INCH-POUND

MIL-P-14105D
6 March 1995
SUPERSEDING
MIL-P-14105C
1 November 1973

MILITARY SPECIFICATION

PAINT, HEAT-RESISTING (FOR STEEL SURFACES)

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

1. SCOPE

1.1 Scope. This specification covers a heat-resisting paint intended for use on steel surfaces exposed to high temperatures and exterior weathering. The paint is lead and chromate free and contains no more than 3.5 pounds per gallon (420 grams per liter) of volatile organic compounds (VOC) as applied.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

TT-T-291	- Thinner, Paint, Mineral Spirits, Regular and Odorless.
PPP-P-1892	- Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing and Marking of.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US ARMY AVIATION & TROOP CMD, ATTN AMSAT I W, ST LOUIS MO 63120-1798, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 8010

DISTRIBUTION STATEMENT A. Approved for public release, distribution is unlimited.

STANDARDS

FEDERAL

FED-STD-141 - Paint, Varnish, Lacquer, and Related Materials; Methods of Inspection, Sampling, and Testing.
FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.
FED-STD-595 - Colors Used in Government Procurement.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from: STDZN DCMNT ORDER DESK, BLDG 4D, 700 ROBBINS AVE, PHILADELPHIA PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted 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)

B 117 - Salt Spray (Fog) Testing.
D 185 - Coarse Particles in Pigments, Pastes and Paints.
D 523 - Specular Gloss.
D 562 - Consistency of Paints using the Stormer Viscosimeter.
D 610 - Evaluating Degree of Rusting on Painted Steel Surfaces.
D 1210 - Fineness of Dispersion of Pigment-Vehicle Systems.
D 1364 - Water in Volatile Solvents (Fischer Titration Method).
D 1475 - Density of Paint, Varnish, Lacquer, and Related Products.
D 1729 - Visual Evaluation of Color Differences of Opaque Materials.
D 2369 - Volatile Content of Coatings.
D 2805 - Hiding Power of Paints by Reflectometry.
D 3335 - Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy.
D 3951 - Standard Practice for Commercial Packaging.
D 3960 - Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
G 26 - Operating Light Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.

(Application for copies should be addressed to: AMERCN SCTY FOR TEST & MTRLS, 1916 RACE STRET, PHILADELPHIA PA 19103.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the document. 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 Formulation. The method of formulation and choice of compounding materials is optional with the supplier provided that the finished paint conforms to all of the other requirements of this specification (see 6.5).

3.2 Quantitative requirements. The paint shall conform to the quantitative requirements specified in table I.

TABLE I. Quantitative requirements.

Characteristics	Requirements	
	Minimum	Maximum
Weight per gallon, pounds	11.0	-
Total solids, percent by weight of paint	70.0	-
Nonvolatile vehicle, percent by weight of vehicle	45.0	-
Coarse particles and skins (retained on No. 325 sieve), percent by weight of paint	-	1.0
Water, percent by weight of paint	-	1.0
Viscosity, Krebs-Stormer, shearing rate 200 rpm:		
Grams	125	225
Equivalent Krebs units	65	85
60 degree specular gloss	-	15
Fineness of grind	4	-
Dry opacity (0.0015 inch wet film thickness), contrast ratio	0.95	-
VOC of paint, pounds per gallon	-	3.5
Lead content, percent	-	0.06

3.3 Qualitative requirements.

3.3.1 Color. The paint shall be of the color specified (see 6.2) and shall match the appropriate color chip of FED-STD-595.

3.3.2 Condition in container. The paint in a freshly opened full container shall show no curdling, livering, caking, lumps, or skins and shall show no more settling than may be redispersed with a paddle to a homogeneous state.

3.3.3 Storage stability. A three-quarter full, closed, 8-ounce glass jar of the paint, after 48 hours storage at room temperature (70 to 90 °F) shall show no skinning. After 30 days standing, the paint shall show no livering, curdling, hard settling, or caking. The paint shall mix readily to a homogeneous state, and any skin formed shall be continuous and removable.

3.3.4 Dilution stability. The paint shall show no evidence of precipitation and shall remain stable and uniform after reduction with an equal part by volume of thinner recommended by the manufacturer.

3.3.5 Suspension properties. When tested as specified in 4.4.3, the paint shall show no more than slight settling, no caking, and shall redisperse to a homogeneous state.

3.3.6 Brushing and spraying properties. The paint shall be satisfactory for brushing, as received, and shall be satisfactory for spraying when reduced in accordance with the supplier's recommendations, but not to exceed the 3.5 pound per gallon VOC limitation. The paint when applied by brush or spray shall not run, sag, or have other defects.

