

Conversion Coating of Titanium Alloys  
Fluoride-Phosphate Type

RATIONALE

AMS2486E results from a Five Year Review and update of this specification and adds a periodic primer adhesion test requirement.

1. SCOPE

1.1 Purpose

This specification establishes the requirements for a chemical conversion coating on titanium alloys.

1.2 Application

This process has been used typically to provide a coating that is receptive to anti-galling and organic finishes, but usage is not limited to such applications.

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 that 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 necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch/>

MIL-PRF-23377 Primer Coatings, High Solids  
MIL-PRF-85582 Primer Coatings: Epoxy, Waterborne

FED-STD-141 Paint, Varnish, Lacquer, and Related Materials: Methods for Sampling and Testing

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### 3. TECHNICAL REQUIREMENTS

3.1 Conversion bath shall consist of an aqueous solution of the following materials in the concentrations shown and shall be operated at  $80\text{ }^{\circ}\text{F} \pm 10$  ( $27\text{ }^{\circ}\text{C} \pm 6$ ).

Trisodium Phosphate ( $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$ ), Technical 6.5 to 6.9 ounce per gallon (49 to 51.5 g/L).

Potassium Fluoride ( $\text{KF} \cdot 2\text{H}_2\text{O}$ ), 2.3 to 3.2 ounces per gallon (17.5 to 24 g/L).

Hydrofluoric Acid, 1.8 to 3.0 fluid ounces per gallon (14 to 24 mL/L) of 70 weight percent HF or 2.6 to 4.4 fluid ounces per gallon (20 to 35 mL/L) of 48 weight percent HF.

#### 3.2 Preparation

3.2.1 The coating shall be applied over a surface free from water breaks. The cleaning procedure shall not produce pitting or intergranular attack of the basis metal and shall preserve dimensional requirements. The use of halogenated solvents is prohibited. See 8.5.

#### 3.2.2 Masking

A suitable maskant shall be applied to any area or areas where (1) application of the coating is not permitted, (2) solution entrapment may occur such as a faying surface or (3) another metal, such as a thread insert, is present.

#### 3.3 Procedure

##### 3.3.1 Coating

Parts shall be immersed in the conversion bath for 2 to 4 minutes.

##### 3.3.2 Rinsing

Coated parts shall be rinsed in a circulating water bath, maintained at a temperature not higher than  $185\text{ }^{\circ}\text{F}$  ( $85\text{ }^{\circ}\text{C}$ ). Rinse time shall be not longer than 16 minutes when rinse water temperature is above  $100\text{ }^{\circ}\text{F}$  ( $38\text{ }^{\circ}\text{C}$ ).

3.3.2.1 Dissolved solids content of circulating rinse water shall be maintained below 200 parts per million.

##### 3.3.3 Drying

Parts shall be dried for not less than 30 minutes in air at  $150$  to  $200\text{ }^{\circ}\text{F}$  ( $66$  to  $93\text{ }^{\circ}\text{C}$ ).

##### 3.3.4 Handling

Parts shall be handled with clean, dry gloves.

#### 3.4 Properties

Coating shall conform to the following requirements:

##### 3.4.1 Color

The coating shall be gray in color but some variation in color is acceptable.

##### 3.4.2 Coating Adhesion

Coating shall be adherent to basis metal when parts are wiped with a clean, cotton cloth. Heavy powdering or coating removal during wiping is not acceptable.

### 3.4.3 Primer Coating Adhesion

Primer coating applied to test panels and tested in accordance with 4.3.3 shall not be removed more than 1/16 inch from the scribed lines.

### 3.4.4 Water Spotting

Random staining, due to water spotting, that does not exceed 5% of the coated area, is acceptable.

## 3.5 Quality

Coating shall be uniform in quality and coverage, free from pits, and from imperfections detrimental to usage of the coating.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for Inspection

The processor of coated parts shall supply all samples for processor's tests and shall be responsible for the performance of all required tests. The cognizant engineering organization reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to specified requirements.

### 4.2 Classification of Tests

#### 4.2.1 Acceptance and Preproduction Tests

Color (3.4.1) and adhesion (3.4.2) are acceptance tests and preproduction tests and shall be performed prior to or on the initial shipment of processed parts to a purchaser, on each lot of processed parts, and when the cognizant engineering organization requires confirmatory testing.

