SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-P-38336 REV. A

Issued 1998-03
Stabilized 2013-07

Superseding AMS-P-38336

Primer Coating, Inorganic, Zinc Dust Pigmented, Self-Curing, for Steel Surfaces

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

STABILIZED NOTICE

This document has been declared "Stabilized" by SAE G-8, Aerospace Organic Coatings Committee, and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS-P-38336A

NOTICE

This document has been taken directly from U.S. Military Specification MIL-P-38336A and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-P-38336A. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Any material relating to qualified product lists has not been adopted by SAE. This material was part of the original military specification and is reprinted here for historic reference only.

1. SCOPE AND CLASSIFICATION:

1.1 SCOPE:

This specification covers a ready-to mix, two component, self-curing, inorganic zinc rich primer for use on steel surfaces.

1.2 Application:

This primer has been typically used on steel surfaces.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take the necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

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

2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111 -5094.

MIL-A-6091	Alcohol, Ethyl, Specially Denatured, Aircraft
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-STD-105	Sampling Procedures and tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
QQ-S-698	Steel, Sheet and Strip, Low Carbon
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-S-735	Standard Test Fluids; Hydrocarbon
UU-T-106	Tape, Pressure-Sensitive Adhesive, Masking, Paper
FED-STD-595	Colors

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428 -2959.

ASTM B 117	Salt Spray (Fog) Testing (DOD adopted)
ASTM D 56	Tester, Closed. Flash Point, Standard Test Method by Tag (DOD adopted)
ASTM D 185	Coarse Particles in Pigmented, Pastes, and Paints (DOD adopted)
ASTM D 522	Mandrel Bend Test of Attached Organic Coatings (DOD adopted)
ASTM D 1296	Solvents and Diluents, Volatile, Standard Test Method for Odor (DOD adopted)
ASTM D 1308	Effect of Household Chemicals on Clear & Pigmented Organic Finished (DOD adopted)
ASTM D 1640	Organic Coating, Drying, Curing or Film Formation of at Room Temperature (DOD adopted)
ASTM D 2197	Adhesion of Organic Coatings, by Scrape Adhesion Standard Test Method for (DOD adopted)
ASTM D 2244	Color Coordinates. Calculation of Color Differences from Instrumentally Measured Standard Test Method for (DOD adopted)

2.2 (Continued):

ASTM D 2247	Testing Water Resistance of Coatings in 100% Relative Humidity (DOD adopted)
ASTM D 2369	Volatile Content of Coatings Standard Test Method (DOD adopted)
ASTM G 26	Operating Light Exposure Apparatus (Xenon Arc Type) With & Without Water for Exposure of Nonmetallic Materials (DOD adopted)

3. REQUIREMENTS:

3.1 Components:

The inorganic zinc rich primer shall be a ready-to-mix, two component material. The two component material shall be furnished in separate companion containers; the dry zinc dust shall be in one container and the liquid inorganic vehicle in the other container. The container size, where specified, shall refer to the liquid vehicle container which shall hold enough of the vehicle to provide the specified volume of the mixed primer. For example, a one gallon container shall be of the standard one gallon size and shall contain adequate amount of liquid vehicle to provide minimum of 231 cubic inches of the mixed primer. The primer must be furnished in pint, quart, half gallon, one gallon or larger containers as specified by the procuring activity.

3.2 Material:

Except where otherwise specified, the manufacturer is given latitude in the selection of raw materials and processes of manufacture but shall be restricted by the requirements of this specification. The materials used shall be of high quality and entirely suitable for the purpose intended.

3.2.1 Toxic products and formations: The materials shall have no adverse effect on the health of personnel when used according in provided instructions and for its intended purpose. Questions pertinent to this effect shall be referred by the procuring activity to the appropriate department medical service who will act as an advisor to the procuring activity.

3.2.2 Zinc dust pigment: The zinc dust pigment shall conform to the requirements of TT-P-460, type II.

3.2.3 Liquid vehicle: When the liquid inorganic vehicle portion of the primer cannot be thinned with water, dilute with organic solvents as specified herein.

3.2.3.1 Thinner: Denatured ethyl alcohol conforming to MIL-S-6091 shall be used as required for thinning the primer.

3.2.3.1.1 Denatured ethyl alcohol: Denatured ethyl alcohol shall be used only when applying the organic solvent dilutable primer to structures located in outside environments. The application procedure is necessary because of the potential fire hazard created by the low flash point of ethyl alcohol.

