

## **FIELD THERMAL SPRAYING (METALLIZING) STRUCTURAL STEEL**

Effective January 28, 2005

**Scope of Work:** This work shall consist of the preparation of all designated metal surfaces by the method(s) specified on the plans in the General Notes. This work also includes the application of a thermally sprayed metallic coating (metallizing) of those designated surfaces with the metallizing system(s) specified on the plans. The Contractor shall furnish all materials, equipment, labor, and other essentials necessary to accomplish this work and all other work described herein and as directed by the Engineer.

The requirements as outlined in the Steel Structure Paint Council's (SSPC-CS 23.00/AWS C2.23M) "Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc and Their Alloys and Composites for the Corrosion Protection of Steel" shall be followed and considered as part of this specification.

**Contractor Prequalification.** The Metallizing Contractor shall have satisfactorily performed a minimum of three (3) previous projects involving thermally applied metals or alloys to steel substrates. The Metallizing Contractor shall have performed at least one similar or at least industrial type metallizing project within the past two (2) years, and provide documentation of successful completion of projects that incorporated the use of thermal spraying. Prior to the pre-construction meeting or the beginning of any work on this project, The Contractor shall provide to the Department a list of previous clients, including the names, addresses and telephone numbers of successfully completed projects done by the Contractor or Subcontractor. Suitability of the Metallizing Contractor's qualifications and prior experience will be considered by the Department before granting approval to proceed.

**Materials:** All metallizing feedstock material to be used shall be produced by the same manufacturer and meet the thermal spray equipment manufacturer's specifications.

- a. The size of the feedstock material shall be the appropriate size as required by the equipment manufacturer.
- b. The wire used for metallizing shall be 85/15 zinc/aluminum per ASTM B-833, Standard Specification for Zinc Wire for Thermal Spraying (Metallizing). The manufacturer's certificate verifying the thermal spray coating (TSC) feedstock chemical composition, obtained from a representative sample of each heat during the pouring or subsequent processing, conforming to AWS C2.25 and all applicable Material Safety Data Sheets (MSDS) shall be provided to the Engineer prior to the start of work.

**Submittals:** The Contractor shall submit for Engineer review and acceptance, the following plans and information for completing the work. The submittals shall be provided within 30 days of execution of the contract unless given written permission by the Engineer to submit them at a later date. Work cannot proceed until the submittals are accepted by the Engineer. Details for each of the plans are presented within the body of this specification.

- a. **Quality Control (QC) Program.** The QC Program shall identify the following: the instrumentation that will be used, a schedule of required measurements and observations, procedures for correcting unacceptable work, and procedures for improving surface preparation and metallizing quality as a result of quality control findings. The program shall incorporate at a minimum, the IDOT Quality Control Daily Report Forms as supplied by the Engineer.

- b. Inspection Access Plan. The inspection access plan shall address procedures for use by the contractor QC personnel for ongoing inspections and by the Engineer during Quality Assurance (QA) observations.
- c. Surface Preparation/Metallizing Plan. The surface preparation/metallizing plan shall include the methods of surface preparation and type of equipment to be utilized for abrasive blasting, wet abrasive blasting, water jetting, removal of rust, mill scale, paint or foreign matter, and remediation of chlorides. If detergents, additives, or inhibitors are incorporated into the water (for wet abrasive blasting, water jetting, or chloride remediation), the Contractor shall include the names of the materials and Material Safety Data Sheets (MSDS). The Contractor shall also include a letter from the feedstock manufacturer stating any such detergent, additive, or inhibitor is compatible and will not adversely affect the metallizing system. The Contractor shall identify the solvents proposed for solvent cleaning together with the appropriate MSDS.

The plan shall also include the methods of coating application and equipment to be utilized.

If the Contractor proposes to heat or dehumidify the containment, the methods and equipment proposed for use shall be included in the Plan for the Engineer's consideration.

- d. Abrasives. Abrasives to be used for abrasive blast cleaning shall include the appropriate MSDS. Abrasive shall be hard and sharp in order to produce an angular surface profile. Acceptable abrasives include but are not limited to, angular aluminum oxide, angular steel grit and angular crushed slag. Silica sand shall not be used. Steel shot and other abrasives producing a rounded surface profile are not acceptable. However, the steel can be pre-blasted with shot provided that the entire surface is reblasted with angular abrasive. A sample of the abrasive shall be submitted to the Engineer two weeks prior to surface preparation for testing and approval.

