

ANSI/AWS C2.16-92
An American National Standard

Guide for Thermal-Spray Operator Qualification



American Welding Society

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documents

ANSI/AWS C2.16-92
An American National Standard

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Guide for Thermal-Spray Operator Qualification

Supersedes AWS C2.16-78

Prepared by
AWS Committee on Thermal Spraying

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

Abstract

This guide sets forth recommended thermal spray operator qualification procedures. It covers applicable documents relating to thermal spray equipment, consumables, and safety. It also contains operator qualification and coating analysis forms.



American Welding Society

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This standard is subject to revision at any time by the AWS Thermal Spraying Committee. It must be reviewed every five years and if not revised, it must be either reapproved or withdrawn. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are requested and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS Thermal Spraying Committee and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS Thermal Spraying Committee to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 550 N.W. LeJeune Road, P. O. Box 351040, Miami, Florida 33135.

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Foreword

(This Foreword is not a part of ANSI/AWS C2.16-92, *Guide for Thermal-Spray Operator Qualification*, but is included for information purposes only.)

The ability to apply quality thermal-spray coatings (TSC) proficiently depends upon a knowledgeable TSC operator with the proper thermal-spray equipment and materials using engineered process instruction (for surface preparation, fixturing, spraying, sealing, finishing, handling, and quality control) in a safe manner. This guide summarizes the recommendations of the AWS Committee on Thermal Spraying for the following:

Initial TSC operator training and qualification

TSC operator qualification maintenance and requalification

TSC operator qualification codification system based on the *AWS Thermal Spraying Handbook*

Generic TSC operator record and qualification forms

It is hoped that through use of this guide, coupled with user feedback, we can establish and maintain technical standards and operator qualification procedures while at the same time develop and use standardized operator qualification personnel records.

Comments and suggestions for this standard are welcome. They should be sent to the Director of Technical Standards and Publications, American Welding Society, 550 NW LeJeune Road, P.O. Box 351040, Miami, FL 33135.

Official interpretations of any of the technical requirements of this standard may be obtained by sending a request, in writing, to the Director of Technical Standards and Publications, American Welding Society. A formal reply will be issued after it has been reviewed by the appropriate personnel following established procedures.

Table of Contents

	Page No
<i>Personnel</i>	iii
<i>Foreword</i>	iv
 1. <i>Introduction</i>	 1
1.1 Objective	1
1.2 Scope	1
1.3 Definitions	1
1.4 Responsibilities	1
 2. <i>Applicable Documents</i>	 1
2.1 ASTM	1
2.2 Military	1
2.3 Federal	2
2.4 AWS	2
2.5 ANSI	2
2.6 Aerospace	2
2.7 Commercial/OEM	2
 3. <i>Thermal-Spray Operator Qualification</i>	 3
3.1 General	3
3.2 Identification of TSC Operator's Qualifications	3
3.3 Operator Qualification	3
3.4 Duration of Qualification	4
3.5 Operator Requalification	4
3.6 Annual Written Test	4
 4. <i>Safety and Health</i>	 4
4.1 References	4
4.2 Eye and Skin Protection	5
4.3 Ear Protection	5
4.4 Particulate Matter	5
 <i>Appendix A. Sample Thermal-Spray Operator Qualification Form</i>	 7
 <i>Appendix B. Recommended Thermal-Spray Procedure Operator Qualification Form</i>	 8
 <i>Appendix C. Thermal-Spray Coating Laboratory Analysis</i>	 9

Guide for Thermal-Spray Operator Qualification

1. Introduction

1.1 Objective. This AWS publication recommends the minimum knowledge and skills required for thermal-spray operators to (1) operate and maintain thermal-spray and required supplementary equipment for the application of thermal-spray coatings (TSC), and (2) execute TSC application processes specified by the Purchaser's or contractor's quality assurance program.