3.3 Quantitative requirements:

The primer shall meet the quantitative requirements as specified in table I.

TABLE I. QUANTITATIVE REQUIREMENTS OF PRIMER

Characteristic	Minimum Requirements
Nonvolatile (solids) content, percent by weight of vehicle	32
Zinc content, percent by weight, total zinc solids of zinc dust pigmented primer	80
Flash point °F, ethyl alcohol diluted primer	65
Weight per gallon in pounds	18

3.4 Quantitative requirements:

3.4.1 Mixing: When tested as specified in 4.6.4, the zinc dust pigment shall be easily mixed, by hand, into the inorganic vehicle to form a smooth, homogeneous material free from lumps, or other objectionable characteristics.

3.4.2 Odor: When tested as specified in 4.6.1, the odor of the wet primer and the dry film shall not be obnoxious.

3.4.3 Coarse particles and skins: When tested in accordance with 4.6.1, the percentage of coarse particles and skins retained on the sieve shall not exceed by more than 0.5 percent the total amount of residue retained when the dry zinc pigment is subjected to the sieve test.

3.4.4 Primer stability: When tested in accordance with 4.6.5 after standing undistributed for eight hours, the primer shall not have aged or settled to the extent that it cannot be easily redispersed into a smooth, homogeneous mixture by hand mixing.

3.4.5 Storage stability: At the time of submission of bid, the manufacturer shall certify that after one years storage at a temperature of 90°F ± 10°F the primer shall meet all the requirements of this specification.

3.5 Coating:

3.5.1 Film properties: The coating shall be at least 3.5 ± 0.5 mils in dry film thickness and shall be smooth, even and free of runs, sags, streaks, or other imperfections.

3.5.2 Application methods: The primer shall be applied by spraying or brushing over solvent cleaned, phosphoric acid treated, or sand blasted steel.

3.5.2.1 Dry surfaces: When tested in accordance with 4.6.6, the coatings shall be applied without “mud-cracking” or loss of adhesion,

3.5.2.2 Wet surfaces: When tested in accordance with 4.6.6, the coating shall cure on wet steel surfaces and on surfaces located in environments of 90°F and 95 percent relative humidity.

3.5.3 Drying time:

3.5.3.1 Dry surfaces: A film of the primer, prepared and tested in accordance with 4.6.7, shall dry dust free in not more than 30 minutes, and shall be dry through in not more than four hours.

3.5.3.2 Wet surfaces: A film of the primer, prepared and tested in accordance with 4.6.7, shall cure dust free in not more than one hour and cure through in not more than six hours.

3.5.4 Flexibility: When tested in accordance with 4.6.8, a film of the primer shall show no cracking or loss of adhesion in the bend areas.

3.5.5 Adhesion: When tested in accordance with 4.6.9, coatings of the primer shall show no lifting, flaking, or other signs of damage.

3.5.6 Fluid resistance properties:

3.5.6.1 Water resistance: When tested as specified in 4.6.10.1, the primer shall show no wrinkling, blistering, loss of adhesion, or other visible defects.

3.5.6.2 Hydrocarbons resistance: When tested as specified in 4.6.10.2, a film of the primer shall show no wrinkling, blistering, loss of adhesion, or other visible defects.

3.5.6.3 Synthetic fluid resistance: When tested as specified in 4.6.10.3, a film of the primer shall show no wrinkling, blistering, loss of adhesion, or other visible defects.

3.5.7 Weathering properties:

3.5.7.1 Accelerated weathering: When tested as specified in 4.6.11, the primer shall not be adversely affected by 30 days accelerated weathering.

3.5.7.2 Weather exposure: At the time of submission of bid, the manufacturer shall certify that a single coat of the primer, 3.5 ± 0.5 mils in dry film thickness, shall provide adequate protection for steel surfaces for a minimum of two years without loss of adhesion, blistering, or rust pitting when exposed in the vicinity of coastal salt water atmospheres.

3.5.8 Humidity resistance: When tested in accordance with 4.6.12, a coating of the primer shall show no blistering, wrinkling, or loss of adhesion.

