

FIELD METALIZING OF EXISTING STRUCTURAL STEEL

****From Bennington-Mt. Tabor BF BPNT(16)**

- xx. DESCRIPTION. This work shall consist of field surface preparation and field application of thermal spray metalizing to existing bridge surfaces followed by the application of a clear sealer coat. The metalizing and sealer materials to be applied are identified in this Specification. The Contractor shall furnish all materials, equipment, labor, and other essentials necessary to accomplish this work and all other work described herein as directed by the Engineer.

The requirements of SSPC-CS23.00/AWS C2.23M/NACE No. 12 are applicable to this work. In the event of a conflict, the requirements of this SSPC Specification shall prevail.

- xx. REFERENCES. The latest edition of the following standards and regulations are a part of this Specification:

(a) Vermont Environmental Protection Act. The Contractor shall follow all applicable regulations published by the Vermont Agency of Natural Resources.

(b) American Society for Testing and Materials.

- (1) ASTM D1186, Standard Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base
- (2) ASTM D4285, Standard Test Method for Indicating Oil or Water in Compressed Air
- (3) ASTM B833, Standard Specifications for Zinc Wire for Thermal Spraying (Metalizing)
- (4) ASTM D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- (5) ASTM D4417, Standard Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel

(c) The Society for Protective Coatings.

- (1) SSPC-AB 1, Mineral and Slag Abrasives
- (2) SSPC-AB 2, Cleanliness of Recycled Ferrous Metallic Abrasives
- (3) SSPC-AB 3, Ferrous Metallic Abrasive
- (4) SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages
- (5) SSPC-QP 1, Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Structures)

- (6) SSPC-QP 2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Coatings
 - (7) SSPC-SP 1, Solvent Cleaning
 - (8) SSPC-SP 5/NACE No. 1, White Metal Blast Cleaning
 - (9) SSPC-SP 11, Power Tool Cleaning to Bare Metal
 - (10) SSPC-PA 17, Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements
 - (11) SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
 - (12) SSPC-VIS 5, Guide and Reference Photographs for Steel Prepared by Wet Abrasive Blast Cleaning
 - (13) SSPC Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Surfaces
 - (14) SSPC CS-23.00/AWS C2.23M/NACE No. 12, Specification for the Application of Thermal Spray Coatings (Metalizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel
- (d) American Welding Society.
- (1) ANSI/AWS A-5.33 Specification for Alloy Wires, Cored, Wires, and Ceramic Rods for Thermal Spraying
 - (2) ANSI/AWS C2.18 Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites
 - (3) AWS C2.25, Specification for Thermal Spray Feedstock-Solid and Composite Wire and Ceramic Rods
- (e) Metalizing wire and coating manufacturer's application instructions, MSDS, and product data sheets
- (f) Code of Federal Regulations.
- (1) 1.29CFR 1910, Occupational Safety and Health Regulations for General Industry
 - (2) 2.29CFR 1926, Occupational Safety and Health Regulations for the Construction Industry
 - (3) 3.29CFR 1926.104, Safety Belts, Lifelines, and Lanyards
 - (4) 4.29CFR 1926.105, Safety Nets
 - (5) 5.29CFR 1926.450-454, Scaffolding
 - (6) 6.29CFR 1926.500-503, Fall Protection

xx. QUALIFICATIONS. The following companies are approved by VTrans for performing the required metalizing work under this Contract:

Company	Address	Telephone	Fax	Website	Contact
International Metal Fusion Corp.	900 NW 10 th Ave. Fort Lauderdale, FL 33311	(609)670- 2200	(954)585 -7042	www.metalize.net	Carl Tudor
Pullman - A Structural Group Company	127 Salem Ave. Thorofare, NJ 08086	(212)460- 6634	-	www.structuraltechnologies.com	Erik Wagner
Regal Industrial Corporation	98 E. 1 st St. P.O. Box 291 Donora, PA 15033	(724)379- 6440	(724)379 -9001	www.regalindustrial.com	James Sasko
Marine Technical Services	7306 Muirfield Valley Dr. Houston, TX 77095	(661)972- 7223	(813)752 -7229	www.marinetechservicesus.com	Jerrod Monaghan
Niagara Coatings Services	8025 Quarry Rd. Niagara Falls, NY 14304	(716)297- 5834	(716)297 -5834	www.niagaracoatings.com	-

Request(s) for substitutions shall be submitted to the Agency's office of Contract Administration a minimum of 10 days in advance of the bid opening date. Substitutions for the above following award of the Contract shall be approved by the Project Manager. Any proposal for substitution shall demonstrate the metalizing Contractor having satisfactorily performed a minimum of three (3) previous projects involving abrasive blast cleaning, metalizing, and sealer coat application; with at least one project within the past two (2) years having involved a bridge or similar industrial type application.

xx. METALIZING AND SEALER MATERIALS. All thermal spray feedstock (metalizing wire) shall be the products of a single manufacturer, meet the requirements specified herein, and meet the thermal spray equipment manufacturer's specifications. Sealer materials shall be the products of a single manufacturer. Products from different manufacturers shall not be mixed. The Contractor shall provide the type and quantity of metalizing wire and sealer materials needed to coat the bridge surfaces as specified herein.