3.3.7 Drying properties.

3.3.7.1 Air drying. The paint, when applied to steel panels as specified in 4.4.4.1, shall dry tack-free within 1 hour to a smooth film free from sags, runs, creep, orange peel, pits, and streaks.

3.3.7.2 Baking. The paint, when applied to steel panels as specified in 4.4.4.2, shall form an adherent, hard, tough film free from blisters, sags, runs, creep, orange peel, pits, and streaks.

3.3.8 Water resistance. A film of the paint applied and tested as specified in 4.4.5 shall show no wrinkling, blistering, softening, or loss of adhesion.

3.3.9 Mineral spirits resistance. A film of the paint tested as specified in 4.4.6 shall show no wrinkling or blistering immediately after removal of the panel from the mineral spirits. The paint film shall show no defect other than a 10 percent change in gloss after testing.

3.3.10 Salt spray resistance. A film of the paint prepared and tested as specified in 4.4.7 shall show no corrosion, creepage, or undercutting beyond 1/8 inch from the scratch mark. At all other points of the panel, there shall be no more than a trace of rusting (ASTM D 610, no. 9) and no more than five scattered blisters no larger than 1 millimeter in diameter.

reagent grade ammonium persulfate in water)

3.3.11 Accelerated weathering. When subjected to the accelerated weathering test specified in 4.4.8, the paint film shall show only slight color change or chalking.

3.3.12 Recoating properties. Recoating the test surface as specified in 4.4.9 shall produce no lifting, blistering, pinholing, or other film irregularity.

3.3.13 High temperature resistance.

3.3.13.1 Heat exposure cycle. When tested as specified in 4.4.10.1, the paint film shall show no cracking, flaking, or chipping after being exposed to one heat exposure cycle.

3.3.13.2 Salt spray. When tested as specified in 4.4.10.2, the paint film shall show not more than a trace of rusting (ASTM D 610, no. 9).

3.3.13.3 Quenching cycle. When tested as specified in 4.4.10.3, the paint film shall show no cracking, flaking, or chipping.

3.3.13.4 Accelerated weathering (high temperature). When tested as specified in 4.4.10.4, the paint film shall show no marked checking, color change, or chalking.

3.3.14 Toxic ingredients. The manufacturer shall certify that the primer contains no hexavalent chromium (chromate), benzene (benzol), chlorinated solvents, or ethylene based glycol ethers and their acetates.

3.3.15 Material Safety Data Sheet. A Material Safety Data Sheet shall be included with each shipment of the material covered by this specification and submitted to pertinent Government agencies in accordance with FED-STD-313 (see 6.6).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, and unless disapproved by the Government, the contractor's own or any other facilities suitable for the performance of the inspection requirements specified herein, may be used. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items 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 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 acceptance of defective material.

4.1.2 Material Safety Data Sheets. Material Safety Data Sheets not prepared in accordance with FED-STD-313 shall be cause for rejection.

4.2 Classification of inspection. Inspection shall be classified as follows:

a. Quality conformance inspection (see 4.3).
b. Inspection of packaging (see 4.5).

4.3 Quality conformance inspection.

4.3.1 Sampling and inspection. Sampling and inspection shall be in accordance with FED-STD-141, method 1031.

4.3.2 Tests. Samples selected in accordance with 4.3.1 shall be tested as specified in 4.4. Quality conformance inspection for individual lots shall be in accordance with table II for the following: VOC, condition in container, total solids, viscosity, fineness of grind, spraying properties, drying properties, color, and specular gloss. Failure of any test shall be cause for rejection of the lot which the sample represents.

4.4 Test procedures.

4.4.1 Preparation of test panels.

4.4.1.1 Test panels. Unless otherwise specified herein, test panels shall be rust-free cold rolled steel panels 0.105 by 3 inches by 9 inches. The panels shall be solvent cleaned in accordance with FED-STD-141, method 2011, after which the panels shall be lightly shot, grit, or sand blasted.

4.4.1.2 Coating and conditioning of test panels. Spray coat the panels so as to produce a dry-film thickness of not greater than 2.5 mils. Then air dry or bake and condition as specified herein. Air drying shall be accomplished at 77 ±4 °F in an atmosphere of 50 percent ±4 percent relative humidity. Baking shall be accomplished in a well-ventilated laboratory oven at 400 ±4 °F. Conditioning of the coated panels for the tests specified herein shall be at atmospheric conditions for air drying.

4.4.2 Test conditions. The routine and referee testing conditions shall be in accordance with section 9 of FED-STD-141 unless otherwise specified. The following tests in table II shall be conducted in accordance with either FED-STD-141 or ASTM as specified herein. The right is reserved to make any additional tests deemed necessary to determine that the paint meets the requirements of this specification. Nonconformance to the requirements of the applicable test method shall constitute failure of the applicable test.

TABLE II. Test methods.