3.5.9 Salt spray resistance: When tested in accordance with 4.6.13, a coating of the primer shall show no blistering, wrinkling, or loss of adhesion. There shall be no general surface corrosion, pitting, or other visual evidence of panel corrosion.

3.5.10 Inhibitive properties: When tested in accordance with 4.6.14, a primer coated panel shall inhibit the spread of corrosion beyond a maximum of 1/32 inch on either side of the score line (a total width of 1/16 inch).

3.5.11 Topcoating properties: When tested in accordance with 4.6.15, the primer shall provide a suitable base for topcoating with additional coats of primer of like material.

3.5.12 Heat resistance: When tested in accordance with 4.6.16, the primer shall not be adversely affected by 24 hour bake at 750°F.

3.5.13 Color: The preferred color of the cured primer is the characteristic metallic color of the zinc pigment which approximates color No. 36231 of FED-STD-595. However, other colors resulting from the use of additional inhibitive pigments shall not be cause for rejection, provided the primer meets all other requirements of this specification.

3.6 Workmanship:

The ingredient material shall be intimately assembled and processed as required in accordance with the best practice for the manufacture of a high quality primer.

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 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 must 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 accept defective material.

4.2 Classification of inspection:

The inspection requirements specified herein are classified as quality conformance inspection (see 4.3).

4.3 Quality conformance inspection:

Quality conformance inspection shall consist of sampling plan A.

4.3.1 Sampling plan A: Sampling, inspection, and testing shall be conducted in accordance with MIL-STD-105, and as specified herein.

4.4 Test panels:

4.4.1 Materials: Test panels shall be prepared from sheet steel conforming to QQ-S-698, cold-rolled, and may be of any convenient size and thickness subject to the following limitations:

a. Unless otherwise specified, panels shall be at least 4 inches wide by 6 inches long.
b. Panels for the flexibility tests shall be 22 ± 2 mils thick.
c. Other test panels shall be not less than 30 nor more than 60 mils thick.

4.4.2 Surface preparation:

4.4.2.1 Solvent cleaned panels: Test panels shall be selected from smooth steel free from rust. The panels shall be scoured with steel wool, washed in an environmentally acceptable cleaner. After the panels have air dried, they shall be wiped clean with a clean lint-free cloth.

4.4.2.2 Phosphoric acid cleaned panels: The test panels selected shall be free from other than light rusting. They shall be scoured with steel wool to remove rust or other adhering contamination, washed as in 4.4.2.1, rinsed and air dried. The panels shall then be treated as follows:

a. Immerse for two hours in an acid cleaner of the following composition maintained at a temperature of 75°F ± 2°F:

   3150 ml of water
   650 ml of technical grade, 85 percent phosphoric acid
   3.8 grams of diethyl 1,3, thiourea
   1.4 grams of alkylarylsurfonate wetting agent

b. Rinse in water and immerse for 15 minutes in the following dichromate solution maintained at a temperature of 75°F ±2°F:

   3785 ml of water
   114 grams of potassium dichromate

c. Force dry the panels at a temperature of 190°F to 212°F

4.4.2.3 Sandblasted panels: The panels shall be washed as specified in 4.4.2.1, rinsed and dried. The entire panel shall be blasted using any suitable equipment and blasting material. The blasting material shall be free from oil, grease, dirt, water, or other contaminants that would impair the coatability of the panel surface. The panels shall be blast cleaned to a white metal. After blasting, the panels shall be cleaned by using clean, dry compressed air or a vacuum.

4.4.3 Application methods:

4.4.3.1 Dry surfaces: After preparing the panels as specified in 4.4.2, the panels shall be kept clean and free from fingerprints, rust, or other surface contamination. Application of the primer shall be accomplished within a maximum of one hour after cleaning, or the cleaned panels may be stored in a desiccator for not more than 72 hours prior to coating. The primer shall be thoroughly mixed in accordance with the manufacturer's instructions. Unless specified a single coat of the primer shall be applied by spray or brush using a wet cross-coat, to a dry film thickness as specified in 3.5.1. The panel shall be in a nearly vertical position during spraying and/or at least two minutes after completion of spraying. Panels that are to be used for salt spray, humidity, or other tests where corrosion or rusting of the panels is a factor shall be coated on both sides and, in addition, shall be dipcoated around the edges to a distance of approximately 1/8 inch. The coated panels shall be air dried for a minimum of two hours and not more than four hours prior to testing (see 4.6).