1.2 Scope. The scope of the minimum recommended knowledge and skills for thermal-spray operators includes:

- (1) General theory and fundamental process of thermal spraying
- (2) Specific knowledge and proficiency in the setup, operation, and maintenance of thermal-spray equipment and in the application of the coating processes for which the operators are to be qualified
- (3) Shop organization, layout, and procedures such as planning (material, labor, and schedule), job scheduling, routing, quality control, and records
- (4) Occupational health and safety, and environmental control

1.3 Definitions. For the purpose of this guide, the following definitions shall apply, in addition to the glossary definitions in AWS publications *Thermal Spraying, Practice, Theory and Application*, and ANSI/AWS A3.0, *Standard Welding Terms and Definitions*, adapted for use in thermal spraying:¹

Purchaser. The organization that issued the purchasing document invoking this guide.

Coating Contractor. The party invoking this guide at the request of the Purchaser, or voluntarily, in the interest of standardization and coating quality.

Thermal-Spray Coating (TSC) Inspector. The individual designated by the Purchaser to accept or reject materials or workmanship based on the results of specified tests. The TSC inspector should be:

- (1) knowledgeable in thermal-spray theory, equipment, and industrial processes, and
- (2) skilled in inspecting, evaluating, and certifying thermal-spray coatings that meet Purchaser's requirements.

1.4 Responsibilities. The contractor should perform all testing and provide documentation of compliance with this guide unless other provisions have been made with the Purchaser.

2. Applicable Documents

2.1 ASTM Specifications.² The following documents form a part of this guide to the extent specified herein. Unless a particular issue is specified, the latest revision shall apply.

- ASTM C633, Adhesive or Cohesive Strength of Flame-Sprayed Coatings
- ASTM E18, Rockwell Hardness and Rockwell Superficial Hardness Testing
- ASTM E384, (NR) Microhardness of Materials
- D4285, Standard Test Method for Indicating Oil or Water in Compressed Gas

2.2 Military Specifications.³ The following documents form a part of this guide to the extent specified herein. Unless a particular issue is specified, the latest revision shall apply.

1. AWS publications are available from American Welding Society, P.O. Box 351040, Miami, FL 33135.

2. Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

3. Available from Standardization Order Desk, 700 Robbins Avenue, Building #4, Section D, Philadelphia, PA 19111-5094.

MIL-C-81751B	72/01/17	Coating, Metallic Ceramic
MIL-M-38000	85/02/12	Metallizing Outfits (Wire-Gas), Guns and Accessories
MIL-M-80141B	87/04/30	Metallizing Outfits, Powder-Gas, Guns, and Accessories
MIL-M-80226A	84/11/26	Metallizing System, Wire, Electric Arc, Guns and Accessories
MIL-P-80109C	81/06/25	Plasma Spray Systems, Powder, Guns, and Accessories
MIL-P-83348A	83/11/30	Powder, Plasma Spray
MIL-P-83348/1	84/10/25	Powder, Plasma Spray Nickel Aluminum Powder, Type 1, Composition G, Class 2 with Interim Amendment 1
MIL-P-85856	88/12/7	Powder Materials for Flame and Plasma Sprayed Coatings, General Specifications for
MIL-W-6712C	87/05/21	Metallizing Wire
MIL-Z-81572	68/01/26	Zirconium Oxide, Lime Stabilized, Powder and Rod for Flame Spraying

Military Standards

MIL-STD-461C	87/04/01	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference with Notice 1
MIL-STD-869	82/09/01	Flame Spraying
MIL-STD-1504A	78/08/23	Abrasive Blasting
MIL-STD-1687A(SH)	87/02/11	Thermal Spray Processes for Ship Machinery Applications
DOD-STD-2138(SH)		Metal Spray Coating for Corrosion Protection Aboard Naval Ships Surface Ships (Metric)

Military Publications

NOS-MT-043	77/03	A Plasma Flame Spray Handbook
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2.3 Federal Specifications.³ The following documents form a part of this guide to the extent specified herein. Unless a particular issue is specified, the latest revision shall apply.

