

MIL-P-46105(1R)  
25 March 1966

## MILITARY SPECIFICATION

### PRIMER COATING; WELD-THROUGH, ZINC-RICH

#### 1. SCOPE

1.1 This specification covers one type of ready-mixed, single-package, epoxy-based, zinc-rich primer for use on ferrous metal surfaces prior to spot welding.

#### 2. APPLICABLE DOCUMENTS

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

#### SPECIFICATIONS

##### FEDERAL

- TT-C-490 - Cleaning Methods and Pretreatment of Ferrous Surfaces for Organic Coatings.
- TT-P-143 - Paint, Varnish, Lacquer and Related Materials; Packaging, Packing and Marking of.
- TT-P-460 - Pigment, Zinc Dust (Metallic-Zinc Powder), Dry.
- TT-X-916 - Xylene (for Use in Organic Coatings).
- PPP-T-60 - Tape; Pressure Sensitive Adhesive, Waterproof, for Packaging and Sealing.

##### MILITARY

- MIL-C-22235 - Corrosion Preventive Oil, Nonstaining

#### STANDARDS

##### FEDERAL

- Fed. Test Method Std. No. 141 - Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing.

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(Copies of specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

### 3. REQUIREMENTS

3.1 Qualification (type or brand approval). Primer furnished under this specification shall be a product that has been tested and has passed the qualification tests specified herein (see 6.3). Any change in the formulation of a qualified product will necessitate its requalification. The material supplied under the contract shall be identical, within manufacturing tolerances, to the product receiving qualification.

3.2 Color. The color of the primer shall be gray, characteristic of the zinc pigment.

#### 3.3 Composition.

3.3.1 Pigment. The pigment portion of the primer shall be zinc dust conforming to TT-P-460, type I together with necessary stabilizers and suspension agents.

3.3.2 Vehicle. The vehicle shall be a one package heat convertible epoxy resin modified with phenolic, amine, or hydrocarbon resins combined with the necessary amounts of curing agents, stabilizers and solvents to meet the requirements of this specification.

3.4 Quantitative requirements. The primer shall conform to the quantitative requirements of table I when tested as in 4.4.

Table I - Quantitative requirements of primer

Characteristics	Requirements	
	Minimum	Maximum
Total solids, percent by weight of primer	80	--
Pigment, percent by weight of primer	75	--
Vehicle solids, percent by weight of primer	5	--
Metallic zinc, percent by weight of pigment	91	
Epoxy resin content		positive
Viscosity (package), No. 4 Ford Cup, seconds	18	50
Weight per gallon, pounds	19	
Flash point, closed cup, °F.	80	--
Drying time		
Air-drying, minutes		
Set to touch	--	10
Dry hard	--	20
Baking.		
Full hardness, at 250°F. <sup>1</sup>		
minutes	--	60

<sup>1</sup>Or at an alternate temperature recommended by the manufacturer.

### 3.5 Qualitative requirements.

3.5.1 Condition in container. The primer tested as in 4.4.6 shall show no livering, curdling, gassing, or settling or gel formation and shall mix to a smooth homogeneous state.

3.5.2 Storage stability. When tested as in 4.4.7 the primer shall show no livering, curdling, gassing, or settling which cannot be remixed to a smooth homogeneous state. It shall not require more than 5 percent by volume of xylene to reduce the primer to a #4 Ford Cup viscosity of less than 50 seconds.

3.5.3 Spraying properties. The primer tested as in 4.4.8 shall spray satisfactorily in all respects and shall produce a uniform film free from pin holes, craters, or abnormal roughness.

3.5.4 Flexibility. Films of the primer prepared and tested as in 4.4.9 shall withstand bending without cracking or flaking.

3.5.5 Adhesion. A film of primer prepared and tested as in 4.4.10 shall show no removal of the primer by the adhesive tape.

3.5.6 Welding characteristics. When tested as in 4.4.11 the primer shall show satisfactory resistance welding characteristics.

3.5.7 Water resistance. When tested as in 4.4.12 the primer shall show no rusting, blistering or softening immediately after removal from the water.

3.5.8 Salt spray resistance. When tested as in 4.4.13 and examined immediately after removal from the salt spray test, films of the primer on all six panels shall show no more than a slight trace of rusting (see 6.4) and no more than five scattered blisters none larger than 1mm.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

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4.2 Sampling, inspection and testing. Unless otherwise specified, sampling, inspection and testing shall be in accordance with method 1031 of Fed. Test Method Std. No. 141.

4.3 Classification of tests. Testing under this specification shall be for the following:

- (a) Qualification.
- (b) Acceptance of individual lots.