4.4.3.2 Wet surfaces: The panels shall be prepared and coated as specified in 4.4.3.1, except the panel surfaces shall be wet prior to primer application. The test panels shall be dipped in tap water, removed, and with a damp fine-pore sponge, smoothed to a bright, even coat of water. The panels shall then be immediately spray or brush coated with the primer and placed in a humidity cabinet at 90°F and 95 percent relative humidity. Test panels shall cure dust free in one hour and cure through in not more than six hours. After curing, the panels shall be removed from the humidity cabinet and tested as specified in 4.6.

4.5 Test conditions:

Unless otherwise specified, all testing, conditioning, and curing, shall be conducted under standard laboratory conditions of 75°F ± 2°F and 50 ± 5 percent relative humidity.

4.6 Test methods:

4.6.1 Methods of test: The test methods of this specification shall be conducted in accordance with the applicable methods of ASTMs as listed in table II, and other methods as described in 4.6.2 through 4.6.18.

TABLE II. TEST METHODS

Test	Requirements Reference	ASTM
Nonvolatile (solids) content	Table I	D 2369
Flash point	Table I	D 56
Odor	3.4.2	D 1296
Coarse particles and skins	3.4.3	D 185
Weight per gallon	Table I	Best commercial practices
Color	3.5.13	D 2244

4.6.2 Zinc dust pigment: The dry zinc dust pigment shall be tested according to the requirement of TT-P-460.

4.6.3 Zinc content: The percentage of zinc dust in the dry film shall be determined as follows: Using one unopened unit of primer (one container of liquid vehicle and the companion container of dry zinc dust) accurately determine the total weight of each component by comparing the weight of the full containers to that of identical, empty, clean containers. Determine the nonvolatile content of the liquid vehicle according to the method listed in table II. Calculate the percent of zinc dust in the dry film as follows:

$$\frac{A \times 100}{A + \frac{(B \times C)}{100}} = D$$

A = Weight of zinc dust
B = Percentage of nonvolatile in the vehicle
C = Weight of vehicle
D = Percentage of zinc in the dry film

4.6.4 Mixing: A one quart sample of the primer shall be mixed according to the manufacturers instructions. The material shall be briskly stirred, by hand, during the mixing. The complete mixing shall be accomplished in not more than five minutes. After the mixture appears homogeneous or at the end of the five minute period, whichever occurs first, the material shall be allowed to stand for one minute. It shall then be poured slowly into another container. The primer shall be observed during pouring and the residue remaining in the mixing container observed for any evidence of lumps or pigment that has not been wetted by the liquid vehicle.

4.6.5 Primer stability: A one quart container shall be filled to within approximately 1/2 inch from the top with well mixed primer. The container shall be sealed and stored at 75°F ± 2°F undisturbed for six hours. At the end of this period the container shall be opened and the primer hand mixed for not more than three minutes. There shall be no evidence of undispersed lumps of pigment remaining after completion of the stirring. (Small amount of pigment clinging to the stirrer shall not be cause for rejection.)

4.6.6 Coating: Panels shall be prepared, cleaned, and coated in accordance with 4.4.1, 4.4.2, and 4.4.3, respectively. The coated panels shall be examined for conformance with 3.5.1.

4.6.7 Drying time: The drying time of the primer shall be determined in accordance with ASTM D 1640, except that the primer shall be sprayed on a cleaned steel panel, as specified in 4.4.2.1, to a dry film thickness as specified in 3.5.1. The drying time shall be in accordance with 3.5.3.

4.6.8 Flexibility: Solvent cleaned panels coated with primer as specified in 4.4.3, and cured as applicable, shall be bent 180 degrees over a 1 inch mandrel in accordance with ASTM D 522, method B. Similar panels shall be conditioned for one hour at 0°F and while still at that temperature, bent around a 4 inch diameter mandrel. The panels shall be visually examined immediately for evidence of failure, and then after conditioning to room temperature, shall be re-examined to determine compliance with 3.5.4.

