



AEROSPACE MATERIAL SPECIFICATION	AMS2448™	REV. C
	Issued 2004-10 Revised 2020-12	
	Superseding AMS2448B	
(R) Application of Tungsten Carbide Coatings on Ultra High Strength Steels High Velocity Oxygen / Fuel Process		

RATIONALE

AMS2448C results from a Five-Year Review and update of this specification. It is complete revision, and therefore, there are no change bars to indicate specific changes from the last revision.

1. SCOPE

1.1 Purpose

This specification covers engineering requirements for applying tungsten carbide thermal spray coatings to ultra-high strength steels (220 ksi and above) utilizing high velocity oxygen fuel (HVOF) combustion driven processes and the properties for such coatings. The processes and procedures herein apply only to the properties of the as-deposited coating.

1.2 Application

This process has been used typically to provide coatings that possess lower porosity and higher adhesive and/or cohesive strength than generally attainable with plasma spray and for applications requiring wear, heat, and corrosion resistance or dimensional restoration that were traditionally chrome plated. However, 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 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.

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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.

AMS6345	Steel, Sheet, Strip, and Plate 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130) Normalized or Otherwise Heat Treated
AMS6356	Steel, Sheet, Strip, and Plate, 0.95Cr - 0.20Mo - (0.30 - 0.35C) (4132)
AMS6454	Steel, Sheet, Strip, and Plate, 1.8Ni - 0.80Cr - 0.25Mo (0.38 - 0.43C) (SAE 4340), Vacuum Consumable Electrode Melted
AMS7881	Tungsten Carbide-Cobalt Powder, Agglomerated and Sintered
AMS7882	Tungsten Carbide-Cobalt Chrome Powder, Agglomerated and Sintered
ARP1917	Clarifications of Terms Used in Aerospace Metals Specifications
ARP5935	Use of HVOF Thermal Spray Coatings for Hard Chrome Replacement in Landing Gear Applications
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 C633	Adhesion or Cohesive Strength of Flame Sprayed Coatings
ASTM E384	Microindentation Hardness of Materials
ASTM E408	Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
ASTM E1245	Determining the Inclusion or Second-Phase Constituent Content of Metals by Automatic Image Analysis
ASTM E1920	Metallographic Preparation of Thermal Sprayed Coatings

2.3 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-STD-871 Electro-Chemical Stripping of Inorganic Finishes

3. TECHNICAL REQUIREMENTS

Parts shall be prepared and coated in accordance with the approved Coating Process Control Sheet described in 4.4.

3.1 Equipment

3.1.1 Torch

A specially constructed gun that utilizes combustion products to generate a high velocity gas stream for heating of the coating material to a molten or plasticized state, and transfer of the coating material to the work piece shall be used. The torch shall be microprocessor-controlled and fitted with an automated device for regulating the gas(es) and fuel(s). The torch shall be mounted on an automated manipulating device during the deposition process to maintain a constant working distance and traverse rate or maintained in a fixed position with the component mounted on a manipulating device that will maintain a constant working distance.

3.1.2 Gauges

3.1.2.1 Pressure gauges shall have a minimum accuracy of $\pm 1.5\%$ of full scale.

3.1.2.2 Flow meters shall have a minimum accuracy of $\pm 2\%$ 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 used by the processor for procurement shall be acceptable to the cognizant engineering organization.

3.2.2 Coating material shall conform to AMS7881 or AMS7882 unless otherwise specified by the cognizant engineering organization. All powders shall be dry, free flowing and uniformly blended.

3.3 Preparation

3.3.1 Cleaning

Surfaces to be coated shall be thoroughly cleaned to remove oil, grease, dirt, paint, and other foreign material. Final cleaning shall take place no more than 4 hours prior to coating. Cleaning procedures shall not embrittle, pit, or damage surfaces to be coated.

3.3.2 Masking

Parts shall be masked by any appropriate means to protect all surfaces that are not being coated.

