4.15 – Protective Coating Systems

Addendum #2

4.15.0 General

4.15.0.1 Section Includes

Furnish labor, materials, equipment, and incidentals necessary to apply protective coatings to material and equipment as specified herein, including the preparation of surfaces prior to application of coatings.

4.15.0.2 Quality Assurance

Steel and Ductile Iron pipe shall be coated in accordance with AWWA C222.

The paint manufacturer shall provide a representative to visit the jobsite at sufficient intervals during surface preparation and painting as may be required for product application quality assurance, and to determine compliance with manufacturer's instruction and these Specifications, and as may be necessary to resolve field problems attributed to, or associated with, the manufacturer's products furnished under the Contract.

Coating System Applicator shall have five years practical experience in application of specified products. Submit a list of recent projects and names of references for those projects. The OWNER may waive the requirement for five years of experience, when at the discretion of the OWNER, the applicator's experience and capabilities meet the intent of the experience requirement. Coating applicator shall be certified by the coating manufacturer as an approved applicator.

Where ANSI/NSF Standard 60 and 61 approval is required, submit ANSI/NSF certification letter for each coating in the system indicating product application limits, dry film thickness, number of coats, specific product tested, colors certified, and approved additives.

Adequate illumination shall be provided while work is in progress. Whenever required by the inspector, the CONTRACTOR shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the inspector.

Ventilation shall be used to control potential dust and hazardous conditions within confined areas. Ventilation flow rates shall be in accordance with OSHA regulations and as required to reduce air contamination to nonhazardous conditions.

4.15.0.3 Inspection

Inspect and provide substrate surfaces prepared in accordance with these specifications and the printed directions and recommendations of paint manufacturer whose product is to be applied. Provide OWNER minimum 3 days advance notice prior to start of surface preparation work or coating application work.

Perform Work only in the presence of OWNER, unless OWNER grants prior approval to perform such work in Owner's absence. Approval to perform work in the Owner's absence is limited to the current day unless specifically noted to extend beyond the completion of the workday. Inspection by the OWNER, or the waiver of inspection of any particular portion of the Work, shall not be construed to relieve the CONTRACTOR of responsibility to perform the Work in accordance with these specifications.

4.15.0.4 Testing

CONTRACTOR shall provide appropriate testing device(s) to verify coating thickness specified in mils and to check for holidays and discontinuities.

Adhesion tests shall be performed in accordance with AWWA C222

The integrity of coated surfaces scheduled for immersion shall be tested for holidays in accordance with NACE Standard SP0188. For dry films less than 20 mils, a non-destructive holiday detector shall not exceed 67.5 volts, nor shall destructive holiday detector exceed the voltage recommended by the manufacturer of the coating system. A solution of 1-ounce non-sudsing type wetting agent, such as Kodak Photo-Flo, and 1 gallon of tap water shall be used to perform the holiday testing. For coating thickness at 20 mils and greater, a high voltage Tinker & Rasor AP/W holiday tester shall be used. Contact coating manufacturer for voltage recommendations and curing parameters.

All pinholes and/or holidays shall be marked and repaired in accordance with the manufacturer's printed recommendations and retested. No pinholes or other irregularities will be permitted in the final coating.

~~Holiday tests on polyurethane coatings or linings will be conducted on the completed coating or lining after cure or 24 hours, whichever is less, using a high voltage spark test in accordance with NACE Standard RP-0274 and these specifications. Coating thickness used for holiday testing shall be the minimum specified coating thickness.~~

~~Coatings shall be tested for dry film thickness using a properly calibrated magnetic pull off or eddy current equipment. Coating thickness measurements shall be conducted as necessary and without limitation. Testing conformance to the requirements of SSPC PA 2 is specifically excluded from this specification.~~

~~Testing devices shall be as manufactured by Nordson Crop or DeFelsko Crop.~~

4.15.1 Materials

4.15.1.1 Paint Materials

All materials shall be lead-free as defined by the Consumer Product Safety Act, Part 1303. All zinc dust pigment contained in any zinc-rich material shall meet the requirements of ASTM D 520 Type III as regards zinc content and purity. No coatings shall contain Methylene Dianiline (MDA). All coatings, including all colors, shall be lead-free. All catalyzed polyurethane products shall meet the minimum requirements of SSPC Paint Specification Number 36, Level 3 Performance Level.