O-T-260	1,1,1, Trichloroethane, Technical, Inhibited (methyl chloroform)
BB-A-106	Acetylene, Technical, Dissolved
BB-A-1034	Air, Compressed, for Breathing Purposes
BB-H-886	Hydrogen
BB-H-1168	Helium, Technical
BB-O-925	Oxygen, Technical Gas and Liquid
TT-T-548	Toluene, Technical

2.4 AWS Publications. The following documents form a part of this guide to the extent specified herein. Unless

a particular issue is specified, the latest revision shall apply.

TSS	Thermal Spraying, Practice, Theory and Application
A3.0	Standard Terms and Definitions

2.5 ANSI Publications. The following documents form a part of this guide to the extent specified herein. Unless a particular issue is specified, the latest revision shall apply.

Z49.1 Safety in Welding and Cutting

2.6 Aerospace Material Specifications.⁴ The following documents form a part of this guide to the extent specified herein. Unless a particular issue is specified, the latest revision shall apply.

AMS 4180	Aluminum Wire, 99.0 Min Al (1100-H18) SAE
AMS 5793	Powder, Plasma Spray, (95Ni - 5Al) SAE
AMS 7875	Chromium Carbide Plus Nickel - Chromium Alloy Powder, Cr ₂ C ₃ -25 (80Ni + 20Cr Alloy) SAE
AMS 7878	Tungsten Carbide Powder, Cobalt Coated (SAE)
AMS 7879	Tungsten Carbide-Cobalt Powder, Cast and Crushed SAE
AMS 7880	Tungsten Carbide-Cobalt Powder, Sintered and Crushed

2.7 Typical Commercial/OEM Specifications The following documents form a part of this guide to the extent specified herein. Unless a particular issue is specified, the latest revision shall apply.

AMS 2435	Detonation Process. Tungsten Carbide - 9% Cobalt (SAE)
AMS 2437	Coating, Plasma Spray Deposition (SAE) 1-1-86
BAC 5851	Plasma Flame Spray Coating (Boeing)
DPS 9.83	Metallizing (Douglas Aircraft)
DPS 9.85	Plasma Arc Spraying (Douglas Aircraft)
EMS 52432	Plasma Spray Coating (Garrett Corp)
EMS 52467	Plasma-Sprayed Abradable Coatings (Garrett Corp)
FP 5045	Metal Spray Coating (Garrett Corp)
MP - 320	Plasma Flame Spraying (Northrop)
P16TF3	Thermal Spray (G.E.)
PWA 53	Coating, Plasma Spray Deposition (Pratt & Whitney Aircraft)
PWA 257	Advanced Technology Plasma Coatings (Pratt & Whitney Aircraft)

4. Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096.

3. Thermal-Spray Operator Qualification

3.1 General. Thermal-spray operators should be qualified for applying TSCs using a specific coating process and method of application. The qualification should only be valid for that specific coating process and method of application. The TSC processes and methods of application covered by this guide are identified in 3.2.1.

3.2 Identification of TSC Operator's Qualifications

3.2.1 The following code should be used to indicate the area of operator qualification (see sample in Appendix A):

Coating Process and Material Form

FP - Flame Powder	AW - Arc Wire
FW - Flame Wire	PP - Plasma Powder
FR - Flame Rod	HP - High-Velocity-
DP - Detonation Powder	Oxygen-Fuel Powder

Application Method

M - Manual (Hand-held gun)	A - Automatic
SA - Semi-Automatic	R - Robotic
CC - Computer Controlled	

Application Environment

Atm - Atmospheric	V - Vacuum
IG - Inert Gas	O - Other (specify)

Material Class (per AWS Thermal Spray Handbook, section 5.9)

1 - Oxide Ceramics	6 - Refractory Materials
2 - Iron-base Alloys	and Alloys
3 - Nickel- and	7 - Self-fluxing Alloys
Cobalt-base Alloys	8 - Tungsten Carbides
4 - Nonferrous Materials	9 - Abradable Coatings
5 - Other Carbides	