(a) Metalizing Wire. The metalizing wire shall consist of 99.9% zinc complying with ASTM B833 or ANSI/AWS C2.25/C2.25M complying with AWS Standard Class W-ZN-2. The Contractor shall provide a certificate of chemical composition of the metalizing wire from the metalizing wire manufacturer. The certificate shall identify the proposed wire.

(b) Sealing Materials. Sealing materials shall be selected from the products listed in Table 1, Clear Metalizing Sealer Materials, of this Specification.

xx. SUBMITTALS. The Contractor shall submit the following plans and information for Engineer review and acceptance within 30 days of Contract execution (unless written permission from the Project Manager states otherwise). Work shall not proceed until submittals are accepted by the Engineer.

- (a) Contractor/Personnel Qualifications. The Contractor shall provide evidence of experience including names, qualifications, experience, and training of the personnel managing and implementing the Quality Control program and also for those performing the quality control tests and inspections.
- (b) Quality Control (QC) Plan. The Contractor shall submit a Quality Control Plan that identifies: test instruments to be used, a schedule of required tests and inspections, procedures for correcting unacceptable work, and procedures for improving surface preparation and metalizing/sealer quality as a result of quality control findings. The program shall include a copy of the Quality Control Daily Report Forms that will be used to document Contractor inspection and testing results.
- (c) Inspection Access Plan. The inspection access plan shall address procedures to be used by the Contractor QC personnel for ongoing inspections and by the Engineer during Quality Assurance (QA) observations.
- (d) Surface Preparation Plan. The surface preparation plan shall include the methods of surface preparation and types of equipment that will be used to prepare the surfaces as specified herein. Proposed detergents, additives, or inhibitors that will be incorporated into the water (for chloride remediation) shall be identified, including the trade names of those products, product technical data sheets, and Material Safety Data Sheets (MSDS). The metalizing wire manufacturer shall issue a letter stating that these detergents, additives, or inhibitors are compatible with and will not adversely affect the metalizing. Also any solvents proposed for solvent cleaning shall be identified and MSDS provided.

If heating or dehumidification of the containment is proposed, the plan shall describe the methods and equipment to be used.

- (e) Abrasives. The Contractor shall identify the type and brand name of the abrasive proposed for use, and provide MSDS and manufacturer's data indicating that the abrasive meets requirements of the SSPC-AB1 or AB3 standards as specified herein.

A sample of the abrasive shall be submitted to the Engineer two weeks prior to surface preparation for testing and acceptance.

- (f) Metalizing Plan. Written procedures for the application of metalizing shall be provided, including the brand name and type of metalizing wire and application equipment to be used. Proof that the metalizing wire complies with ASTM B833 or ANSI/AWS C2.25/C2.25M shall also be provided.
- (g) Sealing Plan. Procedures for the application of the sealer shall be provided along with MSDS and product data sheets. A description of the application equipment to be used shall be included.
- (h) Protective Covering Plan. A written plan for containing or controlling metalizing/sealer debris (droplets, overspray, etc.)

shall be provided, including evidence that any tarps or protective covers proposed for use are fire retardant. When removing existing coatings containing lead or other toxic metals (i.e., lead, cadmium, and chromium) the containment and disposal of the residues shall be as specified in CONTAINMENT AND DISPOSAL OF LEAD PAINT CLEANING RESIDUES of Section 900.

- (i) Progress Schedule. A progress schedule shall be submitted and shall identify all major work items (e.g., installation of rigging/containment, surface preparation, and metalizing/sealer application).