For expendable abrasives, the Contractor shall provide certification from the abrasive supplier that the abrasive meets the requirements of SSPC-AB1. For steel grit abrasives, the certification shall indicate that the abrasive meets the requirements of SSPC-AB3.

- e. Protective Coverings. Plan for containing or controlling metallizing debris (droplets, overspray, and etc.). Any tarpaulins or protective coverings proposed for use shall be fire retardant. For submittal requirements involving the containment used to remove lead paint, the Contractor shall refer to Special Provision for Containment and Disposal of Lead Paint Cleaning Residues.
- f. Progress Schedule. Progress schedule shall be submitted per Article 108.02 and shall identify all major work items (e.g., installation of rigging/containment, surface preparation, and metallizing application).

When the Engineer accepts the submittals, the Contractor will receive written notification. The Contractor shall not begin any paint removal work until the Engineer has accepted the submittals. The Contractor shall not construe Engineer acceptance of the submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety concerns. Acceptance of the programs 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.

Quality Control (QC) Inspections. The Contractor shall perform first line, in process QC inspections. The Contractor shall implement the submitted and accepted QC Program to insure that the work accomplished complies with these specifications. The designated Quality Control inspector shall be onsite full time during any operations that affect the quality of the coating system (e.g., surface preparation and chloride remediation, metallizing application, and evaluation of metallizing upon project completion). The Contractor shall use the IDOT Quality Control Daily Report forms supplied by the Engineer to record the results of quality control tests. The completed reports shall be turned into the Engineer before work resumes the following day.

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

- Suitability of protective coverings and the means employed to control project debris, etc.
- Ambient conditions;
- Surface preparation (solvent cleaning, abrasive blast cleaning, and etc.);
- Chloride remediation;
- Thermal Spray application (specified materials, and dry film thickness);
- Coating continuity and coverage (freedom from overspray, dry spray build-up, pinholes, skips, misses, etc.).

The personnel managing the Contractor's QC Program shall possess a minimum classification as a National Association of Corrosion Engineers (NACE) Coating Inspector Technician, or shall provide evidence of successful inspection of three projects of similar or greater complexity and scope that have been completed in the last two years. References shall include the name, address, and telephone number of a contact person employed by the bridge owner.

The personnel performing the QC tests shall be trained in coatings inspection, thermal spray application and the use of the testing instruments. Documentation of training shall be provided. The QC personnel shall not perform hands on surface preparation or metallizing activities. Applicators shall perform dry film thickness measurements, 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 inspections. Equipment shall include the following at a minimum:

- Psychrometer or comparable equipment for the measurement of dew point and relative humidity, together with all necessary weather bureau tables or psychrometric charts.
- Surface temperature thermometer.
- Hypodermic Needle Pressure Gage for determining blasting pressure at the nozzle.
- SSPC Visual Standards VIS 1 for abrasive blast cleaning, VIS 4 for water jetting, and/or VIS 5 for wet abrasive blast cleaning, as applicable.
- Testex Press-O-Film Replica Tape and Spring Micrometer.
- Bresle Cell Kits or CHLOR\*TEST kits for chloride determinations, or equivalent.
- Blotter paper and plate glass for compressed air cleanliness checks.
- Type 2 Magnetic Dry Film Thickness Gage per SSPC - PA2.
- Calibration standards for dry film thickness gage.
- Light meter for measuring light intensity during paint removal, metallizing, and inspection activities.

- All applicable ASTM, ANSI, AWS, and SSPC Standards used for the work (reference list attached).

The instruments shall be calibrated by the Contractor's personnel according to the equipment manufacturer's recommendations and the Contractor's QC Program. All inspection equipment shall be made available to the Engineer for QA observations on an as needed basis.

**Hold Point Notification:** Specific inspection items throughout 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 before a Hold Point inspection will be reached. If the 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 granted solely at the discretion of the Engineer, and only on a case-by-case basis.

**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 provide all necessary daily QC inspections of his/her 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.

The Engineer will issue a Non-Conformance Report when work is found to be in violation of the specification requirements, and is not corrected to bring it into compliance before proceeding with the next phase of work.

**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 to be cleaned and painted. This equipment shall be provided during all phases of the work. Examples of acceptable access structures include:

- Mechanical lifting equipment, such as, scissor trucks, hydraulic booms, etc.
- Platforms suspended from the structure comprised of trusses or other stiff supporting members and including rails and kick boards.
- Simple catenary's supports are permitted only if independent life lines for attaching a fall arrest system according to Occupational Safety and Health Administration (OSHA) regulations are provided.