3.2.2 The thermal-spray operator qualification designation should be indicated by the above designations for the following:

- (1) Coating process and materials
- (2) Application method
- (3) Application environment
- (4) Thermal-spray material class

For example, the operator qualification designation for plasma-powder spraying nonferrous materials semiautomatically in an atmospheric environment would be PP/SA/Atm/4 and recorded in the numbered columns of Appendix A. (*Note: Companies may use alternate forms if they provide the essential information.*)

3.3 Operator Qualification

3.3.1 Equipment Setup and Operation. The TSC operator should demonstrate the ability to set up and

operate thermal-spray equipment to prepare and spray thermal-spray coatings (1) in accordance with the Purchaser's process instructions, and (2) meeting the Purchaser's technical requirements. Appendix B is the recommended form to record the information that may be specified by the Purchaser. (*Note: Companies may use alternate forms if they provide the essential information.*)

3.3.2 Written Test. The operator should satisfactorily complete a written test covering all aspects of the appropriate coating process and application method, i.e., the spray parameters, procedures, quality control and safety requirements for the five basic production functions: (1) surface preparation, (2) fixturing and gun movement control, (3) thermal-spraying parameters, (4) seal and finishing, and (5) end-item inspection. The written test should be prepared by the coating contractor and approved by the TSC inspector.

3.3.3 Final Approval. Final approval should be contingent upon the ability of the thermal-spray operator to satisfactorily demonstrate proficiency in equipment operation and in coating test specimens, as described in 3.3.4 to 3.3.7. The final approval is granted by the Purchaser's designated agent, e.g., the TSC inspector.

3.3.4 Equipment Operation. The TSC operator should be tested to determine knowledge of proper and safe operation of equipment. This should include connection, setup, and operation of the thermal-spray equipment according to the technical manual provided by the equipment manufacturer. This knowledge should not be limited to normal operation but should test skills sufficiently to recognize when the equipment malfunctions and when and how to take corrective action safely.

3.3.5 Surface Preparation. The operator should prepare the surface of the thermal-spray test specimens or hardware used for qualification.

3.3.6 Masking Procedure. The operator should be tested for knowledge and application of procedures for masking the part to be surfaced.

3.3.7 Application of Coating

3.3.7.1 For each qualification test, the operator should coat at least three specimens for each of the qualifying processes or as otherwise specified by the TSC inspector. Acceptability of performance should be determined by the TSC inspector or as specified by the purchasing contract, or both. The following are suggested thermal-spray materials for demonstrating qualification of the various TSC processes:

Plasma Powder (PP)	- Tungsten carbide-cobalt, Nickel-aluminide, Aluminum oxide or Three coatings selected by the TSC inspector
Flame Powder (FP)	- Two coatings selected by the TSC inspector
Flame Rod (FR)	- Zirconium oxide (MIL-Z- 81572) or One coating selected by the TSC inspector
Flame Wire (FW)	- Aluminum Stainless steel or Two coatings selected by the TSC inspector
Arc Wire (AW)	As agreed upon by the Purchaser and coating contractor
Detonation Powder (DP)	
High-Velocity-Oxygen-Fuel Powder	

3.3.7.2 Test specimens should be prepared from alloys specified by the TSC inspector. The following code should be employed to indicate the test specimens used:

Test Specimens

S(small): The small test specimens should be 25 mm (1 in.) wide x 75 mm (3 in.) long x by a minimum of 1.3 mm (0.05 in.) thick.

L(large): The large test specimens should be 75 mm (3 in.) wide x 125 mm (5 in.) long x by a minimum of 1.3 mm (0.05 in.) thick.

T(tensile): 25 mm (1 in.) diameter x 50 mm (2 in.) long (nominal) or as required for ASTM C633.

The type of test specimen required and the number of test specimens should meet the requirements of the applicable coating selected from those listed in 3.3.7.1, or as specified by the TSC inspector.