~~Products shall meet federal, state, and local requirements limiting the emission of volatile organic compounds. Paint material for steel, ductile and cast iron pipe shall be self-priming, plural component, 100 percent solids, non-extended polyurethane, suitable for burial or immersion.~~

4.15.1.2 Delivery, Storage and Handling

Deliver paint to the project site in unopened containers that plainly show, at the time of use, the designated name, manufacture date, color, and name of manufacturer. Store paints in a suitable protected area that is heated or cooled as required to maintain temperatures within the range recommended by the paint manufacturer. Material shall be stored and handled per manufacturer's written directions.

4.15.1.3 Manufacturers

Materials specified are those that have been evaluated for the specific service. Products of the Tnemec Company, Inc. are listed to establish a standard of quality. Equivalent materials of other manufacturer's may be submitted on written approval of the Engineer. As part of the proof of equality, the Engineer will require at the cost of the Contractor, certified test reports from a nationally known, reputable and independent testing laboratory conducting comparative tests as directed by the Engineer between the product specified and the requested substitution.

Requests for substitution shall include manufacturer's literature for each product giving name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness and certified lab test reports showing results to equal the performance criteria of the products specified herein. In addition, a list of five projects shall be submitted in which each product has been used and rendered satisfactory service.

All requests for product substitution shall be made at least 3 days prior to the bid date.

General Contractor and Painting Contractor shall coordinate work so as to allow sufficient time (normally seven to ten days) for paint to be delivered to the job site.

~~Coating material shall be one of the following products, subject to review and acceptance of submitted product performance reports:~~

~~a) Carboline 777, Carboline, St. Louis, MO~~
~~b) Protec II, Futura Coatings, Hazelwood, Missouri~~
~~c) Chemthane 2265, Chemline, St. Louis MO~~

~~Other manufacturers for consideration of the OWNER shall be submitted a minimum of 7 days prior to bid opening.~~

4.15.1.4 Colors

Manufacturer's color charts shall be submitted to the Engineer at least 30 days prior to coating and/or paint application. Paint colors provided shall consist of up to five (5) colors used to designate commonly encountered piping components within a water treatment system Colors may include white, light brown, dark brown, tan, light blue, dark blue, purple, yellow, green and others. Final paint colors shall be selected by the OWNER from color palette from approved coating manufacturer submitted by CONTRACTOR.

4.15.2 Surface Preparation

Surface preparation and costing application shall be in conformance with the coating manufacturer's written product data sheets and written recommendations of the manufacturer's technical representative. Where conflicts occur with the information presented, the more stringent of the two shall apply unless approved by the OWNER.

4.15.2.1 Existing Coated Surfaces

Shop primed or coated surfaces shall be reviewed with the Engineer to determine the extent of existing coating damage and suitability of the finish coats to adhere to the shop applied coats.

4.15.2.2 Surface Preparation for Over Coating

Areas to be overcoated shall be overcoated as follows:

Surface Preparation:

All surfaces shall be dry, clean and free of all contaminants. Clean all rusted surfaces as per SSPC-SP2 or SP3 Hand or Power Tool Cleaning. Spot prime with Tnemec Series 27WB at 4.0 to 6.0 dry mils. All surfaces to be power washed at 4,000 psi with a zero-degree spinner tip with a minimum flow rate of 3.5 gpm of clean, potable water. All mildew shall be completely removed prior to coating operations.

Coating System:

First Coat: Tnemec Series 1029 Enduratone applied at 2.0 to 3.0 dry mils.
Second Coat: Tnemec Series 1029 Enduratone applied at 2.0 to 3.0 dry mils.

Total minimum dry film thickness shall be 4.0 mils.