When the surface to be inspected is more than 1.8 m (6 ft) above the ground or water surface, the Contractor shall provide the Engineer with a safety harness and a lifeline according to OSHA regulations. The lifeline and attachment shall not direct the fall into oncoming traffic. The Contractor shall provide a method of attaching the lifeline to the structure independent of the inspection facility or any support of the platform. When the inspection facility is more than 800 mm (2 1/2 ft) above the ground, the Contractor shall provide an approved means of access onto the platform.

The Contractor shall provide artificial lighting in areas where natural light is inadequate, as determined by the Engineer, to allow proper cleaning, inspection, and painting. Illumination for inspection shall be at least 325 LUX (30 foot candles). Illumination for cleaning and painting,

including the working platforms, access and entryways shall be at least 215 LUX (20 foot candles).

**Surface Preparation and Metallizing Equipment:** The metallizing unit shall be a gun manufactured by an established domestic company. Arc or flame spray type equipment are acceptable. The equipment shall be used according to manufacturer's recommendations.

All cleaning and metallizing equipment shall include gages capable of accurately measuring fluid and air pressures and shall have valves capable of regulating the flow of air, water, current or feedstock as recommended by the equipment manufacturer. The equipment shall be maintained in proper working order and be of size or capacity to satisfactorily complete the work.

Metallizing and surface preparation equipment shall utilize filters, traps or separators recommended by the manufacturer of the equipment and shall be kept clean to prevent oil, water, dried paint and other foreign materials from being deposited on the surface. The filters, traps and separators shall be cleaned or drained by means, and at intervals, recommended by the manufacturer of the equipment.

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.

**Test Sections:** Before any metallizing is done, the Contractor shall prepare a test section for each batch or lot of wire supplied. The Contractor shall submit to the Engineer a steel plate approximately 300 mm x 300 mm (12-inch x 12-inch) to which the metal has been deposited to the specified thickness, as checked with a magnetic or Eddy Current Gage, for acceptance by the Engineer as to grain size and texture of the sprayed metal. The test plate will be used to determine the acceptance of the finished job.

The Engineer will perform the following test for adhesion on the metallized surface of the test plate. He/she will cut through the coating with a knife or chisel, if the metallizing or any part of it can be lifted from the base metal 6 mm (1/4-inch) or more ahead of the cutting blade without actually cutting the metal, the surface preparation will be deemed improper and the coating will be considered unsatisfactory. Each spray operator shall be qualified to metallize according to ANSI/AWS C2.18-93. Any operator who does not show evidence of qualification shall not be allowed to spray.

Two locations or more as determined by the Engineer, on each beam shall also be tested for adhesion as outlined above. All areas tested shall be repaired and remetallized according to this specification. In the event the Contractor's coating is inferior to the sample, he shall be required to correct the coating by an acceptable repair method to produce a surface comparable to the approved test section.

Prior to surface preparation, the Contractor shall prepare a test section(s) on each structure to be metallized in a location(s), which the Engineer considers to be representative of the existing surface condition and steel type for the structure as a whole. More than one test section may be needed to represent the various design configurations of the structure. The purpose of the test section(s) is to demonstrate the use of the tools and degree of cleaning required (cleanliness and profile) for each method of surface preparation that will be used on the project. Each test section shall be approximately 0.93 sq.m (10 sq.ft.). The test section(s) shall be prepared using the same equipment, materials and procedures as the production operations. The Contractor shall prepare the test section(s) to the specified level of cleaning according to the appropriate SSPC visual standards, modified as necessary to comply with the requirements

of this specification. The written requirements of the specification prevail in the event of a conflict with the SSPC visual standards. Only after the test section(s) have been approved shall the Contractor proceed with surface preparation operations. Additional compensation will not be allowed the Contractor for preparation of the test section(s).