The Engineer will provide written notification to the Contractor when submittals are complete and acceptable. The Contractor shall not begin any paint removal work until that notification is received. The Contractor shall not construe Engineer acceptance to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety concerns. Acceptance does not relieve the Contractor from the responsibility to conduct the work according to the requirements of Federal, State, or Local regulations and this specification, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

- xx. QUALITY CONTROL (QC) INSPECTIONS. The Contractor shall perform first line, in process QC inspections. The Contractor shall implement the accepted QC Program to ensure that the work complies with these specifications. The designated Quality Control Inspector shall be onsite full time during any operations that affect the quality of the system (e.g., surface preparation and chloride remediation, metalizing application, sealer application, and final inspection at project completion). The Contractor shall use a daily quality control report form to record the results of quality control tests and inspections. The completed reports shall be given to the Engineer before work resumes the following day.

Contractor QC inspections shall include, but are not limited to, the following:

- (j) Suitability of protective coverings and the means employed to control project debris
- (k) Ambient conditions
- (l) Surface preparation (solvent cleaning, abrasive blast cleanliness, surface profile depth, etc.)
- (m) Chloride remediation
- (n) Metalizing application (specified materials, bend test, adhesion, dry film thickness)
- (o) Sealer continuity and coverage (skips, misses, etc.)

The personnel who shall function as a metalizing inspector shall have a minimum of five years of metalizing and paint application experience; and shall possess a minimum classification as a NACE CIP Level 2, or shall provide evidence of successful inspection of three projects of similar or greater complexity and scope completed in the last two years. References shall include the name, address, and telephone number of a contact person employed by the facility owner.

The personnel performing the QC tests shall be trained in all tests, inspections, and instrument use required for the inspection of surface preparation, metalizing, and sealer application. Documentation of training shall be provided. The QC personnel shall be solely dedicated to quality control activities and shall not perform any production related work. QC personnel shall take the lead in all inspections, but applicators shall perform wet film thickness measurements during application of the coatings, with QC personnel conducting random spot checks. The Contractor shall not replace the QC personnel assigned to the project without advance notice to the Engineer, and acceptance of the replacement(s), by the Engineer.

The Contractor shall supply all necessary equipment to perform the QC tests and inspections. Equipment shall include the following at a minimum:

- (a) Psychrometer or comparable equipment for measurement of dew point and relative humidity, including weather bureau tables or psychrometric charts
- (b) Surface temperature thermometer
- (c) Hypodermic Needle Pressure Gage for determining blasting pressure at the nozzle
- (d) SSPC Visual Standard VIS 1
- (e) Testex Press-O-Film Replica Tape and Spring Micrometer or electronic surface profile reader
- (f) Bresle Cell Kits or CHLOR*TEST kits for chloride determinations, or equivalent
- (g) Blotter paper for compressed air cleanliness checks
- (h) Type 2 Electronic Dry Film Thickness Gage
- (i) Calibration standards for dry film thickness gage
- (j) Light meter for measuring light intensity during coating removal, metalizing, sealer application, and inspection activities
- (k) All applicable ASTM, ANSI, AWS, and SSPC Standards used for the work (reference list attached)

The instruments shall be verified for accuracy and adjusted by the Contractor's personnel in accordance with the equipment manufacturer's recommendations and the Contractor's QC Program. All inspection

equipment shall be made available to the Engineer for QA observations as needed.

xx. HOLD POINT NOTIFICATION. Specific inspection and testing requirements within this Specification are designated as Hold Points. Unless other arrangements are made at the project site, the Contractor shall provide the Engineer with a minimum four-hour notification in advance of the Hold Point. If four-hour notification is provided and the work is ready for inspection at that time, the Engineer will conduct the necessary observations. If the work is not ready at the appointed time, unless other arrangements are made, an additional four-hour notification is required. Permission to proceed beyond a Hold Point without a QA inspection will be at the sole discretion of the Engineer and will only be granted on a case-by-case basis.

xx. QUALITY ASSURANCE (QA) OBSERVATIONS. The Engineer will conduct QA observations of any or all phases of the work. The presence or activity of Engineer observations in no way relieves the Contractor of the responsibility to perform all necessary daily QC inspections of their own and to comply with all requirements of this Specification.

The Engineer has the right to reject any work that was performed without adequate provision for QA observations.

xx. INSPECTION ACCESS AND LIGHTING. The Contractor shall facilitate the Engineer's observations as required, including allowing ample time to view the work. The Contractor shall furnish, erect, and move scaffolding or other mechanical equipment to permit close observation of all surfaces on which the work is performed. All scaffolding and equipment shall be provided during all phases of the work and meet all OSHA Regulations.

The Contractor shall provide artificial lighting in areas where natural light is inadequate, as determined by the Engineer, to allow proper cleaning, metalizing, sealing, and inspection. Illumination for inspection shall be at least 30 foot candles (325 LUX). Illumination for cleaning, metalizing, and sealer application, including the working platforms, and access and entryways shall be at least 20 foot candles (215 LUX).

xx. CONSTRUCTION REQUIREMENTS.