3.3.8 Retesting of Operator. In the event of the operator's failure to meet the minimum qualification requirements, the operator should be given additional training to meet the knowledge and skill requirements. After suitable training, a retest should be scheduled by the TSC inspector or the Purchaser, or both.

3.3.9 Records. Records of qualification and test results required by the purchaser should be maintained by the TSC inspector for a period of one year or as agreed upon by the Purchaser and thermal-spray contractor. The suggested format and content for recommended laboratory analysis for recording operator qualification is presented in Appendix C. *(Note: Companies may use alternate forms if they provide the essential information.)*

3.4 Duration of Qualification. TSC operators successfully completing the requirements of 3.3 should be qualified for a period of six months and continuously thereafter if they successfully perform production spraying in each process/application area (column of Appendix A) at least once every six months or as specified by the Purchaser. A TSC operator who has not done production spraying for six consecutive months should follow the initial operator qualification procedure (as described in 3.3) to regain a qualified status.

3.5 Operator Requalification

3.5.1 Physical Test Requirements. The requalification requirement should be met by spraying acceptable coating test specimens. Test results from samples sprayed with production equipment or process control sample should be utilized for TSC operator requalification.

3.5.2 Scheduling. Scheduling of requalification should be the responsibility of the TSC inspector and the operator's immediate supervisor.

3.5.3 Expired or Canceled Qualification. Operators with an expired or canceled qualification status should not be permitted to perform thermal-spray operations on parts covered by this guide.

3.5.4 TSC Inspector. Requalification may be requested by the TSC inspector any time there is objective reason to doubt the proficiency or the quality of workmanship of the operator.

3.5.5 Equipment or Process Change. All TSC operators should be requalified when a significant change in equipment, procedure, or processing occurs any time during the life or the contract to provide thermal-spray coating parts.

3.6 Annual Written Test. TSC operators should pass a written test annually. The scope of the annual written test should meet the requirements of 3.3.2.

4. Safety and Health

4.1 References. This technical document does not address all thermal spraying safety and health hazards. However, pertinent information can be found in the following:

- (1) ANSI/AWS F2.2 Lens Shade Selector
- (2) ANSI/ASC Z49.1 Safety in Welding and Cutting

- (3) AWS Publication: Thermal Spraying: Practice, Theory and Application
- (4) AWS Publication: Safety and Health Fact Sheets, Published 1990.
- (5) CFR 29, Part 1910.107 OSHA Health and Safety Standards.⁵

4.1.1 Reference 2, Chapter 11 covers the following topics.

- 11.1 Scope
 - 11.1.1 Safety Guides
 - 11.1.2 Disposal of Toxic Wastes
 - 11.1.3 Flammable Solvents and Sealer Bases
- 11.2 Fire Prevention and Protection
- 11.3 Safe Operating Considerations
 - 11.3.1 Storage, Handling, and Use of Compressed Gas Cylinders
 - 11.3.2 Flow Meters
 - 11.3.3 Compressed Air
- 11.4 Flame-Spray Equipment
- 11.5 Plasma and Arc Equipment
- 11.6 Abrasive Blast Machines
- 11.7 Protection of Personnel
 - 11.7.1 Eye Protection
 - 11.7.2 Respiratory Protection
 - 11.7.3 Noise Protection
 - 11.7.4 Protective Clothing
 - 11.7.5 Confined Spaces
- 11.8 Ventilation
- 11.9 Toxic Material
 - 11.9.1 Beryllium
 - 11.9.2 Cadmium
 - 11.9.3 Lead, Lead Alloys, Chromium and Tellurium
 - 11.9.4 Solvents
 - 11.9.5 Threshold Limit Values
 - 11.9.6 Tin and Zinc
- 11.10 Safety Standards

5. OSHA publications are available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

4.2 Eye and Skin Protection

4.2.1 Plasma Arc and Electric Arc Spray. Plasma and electric arc spray units emit potentially hazardous ultraviolet (UV) radiation. The operator shall use a face shield with adequate protection for the eyes and face from the intense light and harmful radiation generated by the thermal-spray process. UV radiation reflected to the eyes while the helmet is raised to make measurements or adjustments with a lighted plasma or arc gun is a source of danger. It is recommended that Shade 5 eye glasses with side-shield protection plus Shade 5 helmet glass, be used for a total of Shade 10, to prevent burning from reflection. The operator should also wear protective clothing including gloves to protect the skin.