**Adhesion Testing and Coupons:** The Contractor shall provide all materials and testing equipment necessary for the following:

- (1) **Bend Test Coupons.** Each metallizing operator shall be subject daily to providing a minimum of two coupons, or more as directed by the Engineer, per day. The coupons shall be of carbon steel and be prepared to Near White Blast Cleaning SSPC SP-10. The coupon dimensions shall be 50 X 200 X 1.3mm (2 X 8 X 0.050 in.). The coupons shall be sprayed to the same thickness and spray requirements as stipulated in this Specification. Bend test shall be conducted using a hydraulic roller-guided bender with 0.500 inch mandrel per AWS standards.
- (2) **Adhesion Testing.** Adhesion shall be defined as a bond strength of 700psi minimum with approved measuring equipment per ASTM D4541. Measurements shall be taken at a location as designated by the Engineer every 700 square feet. Any failed areas shall be removed and re-metallized with no additional cost to the Department.

**Protective Coverings and Damage:** All portions of the structure that could be damaged by the surface preparation and metallizing operations (e.g., utilities), including any sound paint that is allowed to remain according to the contract documents, shall be protected by covering or shielding. Tarpaulins drop cloths, or other approved materials shall be employed. The Contractor shall comply with the provisions of the Illinois Environmental Protection Act. Metallizing overspray are not permitted to escape into the air or onto any other surfaces or surrounding property not intended to be metallized. Containment shall be used to control metallizing drips, spills, and overspray, and shall be dropped and all equipment secured when sustained wind speeds of 64 kph (40 mph) 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 metallizing debris (spills, overspray, etc.) to the Engineer for approval prior to starting the work. Approval shall not relieve the Contractor of their ultimate responsibility for controlling paint debris from escaping the work zone.

When the protective coverings need to be attached to the structure, they shall be attached by bolting, clamping, or similar means. Welding or drilling into the structure is prohibited unless approved by the Engineer in writing. When removing coatings containing lead the containment and disposal of the residues shall be as specified in the Special Provision for Containment and Disposal of Lead Paint Cleaning Residues contained elsewhere in this Contract. When removing coatings not containing lead the containment and disposal of the residues shall be as specified in the Special Provision for Containment and Disposal of Non-Lead Paint Cleaning Residues contained elsewhere in this Contract.

The Contractor shall be responsible for any damage caused to persons, vehicles, or property, except as indemnified by the Response Action Contractor Indemnification Act. 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. Metallized surfaces damaged by any Contractor's operation shall be repaired, removed and/or remetallized, as directed by the Engineer, at the Contractor's expense.

**Weather Conditions:** The surfaces to be metallized after surface preparation must remain free of moisture and other contaminants. The Contractor shall control his/her operations to insure that dust, dirt or moisture do not come in contact with surfaces prepared that day. In addition to the metallizing system's manufacturer's written instructions for surface preparation, and metallizing, the following conditions shall apply. (When in conflict, the most restrictive conditions shall govern).

- (1) The minimum steel and air temperatures shall be 4°C (40°F). Metallizing shall not be applied to steel which is at a temperature that will cause blistering, porosity or otherwise detrimental to the life of the metallizing. Metallizing shall not be applied in rain, wind, snow, fog or mist, or when the steel surface temperature is less than 3°C (5°F) above the dew point. Metallizing shall not be applied to wet, damp or frosted surfaces. Metallizing shall not be applied when the relative humidity is above 85%.
- (2) If the Contractor proposes to control the weather conditions inside containment, proposed methods and equipment for heating and/or dehumidification shall be included in the work plans for the Engineer's consideration. Any heating/dehumidification proposals accepted by the Engineer shall be implemented at no additional cost to the Department.
- (3) The Contractor shall monitor temperature, dew point, and relative humidity every four hours during surface preparation and coating 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, and metallized at the Contractor's expense.

These conditions will be verified by the Engineer at locations representative of the surfaces to be cleaned, and metallized. Work accomplished under unfavorable weather conditions will be considered unacceptable and complete re-cleaning and metallizing of these areas will be required at the Contractor's expense.

**Compressed Air Cleanliness:** Prior to using compressed air for abrasive blast cleaning, blowing down the surfaces, and metallizing, 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 each 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 compressed air. Effectuated work shall be repaired at the Contractor's expense.

**Solvent Cleaning (HOLD POINT):** The Contractor shall notify the Engineer 24-hours in advance of beginning surface preparation operations.

All traces of asphaltic cement, oil, grease, diesel fuel deposits, and other soluble contaminants on the steel surfaces to be metallized shall be removed by solvent cleaning according to SSPC – SP1, supplemented with scraping (e.g., to remove large deposits of asphaltic cement) as required. The Contractor shall identify the proposed solvent(s) in the submittals. The name and composition of replacement solvents, together with MSDS, shall be submitted for Engineer acceptance prior to use.

