

MIL-STD-1884(AT)
Notice 1
27 August 1986

MILITARY STANDARD

COATING, PLASMA SPRAY DEPOSITION

TO ALL HOLDERS OF MIL-STD-1884(AT):

1. THE FOLLOWING PAGES OF MIL-STD-1884(AT) HAVE BEEN REVISED AND SUPERSEDED THE PAGES LISTED:

| NEW PAGE | DATE | SUPERSEDED PAGE | DATE |
|----------|----------------|-----------------|--------------------------|
| 1 | 27 August 1986 | 1 | 29 July 1985 |
| 2 | 29 July 1985 | 2 | REPRINTED WITHOUT CHANGE |
| 11 | 29 July 1985 | 11 | REPRINTED WITHOUT CHANGE |
| 12 | 27 August 1986 | 12 | 29 July 1985 |
| 13 | 27 August 1986 | 13 | 29 July 1985 |
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2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-1884(AT) will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the military standard is completely revised or canceled.

Custodian:
Army - AT

Preparing activity:
Army - AT

(Project MFFP-A371)

AMSC N/A

AREA MFFP

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1. SCOPE

1.1 Purpose. The procedures covered by this standard are intended to be used to ensure that plasma spray coating operations, either manual or automated, meet prescribed requirements. This process can be used on parts requiring protection from wear, heat, corrosion (with sealer), abrasion and to restore dimensionally discrepant parts.

1.2 Scope. This standard covers the requirements for thermal coating by means of plasma spray deposition.

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2. REFERENCED DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

SPECIFICATIONS
MILITARY

MIL-P-80109

- Plasma Spray Systems, Powder, Guns, and Accessories.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific acquisition functions should be obtained from the acquisitioning authority or as directed by the contracting officer.)

PUBLICATIONS
US DEPARTMENT OF LABOR

OSHA - Safety and Health Standards
(29 CFR 1910,) General Industry.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402.)

2.2 Other publications. The following documents form a part of this standard to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)
SPECIFICATIONS

| | |
|-----------|--|
| AMS 2750 | - Pyrometry. |
| AMS 4026 | - Aluminum Alloy, Sheet and Plate. |
| AMS 4117 | - Aluminum Alloy, Bars and Rings. |
| AMS 4901 | - Titanium Alloy, Sheet, Strip and Plate. |
| AMS 4928 | - Titanium Alloy, Bars and Forgings. |
| AMS 6350 | - Steel, Sheet, Strip and Plate. |
| AMS 6382 | - Steel, Bars, Forgings, and Rings. |
| SAE J 877 | - Properties of Low Carbon Steel Sheets and Strip and Their Relationship to Formability. |

(Copies may be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Avenue, Warrendale, PA 15096.)

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5.2.1 Visual. All parts and assemblies, (before and after machining), test panels, and test specimens, shall be visually inspected to verify that plasma coating is adherent to the substrate material and has a uniform continuous surface free from spalling, chipping, flaking, cracking, and other objectionable imperfections.

5.2.2 Cup test. A test panel (see 5.1.2.1) shall be cup tested to verify conformance to the applicable coating material specification requirements as follow:

- a. Draw the panel on a testing machine equipped with dies (see 4.1.3) to form a cup shape as specified in ASTM E643. The test panel shall be drawn at a prescribed rate with the coated side of the panel being opposite the punch.
- b. Draw the panel to the depth specified in the applicable coating material specification.
- c. Examine coated surface of panel for indications of coating failure. Cracking shall be acceptable provided there is no evidence of flaking or spalling. Flaking or spalling of the coating shall be rejected.

Note: Other devices may be used for cup testing provided equivalent results are obtained and it is approved by the acquisitioning authority materials laboratory.

5.2.3 Bond strength test. Two bond strength test specimens (see 5.1.2.3) shall be bonded together to form a single test specimen and the test specimen shall be bond strength tested to verify conformance to the applicable coating material requirements as follow:

- a. Remove masking materials.
- b. Verify that bonding end of the uncoated section of the test specimen has been cleaned, dried, and abrasive-blasted.
- c. Apply an adhesive (see 4.2.3) to the bonding ends of the coated and uncoated sections of the test specimen.
- d. Accurately align and join the ends of the two specimens.