~~If a cured epoxy, polyurethane, or plural-component material is to be top coated, contact the coating manufacturer concerned for additional surface preparation requirements. At a minimum, existing coated surfaces shall be sanded to remove all gloss and to roughen the existing surface for adhesion of subsequent coats. Surface preparation recommendations of the manufacturer shall be subject to approval of the OWNER.~~

~~All existing coated surfaces, where demolition of equipment was specified or required, shall be surface prepared, touch-up coating repairs completed, and a cosmetic overcoat applied using the specified coating system on all existing coated surfaces associated with the demolition work, unless otherwise specified.~~

~~Apply sealer/primer where recommended by coating manufacturer for coating compatibility.~~

4.15.2.3~~2~~ Steel Surface Preparation

Surface preparation of steel pipe shall be in accordance with SSPC surface preparation standards utilizing the degree of cleanliness specified for the coating system to be applied or as specified herein, whichever is more stringent. Grit and/or shot abrasive mixture and gradation shall be as required to achieve the degree of cleanliness and coating adhesion specified. Pipe cleaned by abrasive blasting with recyclable steel grit and/or shot or other abrasive shall be cleaned of debris and spent abrasive in an air wash separator.

~~Polyurethane coated~~ **S**teel shall have a sharp angular surface profile of the minimum depth specified. After abrasive blasting surfaces and before coating application, the metal surface shall be cleaned of residual dust to a minimum of Grade 2 per ISO Standard 8502-3, Test for the Assessment of Surface Cleanliness.

Minimum surface preparation for steel surfaces is as follows:

Immersion:	**SSPC-SP10/NACE 2 Near White Metal Blast Cleaning with a minimum angular surface profile of 2.0 mils.**
Non-Immersion:	**SSPC-SP6/NACE 3 Commercial Blast Cleaning with a minimum angular surface profile of 2.0 mils.**

Work shall be performed in a manner that does not permit the cleaned metal surface to rust back or flash rust. Rust back or flash rust shall be fully removed with the steel surface cleanliness equal to the metal surface cleanliness prior to rust back or flash rusting. Determination of the equivalent surface cleanliness shall be at the OWNER'S sole discretion.

4.15.2.4~~3~~ Ductile Iron Surface Preparation

Clean all exterior surfaces as per NAPF 500-03-01 Solvent Cleaning to remove all oil, grease, factory-applied tars and/or bitumastic coatings and all other soluble contaminants.

Prepare ductile iron pipe exterior surfaces as per NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe providing a minimum 1.5 mil angular anchor profile.

Prepare ductile iron valves and fittings exterior surfaces as per NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings.

If existing exterior surfaces of ductile is factory coated with Tnemec Series N140, please follow recoat windows listed on the current product data sheet.

All internal surfaces of ductile iron pipe and fittings shall be delivered to the application facility without asphalt or any other protective lining on the interior surface. All oils,

small deposits of asphalt paint, grease, and soluble deposits shall be removed in accordance with NAPF 500-03-01 Solvent Cleaning prior to abrasive blasting.

Pipe: Uniformly rotary-abrasive blast using angular abrasive to a NAPF 500-03-04: Internal Pipe Surface condition, full removal of annealing oxide layer. When viewed without magnification, the interior surfaces shall be free of all visible dirt, dust, annealing oxide, rust, mold coating and other foreign matter. Any area where rust reappears before application shall be re-blasted. The surface shall contain a minimum angular anchor profile of 3.0 mils (762. microns) (Reference NACE RP 0287 or ASTM D 4417, Method C).

Fittings: Uniformly abrasive blast using angular abrasive to an NAPF 500-03-05: Fitting Blast Clean #1 condition, no staining. When viewed without magnification, the interior surfaces shall be free of all visible dirt, dust, annealing oxide, rust, mold coating and other foreign matter. Any area where rust reappears before application shall be re-blasted. The surface shall contain a minimum angular anchor profile of 3.0 mils (762. microns) (Reference NACE RP 0287 or ASTM D 4417, Method C).

4.15.2.5 Coating Systems for Non-Immersion Service

Interior Exposed Steel Piping, Valves & Fittings

Coating System:

First Coat: Tnemec Series 90G-1K97 Tneme-Zinc applied at 2.5 to 3.5 dry mils.

Second Coat: Tnemec Series 66 Hi-Build Epoxoline applied at 4.0 to 6.0 dry mils.

Third Coat: Tnemec Series 66 Hi-Build Epoxoline applied at 4.0 to 6.0 dry mils.

Total minimum dry film thickness shall be 10.5 mils.