Under no circumstances shall abrasive blast cleaning, wet abrasive blasting, or water jetting 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 with both solvent and the specified mechanical means at the Contractor's expense.

Prior to mechanical cleaning, oil, grease, and other soluble contaminants on bare steel or rusted surfaces shall be removed by solvent cleaning according to SSPC-SP1.

**Laminar and Stratified Rust:** All laminar and stratified rust that has formed on the existing steel surfaces shall be removed. Pack rust formed along the perimeter of mating surfaces of connected plates or shapes of structural steel shall be removed to the extent feasible without mechanically detaching the mating surface. Any pack rust remaining after cleaning the mating surfaces shall be tight and intact when examined using a dull putty knife. The tools used to remove these corrosion products shall be identified in the submittals and accepted by the Engineer. If the surface preparation or removal of rust results in nicks or gouges, the work shall be suspended, and the damaged areas repaired to the satisfaction of the Engineer, at the Contractor's expense. The Contractor shall also demonstrate that he/she has made the necessary adjustments to prevent a reoccurrence of the damage prior to resuming work.

**Surface Preparation (HOLD POINT):** In each case, as part of the surface preparation process, soluble salts shall be re-mediated as specified under "Soluble Salt Remediation". The Contractor shall also note that the surface of the steel beneath the existing coating system may contain corrosion and/or mill scale. Removal of said corrosion and/or mill scale, when specified, shall be considered included in this work and no extra compensation will be allowed. One or more of the following methods of surface preparation shall be used as specified on the plans. When a method of surface preparation is specified, it applies to the entire surface, including areas that may be concealed by the containment connection points.

- a. **Limited Access Areas:** A best effort with the specified methods of cleaning shall be performed in limited access areas such as the backsides of rivets inside built up box members. The equipment being used for the majority of the cleaning may need to be supplemented with other commercially available equipment, such as angle nozzles, to properly clean the limited access areas. The acceptability of the best effort cleaning in these areas is at the sole discretion of the Engineer.
- b. **Near White Metal Blast Cleaning:** This surface preparation shall be accomplished according to the requirements of Near White Metal Blast Cleaning SSPC-SP 10. The designated surfaces shall be prepared by dry abrasive blast cleaning, wet abrasive blast cleaning, or water jetting with abrasive injection. A Near White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining.

Random staining shall be limited to no more than five (5%) percent of each 58 sq.cm. (9 sq.in.) of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. With the exception of crevices as defined below, surface discoloration is considered to be a residue that must be removed, rather than a stain, if it possesses enough mass or thickness that it can be removed as a powder or in chips when scraped with a pocketknife.

A surface profile shall be created on the steel as defined later under "Surface Profile."

At the discretion of the Engineer, after a best effort cleaning, slight traces of existing coating may be permitted to remain within crevices such as those created between rivets, bolts, and plates, and the underlying steel. When traces of coating are permitted to remain, the coating shall be tightly bonded when examined by probing with a dull putty knife. The traces of coating shall be confined to the bottom portion of the crevices only, and shall not extend onto the surrounding steel or plate or onto the outer surface of the rivets or bolts. Pitted steel is excluded from exemption considerations and shall be cleaned according to SSPC-SP10.

If hackles or slivers are visible on the steel surface after cleaning, the Contractor shall remove them by grinding followed by re-blast cleaning. At the discretion of the Engineer, the use of power tools to clean the localized areas after grinding, and to establish a surface profile acceptable to the coating manufacturer, can be used in lieu of blast cleaning.

If the surfaces are prepared using wet abrasive methods, attention shall be paid to tightly configured areas to assure that the preparation is thorough. After surface preparation is completed, the surfaces, surrounding steel, and containment materials/scaffolding shall be rinsed to remove abrasive dust and debris. Potable water shall be used for all operations. An inhibitor may be added to the supply water and/or rinse water to prevent flash rusting. If a rust inhibitor is proposed, the Contractor shall provide a sample of the proposed inhibitor together with a letter from the coating manufacturer indicating that the inhibitor is suitable for use with their products. The surfaces shall be allowed to completely dry before the application of any coating.

If the surface is degraded or contaminated subsequent to surface preparation and prior to metallizing, the surface shall be reblasted before metallizing. All surface cleaning shall be approved by the Engineer prior to metallizing.

