (Falling Sand)		Table II
Condition in container	3011.1		3.6.1.1
Mixing properties		4.4.2.5	3.6.1.2
Brushing and spraying properties	4321.1 4331.1		3.6.1.3
Storage stability	3022		3.6.1.4
Impact resistance		4.4.2.6	3.6.2.1
Fresh water resistance	6011	4.4.2.7	3.6.2.2
Salt water resistance	6011	4.4.2.8	3.6.2.3
Salt spray resistance	6061	4.4.2.9	3.6.2.4
Accelerated weathering	6151	4.4.2.10	3.6.2.5

a - Test in accordance with ASTM D-1310, Tag Open Cup

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4.4.2.3 Adhesion - Prepare panel in accordance with 4.4.3.1. Allow coating to cure seven days before test. Cut eleven parallel lines 1/16" apart using a sharp steel stylus, making sure that all cuts go through the film to the substrate. Turn panel 90° and cut eleven additional lines perpendicular to the original lines, thus forming 100 squares. Firmly apply a one inch wide strip of masking tape (Minnesota Mining and Manufacturing Co. Scotch Brand No. 600, or equal) over the cut area, adhesive side down, leaving an exposed tab. Firmly press the tape down over the cut area using a hard rubber roller. Immediately remove the tape by pulling rapidly perpendicular to the panel surface and examine for compliance with Table II.

4.4.2.4 Pencil hardness

4.4.2.4.1 Preparation of pencils - Prepare a set of drawing pencils (See 6.4) by stripping the wood away from the end approximately 3/8 inch without damaging the lead. The tip of the lead should then be squared by holding the pencil in a vertical position and moving the lead back and forth over a very fine (325 grit) abrasive paper. The tip of the lead shall be squared after each trial.

4.4.2.4.2 Procedure - Test panels prepared as specified in 4.4.3.2 and cured for seven days shall be placed in a horizontal position. Pencils of increasing hardness shall be pushed across the coated surface of the panel at a 45 degree angle with a pressure just short of breaking the lead (see Figure I) until one is found which will rupture the coating. The number of the next softer pencil from the one that ruptures the coating shall be used to express pencil hardness.

4.4.2.5 Mixing properties - Thoroughly mix the proper volumes of Part I and Part II in accordance with the manufacturers' instructions and examine for compliance with 3.6.1.2.

4.4.2.6 Impact resistance - Prepare steel panels of the coating system in accordance with 4.4.3.1 and 4.4.3.4. Determine direct impact resistance using a Gardner Variable Inch Pound Impact Tester* or equivalent for compliance with 3.6.2.1.

4.4.2.7 Fresh water resistance - Prepare abrasive blasted panels with the coating system in accordance with 4.4.3.3 and 4.4.3.4. Determine the fresh water resistance by immersing the coated panels in a tank of fresh circulating tap water and examine for compliance with 3.6.2.2.

4.4.2.8 Salt water resistance - Prepare abrasive blasted panels with the coating system in accordance with 4.4.3.3 and 4.4.3.4. Determine the salt water resistance by immersing the coated panels in a tank of circulating salt water (a 3% solution of commercial table salt in fresh tap water) and examine for compliance with 3.6.2.3.

4.4.2.9 Salt spray resistance - Prepare abrasive blasted panels with the coating system in accordance with 4.4.3.3. and 4.4.3.4. Expose the coated panels to a 5% salt spray atmosphere in conformance with Method 6061 of Federal Test Method Standard No. 141. Examine for compliance with 3.6.2.4..

* Available from Gardner Laboratories, P. O. Box 5728, Bethesda, Maryland 20014

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4.4.2.10 Accelerated Weathering - Prepare abrasive blasted panels with the coating system in accordance with 4.4.3.3 and 4.4.3.4. Subject the coated panels for 500 hours to accelerated weathering using the twin arc apparatus in accordance with Method 6152 of Federal Test Method Standard No. 141. Examine for compliance with 3.6.2.5.

4.4.3 PANEL PREPARATION

4.4.3.1 Steel panels - The panels shall be cold-rolled No. 20 gage steel conforming to Method 2011.1 of FTMS No. 141. Mix the components of the paint to be tested and allow to stand for 30 minutes. Apply each coating at a film thickness of 2.0 ± 1 mils.

4.4.3.2 Glass panels - Glass panels shall conform to Method 2021 of FTMS No. 141, clear plate glass not less than 3/16 inch thick. After allowing the mixed components to stand 30 minutes, apply to panel using a 3 mil doctor blade (6 mil clearance).

4.4.3.3 Abrasive blasted panels - Thoroughly clean 16 gage hot rolled steel panels using either solvent spray cleaning or vapor degreasing in accordance with method 2011.1 of FTMS No. 141. Abrasive blast the clean panels in compliance with Steel Structures Painting Council SSPC/SP-5-Vis 1-67T Standards. Apply coating as specified in 4.4.3.1 (see 4.4.3.4).

4.4.3.4 Number of coats - The epoxy primer and epoxy enamel topcoat, when tested separately shall be applied in one coat and allowed to dry for seven days before test. The coating system shall consist of two coats of epoxy primer, allowing each coat to dry two hours, then one coat of epoxy enamel topcoat which shall be allowed to dry seven days before test.