(a) Pre-metalizing Meeting. A pre-metalizing meeting shall be held on site prior to surface preparation and application of metalizing. The meeting shall review the process and approved submittals. Attendees shall be determined by the VTrans Resident Engineer. A five day notice shall be provided for scheduling this meeting.

(b) General. Conduct all activities associated with the coating work described and specified herein in accordance with Federal (OSHA), EPA, State Regulations and local safety regulations, SSPC-PA Guide 3, and SSPC-CS 23.

Provide at no additional expense to VTrans a minimum of three NIOS/MESA approved respirators for the intended purpose and other

safety equipment needed to permit proper inspection of on-going work by the VTrans Resident Engineer.

- (c) Notification. The Contractor shall notify the Engineer 24-hours in advance of beginning surface preparation operations.
- (d) Surface Preparation and Metalizing/Sealing Equipment. The Contractor shall provide surface preparation, metalizing, and sealing equipment as needed to perform the work as specified herein.

Metalizing application equipment shall be portable electric arc units that are set-up, adjusted, and operated in accordance with the manufacturer's written instructions.

Diesel or gasoline powered equipment shall be positioned or vented in a manner to prevent deposition of combustion contaminants on any part of the structure.

- (e) Test Area (Sections). Prior to proceeding with production work on the project, the Contractor shall prepare test sections of at least 10 ft² (0.93 m²) on each structure scheduled for metalizing work. Locations shall be selected by the Engineer that are considered to be representative of existing surface and structural configurations. More than one test section may be needed to represent the various design configurations of the structure. The test section(s) shall be blast cleaned, metalized, and sealed in accordance with the requirements specified herein using the same equipment, materials, and procedures that will be used for the production work. Safe access shall be provided for close visual inspection and testing.

During the blast cleaning, metalizing, and sealing of the test section(s), in the presence of the Engineer, the Contractor shall perform all quality control tests and inspections required by this specification including complete documentation. In addition, the Contractor shall allow sufficient time for the Engineer to perform any or all tests and inspections desired.

Production work shall not proceed until the Engineer agrees that the Contractor's blast cleaning, metalizing, and sealing work, along with their quality control testing, inspection, and documentation are acceptable.

Additional compensation will not be allowed the Contractor for preparation of the test section(s).

- (f) Protective Coverings and Damage. All portions of the structure that could be damaged by the surface preparation and metalizing/sealing operations (e.g., utilities) shall be protected by covering or shielding. Tarpaulins, drop cloths, or other approved materials shall be employed.

When removing existing paint containing lead, the containment and disposal of the residues shall be as specified in CONTAINMENT AND DISPOSAL OF LEAD PAINT CLEANING RESIDUES of Section 900.

Metalizing or sealer overspray shall not be permitted to escape into the air or onto any other surfaces or surrounding property not intended to be metalized or sealed. Containment shall be used to control metalizing/sealer drips, spills, and overspray, and shall be dropped and all equipment secured when sustained wind speeds of 40 mph (64 kph) or greater occur, unless the containment design necessitates action at lower wind speeds. The Contractor shall evaluate project-specific conditions to determine the specific type and extent of containment needed to control emissions and shall submit a plan for containing or controlling surface preparation, metalizing, and sealer debris (spills, overspray, etc.) to the Engineer for review and acceptance prior to starting the work. Acceptance shall not relieve the Contractor of the ultimate responsibility for controlling debris from escaping the work zone.

When the protective coverings need to be attached to the structure, attachment shall be by bolting, clamping, or similar means. Welding or drilling into the structure is prohibited unless approved by the Engineer in writing.

The Contractor shall be responsible for any damage caused to persons, vehicles, or property. Whenever the intended purposes of the controls or protective devices used by the Contractor are not being accomplished, as determined by the Engineer, work shall be immediately suspended until corrections are made. Damage to vehicles or property shall be repaired by the Contractor at the Contractor's expense. Metalized or sealed surfaces damaged by any Contractor's operation shall be repaired, and re-metalized and/or re-sealed, as directed by the Engineer, at the Contractor's expense.

(g) Weather Conditions. Surfaces prepared for metalizing or sealing shall be free of moisture and other contaminants. The Contractor shall control operations to ensure that dust, dirt, or moisture do not come in contact with surfaces on which work will take place. In addition to the metalizing manufacturer's written instructions for surface preparation and metalizing, the below listed conditions shall apply. The conditions shall also apply when the metalizing is sealed. (When in conflict, the most restrictive conditions shall govern).

