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400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2481G

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Superseding AMS 2481F

Phosphate Treatment
Antichafing

1. SCOPE:

1.1 Form:

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

1.2 Application:

This process has been used typically to produce a coating which will minimize chafing of contacting steel surfaces and retain an oil film, 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 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 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.

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2.1 ASTM Publications:

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

ASTM F 519 Test Method for Mechanical Hydrogen Embrittlement Evaluation of Plating Processes and Service Environments

3. TECHNICAL REQUIREMENTS:

3.1 Preparation:

3.1.1 Unless otherwise specified, prior to coating, parts having a hardness of 40 HRC or higher and which have been ground, cold formed, or cold straightened shall be cleaned and given a stress relief treatment at a temperature 50 F (28 C) degrees below the tempering temperature for a minimum of one hour per inch of thickness. When parts, including carburized parts, having a hardness of 55 HRC or higher and having been tempered at less than 400 °F (204 °C), stress relief shall be at a temperature of not less than 275 °F (135 °C) for not less than 23 hours.

3.1.2 Parts shall have clean surfaces, free from waterbreak, prior to phosphate coating.

3.2 Procedure:

Parts shall be coated by immersing in a balanced manganese acid phosphating solution containing a suitable accelerating agent. The solution shall be maintained at the proper temperature and parts shall be held in contact with the solution for sufficient time to form a uniform, insoluble, crystalline manganese phosphate coating meeting the requirements of 3.4. Parts shall then be immediately rinsed in cold, running water.

3.3 Post Treatment:

3.3.1 Chromic Acid Dip: After rinsing, parts shall be immersed in hot water. The hot water may contain small amounts of chromic acid or chromic and phosphoric acids. Parts shall be thoroughly dried unless a water-displacing oil is used for protection of parts in which case, drying may be omitted. Dried parts shall be oiled with a suitable corrosion-inhibiting oil.

3.3.1.1 The application of a water displacing oil or other corrosion inhibiting oil shall follow the hydrogen embrittlement relief bake (See 3.3.2), if baking is required.

3.3.2 After phosphate coating and chromic acid dip, steel parts having a hardness of 40 HRC or higher shall be hydrogen embrittlement relief baked in accordance with the requirements of AMS 2759/9, except that parts shall be baked at 210 to 225 °F (99 to 107 °C) for eight hours.

3.4 Properties:

The coating shall conform to the following requirements:

3.4.1 Appearance: Coated parts shall have a uniform, usually grayish-black, finely-crystalline appearance prior to post-treatment.

3.4.2 The coating process shall not cause hydrogen embrittlement in ferrous parts. Testing in accordance with ASTM F 519, Type 1A using notched round specimens, unless a different specimen type is specified by purchaser, stressed in tension under constant load, is required when parts 40 HRC or higher are coated. Coating shall meet the requirements of this specification on specimen surfaces and shall be visible at the root of the notch.

3.4.3 Phosphate Coating Weight: Unless otherwise specified, shall be 1500 mg/ft^2 minimum, determined using the differential weight method in accordance with the following relationship, using equation 1.

$$\text{Coating Weight} = \frac{\text{Coated Specimen Weight} - \text{Stripped Specimen Weight}}{\text{Total Coated Area}} \qquad \text{(Eq. 1)}$$

Stripping of coating shall be accomplished using a nominal 5% chromic acid solution at 165 °F ± 10 (74 °C ± 6) or by a room temperature solution of 180 grams of sodium hydroxide and 90 grams of sodium cyanide per liter of water. Repeat the stripping operation until no further weight loss is found.

3.5 Quality:

Surfaces of treated parts, as received by 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 specimens for processor's tests and shall be responsible for the performance of all required tests. Where parts are to be tested, such parts shall be supplied by purchaser. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that processing conforms to the specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Appearance (3.4.1) and quality (3.5) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Hydrogen embrittlement relief (3.4.3), coating weight (3.4.3), and tests of cleaning and coating solutions (See 8.4) to ensure that coatings will conform to this specification are periodic tests and shall be performed at a frequency selected by the processor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: All technical requirements are preproduction tests and shall be performed prior to or on the initial shipment of coated parts to a purchaser, when a change in material and/or processing requires reapproval by the cognizant engineering organization (See 4.4.2), and when purchaser deems confirmatory testing to be required.

4.3 Sampling and Testing:

Shall be as follows; a lot shall be all parts of the same part number, heat treated to the same hardness or tensile strength, processed in the same set of solutions within eight consecutive hours, and presented for processor's inspection at one time.

4.3.1 For Acceptance Tests: As shown in Table 1.

TABLE 1 - Acceptance Test Sampling

Number of Parts in Lot	Appearance and Quality
Up to 6	All
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

4.3.2 Periodic Tests: Sample quantity and frequency of sampling shall be selected at the discretion of the processor, unless otherwise specified by purchaser.

4.4 Approval:

4.4.1 The process and control procedures, a preproduction sample coated part, or both, whichever is specified, shall be approved by the cognizant engineering organization before production parts are supplied. When authorized by purchaser, preproduction test specimens may be substituted for a preproduction sample part.

4.4.2 The processor shall make no significant change to materials, processes, coating conditions or control factors from those on which approval was based, unless the change is approved by the cognizant engineering organization (See 4.2.3). A significant change is one which, in the judgment of the cognizant engineering organization, would affect properties or performance of the parts.