4.3.1 Qualification tests. The qualification tests shall consist of tests for all requirements specified in section 3 (see 6.3).

4.3.2 Acceptance tests. Acceptance tests for acceptance of individual lots shall consist of tests specified in section 3 with the exception of storage stability (see 3.5.2 and 4.4.7) and welding characteristics (see 3.5.6 and 4.4.11).

4.4 Test methods.

4.4.1 Test conditions. The routine and referee testing conditions shall be in accordance with section 7, Fed. Test Method Std. No. 141 except as otherwise specified herein.

4.4.2 The following tests shall be conducted in accordance with applicable methods of Fed. Test Method Std. No. 141 or as hereinafter specified.

Table II - Index

Item	Test method		Paragraph of this specification giving requirements
	Applicable method in Fed Std 141	Paragraph of this specification giving further references	
Total solids	4041	---	Table I
Pigment, percentage	4022	---	Table I
Vehicle solids	4052	---	Table I
Metallic zinc	7221	---	Table I
Epoxy resin	---	4.4.3	Table I
Viscosity	4282	4.4.4	Table I
Weight per gallon	4184	---	Table I
Flash point	4293	---	Table I
Drying time	4061	4.4.5	Table I
Condition in container	3011	4.4.6	3.5.1
Storage stability	3022	4.4.7	3.5.2
Spraying properties	4331	4.4.8	3.5.3
Flexibility	6221	4.4.9	3.5.4
Adhesion		4.4.10	3.5.5
Welding characteristics	---	4.4.11	3.5.6
Water resistance	6011	4.4.12	3.5.7
Salt spray resistance	6061	4.4.13	3.5.8

4.4.3 Test for epoxy resin. Place 10 drops of the vehicle in a test tube. Add about 10 drops of benzene and 10 drops of ethyl alcohol, mix and dry in an oven at 105°C. After cooling, add one ml. of concentrated sulfuric acid and warm to about 60°C. in a water bath for 10 minutes. Cool, add 2 drops of 37 percent formaldehyde and allow the sample to stand for a few minutes. Dilute with 10ml. of water added rapidly from a graduate. A green or blue color will form almost immediately if epoxy resins of the bisphenol type are present.

4.4.4 Viscosity (package). Determine viscosity as in method 4282 of Fed. Test Method Std. No. 141 except that the method of mixing shall be to agitate on a paint shaker<sup>1</sup> for 7 minutes. Check viscosity within 10 minutes after shaking for compliance with table I.

4.4.5 Drying time. Determine drying time under referee conditions in accordance with method 4061 of Fed. Test Method Std. No. 141 for compliance with table I.

4.4.5.1 Full hardness. The primer shall be drawn down with a 0.003 inch (0.006 inch gap clearance) film applicator on a 4 by 12 inch steel panel that has been phosphoric acid etched in accordance with procedure B method 2011 of Fed. Test Method Std. No. 141. Air dry the panel for 5 to 10 minutes, and then bake as required in table I and test for compliance with table I. The film shall be considered to have reached full hardness when it is very difficult to remove with a knife blade.

4.4.6 Condition in container. Determine package condition for acceptance testing in accordance with method 3011 of Fed. Test Method Std. No. 141. For qualification testing determine pigment settling or caking as follows: Proceed as in method 3011 of Fed. Test Method Std. No. 141, but do not stir. Reseal and then agitate the can for 7 minutes on a paint shaker. On reexamination of the contents, the disclosure of any gel bodies or undispersed pigment indicates unsatisfactory settling properties. Observe for compliance with 3.5.1.

4.4.7 Storage stability (full container). In accordance with method 3022 of Fed. Test Method Std. No. 141, allow a full standard quart can of the packaged primer to stand undisturbed for 6 months. Examine the container for bulging or deformation indicating gas pressure and listen for a hiss or pop on opening the can to indicate gas accumulation. Evaluate pigment settling or caking as in 4.4.6 and determine viscosity. Examine for compliance with 3.5.2.

<sup>1</sup>An apparatus of this type, powered by 1/4 hp motor, operates at a rate of 1,350 shakes per minute, and is manufactured by Red Devil Tools, Irvington, N. J.

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4.4.8 Spraying properties. In accordance with method 4331 of Fed. Test Method Std. No. 141 spray the packaged primer under conditions specified below and then observe for compliance with 3.5.3.