(1) The surface temperature shall be at least 5°F (3°C) above the dew point during final surface preparation and sealer application operations. The manufacturers' published literature shall be followed for specific temperature, dew point, and humidity restrictions during the application of the metalizing and each coat of sealer. Metalizing or sealer shall not be applied in rain, wind, snow, fog, or mist. Ambient conditions shall be maintained during the drying period specified by the manufacturer.

(2) If the Contractor proposes to control the ambient conditions inside containment, proposed methods and equipment for heating and/or dehumidification shall be included in the Surface Preparation, Metalizing or Sealing Plans, as applicable. Any heating and/or dehumidification

proposals accepted by the Engineer shall be implemented at no additional cost to the Agency.

- (3) The Contractor shall monitor temperature, dew point, and relative humidity every four hours during surface preparation, metalizing, and sealer application in the specific areas where the work is being performed. The frequency of monitoring shall increase if weather conditions are changing. The Engineer has the right to reject any work that was performed under unfavorable weather conditions. Rejected work shall be removed, re-cleaned, re-metalized, and re-sealed, as applicable, at the Contractor's expense.
- (h) Compressed Air Cleanliness. Prior to using compressed air for abrasive blast cleaning, blowing down surfaces, and metalizing or sealer application, the Contractor shall verify that the compressed air is free of moisture and oil contamination according to the requirements of ASTM D 4285. The tests shall be conducted at least one time per shift for each compressor system in operation. If air contamination is evident, the Contractor shall change filters, clean traps, add moisture separators or filters, or make other adjustments as necessary to achieve clean, dry air. The Contractor shall also examine the work performed since the last acceptable test for evidence of defects or contamination caused by the contaminated compressed air. Contaminated work shall be repaired at the Contractor's expense.
- (i) Solvent Cleaning (Hold Point). The Contractor shall remove all traces of oil, grease, diesel fuel deposits, and other detrimental contaminants on the steel surfaces to be metalized by solvent cleaning in accordance with SSPC-SP1. The brand name of proposed cleaning solvent(s) and/or proprietary chemical cleaners, including manufacturers' product data sheet and MSDS, shall be submitted for Engineer acceptance prior to use.
- Under no circumstances shall blast cleaning be performed in areas containing surface contaminants or in areas where the Engineer has not accepted the solvent cleaning. Rejected surfaces shall be re-cleaned to the specified requirements at the Contractor's expense.
- (j) Laminar and Stratified Rust. All laminar and stratified rust that has formed on the existing steel surfaces shall be removed prior to blast cleaning. Pack rust formed along the perimeter of mating surfaces of connected plates or shapes of structural steel, or in crevices, shall be removed to a level below the edges of the mating surfaces to the extent feasible without mechanically detaching the mating surface. In any case, all loose pack rust shall be removed. Any pack rust remaining shall be tight and intact when probed with the blade of a dull putty knife. The tools used to remove these corrosion products shall be identified in the submittals and accepted by the Engineer. Any damage to the base metal from this work (i.e., nicks or gouges, etc.) shall be repaired to the satisfaction of the Engineer, at the Contractor's expense. The Contractor shall also demonstrate to the Engineer that the necessary adjustments have

been made to prevent a reoccurrence of damage prior to resuming work.

(k) Surface Preparation (Hold Point). The following methods of surface preparation shall be used. The method of surface preparation applies to the entire surface, including areas that may be concealed by the containment connection points.

(1) Limited Access Areas. If any surfaces are not accessible for complete and thorough blast cleaning, the Contractor shall notify the Engineer. At the direction of the Engineer, the metalizing may be replaced with an approved coating system in select areas and a best effort with the specified methods of cleaning shall be performed. The equipment being used for the majority of the cleaning may need to be supplemented with other commercially available equipment, such as angled blast nozzles, to properly clean the limited access areas. The acceptability of the best effort cleaning in these areas shall be at the sole discretion of the Engineer.

(2) Flame Cut Steel. Prior to blast cleaning, all flame cut edges shall be ground to remove hardened steel and any sharp or irregular shapes.

(3) White Metal Blast Cleaning. All steel surfaces to be metallized shall be white metal blast cleaned in accordance with SSPC-SP 5 using dry abrasive blast cleaning methods.

If hackles, burrs, or slivers in the base metal are visible on the steel surface after cleaning, the Contractor shall remove them by grinding followed by re-blast cleaning.