**Abrasives:** Abrasive blast cleaning shall be performed using either expendable abrasives (other than silica sand) or recyclable steel grit abrasives. Expendable abrasives shall be used one time and disposed of. The abrasive shall be angular, and the abrasive suppliers shall certify that the expendable abrasives meet the requirements of SSPC-AB1 and that recyclable steel grit abrasives meet AB3. The Contractor shall verify that recycled abrasives meet the requirements of SSPC-AB2 during use. All surfaces prepared with abrasives not meeting the SSPC-AB1, AB2, or AB3 requirements, as applicable, shall be solvent cleaned or low pressure water cleaned as directed by the Engineer, and re-blast cleaned at the Contractor's expense.

Abrasive suppliers shall certify that abrasives are not oil contaminated and shall have a water extract pH value within the range of six to eight. All surfaces prepared with abrasives which are oil contaminated or have a pH outside the specified range shall be cleaned with solvent cleaner or low pressure water as directed by the Engineer and re-blasted by the Contractor at his/her expense.

**Surface Profile (HOLD POINT):** The abrasives used for blast cleaning shall have a gradation such that the abrasive will produce a uniform angular surface profile of 64 to 114 microns (2.5 to 4.5 mils). If the profile requirements of the feedstock manufacturer are more restrictive, advise the Engineer and comply with the more restrictive requirements. For recycled abrasives, an appropriate operating mix shall be maintained in order to control the profile within these limits.

The average surface profile produced by the Contractor's surface preparation procedures will be determined at the beginning of the work and as required by the Engineer using a profile depth tape and micrometer. Profile depth tape measurements shall be retained and included with QA documents. Single measurements less than 64 microns (2.5 mils) or greater than 114 microns (4.5 mils) blast profile, or as determined by the Engineer, will be considered unacceptable. Areas having unacceptable measurements will be further tested to determine the limits of the deficient area. If unacceptable profiles are provided, work will be suspended. The Contractor shall submit a plan for the necessary adjustments to insure the correct surface profile on all surfaces. The Contractor shall not resume work until the new profile is verified by the QA observations, and the Engineer confirms, in writing, that the profile is acceptable.

**Soluble Salt Remediation (HOLD POINT):** The Contractor shall implement surface preparation procedures and processes that will remove chloride from the surfaces. Surfaces that may be contaminated with chloride include, but are not limited to, expansion joints and all areas that are subject to roadway splash or run off such as fascia beams and stringers.

Methods of chloride removal may include, but are not limited to, steam cleaning or pressure washing with or without the addition of a chemical soluble salt remover as approved by the feedstock manufacturer, and scrubbing before or after initial paint removal. The Contractor may also elect to clean the steel and allow it to rust overnight followed by re-cleaning, or by utilizing blends of fine and coarse abrasives during blast cleaning, wet abrasive/water jetting methods of preparation, or combinations of the above. If steam or water cleaning methods of chloride removal are utilized over surfaces where the coating has been completely removed, and the water does not contact any lead containing coatings, the water does not have to be collected. The Contractor shall provide the proposed procedures for chloride remediation in the Surface Preparation/Painting Plan.

Upon completion of the chloride remediation steps, the Contractor shall use cell methods of field chloride extraction and test procedures (e.g., silver dichromate) accepted by the Engineer, to test representative surfaces that were previously rusted (e.g., pitted steel) for the presence of remaining chlorides. Remaining chloride levels shall be no greater than  $7\mu\text{g}/\text{sq.cm.}$  as read directly from the surface without any multiplier applied to the results. The testing must be performed, and the results must be acceptable, prior to painting each day.

A minimum of five tests per 93 sq.m (1,000 sq.ft.) or fraction thereof completed in a given day, shall be conducted at project start-up. If results greater than  $7\mu\text{g}/\text{sq.cm.}$  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 93 sq.m (1,000 sq.ft.) 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 93 sq.m (1,000 sq.ft.).

Following successful chloride testing, the chloride test areas shall be cleaned to the requirements of Near White Metal Blast Cleaning SSPC-SP 10.

**Surface Condition Prior to Metallizing (HOLD POINT):** Prepared surfaces, shall meet the requirements of the respective degrees of cleaning immediately prior to metallizing, and shall be metallized within five hours of blast cleaning. If rust appears or bare steel remains unmetallized for more than five hours, the affected area shall be prepared again at the expense of the Contractor. The Contractor may apply a light preservation coat (thick enough to sufficiently cover the profile peaks) of metallizing in order to preserve the cleaned steel if conditions will prevent the correct application thickness. The Contractor will need to add the correct millage as

soon as possible to the areas which may have received a light preservation coat. The areas that received the preservation coat will be free of dirt, dust, oxidized coating and any other deformities as determined by the Engineer prior to metallizing.