5. PREPARATION FOR DELIVERY

5.1 Packaging, packing, and marking - The epoxy primer and epoxy enamel shall be packaged and packed in accordance with Specification TT-P-143. The level of packaging shall be A or C, the level of packing shall be A, B, or C, as specified (see 6.2). The size of containers shall be as specified (see 6.2).

5.1.1 Both the epoxy primer (CLASS A), and enamel coating (CLASS B) shall be supplied in a kit packaged as a unit, consisting of pigmented epoxy resin base compound marked COMPONENT I and the converter (catalyst) marked COMPONENT II.

5.2 Marking and labeling - Each component container in every kit and every exterior shipping container shall be marked in accordance with MIL-STD-129. In addition to the marking specified in MIL-STD-129, individual cans and containers shall bear a printed label (all printed labels shall be overcoated with a clear coating for weather protection) showing the following nomenclature and information as applicable:

COMPONENT IDENTIFICATION

COMPONENT I - Pigmented Epoxy Resin Compound (CLASS A or B)

COMPONENT II - Converter (CLASS A or B) (as applicable)

SPECIFICATION - MIL-C-82407(CG)

Manufacturer's Name and/or Trademark
Date Manufactured, month/year
Weight per gallon
Mixing, Thinning, and simple directions for application

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6. NOTES

6.1 Intended use - The coating materials covered by this specification, when used as a system, are intended for protection of vessels and marine structures against corrosion and exposure. They are suitable for interior and exterior application on steel surfaces.

6.2 Ordering data - Procurement documents should specify the following:

(a) Title, number and date of this specification.
(b) Level of packaging and level of packing (see section 5)
(c) Size of container required for Part A and size container for Part B (see Section 5).
(d) Color. (Applies to epoxy enamel CLASS B only).

6.3 The coatings covered by this specification should be purchased by volume, the unit being one U. S. liquid gallon of 231 cubic inches at 68°F (20°C).

6.4 A set of Venus drawing pencils (3B, 2B, B, HB, F, H, 2H, 3H, 4H, 5H, 6H, and 7H) manufactured by the American Pencil Company were found to be satisfactory for conducting the pencil hardness test (see 4.4.2.4.1).

Preparing Activity:
U. S. Coast Guard

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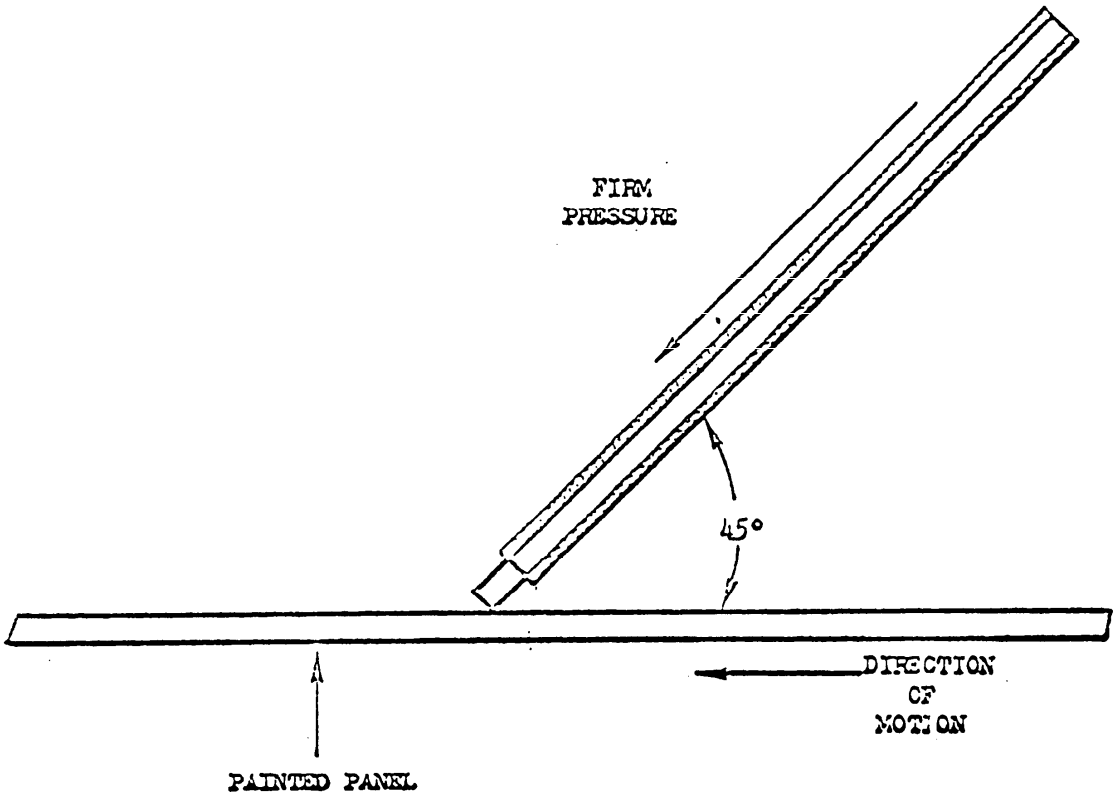

FIGURE 1. PENCIL HARDNESS

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