Exterior Exposed Ductile Piping, Valves & Fittings

Coating System:

First Coat: Tnemec Series N69 Hi-Build Epoxoline II applied at 6.0 to 8.0 dry mils.

Second Coat: Tnemec Series N69 Hi-Build Epoxoline II applied at 6.0 to 8.0 dry mils.

Third Coat: Tnemec Series 290 CRU applied at 2.0 to 3.0 dry mils.

Total minimum dry film thickness shall be 16.0 mils.

Interior Exposed Ductile Piping, Valves & Fittings

Coating System:

Tnemec Series N69 Hi-Build Epoxoline II applied at 6.0 to 8.0 dry mils.

Tnemec Series N69 Hi-Build Epoxoline II applied at 6.0 to 8.0 dry mils

Total minimum dry film thickness shall be 12.0 mils.

4.15.2.6 Coating Systems for Immersion Service

Steel Piping, Valves & Fittings:

First Coat: **Tnemec Series 91-H_2O Hydro-Zinc applied at 2.5 to 3.5 dry mils. Thin only with approved thinner, Tnemec 41-2 or 41-3 Thinner.**

Stripe Coat: **Tnemec Series 20-15BL Pota-Pox applied by brush and scrubbed into all weld seams. In addition to weld seams, all edges, corners, bolts, rivets, pits, etc. shall receive a stripe coat.**

Second Coat: **Tnemec Series 20-1255 Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.**

Third Coat: **Tnemec Series 20-15BL Pota-Pox applied at 4.0 to 6.0 dry mils. Thin only with approved thinner, Tnemec 41-4 Thinner.**

Total dry film thickness shall be a minimum of 12.0 mils.

Ductile Iron Pipe, Valves & Fittings

Coating System:

First Coat: **Tnemec Series N140 Pota-Pox Plus applied at 6.0 to 8.0 dry mils.**

Second Coat: **Tnemec Series 141 Epoxoline applied at 10.0 to 12.0 dry mils**

Total minimum dry film thickness shall be 16.0 mils.

~~Surface preparation cleanliness shall be similar to the equivalent SSPC surface preparation grade as specified with consideration that color of blasted ductile iron will not match that of abrasively blasted steel. Properly cleaned ductile or cast iron will be a near-gray color.~~

~~Use SSPC SP grades as a surface preparation guide only for percentage cleanliness required and surface contaminants removed. Abrasive cleaning shall remove the same percentage of all surface contaminants (including tightly adhered annealing scale) as specified in the SSPC standard. Avoid over blasting, high nozzle velocities, and excessive blast times. Abrasive blasting of cast or ductile iron shall be performed in a manner to avoid lifting or exfoliating of the metal surface. Pipe manufactured using the deLavaud Process (dual spray) are highly susceptible to exfoliation of the metal surface. Any surface exfoliation shall be removed by~~

~~grinding followed by reblasting. The entire surface area shall be abrasive blasted. No tight rust stains shall be allowed.~~

~~Applicator and OWNER will agree on an acceptable level of blast at the beginning of the project that will become the standard from which all other blast work will be compared~~

4.15.3 Application

4.15.3.1 Dehumidification

Where weather conditions or project requirements dictate, CONTRACTOR shall provide and operate dehumidification and appropriate ventilation equipment to maintain environmental conditions suitable for abrasive blasting and coating application as specified herein and in accordance with the manufacturer's published instructions and product data sheets. CONTRACTOR shall provide and operate desiccant dehumidification equipment to maintain environmental conditions for 24 hours a day during abrasive blasting and coating application and coating cure. Liquid, granular, or loose lithium chloride drying systems will not be acceptable.

CONTRACTOR shall provide dehumidification equipment sized to maintain dew point temperature 17 degrees or more below surface temperature of metal surfaces to be cleaned and coated. System shall provide air flows as required to maintain positive pressure and ventilation within the environmentally controlled areas, Work activities within environmentally controlled areas shall meet all of the following requirements:

1. Two air exchanges per hour, minimum,
2. Personnel exposures limits (PEL) at 50 percent of OSHA PEL limits for all chemicals used in the performance of the work, and
3. Lower explosive limits (LEL) to less than 50 percent of the most volatile solvent used in the performance of the work.

