



AEROSPACE MATERIAL SPECIFICATION

AMS2447™**REV. D**

Issued 1998-05
Revised 2012-01
Reaffirmed 2019-01

Superseding AMS2447C

Coating, Thermal Spray
High Velocity Oxygen/Fuel Process

RATIONALE

AMS2447D results from a Five Year Review and update of this specification.

1. SCOPE

1.1 Purpose

This specification covers the requirements for thermal spray coatings applied using the high velocity oxygen fuel (HVOF) combustion process. This specification is not intended to be used for duplex coatings, i.e., the application of the coating over a previously applied coating.

1.2 Application

This process has been used typically to provide coatings of lower porosity and higher adhesive, and/or cohesive, strength than generally attainable with typical plasma spray processes for applications requiring wear, heat, and corrosion resistance and for dimensional restoration, 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.

1.4 Classification

Type 1 - Coatings with no residual stress requirements

Type 2 - Coatings where the residual stress state is specified

1.4.1 If no Type is specified Type 1 shall be provided.

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 revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2019 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
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE AMS2447D

SAE values your input. To provide feedback on this Technical Report, please visit <http://standards.sae.org/AMS2447D>

Documents
Document Sharing Hub

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 724-776-4970 (outside USA), www.sae.org.

AMS4027	Aluminum Alloy, Sheet, and Plate, 1.0Mg - 0.060Si - 0.28Cu - 0.2Cr (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), Solution and Precipitation Heat Treated
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
AMS5596	Nickel Alloy, Corrosion and Heat-Resistant, Sheet, Strip, Foil and Plate, 52.5Ni - 19Cr - 3.0Mo - 5.1Cb (Nb) - 0.90Ti - 0.5Al - 18Fe, Consumable Electrode Remelted or Vacuum Induction Melted, 1775 °F (968 °C) Solution Heat Treated
AMS5645	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings, 18Cr - 10Ni - 0.40Ti (SAE 30321), Solution Heat Treated
AMS5662	Nickel Alloy, Corrosion and Heat-Resistant, Bars, Forgings, and Rings, 52.5Ni - 19Cr - 3.0Mo - 5.1Cb (Nb) - 0.90Ti - 0.50Al - 18Fe, Consumable Electrode or Vacuum Induction Melted, 1775 °F (968 °C) Solution Heat Treated, Precipitation-Hardenable
AMS7879	Tungsten Carbide-Cobalt Powder, Cast and Crushed
SAE J442	Test Strip, Holder, and Gage for Shot Peening

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 C 633 Adhesion or Cohesive Strength of Flame-Sprayed Coatings

ASTM E 384 Microhardness of Materials

2.3 ASME Publications

Available from American Society of Mechanical Engineers, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

ASME B46.1 Surface Texture (Surface Roughness, Waviness, and Lay)

3. TECHNICAL REQUIREMENTS

3.1 Equipment

3.1.1 Torch

A specially constructed gun that uses combustion products to generate a high velocity gas stream for heating the coating material to a molten or plasticized state and transfers the coating material to the work piece shall be used.

3.1.2 System

The system shall be fitted with controls for adjusting and monitoring the gas(es) and fuel(s) used to operate the torch.

3.1.2.1 Indicating devices used as a system controls, as applicable to the process gases and fuels, shall have a minimum accuracy as follows: pressure gauges $\pm 1.5\%$ of full scale; flow meters $\pm 2\%$ of full scale.

3.1.3 Powder Feeder

The powder feed system shall supply a metered flow of material.

3.2 Materials

3.2.1 Gases and Fuels

Specifications chosen by the processor to procure these materials shall be acceptable to purchaser.

3.2.2 Coating material shall conform to the specification referenced by the drawing or otherwise specified by purchaser. All powders shall be dry, free flowing and uniformly blended.

3.2.2.1 Coating Designation

Coating specification number and appropriate suffix number designate the material composition to be applied in accordance with Table 1, e.g., AMS2447-7 means the part shall be coated with 78W - 16Co - 5.1C powder.

3.3 Preparation

3.3.1 Cleaning

Surfaces to be coated shall be thoroughly cleaned to remove moisture, oil, grease, dirt, scale, paint and other foreign material. Final cleaning shall take place no more than 4 hours prior to coating. Cleaning procedures shall not cause hydrogen embrittlement or cause other detrimental effects to materials to be coated.

3.3.2 Masking

Parts shall be masked to protect surfaces that are not to be coated.

3.3.3 Surface Conditioning

Surfaces to be coated may be grit blasted with clean, dry, oil free grit. After grit blasting loose particles shall be removed from the surface by a dry filtered air blast, brushing with a clean nylon brush, or other applicable methods that do not contaminate the prepared surface. A maximum average surface roughness of 150 microinches (3.81 microns) shall not be exceeded for Type 2 coatings. Surface finish measurements shall be made in accordance with ASME B46.1.

3.4 Application

3.4.1 Preheating

Surfaces to be coated shall be preheated as necessary to remove moisture. Preheating may be accomplished by use of the torch or by other suitable means. Maximum substrate temperature during preheating shall not exceed limits shown in 3.4.3.

TABLE 1 - POWDER SPECIFICATION

Coating Designation	Typical Composition	Recommended Method of Manufacture	Recommended Particle Size, Microns
AMS2447-1	57Co - 25Cr - 10Ni - 7W	Gas Atomized	-45/+5
AMS2447-2	60Co - 29Mo - 8Cr - 3Si	Gas Atomized	-45/+10
AMS2447-3	69Cr - 20Ni - 11C (75Cr ₃ C ₂ - 25 Ni Cr)	Sintered	-53/+10
AMS2447-4	95Ni - 5Al (Alloyed Ni-Al)	Gas Atomized	-45/+15
AMS2447-5	76Ni - 18Cr - 6Al (Alloyed Ni-Cr-Al)	Gas Atomized	-45/+15
AMS2447-6	60Ni - 19Cr - 18Fe - 3Mo	Gas Atomized	-53/+15
AMS2447-7	78W - 16Co - 5.1C (83WC - 17Co)	Agglomerated Sintered	-53/+10
AMS2447-8	82W - 11Co - 4.1C (88WC - 12Co, AMS7879)	Cast	-45/+5
AMS2447-9	82W - 10Co - 4Cr - 3.5C (86WC - 10Co - 4Cr)	Sintered	-53/+10
AMS2447-10	86W - 10Ni - 3.5C (90WC - 10Ni)	Cast	-53/+10

3.4.2 Coating

Coating material shall be deposited on the designated surface to a sufficient thickness to permit finishing to specified dimensions. Coating thickness requirements do not apply to areas designated as optional coating areas.

3.4.2.1 Areas on which coating is optional shall, if coated, be prepared and handled in the same manner as the area on which coating is required.

3.4.2.2 Spray deposition shall be continuous, except for interruptions to measure coating thickness and/or for cooling cycles to maintain part below maximum allowable temperature.

3.4.3 Substrate Temperature

Unless otherwise specified, maximum temperature of the substrate during preheating and coating application shall not exceed the temperatures shown in Table 2.