#### 4.2.2 Periodic Tests

Tests of cleaning and processing solutions and primer adhesion (3.4.2) are periodic tests and shall be performed at a frequency established by the processor unless frequency of testing is specified by the cognizant engineering organization. See 8.4 and 4.4.3.

### 4.3 Sampling for Testing

#### 4.3.1 Acceptance Tests

Acceptance test samples shall be randomly selected from all parts in the lot. A lot shall be all parts of the same part number, processed in a continuous series of operations (3.3.1 and 3.3.2), in not longer than 24 consecutive hours, and presented for processor's inspection at one time. Unless the cognizant engineering organization provides a sampling plan, the minimum number of samples shall be as shown in Table 1.

TABLE 1 - Sampling For Acceptance Tests

Number of Parts in Lot		Visual for Water Spotting, Color, and Quality	Coating Adhesion
1 to	7	all	all
8 to	15	7	3
16 to	40	10	4
41 to	150	15	5
151 to	300	25	6
301 to	500	35	7
Over	500	50	8

#### 4.3.2 Periodic and Preproduction Tests

Sample quantity shall be at the discretion of the processor, unless otherwise specified by the cognizant engineering organization.

#### 4.3.3 Primer Coating Adhesion Testing

Adhesion testing shall be in accordance with FED-STD-141 Method 6301.3 modified as follows. 6AL-4V titanium panels shall be cleaned in accordance with 3.2.1 and coated in accordance with 3.3. One coat of MIL-PRF-23377 or MIL-PRF-85582 epoxy primer to a dry film thickness of 0.0006 to 0.0009 inch (15 to 23  $\mu\text{m}$ ) shall be applied to the panels and fully cured in accordance with manufacturer's instructions. The panels shall be immersed in reagent water at  $77\text{ }^{\circ}\text{F} \pm 5$  for 24 hours  $\pm 1$ . Within 10 minutes of removal from the water, the panels shall be wiped dry, scribed with 2 parallel lines 1 inch apart (nominal) and an "x" scribed between (and connecting the ends of) the parallel lines. Tape specified in FED-STD-141 Method 6301.3, or an equivalent tape acceptable to the cognizant engineering organization, shall be applied to scribed lines, pressed firmly and quickly pulled from the coating.

#### 4.4 Approval

4.4.1 The process and control factors, a preproduction sample coated part, or both, whichever is specified, shall be approved by the cognizant engineering organization before production parts are supplied.

4.4.2 If the processor makes a significant change to any material, process, or control factor from that which was used for process approval, all preproduction tests shall be performed and the results submitted to the cognizant engineering organization for process reapproval unless the change is approved by the cognizant engineering organization. A significant change is one that, in the judgment of the cognizant engineering organization, could affect the properties or performance of the part.

4.4.3 Control factors shall include, but not be limited to, the following:

Method of cleaning  
Coating time  
Rinse temperature and time  
Control of dissolved solids in rinse bath  
Periodic test plan for cleaning and processing solutions. See 8.4.

#### 4.5 Reports

The processor of coated parts shall furnish with each shipment a report stating that the parts have been processed and tested in accordance with specified requirements and that they conform to the acceptance test requirements. This report shall include the purchase order number, AMS2486E, part number, and quantity.

#### 4.6 Resampling and Retesting

4.6.1 If any lot of acceptance test fails to meet specified requirements, the parts in that lot may be stripped, coated as defined herein, and retested. Alternatively, all parts in the lot may be inspected for the nonconforming attribute, and the nonconforming parts may be stripped, coated as defined herein, and retested. After any stripping and recoating, parts shall meet the dimensional requirements of the drawing.

4.6.1.1 When stripping is performed, the method shall be acceptable to the cognizant engineering organization and shall not roughen, pit, or embrittle the basis metal or adversely affect part dimensions. When parts have been stripped and replated, the purchaser shall be informed. See 8.2.

4.6.2 If any periodic test fails to meet specified requirements, the process is nonconforming. No additional parts shall be coated until the process is corrected and new specimens are coated and tested. Results of all tests shall be recorded, and, when requested, reported. Purchaser shall be notified of all parts coated since the last periodic test.