



<b>AEROSPACE MATERIAL SPECIFICATION</b>	<b>AMS2437™</b>	<b>REV. E</b>
	Issued 1971-11 Reaffirmed 2012-08 Revised 2024-12	
Superseding AMS2437D		
Coating, Plasma Spray Deposition		

### RATIONALE

AMS2437E results from a Five-Year Review and update of this specification with changes to Ordering Information, powder specifications and coating properties (see Table 1), Procedure (see 3.5.4), Quality (see 3.7.2 and 3.7.3), Periodic Tests (see 4.2.2), and Note (see 8.5).

### NOTICE

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

- Purchase order or engineering drawing shall specify not less than the following.
  - AMS2437E
  - Quantity of pieces to be coated
  - Coating material (see 3.5.4)
  - Finished coating thickness desired (see 3.5.4)
  - Standards for acceptance of cup test or bend test and microexamination (see 3.6.1 and 3.6.4)
- 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.
- The parts manufacturer shall ensure that surfaces of metal parts supplied to the processor are free from blemishes, pits, tool marks, and other irregularities that will affect the quality of the finished parts (see 3.7.2).

### 1. SCOPE

#### 1.1 Process

This specification covers the engineering requirements for applying coatings to parts by the plasma spray process and the properties of such coatings.

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For more information on this standard, visit  
<https://www.sae.org/standards/content/AMS2437E/>

## 1.2 Application

This coating has been used typically to provide protection from wear, heat, corrosion (with sealer), and abrasion. The coating can also be used to restore dimensionally discrepant parts, but usage is not limited to such applications.

## 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](http://www.sae.org).

AMS4027	Aluminum Alloy, Sheet and Plate, 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061; -T6 Sheet, -T651 Plate), Solution and Precipitation Heat Treated
AMS4117	Aluminum Alloy, Rolled or Cold Finished, Bars, Rods, and Wire, and Flash Welded Rings, 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061; -T6, -T651)
AMS4911	Titanium Alloy, Sheet, Strip, and Plate, 6Al - 4V, Annealed
AMS4928	Titanium Alloy, Bars, Wire, Forgings, Rings, and Drawn Shapes, 6Al - 4V, Annealed
AMS5510	Steel, Corrosion- and Heat-Resistant, Sheet, Strip, and Plate, 18Cr - 10.5Ni - 0.40Ti (SAE 30321), Solution Heat Treated
AMS5645	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Mechanical Tubing, Rings and Forging Stock, 18Cr - 10Ni - 0.40Ti (321), Solution Heat Treated
AMS5791	Cobalt Alloy, Powder, Plasma Spray, 56.5Co - 25.5Cr - 10.5Ni - 7.5W
AMS5792	Powder, Plasma Spray, 50 (88WC - 12Co) + 35 (70Ni - 16.5Cr - 4Fe - 4Si - 3.8B) + 15 (80Ni - 20Al), Three-Component Mixture
AMS5793	Powder, Plasma Spray, 95Ni - 5Al
AMS6350	Steel Sheet, Strip, and Plate, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)
AMS6370	Steel, Bars, Forgings, and Rings, 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130)
AMS7875	Powder, Chromium Carbide Plus Nickel-Chromium Alloy, 75Cr <sub>3</sub> C <sub>2</sub> + 25 (80Ni - 20Cr Alloy)
AMS7879	Tungsten Carbide-Cobalt Powder
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](http://www.astm.org).

ASTM C633 Adhesion or Cohesion Strength of Thermal Spray Coatings

ASTM E384 Microindentation Hardness of Materials

## 2.3 Definitions

Terms used in AMS are defined in AS7766.

## 3. TECHNICAL REQUIREMENTS

### 3.1 Equipment

#### 3.1.1 Torch

A specially constructed torch that dissociates and ionizes a suitable plasma-forming gas when an electric arc is struck between an anode and cathode. Coating particles, which are injected into the resultant high-velocity, high-temperature flame, are heated to plasticity and propelled toward the workpiece to be coated.