Feed tank type -- Motor driven agitator  
Feed tank pressure -- 5 to 25 pounds depending on hose length  
Atomization air pressure -- 30 to 65 pounds  
Air adjustment valve on spray gun -- Wide open  
Fluid adjustment valve on spray gun -- 1/2 open or less  
Air cap, needle and fluid tip -- Devilbiss FF needle & tip with No. 704 air cap (or equivalent)  
Distance of spray gun from work -- 9-11 inches

4.4.9 Flexibility. Determine flexibility in accordance with method 6221 of Fed. Test Method Std. No. 141. Solvent clean two 3 by 6 inch 31 gage steel panels in accordance with method 2011 using the aliphatic naphthaethylene glycol monoethylether mixture. Spray the test panels to a uniform dry film thickness between 0.002 and 0.0025 inch, allow the panels to air dry for 1/2 hour and then bake for 48 hours at  $149 \pm 2^{\circ}\text{C}$ . ( $300 \pm 4^{\circ}\text{F}$ ). Condition the panels for 1/2 hour at  $23 \pm 1^{\circ}\text{C}$ . Bend over a 1/8 inch mandrel. Both panels must comply with 3.5.4.

4.4.10 Adhesion, tape test.

4.4.10.1 Panel preparation. Using a 0.0030 inch (0.0060 inch gap clearance) film applicator, draw down a 2 inch wide film of the enamel on a 4 by 12 inch steel panel, solvent cleaned and phosphoric acid etched in accordance with procedure B, method 2011 of Fed. Test Method Std. No. 141.

4.4.10.2 Procedure. Air dry the specimen for 1 hour under referee conditions and then score a line through to the metal across the width of the film using a sharp pointed knife. Bake the panel as required for full hardness in table 1, cool for 15 minutes. The film shall then be taped perpendicular to and across the score line with waterproof, pressure-sensitive adhesive tape (3/4 inch wide) conforming to Specification PPP-T-60, Type II, Class I. The tape shall be pressed in firm contact with the film and shall extend for approximately 1 inch on each side of the score line. All air bubbles shall be rolled out by firm pressure of the thumb. Allow approximately 10 seconds for the test area to return to room temperature. Grasp a free end of the tape, at a rapid speed, strip it from the specimen by pulling the tape back upon itself at an angle of  $180^{\circ}$ . Observe the specimen for compliance with 3.5.5.

4.4.11 Welding characteristics.

4.4.11.1 Equipment and instrumentation required.

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4.4.11.1.1 Spot welder - single point. A single point spot welder having a low inertia head shall be used. At a transformer tap setting of 4.0 - 5.0 volts, open circuit, secondary voltage, adjustments shall be made to obtain the following weld schedule:

Electrode force - 550 lb.  
Weld time - 12 cycles  
Secondary amperes - 12,500

The welding transformer shall be excited by means of a NEMA Type 3BH control panel utilizing phase shift heat control for adjustment of the welding current. Its timing accuracy (0 to 15 cycles) shall be plus or minus 0 cycles.

4.4.11.1.2 Electrodes. Two RWMA Class 2 material spot welding cap electrodes .75 inch in diameter, having a .25 inch diameter welding face formed from a 45° truncated cone, are used for these weld tests. Burn-off copper will be .38 inch.

4.4.11.1.3 Instrumentation. A galvanometer-type oscillograph shall be used for recording the sine wave of the secondary current.

4.4.11.2 Panel preparation. Solvent clean thirty-two 4 by 12 inch 20 gage steel panels in accordance with method 2011 of Fed. Test Method Std. No. 141 using the aliphatic naphtha-ethylene glycol monoethyl ether mixture. Spray the test panels to a dry film thickness of 0.002 to 0.003 inches per side preferably in one wet cross pass on both sides. Air dry for 72 hours and cut two panels into 1 by 4 inch test coupons. Inspect and dress the coupons to free them from burrs or ragged edges that might provide a shunt path for the welding current.

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4.4.11.3 Test procedure. Place two of the 1 by 4 inch coupons together and make two spot welds 1-1/2 inch apart with a weld button .25 - .26 inch in diameter (to obtain this quality of weld, a 10 percent deviation from the above specified weld schedule is permissible). Measure weld quality only on the second spot weld of each coupon. The welding current is adjusted to obtain the above diameter by means of transformer tap switch and/or phase shift heat control adjustment.

Place the 4 by 12 inch test panels together with primer on both sides and spot weld them at the rate of 20 welds per minute. Make approximately 30 welds in one pair of test panels and then use a second set. Rotate 6 or 7 sets of panels in this manner allowing them to cool during the interim rest period. The welds shall be made without attention to the electrodes or adjustment of the weld schedule. Check weld quality every 250 welds using the 1 by 4 inch coupons. Destruction separation testing of the 1 by 4 inch weld coupons shall give a weld button with a minimum diameter across its narrowest width of 0.22 inch. Continue test until 2000 spot welds have been made or a destructive test of the weld button from a 1 by 4 inch coupon produces a failure.