3.3.3 Surface Conditioning

After cleaning, surfaces to be coated shall be grit-blasted with aluminum oxide blast media to clean and prepare the surface for HVOF deposition. Grit and the air producing the blasting shall be free from moisture, oil, dirt, and other contaminants. Grit size shall be of the finest possible size necessary to achieve a 120 to 150 Ra surface roughness but shall never be coarser than 54 grit. A surface profilometer shall be used to verify the proper surface conditioning for each procedure used.

3.4 Application

3.4.1 Process Determination

The parameters for gas flows and pressures, powder feed rates, and spray distance, as well as deposition rates and traverse speeds shall be determined by a statistical method designed to achieve the desired coating properties specified by this document and/or the cognizant engineering organization.

3.4.2 Preheating

Surfaces to be coated shall be heated to remove moisture. Surface temperature shall not exceed 300 °F (149 °C). Preheating may be accomplished with the torch or by other suitable means and shall be monitored as specified in 3.4.3.5.

3.4.3 Coating

The coating material shall be deposited on the designated surface in sufficient thickness to permit finishing to specified dimensions.

3.4.3.1 The coating shall cover the entire area specified. Unless otherwise specified, a tolerance of -0 to +0.125 inch (3.2 mm) is allowed on the boundaries of the coated area.

- 3.4.3.2 Areas on which coating is optional must be prepared and handled in the same manner as the area on which coating is required and adhesion requirements still apply.
- 3.4.3.3 A spray angle of 90 degrees \pm 5 degrees should be maintained. For cylindrical components, angle is measured relative to the centerline axis of the cylinder. For any application that requires a spray angle at less than 85 degrees, all test specimens shall be sprayed at the same angle as the component and all minimum mechanical property requirements will apply.
- 3.4.3.4 Spray deposition shall be continuous except for interruptions to measure coating thickness and/or for cooling cycles to maintain part below maximum allowable temperature.
- 3.4.3.5 Substrate Temperature

Unless otherwise specified, maximum temperature of the substrate during preheating and coating application shall not exceed 300 °F (149 °C). Temperature measurements shall be made utilizing a laser-sighted infrared (IR) pyrometer with adjustable emissivity (0.1 to 0.99) and response time of less than 1 second. Measurement shall be taken on the parent metal adjacent to the edge of the coating as it traverses the area to be coated or on the coating itself. Emissivity shall be set to a value for the coating or substrate material being measured. The emissivity value shall be determined in accordance with ASTM E408 Method A. Alternatively, the emissivity level of the infrared pyrometer may be adjusted such that the temperature output agrees to within 5% of the value obtained with a contact temperature measurement device. Resolution of the infrared pyrometer shall be 1 °C or 1 °F, depending on the scale used and spot diameter should be less than 2.5 inch (64 mm) or equivalent to the actual diameter of the IR beam. If geometric constraints, part size, or other considerations do not allow the use of an IR pyrometer, then the cognizant engineering organization shall approve an alternative temperature measurement method.

3.5 Process Monitoring

Process monitoring is an optional procedure that when used allows for reduced testing frequency.

3.5.1 Equipment

Process monitoring requires the use of diagnostic equipment that is capable of periodically monitoring particle velocity, particle temperature, and flame plume geometry (length and width).

- 3.5.1.1 The equipment shall record each of the parameters being monitored.
- 3.5.1.2 The equipment shall be capable of notifying the operator when any parameter being monitored goes outside the approved range.

3.5.2 Process Monitoring Procedure

- 3.5.2.1 A process monitoring procedure shall be established for each part number specifying the equipment and the parameters to be monitored and the ranges the parameters are to stay within during the coating process. At a minimum, the parameters shall be particle velocity, particle temperature, and flame plume geometry (length and width).
- 3.5.2.2 The allowable limits or ranges for each of the parameters being monitored shall be established by a statistical method that correlates to those used for the initial process determination in 3.4.1.
- 3.5.2.3 Each process monitoring procedure and any revisions to them, requires approval by the cognizant engineering organization as stated in 4.4.4.

3.5.3 Parameters Out of Limit or Range

At any time during monitoring, if any of the parameters being monitored go outside the approved limits or ranges, testing shall revert back to acceptance lot testing until such time as the parameter(s) return to within the approved limits or ranges.