#### 3.1.2 Gas

A suitable plasma-forming gas, as used in 3.1.1, may be any of the following, but the gas used shall be acceptable to the cognizant engineering organization (CEO):

- Nitrogen
- Mixtures of nitrogen and hydrogen
- Argon
- Mixtures of argon and hydrogen
- Mixtures of argon and helium

3.1.2.1 For substrates of titanium, titanium alloys, and steels heat treated above 180 ksi (1241 MPa) tensile strength, the plasma-forming gases shall be argon or a mixture of argon and helium.

#### 3.1.3 Coating Material

Shall be a powder conforming to the specification required by the coating designation (see 3.5.1) specified. All powder shall be dry, free-flowing, and uniformly blended.

### 3.2 Personnel

Operators or other personnel performing manual plasma spray operations shall be trained to spray using each material and gas system designated. Competence of the manual spray operator or of fully mechanized equipment shall be demonstrated by spraying a set of test specimens as in 4.5.1, which shall meet the requirements of 3.6.

### 3.3 Operation Sheets

For each different part number to be sprayed, an operation sheet shall be established covering preparation, preheating, and spraying parameters. Figure 1 shows a typical operation sheet; use of the format shown is not mandatory provided all applicable information thereon is shown. A single operation sheet may cover more than one part number if all parameters for coating the parts are the same. This operation sheet shall be available for review by the purchaser and the CEO upon request.

### 3.4 Preparation

3.4.1 Surfaces to be coated shall be machined to allow for the finished thickness of the coating.

3.4.2 Surfaces to be coated shall be cleaned to remove water, oil, grease, dirt, scale, paint, and other foreign matter detrimental to adherence of the sprayed coating. Special cleaning procedures shall be employed in treating titanium parts to avoid hydrogen embrittlement and halide contamination. Cleaned surfaces shall be handled only with clean cloth or gloves before coating.

3.4.3 Parts shall be suitably masked to protect surfaces not required to be coated.

3.4.4 Surfaces to be coated shall be grit blasted to produce a uniform matte finish sufficient to produce good adhesion of the coating. The grit type and size shall be reported in the operation sheet for each part. Surfaces shall not be blasted with grit previously used on dissimilar materials.

### 3.5 Procedure

#### 3.5.1 Coating Designation

3.5.1.1 The required coating material may be specified by this specification number and a suffix number designating the powder to be used, in accordance with Table 1; e.g., AMS2437-2 indicates that parts are to be coated with AMS7875 powder. Coating materials other than those shown in Table 1 may be used when specified by the CEO.

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**Table 1 - Powder specifications and coating properties<sup>(1)</sup>**

Coating Designation	Powder Specification Number	Bond Strength psi (MPa) Min	Average Hardness HV300 Min	Average Hardness HV300 Max	Nominal Composition
AMS2437-2	AMS7875	6000 (41)	500	850	75 Chromium Carbide, 25 (80 Nickel - 20 Chromium Alloy)
AMS2437-3	AMS7879	6500 (45)	700	N/A	88 Tungsten Carbide, 12 Cobalt (Cast and Crushed)
AMS2437-5	AMS5791	6000 (41)	N/A	N/A	56.5 Cobalt - 25.5 Chromium - 10.5 Nickel - 7.5 Tungsten
AMS2437-6	AMS5792	6000 (41)	N/A	N/A	50 (88 Tungsten - 12 Cobalt) + 35 (70 Nickel - 16.5 Chromium - 4 Iron - 4 Silicon - 3.8 Boron) + 15 (80 Nickel - 20 Aluminum) Three-Component Mixture
AMS2437-7	AMS5793	5000 (35)	N/A	N/A	95 Nickel, 5 Aluminum

<sup>(1)</sup> AMS2437-1 and AMS2437-4 have been deleted as the powder specifications used for them have been canceled and may no longer be produced.

