



AEROSPACE MATERIAL SPECIFICATION

AMS2452™

Issued 2011-06
Reaffirmed 2025-01

Superfinishing of HVOF Applied Tungsten Carbide Coatings

RATIONALE

Superfinishing is a process that follows in the process sequence after grinding of tungsten carbide HVOF coatings that have been ground in accordance with AMS2449. The superfinishing process requires different equipment and procedures from grinding and therefore merits separate documentation.

AMS2452 has been reaffirmed to comply with the SAE Five-Year Review policy.

NOTICE

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

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

- AMS2452
- Basis metal under tungsten carbide
- Type of HVOF tungsten carbide coating to be superfinished. See AMS2447 or AMS2448.
- Coating thickness required after superfinishing
- Coating acceptance criteria if not as specified herein
- Minimum and maximum surface finish requirements. Examples: Ra (average roughness), Rz (average peak to valley height), Rp (mean line to highest peak height), Tp/Mr/Rtp/Rmr (bearing ratio), or other relevant parameters may be specified as necessary to adequately characterize the required surface finish depending on the application. See 3.6 and 8.2.7.
- Finish diameter and/or dimensional requirements after processing. See 8.5.
- Quantity of parts to be superfinished

SAE Executive Standards Committee 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 © 2025 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, or used for text and data mining, AI training, or similar technologies, 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 AMS2452

For more information on this standard, visit
<https://www.sae.org/standards/content/AMS2452/>

Documents

Standard Sharing Hub

1. SCOPE

1.1 Purpose

This specification covers requirements for the superfinishing of High Velocity Oxygen/Fuel (HVOF) applied tungsten carbide thermal spray coatings.

1.1.1 Superfinishing is a process used to produce high quality surface finishes characterized by low Ra (roughness average), such as 8 μ inch Ra or less, in comparison to conventional ground coatings as in AMS2449. See 8.2.6.

1.2 Application

This process has been used typically to superfinish tungsten carbide HVOF coatings applied in accordance with AMS2447 or AMS2448 to high strength steels for applications requiring wear, heat, and corrosion resistance or dimensional restoration, such as aircraft landing gear and hydraulic actuator components. However, usage is not limited to such applications. Tungsten carbide HVOF coated surfaces for seal applications such as hydraulic actuators typically require a surface roughness of 0 to 4 μ inch (0 to 0.1 μ m) Ra. Tungsten carbide HVOF-coated surfaces mating with a bushing or sleeve typically require a surface finish of 4 to 8 μ inch (0.1 to 0.2 μ m) Ra. This process follows grinding of HVOF coatings processed in accordance with AMS2449. The intent of this specification, in addition to improving surface finish, is to change the morphology or surface characteristics in order to prolong the service life of the component.

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.

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.

AMS2447	Coating, Thermal Spray, High Velocity Oxygen/Fuel Process
AMS2448	Application of Tungsten Carbide Coatings on Ultra High Strength Steels, High Velocity Oxygen/Fuel Process
AMS2449	Grinding of HVOF Sprayed Tungsten Carbide Coatings Applied to High Strength Steels
ARP5935	Use of HVOF Thermal Spray Coatings for Hard Chrome Replacement in Landing Gear Applications

2.2 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 Parts to be superfinished shall have been coated with tungsten carbide coating in accordance with AMS2447 or AMS2448 and ground to a surface roughness of 12 to 20 μinch (0.3 to 0.5 μm) Ra in accordance with AMS2449.

3.2 Surface Finish

Unless otherwise specified by the cognizant engineering organization, the surface roughness after superfinishing shall be 4 μinch (0.1 μm) Ra or better. Surface finish shall meet the minimum and maximum values specified for Ra, Rp, Rz, and Tp/Mr/Rtp/Rmr or other parameters specified by the purchaser, including finish diameter and/or dimensional requirements after all processing has been completed. See 8.2.7 and 8.5. Type 1 surfaces in accordance with ARP5935 are surfaces that require sealing a hydraulic fluid with a sliding interface, such as landing gear struts and hydraulic actuator piston rods. To maximize seal life for these applications, superfinishing to 4 μinch (0.1 μm) Ra or better is required. ARP5935 recommended surface finish parameters for Type 1 surfaces include Rz of 40 μinch maximum (1.0 μm), Rp of 8 μinch maximum (0.2 μm), Rmr 70 to 90% at $C_o=5\%$ and $C_1=0.25Rz$. See 3.6 and 8.2.7.