3.5.4 Reduced Testing

If process monitoring is being used and as long as the process parameters are within the approved limits or ranges, the properties indicated in 4.2.1 instead of being acceptance tests may be performed as periodic tests as stated in 4.2.2.

3.6 Surface Finishing

Procedures for finishing shall be in accordance with the cognizant engineering organization's specifications.

3.7 Properties

3.7.1 Adhesion

3.7.1.1 Bend Test

Specimens, as in 4.3.3.4, tested as in 4.3.3.1 shall not show separation of the coating from the substrate, when examined visually without magnification. Cracking of the coating and minimal separation at the specimen edges shall be considered acceptable.

3.7.1.2 Bond Strength

Specimens, as in 4.3.3.4, tested as in 4.3.3.2, shall have a bond strength of 10 ksi (69 MPa) minimum.

3.7.2 Coating Hardness

Specimens, as in 4.3.3.4, tested as in 4.3.3.3, shall have a hardness of HV_{300g} 950 minimum.

3.7.3 Microstructure

Metallographic preparation shall be performed in accordance with ASTM E1920. Examination of a suitably prepared cross-sectioned specimen shall show the coatings to be free from cracks and delaminations. Repolishing can only be performed on specimens that show flaws induced by the polishing method. Oxide content cannot be induced and is not grounds for repolishing. Microstructural properties shall be evaluated in accordance with the following:

3.7.3.1 Voids and oxides shall be uniformly distributed and not greater than 1% in any field of view when examined at 380 to 520X magnification on the cross sectioned specimen performed in accordance with ASTM E1245. Any single void greater than 0.002 inch (0.05 mm) shall be cause for rejection. Alternatively, if image analysis using a threshold method is not available, then voids and oxides shall be uniformly distributed and not greater than 1% of any 0.020 inch length in any field of view when viewed at between 380 to 520X magnification on the cross sectioned specimen. Any single void greater than 0.002 inch (0.05 mm) shall be cause for rejection.

3.7.3.2 Unmelted Particles

None in any field view at 180 to 220X magnification on the cross sectioned specimen performed in accordance with ASTM E1245. Alternatively, if image analysis using a threshold method is not available, then no unmelted particles are allowed in any 0.04 inch length in any field of view when viewed at 180 to 220X magnification on the cross sectioned specimen.

3.7.3.3 Interface

Contamination of the coating at the substrate interface with surface preparation media shall not exceed 10% in any field of view at 180 to 220X magnification performed in accordance with ASTM E1245. Alternatively, if image analysis using a threshold method is not available, then contamination of the coating at the substrate interface with surface preparation media shall not exceed 10% of any 0.04 inch (1 mm) length in any field of view when viewed at 180 to 220X magnification on the cross-sectioned specimen. Any coating separation at the interface will not be acceptable. Separation is defined as gap between the coating and substrate greater than 0.002 inch (0.05 mm) in length following directly along the bond line. Any length less than this will be considered acceptable voids or porosity.

3.7.3.4 Carbide Distribution

In any field of view when examined at 380 to 520X magnification, all carbides shall be uniformly distributed with no banding or clustering.

3.7.4 Residual Stress

Coatings shall be evaluated for residual stress by preparing and spraying a standard Almen Type "N" strip (refer to SAE J442) in identical fashion as the component being coated. Both the surface to be coated and uncoated surfaces of the Almen strip shall be grit-blasted to minimize curvature of the Almen strip to less than 0.002 inch (0.05 mm) arc height. The arc height of the Almen strip surface to be coated shall be measured after grit-blast surface preparation (first reading) and again after coating application (second reading). The first reading and subsequent coating application shall be with the convex surface of the Almen strip in the up position if the strip is not flat after grit blast and the second reading with the same surface, now coated, in the up position. The Almen strip shall be restrained flat, in the transverse direction by four screws located as indicated in SAE J442 during coating deposition. The measured change in deflection of the Almen strip resulting from the application of the coating shall be reported as the difference of the two readings, second reading minus first reading, and is indicative of the desired compressive coating stresses if the sign of the difference is positive. Acceptable values for Almen type "N" strip arc heights are positive 0.003 to 0.012 inch (0.076 to 0.30 mm) for a 0.005 inch \pm 0.001 inch (0.13 mm \pm 0.025 mm) thick coating.