- 3.5.2 Surfaces to be coated shall be preheated, as required, to remove moisture and to control expansion of the part with respect to the coating. Preheating may be accomplished by use of the plasma torch or by other suitable means. Temperature of the part during preheating and spraying shall be controlled to prevent discoloration, oxidation, distortion, and other conditions detrimental to the coating or substrate. Special precautions shall be taken in coating high-thermal-conductivity materials, such as aluminum and magnesium, to avoid overheating.
- 3.5.3 Areas on which coating is optional shall, if coated, be prepared, handled, and coated in the same manner as the areas on which coating is required.
- 3.5.4 The specified coating material shall be deposited onto the designated surfaces to the specified thickness stated in the operation sheet for each part. Minimum coating thickness requirements do not apply to areas designated as optional coating areas.
- 3.5.5 Surface Finishing

Procedures for grinding and lapping shall be acceptable to the CEO.

### 3.6 Properties

The coating on parts and representative test specimens shall conform to the following requirements:

#### 3.6.1 Adhesion

##### 3.6.1.1 Cup Test

Test panels shall not show separation of the coating from the substrate when tested in accordance with 4.5.2 and examined without magnification. Standards for acceptance shall be as specified by the CEO. Test is not applicable to ceramic coatings.

##### 3.6.1.2 Bend Test

This test may be substituted for the cup test of 3.6.1.1 when permitted by the CEO. Test panels shall not show separation of the coating from the substrate when tested in accordance with 4.5.3 and examined without magnification. Standards for acceptance shall be as specified by the CEO. This test is not applicable to ceramic coatings.

#### 3.6.2 Bond Strength

Shall be as stated in Table 1, determined in accordance with ASTM C633.

#### 3.6.3 Hardness

Average hardnesses as calculated from a minimum of ten representative readings of coatings, determined in accordance with ASTM E384 on cross sections of those coatings, shall be as stated in Table 1.

#### 3.6.4 Microexamination

Examination of the deposited coatings shall show the coatings to be free from cracks, excessive and massive oxides, and excessive porosity. Coatings shall be essentially free from grit particles and contamination at the interface between the coating and substrate. Metallographic standards for acceptance shall be as specified by the CEO.

### 3.7 Quality

3.7.1 The coating, as received by the purchaser, shall be adherent to the basis metal and shall have a uniform, continuous surface free from spalling, chipping, flaking, and other imperfections detrimental to usage of the coating.

3.7.2 Imperfections in appearance that arise from surface conditions of the substrate, such as weld areas, variations in surface finish roughness, porosity, scratches, or inclusions, that persist in the finished coating despite observance of industry-accepted coating practices shall not be considered as cause for rejection of the coating (see 8.5).

3.7.3 If the coating is specified to be subsequently ground or machined, the above requirements are not required to be inspected for.

### 3.8 Tolerances

A tolerance of -0 and +0.125 inch (+3.18 mm) is permissible on the boundaries of areas designated to be coated.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for Inspection

The processor of coated parts shall supply all samples for the processor's tests and shall be responsible for performance of all required tests. The purchaser and the cognizant quality organization (CQO) reserve the right to sample and to perform any confirmatory testing deemed necessary to ensure that the coating conforms to the requirements of this specification.

## 4.2 Classification of Tests

### 4.2.1 Acceptance Tests

Thickness (see 3.5.4), adhesion (see 3.6.1), hardness (see 3.6.3), microexamination (see 3.6.4), quality (see 3.7), and tolerances (see 3.8) of coated parts are acceptance tests and shall be performed to represent each lot.

### 4.2.2 Periodic Tests

Bond strength of test specimens (see 3.6.2) is a periodic test and shall be performed at a frequency selected by the processor unless frequency of testing is specified by the CQO.

### 4.2.3 Preproduction Tests

All technical requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of coated parts to a purchaser, when a change in processing requires reapproval as in 4.4.2, and when the purchaser, the CEO, or the CQO deems confirmatory testing to be required.

## 4.3 Sampling

For this specification, a lot shall be all parts of essentially the same configuration coated in a continuous operation to the same range of thickness with powder from the same batch and presented for the processor's inspection at one time.