Test	ASTM Test Method	FED-STD-141 Test Method
Condition in container	-	3011
Weight per gallon	D 1475	-
Total solids	D 2369	-
Nonvolatile vehicle	-	4051
Water	D 1364	-
Coarse particles and skins	D 185	4092
Dry opacity 1/	D 2805	4122
Storage stability	-	3022
Viscosity	D 562	-
Brushing properties	-	4321
Spraying properties	-	4331
Dilution stability	-	4203
Fineness of grind	D 1210	4411
Specular gloss 2/	D 523	6101
Color 3/	D 1729	6250
VOC of paint	D 3960	-
Lead content	D 3335	-

1/ Apply the paint as received by drawdown using a 0.0015 inch (0.003-inch gap clearance) Bird film applicator or similar doctor blade, air dry for 24 hours, and then measure.
2/ Determine gloss on sprayed steel panels prepared as specified in 4.4.1 and air dried for 16 hours.
3/ Determine color on coated test panels prepared as specified in 4.4.4.1 and 4.4.4.2.

4.4.3 Suspension properties. Reduce the paint to spraying consistency according to the supplier's instructions. Place 6 ounces of the reduced paint in an 8-ounce glass jar and do not agitate or disturb for 24 hours. At the end of this period, examine the paint for hard or excessive settlings by means of a spatula. Restopper the jar and shake vigorously for 20 seconds. Reexamine the paint for any evidence of nonhomogeneity or undispersed pigment. Nonconformance to 3.3.5 shall constitute failure of this test.

4.4.4 Drying properties.

4.4.4.1 Air drying. Determine the air drying properties of the paint by spraying or brushing a coat of the paint to a dry-film thickness of not greater than 2.5 mils on test panels prepared as specified in 4.4.1.1 and air drying in a vertical position for 1 hour. Nonconformance to 3.3.7.1 shall constitute failure of this test.

4.4.4.2 Baking. Bake a coated test panel prepared as specified in 4.4.1 in a well-ventilated laboratory oven at 400 °F for 30 minutes, allow to cool to room temperature, and examine. Nonconformance to 3.3.7.2 shall constitute failure of this test.

4.4.5 Water resistance. Prepare a coated test panel in accordance with 4.4.1 and air dry for 168 hours. Coat all exposed uncoated metal surfaces with wax or other suitable protective coating and immerse the test panel to a depth of 3 inches for 18 hours in distilled water at 25 ±5 °C. At the end of the immersion time, remove the panel from the distilled water and examine the paint film. Nonconformance to 3.3.8 shall constitute failure of this test. Disregard any change in color.

4.4.6 Mineral spirits resistance. Prepare a coated test panel in accordance with 4.4.1, air dry for 30 minutes, then bake in a well-ventilated laboratory oven at 400 °F for 30 minutes and allow to cool to room temperature. Measure gloss in accordance with 4.4.2. Unpainted surfaces shall not be coated with wax or other material. Immerse the coated test panel to a depth of 3 inches for 18 hours in mineral spirits conforming to TT-T-291, type 1. Remove the test panel and immediately examine the paint film for wrinkles or blisters. Air dry the test panel for 2 hours and reexamine the film for defects. Then test for gloss in

accordance with 4.4.2. Nonconformance to 3.3.9 shall constitute failure of this test.

4.4.7 Salt spray resistance. Prepare a coated steel test panel in accordance with 4.4.1 and air dry for 168 hours. Coat the exposed unpainted areas of the panel with a protective material. Score the painted surface longitudinally to the base metal 1 inch from an edge. Expose to salt spray for 100 hours in accordance with ASTM B 117, using 5 percent salt solution and examine. Nonconformance to 3.3.10 shall constitute failure of this test.

4.4.8 Accelerated weathering. Prepare a coated steel test panel in accordance with 4.4.1 and air dry for 168 hours. Expose the panel for 300 hours to accelerated weathering in accordance with ASTM method G-26, method A, type BH, and examine the paint film. Nonconformance to 3.3.11 shall constitute failure of this test.

4.4.9 Recoating. Prepare two coated steel test panels in accordance with 4.4.1, air dry one test panel for 18 hours, and bake the other test panel in a well-ventilated laboratory oven at 400 °F for 30 minutes. Allow the baked panel to cool to room temperature. Recoat each panel as above, redry each panel as specified for the initial coat, and examine the paint film. Nonconformance to 3.3.12 shall constitute failure of this test.