If the blast cleaned steel surface rusts or becomes contaminated, or has been exposed for longer than 6 hours before metalizing, the surface shall be re-blasted prior to metalizing. All re-blasted surfaces shall be approved by the Engineer prior to metalizing.

(1) Abrasives. Abrasive blast cleaning shall be performed using either expendable abrasives or recyclable steel grit abrasives. Expendable abrasives shall be used one time and discarded. The abrasive shall be angular in shape. Acceptable angular shaped abrasives include, but are not limited to, aluminum oxide, steel grit, and crushed slag. Silica sand shall not be used. Steel shot and other abrasives producing a rounded surface profile are not acceptable, even if mixed with angular grit abrasives.

Abrasive suppliers shall provide written certification that expendable abrasives and recyclable steel grit abrasives meet the requirements of SSPC-AB1 or AB3, respectively. Abrasive suppliers shall certify that abrasives are not oil contaminated and shall have a water extract pH value within the range of 6 to 8. On a daily basis, the Contractor shall verify that recycled abrasives are free of oil and contamination by performing a vial test in accordance with SSPC-AB2.

All surfaces that are found to have been prepared using abrasives not meeting the SSPC-AB1, AB2, or AB3 requirements, as applicable, are oil contaminated, or have a pH outside the specified range, shall be solvent cleaned or low pressure water cleaned as directed by the Engineer, and re-blast cleaned at the Contractor's expense.

- (m) Surface Profile (Hold Point). Blast cleaning abrasives shall be of the size and grade that will produce a finished surface condition to achieve the bend test and adhesion test criteria for the metalizing and produce a uniform angular surface profile depth of 3.5 to 4.5 mils (89 to 114 microns). If the metalizing wire manufacturer's profile requirements are more restrictive, the Contractor shall advise the Engineer and comply with those requirements. For recycled abrasives, an appropriate operating mix shall be maintained in order to control the profile within these limits.

The average surface profile shall be determined each work day and as required by the Engineer. All surfaces, including flame cut edges, shall be tested in accordance with SSPC PA 17. Testex profile depth tape shall be used. The Testex tape shall be retained and included with the daily QC report. Single measurements less than 3.5 mils (89 microns) are unacceptable. In that event, additional testing shall be done to determine the limits of the deficient area and, if it is not isolated, work will be suspended. The Contractor shall submit a plan for making the necessary adjustments to ensure that the specified surface profile is achieved on all surfaces. Work shall not resume until the Engineer provides written acceptance.

- (n) Soluble Salt (Chloride) Remediation (Hold Point). The Contractor shall remediate chloride levels on blast cleaned surfaces to acceptable levels. Surfaces subject to chloride contamination include, but are not limited to, steel surfaces within or beneath expansion joints, areas subject to moisture splashing, misting or seeping downward from the roadway, and corrosion pitted areas.

Methods of chloride removal such as steam cleaning or pressure washing (with or without the addition of a chemical soluble salt remover as approved by the metalizing manufacturer) and scrubbing before or after blast cleaning shall be used. The Contractor may also elect to use wet abrasive methods of preparation, or combinations of the above. If wet methods are used, the steel shall be re-blast cleaned by dry abrasive blast cleaning. If steam or water cleaning methods of chloride removal are used on surfaces where the existing paint has been completely removed, and the water does not contact any lead containing coating, the water does not have to be collected. The Contractor shall provide the proposed procedures for chloride remediation in the Surface Preparation/Sealing Plan.

The Contractor shall use Class A (cell or sleeve) methods of field chloride extraction and test procedures (e.g., silver dichromate) in accordance with SSPC Guide 15 to test representative surfaces that were previously rusted (e.g., pitted steel) for the presence of remaining chlorides. Chloride levels

shall be no greater than $7\mu\text{g}/\text{cm}^2$ as read directly from the surface without any multiplier applied to the results. The testing shall be performed, and the results shall be acceptable, prior to metalizing each day.

A minimum of five tests per $1,000\text{ ft}^2$ (93 m^2) or fraction thereof completed in a given day, shall be conducted at project start-up. If results greater than $7\mu\text{g}/\text{cm}^2$ are detected, the surfaces shall be re-cleaned and retested at the same frequency. If acceptable results are achieved on three consecutive days in which testing is conducted, the test frequency may be reduced to one test per $1,000\text{ ft}^2$ (93 m^2) prepared each day provided the chloride remediation process remains unchanged. If unacceptable results are encountered, or the methods of chloride remediation are changed, the Contractor shall resume testing at a frequency of five tests per $1,000\text{ ft}^2$ (93 m^2).

