AEROSPACE MATERIAL SPECIFICATION

AMS2480™	REV. K

Issued 1948-05
Reaffirmed 2013-11
Revised 2024-07

Superseding AMS2480J

Zinc Phosphate Treatment
Paint Base

RATIONALE

AMS2480K results from a Five-Year Review and update of this specification with changes to Ordering Information, Stress Relief (see 3.1.1), Fixture/Electrical Contact Locations (see 3.1.3), Hydrogen Embrittlement Relief (see 3.3.2), Periodic Tests (see 4.2.2), Acceptance Tests (see 4.3.1), control factors (see 4.4.3), and Note (see 8.4).

NOTICE

ORDERING INFORMATION: The following information shall be provided to the plating processor by the purchaser:

1. Purchase order shall specify not less than the following:

- AMS2480K
- Basis metal to be treated
- Tensile strength or hardness of the basis metal
- If pre-treatment stress relief to be performed by processor (time and temperature) and if different from 3.1.1
- Special features, geometry, or processing present on parts that requires special attention by the processor
- Hydrogen embrittlement relief to be performed by the processor if different from 3.3.2
- If parts were machined, ground, cold formed, or cold straightened after heat treatment (see 3.1.1)
- Optional: Fixture/electrical contact locations, when not specified (see 3.1.3)
- Quantity of pieces to be treated

2. Parts manufacturing operations, such as heat treatment, forming, joining, and media finishing, can affect the condition of the substrate for coating or, if performed after coating, could adversely affect the coating. The sequencing of these types of operations should be specified by the cognizant engineering organization and is not controlled by this specification.

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**

For more information on this standard, visit
https://www.sae.org/standards/content/AMS2480K/

1. SCOPE

1.1 Form

This specification covers the requirements for producing a zinc phosphate coating on ferrous alloys and the properties of the coating.

1.2 Application

This process has been used typically to produce a coating that will ensure satisfactory paint adherence, 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 cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2750 Pyrometry

AMS2759/9 Hydrogen Embrittlement Relief (Baking) of Steel Parts

ARP4992 Periodic Test Plan for Processing Solutions

AS2390 Chemical Process Test Specimen Material

AS7766 Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B117 Operating Salt Spray (Fog) Apparatus

ASTM F519 Mechanical Hydrogen Embrittlement Evaluation of Plating/Coating Processes and Service Environments

2.3 U.S. Government Publications

Copies of these documents are available online at https://quicksearch.dla.mil.

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

MIL-PRF-85582 Primer Coatings: Epoxy, Waterborne

2.4 Definitions

Terms used in AMS are defined in AS7766.

3. TECHNICAL REQUIREMENTS

3.1 Preparation

3.1.1 Stress Relief

Steel parts having a hardness of 40 HRC and above and that have been ground, cold formed or cold straightened after heat treatment shall be cleaned to remove surface contamination and thermally stress relieved before preparation for coating. Furnaces used for stress relief shall be controlled per AMS2750; the minimum requirements shall be Class 5 and Type D Instrumentation. Temperatures to which parts are heated shall be such that stress relief is obtained while still maintaining hardness of parts within drawing limits. Unless otherwise specified, the following treatment temperatures and times shall be used:

3.1.1.1 For parts, excluding nitrided parts, having a hardness of 55 HRC and above, and for carburized and induction hardened parts, stress relieve at 275 °F ± 25 °F (135 °C ± 14 °C) for 5 to 10 hours.

3.1.1.2 For parts having a hardness less than 55 HRC, and for nitrided parts, stress relieve at 375 °F ± 25 °F (191 °C ± 14 °C) for a minimum of 4 hours. Higher temperatures shall be used only when specified or approved by the cognizant engineering organization.

3.1.1.3 For peened parts: If stress-relief temperatures above 375 °F (191 °C) are specified, the stress relieve shall be performed prior to peening.

3.1.2 Cleaning

The phosphate 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.

3.1.3 Fixture/Electrical Contact Locations

3.1.3.1 Except for barrel/basket coating, for parts that are to be coated all over, and contact locations are not specified, contact locations shall be at the discretion of the processor.

3.1.3.2 For parts that are not to be coated all over, and contact locations are not specified, contact locations may be in the areas being coated provided the parts are moved to prevent contact marks/voids within the coating.

3.2 Procedure

Parts shall be coated by immersing in, or spraying with, a balanced phosphate solution containing a nitrate salt as an accelerating agent. The solution shall be maintained at the temperature recommended by the manufacturer. The parts shall be held in contact with the solution for sufficient time to form a uniform, insoluble, crystalline zinc phosphate coating meeting the requirements of 3.4. Immediately after coating, parts shall be thoroughly rinsed in cold, running water.