4.2.2 Flame Spray. The operator should use Shade 5 eye glasses and wear protective clothing including gloves.

4.3 Ear Protection. The operator shall wear ear protection because of the high noise levels inherent in the thermal-spray processes. Use of high-energy plasma will produce noise levels in excess of 120 decibels, therefore, suitable ear protection (i.e., ear plugs and ear muffs) is required. Alternatively, soundproof booths with remotely controlled handling equipment may be installed.

4.4 Particulate Matter. Airborne particulate matter is present in most thermal-spray processes. High-capacity suction devices or similar dust collection (exhaust) devices which will remove the airborne particulates should be used, and adequate ventilation shall be provided. Enclosed areas should be equipped with positive exhaust and wet duct, or equally effective, collector systems which provide adequate air flow in accordance with OSHA Health and Safety Standards, CFR 29, Part 1910.107. For example, the 1989 regulations require that the hood face velocity shall be between 1 to 2 m/s (200 to 400 ft/min) with a minimum flow rate of 61 m³/min per m² (200 cfm per ft²) of hood opening. An air respirator mask and eye and ear protection shall be provided for the operator. If toxic materials, such as beryllium, lead, or cadmium are to be sprayed, respirators as well as other safety measures to prevent the spread or inhalation of particulate matter must also be used.

Appendices

The following appendices are not considered a part of this guide and are provided for information purposes only.

APPENDIX A

SAMPLE THERMAL SPRAY OPERATOR QUALIFICATION FORM

Pg __ of __

Name _____ Identification/Employee No. _____

Social Security No. _____

Company _____ Date _____

Co. Address _____ Co. Phone # _____

EXPERIENCE	NOTE	1	2	3	4	5	6
------------	------	---	---	---	---	---	---

Process/Material Form*	1						
------------------------	---	--	--	--	--	--	--

Equipment Model/Mfg.							
----------------------	--	--	--	--	--	--	--

Application Method	2						
--------------------	---	--	--	--	--	--	--

Application Environment*	3						
--------------------------	---	--	--	--	--	--	--

Safety Practices	4						
------------------	---	--	--	--	--	--	--

Material Classification	5						
-------------------------	---	--	--	--	--	--	--

Training School	6						
-----------------	---	--	--	--	--	--	--

Plant Production	7						
------------------	---	--	--	--	--	--	--

Aircraft Production	7						
---------------------	---	--	--	--	--	--	--

Present Employer	7						
------------------	---	--	--	--	--	--	--

Last Certified	8						
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Note 1. FP - Flame Powder FW - Flame Wire FR - Flame Rod	DP - Detonation Powder AW - Arc Wire PP - Plasma Powder	HP - High-Velocity-Oxygen-Fuel Powder					
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2. M - Manual CC - Computer Controlled	SA - Semi-Automatic	A - Automatic	R - Robotic				
---	---------------------	---------------	-------------	--	--	--	--

3. Atm - Atmospheric	IG - Inert Gas	V - Vacuum	O - Other (specify)				
----------------------	----------------	------------	---------------------	--	--	--	--

4. Per AWS Thermal Spray Handbook Sec. 5.9:							
1 - Oxide Ceramics	4 - Nonferrous Materials	7 - Self-Fluxing Alloys					
2 - Iron Base Alloys	5 - Other Carbides	8 - Tungsten Carbides					
3 - Nickel- and Cobalt-base Alloys	6 - Refractory Materials and Alloys	9 - Abradable Coatings					