Following successful chloride testing, test areas shall be re-cleaned in accordance with SSPC-SP 5.

- (o) Surface Condition Prior to Metalizing (Hold Point). Prepared surfaces shall meet the requirements of SSPC-SP 5 immediately prior to metalizing, and shall be metalized within six hours of blast cleaning. If rust appears or bare steel has been exposed for more than six hours, the affected area shall be re-blasted at the Contractor's expense.

All dust, loose coating, and surface preparation residue on bridge steel surfaces, scaffolding and platforms, containment materials, and tops of abutments and pier caps shall be removed prior to metalizing. When lead coating is being disturbed, cleaning shall be accomplished by HEPA vacuuming unless it is conducted within a containment that is designed with a ventilation system capable of collecting the airborne dust and debris created by sweeping and blowing with compressed air.

The quality of surface preparation and cleaning of surface dust and debris shall be accepted by the Engineer prior to metalizing.

The Engineer has the right to reject any work that was performed without adequate provision for QA observations to accept the degree of cleaning. Rejected metalizing work shall be removed and replaced at the Contractor's expense.

- (p) Daily Metalizing Operator-Equipment Qualification - Bend Tests. Unless directed otherwise by the Engineer, each day that metalizing will be applied, the Contractor shall perform bend testing prior to beginning production work. For each metalizing applicator, five carbon steel coupons measuring 2" wide x 8" long x 0.05" thick shall be blast cleaned using the same equipment and abrasive used for the production work. Each applicator shall apply the metalizing to five coupons in accordance with the requirements of this Specification to a dry film thickness of 8.0 to 12.0 mils. 180 degree bend testing shall be performed on all five coupons using a 13 mm mandrel in accordance with the requirements and acceptance criteria of SSPC-CS 23/AWS C2.23M/NACE 12. Minor cracks that cannot be lifted from the

substrate with a knife blade are acceptable. If lifting occurs on any coupon, the surface preparation and/or metalizing process shall be modified until acceptable results are achieved before proceeding with production work.

- (q) Application of Metalizing. Metalizing application shall be done using electric arc thermal spray metalizing equipment in accordance with the requirements of the material supplier. SSPC-CS Application shall be done in overlapping passes in a cross-hatch pattern (i.e., a second set of overlapping passes shall be applied at right angles to the first set of overlapping passes) to ensure uniform coverage. The gun shall be held at such a distance from the work surfaces that the metal is still molten on impact. The metalizing shall be applied as a continuous film of uniform thickness, firmly adherent, and free from thin spots, misses, lumps or blisters, and have a fine sprayed texture. Thin spots and misses shall be re-metalized. If the configuration of the surface being metalized does not allow for a proper gun-to-work piece standoff distance, the Contractor shall notify the Engineer.

The Contractor may apply a light preservation coat of metalizing (thick enough to sufficiently cover the profile peaks) in order to preserve the blast cleaned steel if conditions prevent the immediate application of the correct thickness. The Contractor shall add the correct thickness as soon as possible to those areas but in no longer than 8 hours. The preservation coat shall be free of dirt, dust, oxidized coating, and any other deformities prior to application of additional metalizing. If the preservation coat fails to prevent rusting, the surface shall be completely blast cleaned and re-metalized at no cost to the Agency.

- (1) Metalizing Thickness. The thickness of the metalizing shall be 8.0 to 12.0 mils (200-300 microns) measured as specified by SSPC-PA2 (Type 2 Electronic Gauge only).
- (2) Metalizing Adhesion. Adhesion testing of metalizing applied each day shall be determined with a self-adjusting adhesion tester in accordance with ASTM D 4541. Unless otherwise directed by the Engineer, a minimum of one test shall be conducted for every 500 ft² (46.45 m²) of metalized surface. The tests shall be conducted prior to application of the seal coat. If any of the tests exhibit less than 700 psi (4.83 MPa), additional tests shall be conducted to determine the extent of the deficient material. All deficient metalizing shall be removed by blast cleaning and re-applied at no cost to the Agency.

At the discretion of the Engineer, a representative blast cleaned test panel (or companion panel) can be metalized at the same time each 500 ft² (46.45 m²) of surface area, or portion thereof, is metalized. Adhesion testing can be performed on the companion panel rather than on the structure. If the adhesion tests on the panels are acceptable, the metalizing on the structure is considered acceptable and testing on the structure is not required.

If adhesion testing of the panels fails, testing shall be conducted on the structure. If adhesion testing on the structure is acceptable, the metalizing on the structure is considered to be acceptable. If tests on the structure are unacceptable, complete removal of the failing metalizing and re-metalizing in accordance with this Specification shall be performed at no cost to the Agency.