3.7.5 Finished Thickness

The minimum finished coating thickness shall be 0.003 inch (0.076 mm). Thickness shall be determined using direct dimensional inspection provided the resolution of the measuring instrument is at least ten times more precise than the attribute being measured, or other method permitted by the cognizant engineering organization. Areas on which the coating presence is optional shall be exempt from the minimum thickness requirement.

3.8 Quality

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

4. QUALITY ASSURANCE

4.1 Responsibility for Inspection

Processor shall supply all test specimens for processor's tests and shall be responsible for the performance of all required tests. When parts are to be tested, the purchaser shall supply such parts. The cognizant engineering organization reserves the right to sample and to perform any conformity testing deemed necessary to ensure that the coating conforms to specified requirements.

4.2 Classification of Tests

4.2.1 Acceptance Tests

Coverage (3.4.3.1), thickness (3.7.5), and quality (3.8) are acceptance tests and shall be performed on each lot. When process monitoring (3.5) is not being used, bend test (3.7.1.1), coating hardness (3.7.2), microstructure (3.7.3), and residual stress (3.7.4) are acceptance tests, and shall be performed on each lot.

4.2.2 Periodic Tests

Coating material composition verification (3.2.2) and bond strength (3.7.1.2) are periodic tests and shall be performed at a frequency selected by the processor unless frequency of testing is specified by the cognizant engineering organization. Bond strength testing shall be performed when a new material lot of powder is being used to spray components. When process monitoring (3.5) is being used, bend test (3.7.1.1), coating hardness (3.7.2), microstructure (3.7.3), and residual stress (3.7.4) are periodic tests, and shall be performed on a weekly basis.

4.2.3 Preproduction Tests

All technical requirements of this specification are preproduction tests and shall be performed prior to, or on the initial shipment of coated parts to a purchaser. In addition, these tests shall be performed when a significant change in material, and/or processing requires approval as in 4.4.3, and when the cognizant engineering organization requires conformity testing.

4.3 Sampling and Testing

4.3.1 Acceptance Tests

One or more sets of test specimens shall represent each lot of parts (see 4.6). A lot shall be all parts of a similar configuration, coated sequentially on the same machine setup using the same batch of coating material and process parameters, within a shift or 8 hours of torch time, and presented for processor's inspection at one time.

4.3.2 Periodic Tests

Sample quantity shall be selected at the discretion of the processor unless otherwise specified by the cognizant engineering organization.

4.3.3 Test Methods

4.3.3.1 Bend Test

Test specimens shall be approximately 0.05 x 1 x 3 inch (1.3 x 25 x 76 mm) and shall be coated on one side to a thickness of 0.003 to 0.005 inch (0.075 to 0.127 mm). Panels shall be tested by being bent around a 0.5 inch (13 mm) diameter bar, with the coated surface on the outside of the bend, at a rate of approximately 10 degrees per second. Panels shall be bent to obtain a 90 degree permanent set.

4.3.3.2 Bond Strength

Test specimens shall be bar approximately 1 inch (25 mm) in diameter by 2 inch (51 mm) long and shall be coated to a thickness of 0.009 to 0.012 inch (0.2 to 0.3 mm). Specimens shall be prepared and tested in accordance with ASTM C633. The integrity of the adhesive used to perform bond strength tests shall be determined by performing adhesive-only qualification tests run under the same test conditions as the bond strength test to be performed.

4.3.3.3 Hardness and Microstructure

Test specimens for hardness tests and microstructure examination shall be approximately 0.05 x 1 x 1 inch (1.3 x 25 x 25 mm) minimum and shall be coated on one side to a minimum thickness of 0.009 inch (0.23 mm). The hardness of the coating shall be the average of a minimum of ten evenly spaced indentations performed in accordance with ASTM E384.

4.3.3.4 Test Specimens

4.3.3.4.1 Specimen Material

4.3.3.4.1.1 Specimens for bond strength testing (see 3.7.1.2) shall be fabricated from the same alloy and heat treat condition as the part being coated.