After the 2000 welds, three pairs of the test coupons, 1 by 4 inch coated in the same manner as the panels, shall be welded and upon destruction, the weld buttons shall measure a minimum of .22 inch.

Note: During the above tests, there shall be no constant or violent metal expulsion nor excessive smoke or fumes which are irritating to the operator. Periodic surface expulsion which is characteristic of most of these coating materials is acceptable.

4.4.12 Water resistance. Solvent clean two 4 by 12 inch steel panels in accordance with procedure A, method 2011 of Fed. Test Method Std. No. 141 using the aliphatic naphtha ethylene glycol monoethyl ether mixture. Coat the panels with iron phosphate in accordance with TT-C-490 type II. Spray the back of the panels with the test primer to a uniform dry film thickness between 0.002 and 0.003 inch and allow the panels to air dry for 1/2 hour, then coat the front in the same manner and allow the panels to dry 5 to 10 minutes. Then bake as per schedule in table I for full hardness. Coat all exposed uncoated steel surfaces with wax or other suitable coating. Immerse in distilled water at  $23^{\circ} \pm 1^{\circ}\text{C}$ . for 250 hours in accordance with method 6011 of Fed. Test Method Std. No. 141. On removal observe the panels for compliance with 3.5.7.



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4.4.13 Salt spray resistance. Clean six 4 by 12 inch panels as in 4.4.12. Dipcoat three panels in accordance with method 2121 of Fed. Test Method Std. No. 141 with MIL-C-22235, "Corrosion Preventive Oil, Nonstaining", type A. Withdraw the coated panels from the oil at a rate of four inches per minute. Draw a squeegee over both sides of the panel, stand the panels in a nearly vertical position and allow them to dry under referee conditions for 72 hours. If a squeegee is not available allow the panels to stand nearly vertical for fourteen days under referee conditions. Coat the other three panels with iron phosphate in accordance with TT-C-490 type II. Spray all six panels with the test primer as in 4.4.12 and bake 15 minutes at 250°F. Apply zinc phosphate conforming to TT-C-490 type I by spray method to the iron phosphated and primed panels. (Do not treat the oiled and primed panels with zinc phosphate.) Bake all six panels for 45 minutes at 250°F. and expose the panels to the salt spray for 250 hours as described in method 6061 of Fed. Test Method Std. No. 141 using a 5 percent salt solution. (Do not score the panels as described in method 6061.) Upon removal, wash the panels gently in running water not warmer than 100°F. until free from any visible salt deposits and examine all six panels immediately for compliance with the requirement of 3.5.8.

## 5. PREPARATION FOR DELIVERY

5.1 Packaging and packing. The primer shall be delivered in 1 quart or 1 gallon multiple friction top containers, in 5 gallon lug cover steel pails or in 30 gallon steel drums as specified. When 30 gallon steel drums are specified, they shall contain only 28 gallons of primer (see 6.2). The primer shall be packaged level A or C; packed level A, B, or C as specified (see 6.2) in accordance with TT-P-143.

5.2 Marking. The containers shall be marked in accordance with TT-P-143. In addition each container shall be marked with the manufacturer's Qualified Products List designation.

## 6. NOTES

6.1 Intended use. The primer covered by this specification is intended for application at a dry film thickness between 0.002 and 0.003 inch on parts fabricated from sheet steel. It is usually applied to the parts prior to assembly and must not adversely affect spot or gas welding.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Size of container (see section 5).
- (c) Level of packaging and level of packing (see section 5).
- (d) The primer should be purchased by volume, the unit being one U.S. liquid gallon of 231 cubic inches at 68°F. (20°C.).

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6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement and manufacturers are urged to arrange to have the products that they proposed to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the U.S. Army Coating and Chemical Laboratory, Aberdeen Proving Ground, Maryland, 21005, and information pertaining to qualification of products may be obtained from that activity.

6.4 It is intended that the maximum amount of rusting in the salt spray test (see 3.5.8) be comparable to Photo 8-2 in ASTM Standard Method of Evaluating Degree of Resistance to Rusting Obtained with Paint on Iron or Steel Surfaces D 610-43. This standard may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, Pa.

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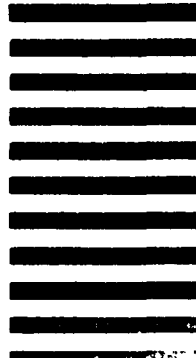
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