Note: A fixture may be used to facilitate bonding of the test specimen.

- e. Cure the adhesive in a hot air circulating oven at the temperature recommended by the manufacturer.
- f. After bonding, dress the edge of the coating flush with the outside diameter of the test specimen.

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Note: An abrasive disc or wheel may be used for this purpose but care shall be taken that the disc or wheel moves parallel to the centerline of the test specimen. Care shall be taken during dressing to ensure the temperature does not increase to affect the bond adhesion.

- g. Test the bond specimen with a standard laboratory tensile tester equipped with universal joint grippers for each end of the joined specimens. Set the no-load cross-head speed at approximately 0.050 inch (1.27 mm) per minute.

5.2.4 Micro examination. A microscopic examination of a specimen cut normal to the coating surface shall not reveal any cracks, excessive or massive oxides or porosity when examined at an appropriate magnification in the etched and unetched condition in accordance with the procedures outlined in ASTM E3 and ASTM E407.

5.2.4.1 Oxides and porosity. Excessive porosity shall be defined as not greater than 1 percent when viewed at 100X after etching. Excessive or massive oxides shall be defined as not greater than 3 percent for coatings where oxygen is not an integral part of the material. Examination of the part for oxides shall be at 100X after etching. A minimum of 16 square inches (4 inches X 4 inches) of field shall be viewed at 100 percent for determining massive or excessive oxides or porosity.

Note: The metallurgical specimen initially approved for a particular plasma spray application shall be the minimum acceptance standard for that plasma spray application.

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6. NOTES

6.1 Safety. Use of plasma spray equipment involves exposure to certain safety hazards specified in "OSHA Safety and Health Standards (29 CFR 1910), General Industry".

6.2 Cup test machine. The base machine to be used for this test shall be the industry accepted model available from Detroit Testing Machine Co., Detroit, Michigan or an approved equivalent (see 4.1.3).

6.3 Subject term (key word) listing.

Coating
Plasma

6.4 Supersession data. This standard supersedes AVCO Lycoming Division, Stratford, Connecticut, specification No. P6405D entitled "Coating, Plasma Spray Deposition", dated 27 January 1983.

Custodian:
Army - AT

Preparing activity:
Army - AT

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TABLE I. Typical plasma spray control sheet.
Sheet ____ of ____.

VENDOR _____ VENDOR PROCESS # _____
 PURCHASE ORDER NUMBER _____
 PART NUMBER _____ S/N _____
 AREA TO BE COATED _____
 PART MATERIAL _____
 GUN TYPE _____ GUN MODEL _____ NOZZLE _____

PART PREPARATION

METHOD OF CLEANING _____
 MASKING INFORMATION _____
 GRIT TYPE AND SIZE _____
 GRIT BLAST PRESSURE (PSI) _____ + Suction _____ Pressure _____
 NOZZLE TO WORK DISTANCE _____

ARC GAS

GAS (1) PRIMARY _____
 GAS (2) SECONDARY _____
 Regulator (1) PSI _____ +
 Regulator (2) PSI _____ +
 Console (1) PSI _____ +
 Console (2) PSI _____ +
 Console Flow (1) C.F.H. _____ +
 Console Flow (2) C.F.H. _____ +

POWER

Voltage DC Operating _____ +
 Amperes DC Operating _____ +

COATING MATERIAL

Material Specification _____ Other _____
 Material Lot # _____

COATING DATA

Elapsed Time Between Surface Prep and Spraying _____
 Powder Feed Rate (LB/HR) _____
 Powder Port _____ Meter Wheel _____
 Gun to Work Distance _____ Carrier Gas Flow _____
 Minimum Gun to Work Angle _____
 Part RPM _____ + Surface Feed/Min _____ +
 Coating Thickness as Sprayed _____
 Preheat Temp _____ + Method of Preheat _____
 Max Part Temp During Spraying _____
 Number of Passes Per Cycle _____
 Cool Timer Per Cycle _____ +
 Method of Cooling Air _____ Gas _____ Static _____
 Total Number of Cycles (Cool & Spray) _____ +
 CERTIFICATION # _____
 APPROVAL _____

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