4.3.3.4.1.2 Specimens for bend testing (see 3.7.1.1) shall be fabricated from AMS6454, AMS6356, or AMS6345 and heat treated to produce a hardness of 40 HRC minimum.

4.3.3.4.1.3 Specimens for the examination of microstructure (see 3.7.3) and hardness (see 3.7.2) shall be fabricated from the same alloy and heat treat condition of the part being coated, or if the same alloy is not available in sheet form, from AMS6454, AMS6356 or AMS6345 and heat treated to produce a hardness of 40 HRC minimum. The same specimen may be used for both microstructure examination and hardness testing.

4.3.3.4.2 Specimen Processing

The above specimens shall be coated, as far as practicable, in accordance with the applicable Coating Process Control Sheet (see Figure 1) along with the parts that they represent. Specimens representing components rotated under the spray shall be sprayed at the same surface speed and incremental step rate as the component. If there are multiple application angles on the same component, specimens shall be run for the maximum and minimum deposition angle used, and shall be compliant with minimum mechanical property limits. Specimens shall be evaluated prior to coating application on production components.

4.4 Approval

- 4.4.1 The processor shall establish a written process description of preparation, application, and inspection for each part number an example of which is shown in Figure 1 and is called a Coating Process Control Sheet. The description shall include control factors and parameters that provide coated parts meeting specified requirements. Control factors considered proprietary by the processor shall be assigned codes within the process description. The processor shall maintain a complete record of proprietary factors and codes. The Coating Process Control Sheet shall include sufficient information to reproduce the process.
- 4.4.2 The Coating Process Control Sheet, or first article, whichever is specified, shall be approved by the cognizant engineering organization before production coated parts are supplied.
- 4.4.3 The processor of coated parts shall make no change to the Coating Process Control Sheet (see Figure 1) unless the change is approved by the cognizant engineering organization.
- 4.4.4 When process monitoring (see 3.5) is being used, process monitoring procedures and any revisions to them shall be approved by the cognizant engineering organization.

4.5 Reports

Processor shall furnish with each lot 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. The report shall include the purchase order number, lot number, AMS2448C, part number, quantity, and numerical test results.

4.6 Resampling and Retesting

- 4.6.1 If any lot acceptance test fails to meet specified requirements, disposition of parts may be based upon the results of a retest on three additional specimens for each nonconforming specimen if coated within the same lot. Except as specified in 4.6.1.1, failure of any retest to meet specified requirements shall be cause for rejection of parts represented. Results of all tests shall be recorded.
- 4.6.1.1 If any lot acceptance test or retest fails to meet specified requirements, the parts in that lot may be stripped as stated in Appendix A, recoated, and retested. Alternatively, all parts in the lot may be inspected for the nonconforming attribute, and nonconforming parts may be stripped, recoated, and retested. After stripping and recoating, parts shall meet the dimensions on the drawing.
- 4.6.1.1.1 When stripping is performed as stated in Appendix A, the method shall be acceptable to the cognizant engineering organization and shall not roughen, pit, or embrittle the basis metal or adversely affect part dimensions. When parts have been stripped and replated, the purchaser shall be informed.
- 4.6.2 If the results of any periodic test fail to meet the specified requirements, the process is nonconforming. No additional parts shall be processed until the process is corrected and new specimens are coated and tested. Results of all tests shall be recorded and when requested, reported. Purchaser shall be notified of all parts coated since the last acceptable test.
- 4.6.2.1 If a bond strength specimen fails in the adhesive or at the adhesive-coating interface, at a value less than the required minimum (see 3.7.1.2), the test result may be declared invalid and the test repeated. Such retest shall not be considered as one of the retests specified in 4.6.1.

5. PREPARATION FOR DELIVERY

- 5.1 Coated parts shall be handled and packaged in such a manner as will ensure that the required physical characteristics and properties of the coating are preserved. To ensure that corrosion damage does not occur on uncoated areas of the substrate, an application of a corrosion preventative compound shall be applied to all uncoated areas of the component.
- 5.2 Packages of 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 parts to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

6. ACKNOWLEDGMENT

Processor shall mention this specification number 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.