5. Safety Practices in Exam (Yes or No)	6. Last Written examination Score (%) and Date						
---	--	--	--	--	--	--	--

7. Cumulative Years and Inclusive Years, e.g., 6 (77-83)							
--	--	--	--	--	--	--	--

8. Month/Year of Most Recent Certification. ATTACH TSC LAB ANALYSIS (Appendix C)							
--	--	--	--	--	--	--	--

*Single Entry Only

Remarks _____

Signatures: Applicant/TSC Operator _____ Date: _____

TSC Inspector: _____ Date: _____

APPENDIX B

**RECOMMENDED THERMAL SPRAY PROCEDURE OPERATOR
QUALIFICATION FORM**
(Fill in applicable information)

Company _____ Operator _____

Date Submitted _____ Work Station _____

Sample Number _____ No. Pieces _____

Part Number _____ Serial Number _____

Process/Material/Form* _____ Application Method* _____

Application Environment* _____ Material Classification* _____

(*Codification per Notes 1 thru 4 on Appendix A)

Material Name _____ Spec. # _____

TEST	Purchaser's Requirement	Operator Performance
------	-------------------------	----------------------

Tensile Bond # Samples _____

MPa(psi) Range (hi, lo) _____

Average _____

Superficial Hardness _____

METALLOGRAPHIC EVALUATION

Purchaser's Requirement

Oper. Perf.

1. Oxides (%) _____ 2. Porosity (%) _____

3. Transverse Cracks _____ 4. Delaminations _____

5. Substrate-Coating Interface Voids, Oxides, and Grit Entrapment (%) _____

6. Unmelted Spheroid Particles _____

7. Other _____

Does _____ Does Not _____ meet specification requirements per _____

Signature _____ Date _____

Testing Lab _____

APPENDIX C

THERMAL SPRAY COATING LABORATORY ANALYSIS

Fill in applicable information

Company _____ Date Submitted _____
 Address _____ Operator _____
 Work Station _____ Identification No. _____
 Sample Number _____
 Part Number _____ Serial Number _____
 Substrate Material _____ Material Specification _____
 Reference/Drawing _____

A. COATING MATERIALS AND PROCESS PARAMETERS

Parameters

Coat	Spray Process	Spray Material	Thickness (mm)	Surface Speed/Min (m/sec)	Preheat (°C)	(Other)
Bond	_____	_____	_____	_____	_____	_____
Intermediate	_____	_____	_____	_____	_____	_____
Top	_____	_____	_____	_____	_____	_____
PHASED	Bond	_____	_____	_____	_____	_____
	Middle	_____	_____	_____	_____	_____
	Top	_____	_____	_____	_____	_____

B. PURCHASERS REQUIRED TESTS AND PASS/FAIL CRITERIA

MOUNT #

Test	Acceptance Criteria	Results
VISUAL & 10X MAGNIFICATION	_____	_____
TENSILE STRENGTH (MPa)	_____	_____
HARDNESS	_____	_____

METALLOGRAPHIC EVALUATION (200X)

1. Oxide (%) _____
2. Porosity (Voids) (%) _____
3. Transverse Cracks _____
4. Delaminations _____
5. Substrate-Coating Interface Voids, Oxides, and Grit Entrapment (%) _____
6. Unmelted Spheroidal Particles _____
7. Other _____

Does _____ Does Not _____ meet specification requirements Date _____

Signature _____

TESTING LAB/ADDRESS _____

Thermal Spray Document List

AWS Designation	Title
TS	Thermal Spraying: Practice, Theory, and Application
C2.2-67	Recommended Practices for Metalizing with Aluminum and Zinc for Protection of Iron
C2.14-74	Corrosion Tests of Flame Sprayed Coated Steel, 19-Year Report
C2.16-92	Guide for Thermal-Spray Operator Qualification

For ordering information, contact the Order Department, American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida. Phone (1-800-334-9353).