3.3 Post-Treatment

3.3.1 Chromic Acid Dip

After the cold-water rinse, parts shall be dipped in dilute chromic acid solution for 20 to 60 seconds at 190 °F ± 10 °F (88 °C ± 6 °C), and dried. The chromic acid solution shall be 7.5 ounces of chromic acid in 100 gallons of water (0.56 g/L) with an approximate pH of 5. Other post-treatments may be used in place of the chromic acid dip, if approved by the cognizant engineering organization. After drying, parts shall be protected against contamination and shall be painted, if applicable, as soon as practicable.

3.3.2 Hydrogen Embrittlement Relief

Hydrogen embrittlement relief baking of steel parts shall be in accordance with AMS2759/9 except that parts shall be baked at 210 to 225 °F (99 to 107 °C) for a minimum of 8 hours.

3.4 Properties

The coating shall conform to the following requirements:

3.4.1 Coverage

Prior to post-treatment, coated parts and test specimens shall have a uniform, dull appearance ranging from light to dark gray, with or without some silvery iridescence.

3.4.2 Corrosion Resistance

Phosphate-treated, primed, and scratched test specimens shall show no visual evidence of corrosion extending more than 0.125 inch (3.2 mm) on either side of the scratch mark after being subjected to 150 hours of continuous salt spray conducted in accordance with ASTM B117. Prior to testing, phosphate-treated test specimens shall be coated with either MIL-PRF-23377 or MIL-PRF-85582 primer to a dry film thickness of 0.0004 to 0.0010 inch (10 to 25 µm) and cured in accordance with the manufacturer's instructions. The primer shall be scratched with a sharp instrument to a depth that cuts through the primer film and phosphate coating, exposing the base metal. The scratch shall be 1 inch (2.5 cm) minimum in length (see 4.3.3.2).

3.4.3 Hydrogen Embrittlement

The coating process after baking shall not cause hydrogen embrittlement in steel parts 40 HRC (180 ksi) and over, determined in accordance with 4.3.3.3.

3.5 Quality

Surfaces of treated parts, as received by the purchaser, shall be uniform in texture and appearance. Powdery areas, excessive buildup, and darkening of corners and edges are not acceptable.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

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

4.2 Classification of Tests

4.2.1 Acceptance Tests

Coverage (see 3.4.1) and quality (see 3.5) are acceptance tests and shall be performed on parts, or specimens representing parts, when permitted herein from each lot (see 4.3.3.1).

4.2.2 Periodic Tests

Corrosion resistance (see 3.4.2) is a periodic test and shall be performed at least monthly unless frequency of testing is specified by the cognizant engineering organization. Hydrogen embrittlement (see 3.4.3) is a periodic test and shall be performed at least once in each month that steel parts 40 HRC and over are coated unless frequency of testing is specified by the cognizant engineering organization. Tests of cleaning and coating solutions 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 4.4.3 and 8.3).

4.2.2.1 Periodic testing may be suspended in any test period when parts are not processed but shall be performed before or at time such processing is resumed. Preproduction testing may be required by the cognizant quality organization upon resumption of processing.

4.2.3 Preproduction Tests

All property verification tests (see 3.4) are preproduction tests and shall be performed prior to or on the initial shipment of coated parts to a purchaser and when the cognizant engineering organization requires confirmatory testing.

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 is a group of parts, all of the same part number, processed through the same chemical solutions in the same tanks under the same conditions, which have completed the chemical processing within a period of 24 hours of each other and are presented to inspection at the same time. Unless the cognizant engineering organization provides a sampling plan, the minimum number of samples shall be shown in Table 1.

Table 1 - Acceptance test sampling

Number of Parts in Lot	Coverage and Quality
Up to 6	All or 3*
7 to 15	7
16 to 40	10
41 to 110	15
111 to 300	25
301 to 500	35
501 to 700	50
701 to 1200	75
Over 1200	125

*Whichever is less.

4.3.2 Periodic Tests

Sample quantity shall be two for corrosion resistance. For hydrogen embrittlement, sample quantity shall be as specified in ASTM F519 unless otherwise specified by the cognizant engineering organization.

4.3.3 Sample Configuration

4.3.3.1 Separate test specimens may be used under any one of the following circumstances: the parts are of such configuration or size as to be not readily adaptable to specified tests, nondestructive testing is not practical on actual parts, or it is not economically acceptable to perform destructive tests on actual parts. Except as specified below, acceptance test specimens shall be made of the same generic class of alloy as the parts, established in accordance with AS2390, distributed within the lot, cleaned, coated, and post-treated with the parts represented.

4.3.3.2 Corrosion Testing

Test specimens shall be fabricated from low-carbon steel measuring 0.025 inch (0.64 mm) minimum thickness and 4 x 2 inches (102 x 51 mm) minimum. Test specimens made of the predominant generic class of alloy as the parts coated in the test period may be used when acceptable to the cognizant engineering organization.