8. NOTES

NOTICE

This specification may reference the use of substances, products, or processes that are restricted or banned by local (regional) chemical substance regulations. Users of this specification should consider the implications of local legislation on the products, substances, and processes referred to within the document.

8.1 Revision Indicator

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

8.2 The following nickel plate strip solution has been demonstrated to meet the requirements of this specification.

Table 1

Variable	Range
METAL-X B929™ Nickel Strip Solution*	2.5 lb/gal (300 g/L) **
pH	9.2 to 9.8
Temperature	120 to 150 °F (49 to 66 °C)

* Other stripping methods may be used with permission of the cognizant engineering organization.

**Deionized water is recommended.

- 8.3 Part manufacturing operations, such as heat treatment, forming, joining, and media finishing, can affect the condition of the substrate, or, if performed after coating, could adversely affect the coating. The sequencing of operations should be specified by the cognizant engineering organization and is not controlled by this specification.
- 8.4 Further information may be found in ARP5935.
- 8.5 Terms used in AMS are clarified in ARP1917.
- 8.6 Dimensions and properties in inch/pound units and the Fahrenheit temperatures are primary; dimensions and properties in SI units and the Celsius temperatures are shown as the approximate equivalents of the primary units and are presented only for information.

8.7 Purchase documents should specify not less than the following:

AMS2448C

Coating material if different from 3.2.2

Coating thickness required if not 0.003 inch minimum (see 3.7.5)

Maximum temperature of substrate if not 300 °F (177 °C) (see 3.4.2)

Masking boundary tolerances if different from 3.4.3.1

Frequency of test if not selected by processor (see 4.2.2 and 4.3.2)

Coating acceptance criteria if not specified herein

Quantity of parts to be coated

PROCESSOR: _____ COATING SPECIFICATION: _____
PURCHASER: _____

APPLICATION: _____
PART NAME: _____
PART NUMBER: _____ BASIS MATERIAL: _____

PREPARATION:
PRE-BLAST CLEANING: _____
BLASTING GRIT TYPE: _____ GRIT SIZE: _____ PRESSURE: _____
BLASTING TIME, INTENSITY, and COVERAGE: _____

SPRAY EQUIPMENT & ACCESSORY EQUIPMENT:
MANUFACTURER: _____ TORCH: _____
POWDER PORT: _____ HEAD: _____ NOZZLE: _____
INJECTOR: OXYGEN: _____ FUEL: _____ POWDER: _____
ADAPTORS: _____

CONSOLE PARAMETERS:
OXYGEN: SUPPLY PRESSURE: _____ FLOW RATE: _____
TORCH PRESSURE: _____
FUEL: TYPE: _____ SUPPLY PRESSURE: _____
TORCH PRESSURE: _____ FLOW RATE: _____

POWDER FEEDER:
FEEDER TYPE: _____
CARRIER GAS: _____ SUPPLY PRESSURE: _____
FEEDER PRESSURE: _____ FLOW RATE: _____ DIAL: _____
VIBRATOR USED: [] YES [] NO AMPLITUDE: _____
FEEDER HOSE: DIAMETER: _____ LENGTH: _____

COATING PROCESS DATA:
PREHEAT TEMPERATURE: _____ MAXIMUM PART TEMPERATURE: _____
COOLING, METHOD: _____ POSITION: _____
COOLING, CYCLE TIME: _____ SPRAY, CYCLE TIME: _____
SPRAY, NO. OF CYCLES: _____ SPRAY, COATING THICKNESS: _____

WORK HANDLING:
PART MOTION: _____ SPEED: _____
GUN MOTION: _____ SPEED: _____
GUN-TO-WORK: DISTANCE: _____ ANGLE: _____
SPRAY MASKING/FIXTURES: _____

METALLOGRAPHY:
MICROSTRUCTURE: _____ HARDNESS: _____
BOND STRENGTH: _____ BEND TEST: _____
COATING MATERIAL: _____ LOT/BATCH NO: _____

OPERATOR: _____ CERTIFICATION NO: _____
APPROVAL: _____ DATE: _____

Figure 1 - Coating process control sheet