### 4.3.1 Sampling for Acceptance Tests

#### 4.3.1.1 Thickness and Properties of Test Specimens

Two sets of specimens, one coated at the beginning and one coated at the end of each lot.

#### 4.3.1.2 Quality and Tolerances of Coated Parts

As acceptable to the CQO.

### 4.3.2 Sampling for Periodic Tests and Preproduction Tests

As determined by the processor unless otherwise specified by the CQO.

## 4.4 Approval

4.4.1 The operation sheet and control factors and/or a preproduction part, whichever is specified, shall be approved by the CEO before production parts are supplied.

4.4.2 The processor shall make no significant change to materials, operation sheet, or control factors (see Figure 1) from those on which the approval was based, unless the change is approved by the CEO. A significant change is one that, in the judgment of the CEO, could affect the properties or performance of the parts.

## 4.5 Test Methods

### 4.5.1 Test Specimens

Cup, bend, bond, and microexamination test specimens shall be made from the materials as shown in Table 2, unless otherwise permitted by the CEO.

**Table 2 - Test specimens**

Material of Part to be Coated	Bond Strength Specimen	Cup and Bend Specimens
All Steels	AMS6370	AMS6350
Nickel Alloy or Cobalt Alloy	AMS5645	AMS5510
Aluminum Alloy or Magnesium Alloy	AMS4117	AMS4027
Titanium or Titanium Alloy	AMS4928	AMS4911

#### 4.5.2 Cup Test

Test specimens, approximately 3 x 1.75 x 0.05 inches (76 x 44 x 1.3 mm), shall be coated on one side with the same material as the parts to the applicable thickness shown in Table 3, using as far as practicable the same preparation, equipment, and machine settings as for the parts they represent. The specimen shall be cup tested on a Detroit or equivalent testing machine using a 0.875-inch (22-mm) diameter ball and die with a 1.375-inch (35-mm) diameter opening to form a depression in the panel to a depth of 0.300 inch (7.6 mm), except 0.200 inch (5.1 mm) for fine powders up to 20 microns (20  $\mu\text{m}$ ). The cup shall be drawn at a slow, uniform deformation rate with the coated side of the panel on the outside of the cup.

#### 4.5.3 Bend Test

Test specimens, approximately 3 x 1 x 0.05 inches (76 x 25 x 1.3 mm), shall be coated on one side with the same material as the parts to a thickness as shown in Table 3, using as far as practicable the same preparation, equipment, and machine settings as for the parts they represent. Specimens shall be tested by bending the panel 90 degrees around a 1/2-inch (12.7-mm) diameter bar in a direction away from the coating (coating on OD of bend) at a rate of approximately 4 degrees per second.

**Table 3 - Test specimen coating thickness<sup>(1)</sup>**

Coating Designation	Cup or Bend Inch	Cup or Bend Millimeter	Bond Strength Inch	Bond Strength Millimeter
AMS2437-2	0.004 to 0.006	0.10 to 0.15	0.009 to 0.012	0.23 to 0.30
AMS2437-3	0.004 to 0.006	0.10 to 0.15	0.009 to 0.012	0.23 to 0.30
AMS2437-5	N/A	N/A	0.008 to 0.010	0.20 to 0.25
AMS2437-6	N/A	N/A	0.008 to 0.010	0.20 to 0.25
AMS2437-7	N/A	N/A	0.008 to 0.010	0.20 to 0.25

<sup>(1)</sup> AMS2437-1 and AMS2437-4 have been deleted as the powder specifications used for them have been canceled and may no longer be produced.

#### 4.6 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, AMS2437E, part number, and quantity.

#### 4.7 Resampling and Retesting

If any specimen used in the above tests fails to meet the specified requirements, disposition of the coated parts may be based on the results of testing three additional specimens, except as stated in 4.7.1, for each original nonconforming specimen. Except as stated in 4.7.2, failure of any retest specimen to meet the specified requirements shall be cause for rejection of the parts represented.