- (r) Application of Metalizing Sealer Coat. The metalizing sealer coat shall be applied within 8 hours of metalizing. The metalizing shall be dry and free of any visible debris or oxidation at the time of application. Visible oxidation shall be removed.

The sealer coat shall be applied in accordance with the manufacturer's instructions and in such a manner to assure thorough wetting and sealing of the metalizing.

All sealer shall be applied by spray, supplemented with brushing or rolling, if needed. Special attention shall be given to obtaining complete coverage in crevices, on welds and edges, and in hard to reach areas.

TABLE 1
Clear Metalizing Sealer Materials

MANUFACTURER	SEALER COAT (DFT)
Carboline Company (See Note 1 Below)	Carbothane Clear Gloss (3.0 to 5.0 mils) (75 to 125 microns)
Pittsburgh Sealers (PPG) (See Note 1 Below)	Pitthane Ultra Clear 95-8000 (2.0 to 3.0 mils) (50 to 75 microns)
Sherwin-Williams (See Note 1 Below)	ArmorSeal Rexthane I MCU (3.0 to 5.0 mils) (75 to 125 microns)

Note 1: The clear sealer shall be applied in a 2 step process. The first step shall be to apply a "mist coat" that is thinned at the maximum allowable thinning rate as listed on the manufacturer's product data sheet. The intent of the mist coat is to saturate the porous metalizing surface and displace entrapped air within the porosity of the metalizing. After allowing the mist coat to flash off for 20 minutes, a second full coat of clear sealer shall be applied to achieve the manufacturer's recommended dry film thickness.

- (s) Touch-up of Damage or Unacceptable Metalizing/Sealer Layers. The Contractor shall repair all damage or unacceptable metalizing/sealer layers and also areas concealed by containment/protective covering attachment points, if applicable.

Damage to the metalizing/sealer that does not expose the substrate shall be prepared by solvent cleaning in accordance with SSPC-SP1 followed by power tool cleaning in accordance with SSPC-SP3 to remove loose material. For the repair of damaged metalizing that exposes the substrate or containment/protective covering attachment points, the surface shall be spot blast cleaned in accordance with SSPC-SP5.

The metalizing and/or sealer surrounding each repair area shall be feathered for a distance of 1" to 2" to provide a smooth, tapered transition into the existing intact material. The surrounding intact sealer shall be roughened to promote adhesion of the repair coats.

If the damage extends to the substrate, the metalizing and sealer shall be applied. When damage does not expose the substrate, only the affected coat(s) shall be applied.

- xx. SPECIAL INSTRUCTIONS. At the completion of the work, the Contractor shall stencil, in black urethane coating, the date of metalizing the bridge. The letters shall be capitals, not less than 2 inches (50 mm) and not more than 3 inches (75 mm) in height.

The stencil shall contain the following words on four lines: "METALIZED BY" on the first line; name of the Contractor on the second line; the month and year in which the coating was completed on the third line; and 99.9% zinc, on the fourth line. This shall be stenciled on the outside face of an outside beam near one end of the bridge, or at some equally visible surface near the end of the bridge, as designated by the Engineer.

- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Field Metalizing of Existing Structural Steel) at the location specified to be measured for payment will be on a lump sum basis in the complete and accepted work.

- xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Field Metalizing of Existing Structural Steel) will be paid for at the Contract lump sum price. Payment will be full compensation for

performing all work specified and for furnishing all labor, tools, equipment, and incidentals to complete the work.

Removal from the job site of all debris, rust, and waste generated by the work is the Contractor's responsibility and shall be included in the unit price bid for Special Provision (Field Metalizing of Existing Structural Steel).

Payment will not be authorized until all requirements for surface preparation, metalizing, and sealing have been fulfilled as described in this Specification, including but not limited to the preparation and submittal of all QC documentation. Payment will also not be authorized for non-conforming work until the discrepancy is resolved in writing.

Payment will be made as follows:

- (a) Fifteen (15) percent of the Contract unit price will be paid when all submittal requirements have been met and accepted by the Agency, and the Contractor is fully mobilized to begin work.
- (b) An additional seventy-five (75) percent of the Contract unit price will be paid when all field metalizing work is complete.
- (c) The final ten (10) percent of the Contract unit price will be paid when the Contractor has fully demobilized and all equipment and waste have been removed from the project site to the satisfaction of the Engineer.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.645 Special Provision (Field Metalizing of Existing Structural Steel)(TH 14 - Br. No. D15)	Lump Sum