3.3 Cleaning

Protective coatings and other foreign materials shall be removed from parts prior to superfinishing to preclude contamination of cutting fluid (coolant) and abrasives.

3.4 Superfinishing Process Requirements

Parts shall be processed in accordance with 3.4.1 or 3.4.2. The superfinishing process shall be performed in accordance with Tables 1, 2, or 3, as applicable, and Figures 1 or 2, a stone or tape Superfinishing Process Control Sheet (or equivalent acceptable to the cognizant engineering organization), as applicable, to result in acceptable parts.

3.4.1 Stone Method

The superfinishing equipment shall be mounted as an attachment on a suitable support machine (such as a lathe) capable of providing rotation to the workpiece and traverse of the attachment. A self-dressing, superfinishing stone shall be inserted into the stone guide. The stone shall oscillate perpendicular to the direction of rotational velocity of the component being superfinished. Stone guides shall be attached to pneumatic pistons and shall provide constant contact force, rather than being set to a specified infeed or discrete stock removal depth per pass.

3.4.1.1 Superfinishing Stones

A diamond abrasive stone shall be used. See 8.6.

3.4.1.1.1 Each of the following parameters shall be met when selecting an abrasive stone.

3.4.1.1.1.1 Abrasive shall be metal-bonded diamond.

3.4.1.1.1.2 Grit or grain size shall be 9 to 30 μm .

3.4.1.2 Cutting Fluids (Coolants) Used for Stone Superfinishing

Honing oil or mineral oil shall be used as a flushing medium to rinse away the particles between the stone and workpiece. Honing oil or mineral oil shall be applied to the part and stone during operation.

3.4.1.3 Workpiece Surface Speed Used for Stone Superfinishing

Unless otherwise specified, the surface speed of the workpiece shall be 25 to 75 surface feet per minute (SFPM) (7.5 to 22 m/minute). Direction of rotation shall be "forward" or counter-clockwise so that applied fluid is carried directly underneath the stone.

3.4.1.4 Contact Pressure for Stone Superfinishing

On typical applications with typical superfinishing units the contact pressure shall be 30 to 45 psi (2 to 3 bars).

3.4.1.5 Traverse Rates

Unless otherwise specified, traverse rates shall be 0.062 to 0.125 inches per revolution (IPR) (1.6 to 3.2 mm per revolution). If spiral or other undesired optical patterns are being generated due to the traverse rate, traverse rate shall be consequently decreased.

3.4.1.6 Oscillation Rates

Unless otherwise specified, the oscillation rate shall be 900 to 2400 strokes per minute (15 to 40 Hz).

3.4.1.7 Processing with Diamond Polishing Paste

After processing with the diamond stone is complete and the workpiece surface roughness has been brought down to the specified surface roughness, a diamond paste shall be used as required to remove spiral or other undesirable optical patterns using a hardwood/felt pad block. The part shall be cleaned to remove honing oil using a suitable method such as with acetone or alcohol in preparation for the diamond paste. The felt pad shall be saturated with mineral oil (or equivalent acceptable to the cognizant engineering organization) and a thin strip of diamond paste applied to the pad. The diamond paste shall be evenly spread over the surface of the felt pad.

3.4.1.7.1 Polishing Paste Abrasive Requirements

3.4.1.7.1.1 Abrasive shall be diamond.

3.4.1.7.1.2 Grit or grain size shall be 3 µm or 6 µm.

3.4.1.8 Surface Speed When Using Diamond Polishing Paste

The surface speed of the workpiece shall be 75 to 150 surface feet per minute (SFPM) (23 to 46 m per minute). Direction of rotation shall be "forward" or counter-clockwise so that applied fluid is carried directly underneath the stone.

3.4.1.9 Contact Pressure

Contact pressure for polishing using diamond paste shall be 45 to 60 psi (3 to 4 bars).

3.4.1.10 Stone Superfinishing Method

Surface finish requirements versus grit size selection for stone superfinishing shall be as specified in Table 1. Incoming surface quality will affect the results. Alternative grit sizes may be used when approved by the cognizant engineering organization.