4.6.9 Adhesion tests of primer coated panels:

4.6.9.1 Unexposed and exposed to aqueous media: Test panels cleaned by each of the three methods in 4.4.2, shall be coated with the primer and cured as specified in 4.4.3. Two parallel scratches down to metal, using a stylus, shall be made 1 inch apart. A 1 inch wide strip of masking tape conforming to UU-T-106 shall be applied, adhesive side down, across the scratches. The tape shall be pressed down using two passes of a 4-1/2 pound rubber-covered roller approximately 3-1/2 inches in diameter by 1-3/4 inches in width, the surface of which has a durometer hardness value within the range of 70 to 80. The roller shall be moved at the rate of approximately 1 inch per second. The tape shall be removed in one abrupt motion with the pull exerted at approximately a 90 degree angle to the panel, and the panel examined for removal of primer from the metal. Stripping of the tape shall be accomplished immediately after application.

4.6.9.2 Exposed to nonaqueous media: Test shall be accordance with ASTM D 2197.

4.6.10 Fluid resistance properties: Test panels prepared, coated, and cured as specified in 4.4, shall be half immersed in the fluids (see 3.5.6) and tested in accordance with ASTM D 1308, method 6.4. Resistance properties shall conform to the requirements of 3.5.6.

4.6.10.1 Water resistance: Immersion in distilled water shall be 14 days at 75°F. Twenty four hours after removal from water, the immersed portion of the film shall be equal in hardness and adhesion to the unimmersed portion as determined in 4.6.9.1.

4.6.10.2 Hydrocarbon resistance: Immersion in fluid conforming to TT-S-735, type III, shall be 24 hours at 75°F. Twenty four hours after removal, the immersed portion of the film shall be equal in hardness and color to the unimmersed portion as determined in 4.6.9.2.

4.6.10.3 Synthetic fluid resistance: Immersion in fluid conforming to MIL-L-7808, shall be 168 hours at 160°F. Twenty four hours after removal, the immersed portion of the film shall be equal in hardness and color to the unimmersed portion as determined in 4.6.9.2.

4.6.11 Accelerated weathering: Test panels prepared, cleaned, and coated with primer as specified in 4.4, shall be subjected to 300 hours exposure to accelerated weathering in accordance with ASTM G 26. Following this exposure, the panels shall be inspected for loss of flexibility, blistering, loss of either intercoat or metal adhesion, or any other apparent defects. (Slight whitening of the film shall be disregarded.)

4.6.12 Humidity resistance: Panels prepared by each of the three cleaning methods as specified in 4.4.2, shall be coated with primer and cured as specified in 4.4.3. The panels shall be in accordance with ASTM D 2247 and operated at 120°F ± 2°F and 100 percent humidity. The primer shall be exposed for 30 days. After exposure the panels shall be examined for conformance to 3.5.8.

4.6.13 Salt spray: Panels shall be prepared, cleaned, coated with primer and cured as specified in 4.4. They shall then be exposed to salt spray in accordance with ASTM B 117, except they shall not be scored. Exposure time shall be 30 days.

4.6.14 Inhibitive properties: Panels shall be prepared, cleaned, coated, cured, and exposed as specified in 4.6.13, except that they shall be scored and the time of exposure shall be 30 days. After exposure period, the panel shall be removed, washed in water without scrubbing, allowed to dry, and examined for conformance to 3.5.10.

4.6.15 Topcoating properties: A solvent cleaned panel shall be coated and cured in accordance with 4.4. After curing the panel shall be coated with an additional 1.0 ± 0.5 mil dry film thickness of the primer. The additional coat of the primer shall also be cured as specified in 4.4. The panel shall then be tested in accordance with 4.6.9.1, and inspected for adhesion of the second coat to the initial coat of primer.

4.6.16 Heat resistance: Panels cleaned with solvent, coated with primer, and cured as specified in 4.4, shall be exposed in an oven to a temperature of 750°F ± 5°F for 24 hours. The panels shall then be removed and conditioned to room temperature. The coating shall be tested for adverse effects by the flexibility test, 4.6.8, and the humidity test, 4.6.12. Performance of the oven-exposed coating shall be equal to or better than the unexposed coating.

4.6.17 Toxicological data and formulations: The supplier shall furnish the toxicological data and formulations required to evaluate the safety of the material for the proposed use.

4.6.18 Packaging, packing, and marking: Packaging shall be examined for conformance with Section 5.