4.4.10 High temperature resistance.

4.4.10.1 Heat exposure cycle. Four coated steel test panels shall be used in this test: Three for further testing (see 4.4.10.2, 4.4.10.3, and 4.4.10.4) and one for use as a comparative standard. Prepare four coated steel test panels and bake for 30 minutes in accordance with 4.4.1 (see 6.5) except the panel thickness shall be 0.194 inches (6 gauge) minimum, and the blasting shall be to a 1.5 mil profile minimum. Subject the panels to one heat exposure cycle consisting of heating for 8 hours at 400 °F, cooling for 16 hours at room temperature; heating for 8 hours at 800 °F, cooling for 16 hours at room temperature; and heating for 8 hours at 1,400 °F, and cooling for 16 hours. Examine the panels at the end of each temperature variation. Nonconformance to 3.3.13.1 shall constitute failure of this test.

4.4.10.2 Salt spray. Subject one heat-exposed test panel to 100 hours of salt spray in accordance with ASTM B 117 using 5 percent salt solution, and examine. Nonconformance to 3.3.13.2 shall constitute failure of this test.

4.4.10.3 Quenching cycle. Subject one heat-exposed test panel to five quenching cycles consisting of heating the panel to

formula ammonium sulfate solution gages.

650 °F and plunging it immediately into fresh tap water at a temperature of 70 ±10 °F. Examine the paint film after each quenching cycle. Nonconformance to 3.3.13.3 shall constitute failure of this test.

4.4.10.4 Accelerated weathering (high temperature). Expose one test panel that has been subjected to the heat exposure cycle to 300 hours of accelerated weathering in accordance with ASTM method G-26, method A, type BH, and examine the paint film. Nonconformance to 3.3.13.4 shall constitute failure of this test.

4.4.11 Test for chlorinated solvents. Form a small loop of copper wire (18 to 20 gauge) and heat in a small Bunsen flame until it no longer colors the flame. Allow the loop to cool and then dip it in a sample of solvent separated by vacuum distillation. Immediately place in the outer part of the flame and when the first luminous flame disappears, examine for the green coloration due to chlorinated compounds. Nonconformance to 3.3.14 shall constitute failure of this test.

4.5 Inspection of packaging. Packaging inspection shall be in accordance with the quality assurance provisions of PPP-P-1892 or ASTM D 3951.

5. PACKAGING

5.1 Preservation, packing, and marking. Preservation, packing and marking shall be level A, B, C, or commercial as specified (see 6.2). Level A, B, and C requirements shall be in accordance with PPP-P-1892. Commercial requirements shall be in accordance with ASTM D 3951. The paint shall be preserved in quantities as specified (see 6.2).

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 paint is intended for use on solvent degreased and blasted steel surfaces of components which are subject to temperatures as high as 1,400 °F and exterior weathering. Components such as mufflers, manifolds, and stacks may be protected by the use of this paint. The paint provides excellent protection against corrosion and chemical attack.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of the specification.
b. Color required (see 3.3.1).
d. Level of packaging and level of packing required (see 5.1).
e. Size of container required (see 5.1).

6.3 Basis of purchase. The paint covered by this specification should be purchased by volume, the unit being 1 US gallon of 231 cubic inches at 68 °F (20 °C).

6.4 Painting other than blasted surfaces. These coatings have been found to perform satisfactorily when applied to parts that do not lend themselves to sand blasting. In application to such parts, however, it is absolutely necessary that all loose rust and tight and loose mill scale must be removed by wire brushing and chipping. Coatings should then be applied by brushing, taking care to work the paint well into the roughened surfaces.

6.5 Formulation. As a guide to the supplier, paints which meet the requirements of this specification contain a blend of ceramic frits, refractories, and pigments in a vehicle of pure or modified silicone resins; a mixture thereof; or a blend of the aforementioned with other compatible resins.

6.6 Material Safety Data Sheets. Contracting officers should 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.

6.7 Subject term (keyword) listing.

VOC compliant
Heat resistant

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

Custodians:
Army - AV
Navy - YD1

Review activities:
Army - AT, MI, MD, MR, SM
Navy - MC

Civilian Agency Coordinating Activity:
GSA-FSS

Preparing activity:
Army - AV

Agent Activity:
Army - ME

Project 8010-0785

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

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

RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-P-14105D	2. DOCUMENT DATE (YYMMDD) 950306

3. DOCUMENT TITLE
PAINT, HEAT-RESISTING (FOR STEEL SURFACES)

4. NATURE OF CHANGE (Identify 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 (if applicable) (2) DSN	7. DATE SUBMITTED

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code) (1) Commercial (2) DSN
c. ADDRESS (Include Zip Code) ARMY AVIATION & TROOP CMD TN AMSAT-R-EDS 4300 GOODFELLOW BOULEVARD ST LOUIS MO 63120-1798	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: DEFNS QLTY & STDZN OFC 5203 LEESBURG PIKE STE 1403 FLS CHURCH VA 22041-3466 Telephone (703) 756-2340 DSN 289-2340