All static dust, loose paint and surface preparation cleaning residue on bridge steel surfaces, scaffolding and platforms, containment materials, and tops of abutments and pier caps shall be removed prior to metallizing. When lead paint 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 must be accepted by the Engineer prior to metallizing. 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 coating work shall be removed and replaced at the Contractor's expense.

**Application of Metallizing.** No surface shall be sprayed which shows any sign of rust, scale or moisture. If flame spraying is used the substrate shall be preheated to 50°C (120°F) to minimize condensation of moisture in the flame on to the substrate. All metallizing shall be applied within a maximum of five hours of the blasting. Spraying shall be done in a block pattern not to exceed 600 mm (two feet) on a side with overlapping passes to ensure uniform coverage.

The thickness of the metallizing shall be 250-300 microns (10 - 12 mils) measured as specified by SSPC-PA2 (Type 2 Fixed Probe Gauge only).

To produce the required thickness and uniformity, a minimum of two passes are required, overlapping and at right angles to each other. The gun shall be held at such a distance from the work surfaces that the metal is still plastic on impact 125 mm - 230 mm (5 to 9 inches). The coating shall be firmly adherent and free from uncoated spots, lumps or blisters, and have a fine sprayed texture.

To the maximum extent practicable, metallizing shall be applied as a continuous film of uniform thickness free of pores. All thin spots or areas missed in the application shall be re-metallized.

**Repair of Damage to New Coating System and Areas Concealed by Containment:** The Contractor shall repair all damage to the newly installed coating system and areas concealed by the containment/protective covering attachment points, at no cost to the Department. If the damage extends to the substrate and the original preparation involved abrasive blast cleaning, the damaged areas shall be prepared to Near White Metal Blast Cleaning SSPC-SP 10

### **Special Instructions:**

**Metallizing Date.** At the completion of the work, the Contractor shall stencil in contrasting color paint the date of metallizing the bridge. The letters shall be capitals, not less than 50 mm (2 inches) and not more than 75 mm (3 inches) in height.

The stencil shall contain the word "METALLIZED" and shall show the month and year in which the coating was completed. This shall be stenciled on the outside face of an outside stringer near one end of the bridge, or at some equally visible surface near the end of the bridge, as designated by the Engineer.

Removal of all debris, rust and waste generated by this work from the job site is the Contractor's responsibility and included in the Lump Sum Price.

It is understood and agreed that the cost of all work outlined above, unless otherwise specified, has been included in the bid, and no extra compensation will be allowed.

**Basis of Payment:**

This work shall be paid for at the contract Lump Sum price for Field Thermal Spraying (Metallizing) Structural Steel, and shall include all work specified herein.

## **Appendix 1 – Reference List**

The Contractor shall maintain the following regulations and references on site for the duration of the project:

- Illinois Environmental Protection Act
- ASTM D 4285, Standard Test Method for Indicating Oil or Water in Compressed Air
- SSPC-AB 1, Mineral and Slag Abrasives
- SSPC-AB 2, Specification for Cleanliness of Recycled Ferrous Metallic Abrasives
- SSPC-AB 3, Newly Manufactured or Re-Manufactured Steel Abrasives
- SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages
- SSPC-QP 1, Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Structures)
- SSPC-QP 2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint
- SSPC-SP 1, Solvent Cleaning
- SSPC-SP 10/NACE No. 2, Near White Metal Blast Cleaning
- SSPC-SP 12/NACE No. 5, Surface Preparation and Cleaning of Metals by Water Jetting Prior to Recoating
- SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
- SSPC-VIS 4, Guide and Reference Photographs for Steel Cleaned by Water Jetting
- SSPC-VIS 5, Guide and Reference Photographs for Steel Prepared by Wet Abrasive Blast Cleaning
- ASTM B833 “Standard Specifications for Zinc Wire for Thermal Spraying (Metallizing)”
- ANSI/AWS C2.18 “Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and their Alloys and Composites”, and current revisions to 1999
- The metallizing feedstock and applicator manufacture’s application instructions, MSDS and product data sheets