

AEROSPACE MATERIAL SPECIFICATION

SAE AMS2475

REV. G

Issued 1940-03
Reaffirmed 2006-04
Revised 2009-12

Superseding AMS2475F

Protective Treatments
Magnesium Alloys

RATIONALE

AMS2475G results from a Five Year Review and update of this specification.

1. SCOPE

1.1 Purpose

This specification establishes the requirements for chromate conversion coatings on magnesium alloys.

1.2 Application

This process has been used typically to improve corrosion resistance and adherence of organic finishes but usage is not limited to such applications. The dichromate treatment may not be suitable for alloys with high manganese content. The chrome pickle treatment has been used as touch-up for previously dichromate-treated surfaces and for improving corrosion protection temporarily, but usages are 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 SAE Publications

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

AMS-M-3171 Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2009 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

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/AMS2475G>

3. TECHNICAL REQUIREMENTS

3.1 Solutions

3.1.1 Acid Pretreatment and Preparation

3.1.1.1 Hydrofluoric acid solution shall be an aqueous solution containing 15 to 20% by weight of 48% hydrofluoric acid (HF). The hydrofluoric acid solution shall be operated at room temperature.

3.1.1.1.1 When handling hydrofluoric acid, great care should be taken to avoid contact with the skin; rubber gloves, face shield, and protective clothing should be worn by operators.

3.1.1.2 Acid pickle solution (3.2.2):

TABLE 1 - Acid Pickle Solution**

Ingredients	Quantity for Cast Surfaces*	Quantity for Other than Cast Surfaces*
Sulfuric acid (H_2SO_4 , sp gr 1.84)	2.5 fl oz (63 mL)	none
Nitric acid (HNO_3 , sp gr 1.42)	10.25 fl oz (260 mL)	none
Chromic acid	none	1.5 lbs (680 g)
Water to make	1 gallon (3.8 L)	1 gallon (3.8 L)

*Quantities are approximate

** Ambient temperature operation required

3.1.2 Sodium dichromate solution shall be an aqueous solution containing 10 to 15% of sodium dichromate ($\text{Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$) and 0.25% of either magnesium fluoride (MgF_2) or calcium fluoride (CaF_2) by weight. The solution shall be maintained saturated with magnesium or calcium fluoride by the continuous immersion of a cloth bag, or equivalent, containing the compound. The sodium dichromate solution shall be operated at not lower than 200 °F (93 °C) and preferably at its boiling point.

3.1.3 Chrome pickle solution shall be as shown in Table 2.

TABLE 2 - Chrome Pickle Solution**

Ingredients	Quantity for Wrought Surfaces	Quantity for Cast Surfaces*
Sodium dichromate ($\text{Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$)	1.5 pounds (680 g)	1.5 pounds (680 g)
Nitric acid (HNO_3 , sp gr 1.42)	1.5 pints (610 mL)	1 to 1.5 pints (450 to 610 mL)
Water to make	1 gallon (3.8 L)	1 gallon (3.8 L)
NaHF_2 , KHF_2 , or NH_4HF_2	None	2 oz (51 g)

Quantities are approximate

* As defined in AMS-M-3171 Type I.

** A proprietary solution, acceptable to the cognizant engineering organization, applied in accordance with manufacturer's instructions, may be used.

3.2 Preparation

3.2.1 The coating shall be applied to a surface free from water breaks, dirt, mill marking, heat scale, and discoloration. The cleaning procedure shall not produce pitting or intergranular attack of the basis metal and shall preserve dimensional requirements.

3.2.2 Acid Pickle

- 3.2.2.1 Castings with oxidized surfaces may be immersed in acid pickle solution in accordance with Table 1 for approximately ten seconds rinsed thoroughly in cold, flowing water, dipped in hot water, and dried rapidly.
- 3.2.2.2 Parts, other than castings, with oxidized surfaces may be immersed in acid pickle solution in accordance with Table 1, rinsed thoroughly in ambient, flowing water, dipped in hot water at 190 to 212 °F (88 to 100 °C) and dried rapidly.

3.3 Procedure

3.3.1 Dichromate Treatment

- 3.3.1.1 Prior to dichromate treatment, cleaned parts shall be immersed in the 3.1.1.1 hydrofluoric acid solution for not less than five minutes, or pickled by an alternative procedure approved by the cognizant engineering organization and rinsed thoroughly in ambient, flowing water.
- 3.3.1.2 The wet parts shall be immersed in the 3.1.2 sodium dichromate solution for not less than 30 minutes, thoroughly rinsed in ambient, flowing water, dipped in hot water, and dried rapidly with a clean, dry air blast.
- 3.3.2 Chrome pickle treatment shall be applied by local application to previously dichromate-treated surfaces where required application of an organic finish or where surfaces have been marred or to other surfaces when specified by the cognizant engineering organization.
- 3.3.2.1 The surfaces to be treated shall be contacted continuously with freshly-prepared (Table 2) chrome pickle solution by flowing, brushing, or swabbing, or parts shall be immersed in the solution at room temperature. Exposure time to the solution shall be as long as practicable provided dimensional requirements are preserved. Normal exposure time is 30 to 120 seconds. Parts shall then be rinsed thoroughly with clean, flowing water and dried with a clean, dry air blast.
- 3.3.3 Surfaces shall be handled after treatment carefully to prevent rupture of the film and contamination by dirt or oil. Organic finishing shall occur as soon after treatment as practicable.

3.4 Quality

Surfaces of coated parts, as received by purchaser, shall be substantially uniform in color, texture, and appearance. There shall be no bare or definite light-colored areas, powdery areas, and darkening of the corners and edges.

- 3.4.1 Color of properly applied dichromate coatings may vary, depending on the alloy composition, condition of the solution, and length of time of treatment. On most alloys, color ranges from dark brown to black; however, some process/alloy combinations may produce different colors, including dark neutral gray and colder tone grays containing slight amounts of blue or green.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The processor 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 Tests

Quality (3.4) is an acceptance test and shall be performed on all parts in each lot.

4.2.2 Periodic Tests

Tests of cleaning and processing 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 8.5.

4.2.3 Preproduction Tests

Quality (3.4) is a preproduction test 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 shall be every part in the lot. A lot shall be all parts of the same part number processed in a continuous series of operations in the same solutions and presented for processor's inspection at one time.

4.4 Approval

4.4.1 The process and control procedures, a preproduction sample, or both, whichever is specified by the cognizant engineering organization, 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 procedure from that which was used for process approval, preproduction testing (4.2.3) 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 parts.

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

- Surface preparation and cleaning methods
- Coating material trade name and manufacturer
- Coating bath composition and composition control limits
- Coating bath temperature limits and controls
- Periodic test plan for cleaning and processing solutions. See 8.5.

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, lot number, AMS2475G, part number, and quantity.

5. PREPARATION FOR DELIVERY

5.1 Coated parts shall be handled and packaged to ensure that the required physical characteristics and properties of the coating are preserved.

5.2 Packages of coated parts shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the coated parts to ensure carrier acceptance and safe delivery.

6. ACKNOWLEDGMENT

Processor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS

Parts on which the coating does not conform to this specification, or to modifications authorized by the cognizant engineering organization, will be subject to rejection.