Dehumidification and ventilation equipment shall also provide ventilation at a minimum of 0.75 air exchanges per hour within all accessible work areas for worker protection or as required for maintaining PEL and LEL explosive limits as defined herein, whichever is more stringent. Dehumidification and ventilation equipment type, size, air flow, and power requirements shall be designed by a qualified company knowledgeable in dehumidification equipment, and its operation based on project requirements and anticipated seasonal weather conditions for the project schedule. Design to include evaluation of existing conditions, humidity, and temperature, proper air exchange requirements, ventilation requirements, ducting requirements for adequate air flow, and any other issues necessary to achieve the specified performance and environmental conditions throughout the duration of the project.

CONTRACTOR to submit written recommendations from dehumidification subcontractor for bulkhead locations, bulkhead venting, duct work for each bulkhead section, any secondary ventilation requirements for coating cure, dust collection equipment CFM requirements, and drying requirements for blast hose compressed air necessary to maintain environmental control as specified herein. At a minimum, bulkheads shall be provided to separate surface preparation work zones, coating application zones, and coating cure zones.

Dehumidification subcontractor shall either operate the equipment or provide training to CONTRACTOR on the proper operation and setup of dehumidification equipment. Dehumidification subcontractor shall provide a technical representative on site for a minimum of two 8 hour days to insure proper operation of the equipment, achievement of desired environmental control, and to insure CONTRACTOR can properly setup, operate, monitor, and maintain the equipment. Dehumidification and ventilation equipment shall be operated in a manner that prevents all condensation or icing throughout surface preparation and coating application and cure.

Reblasting of flash rusted metal surfaces or removal of damaged coatings, as a result of equipment malfunction, shutdown, or other events that result in the loss of environmental control, will be at the sole expense of the CONTRACTOR. Cleaned metal surfaces subject to flash rusting shall be cleaned to the same cleanliness as prior to the flash rust formation and shall be approved by the OWNER.

CONTRACTOR shall monitor ambient temperature, humidity, dew point temperature, and pipe surface temperature both outdoors and within the work area at the start, midpoint, and end of each work shift, minimum, but not greater than 5 hours between measurements.

Daily environmental condition monitoring and maintenance of the equipment shall be documented in writing and posted near the equipment for review by the OWNER.

4.15.3.2 Film Thickness

Film thickness for coating systems shall be as specified herein, within limits set by coating manufacturer on the manufacturer's printed product data sheets, or as required to meet holiday and coating defects requirements

~~Film thickness for polyurethane coating systems shall be 35 mils total dry film thickness, minimum, or as specified by coating manufacturer or required to meet holiday and coating defects requirements~~.

Coverage is listed as either total minimum dry film thickness in mils (MDFT) or the spreading rate in square feet per gallon (SFPG). Per coat determinations are listed as MDFTPC or SFPGPC. Applied coating system film thickness per coat shall be applied at the specified coating thickness or the manufacturer's recommended minimum thickness, whichever is greater. Where the manufacturer has not specified a minimum coating thickness on the product data sheets, the minimum recommended coating application thickness shall apply. Maximum film build per coat shall not exceed the coating manufacturer's recommendations.

4.15.3.3 Number of Coats

Apply specified number of coats, minimum, irrespective of coating thickness. Additional coats may be required to obtain the minimum required paint thickness, depending on the method of application, differences in manufacturers' products, and atmospheric conditions.

4.15.4 Repair of Coating and Linings

4.15.4.1 General

All areas where holidays are detected or coating is visually damaged, such as blisters, tears, rips, bubbles, wrinkles, cuts, or other defects shall be repaired. Areas where no holidays are detected, but are visually damaged shall also be repaired. Maximum defects allowable shall be as specified herein for the coating system.

~~4.15.4.2 Polyurethane Coatings or Lining Repairs~~

~~Complete coating or lining repairs in accordance with the coating manufacturers written instructions and these specifications, whichever is stricter.~~

~~Defect Size:~~

~~a. Minor repairs - repairs that are less than 6-inches in the greatest dimension.~~
~~b. Major repairs - repairs that exceed 6-inches in the greatest dimension.~~

~~4.15.4.2.A Maximum Quantity of Defects Allowed:~~

~~Coating or lining repairs on any joint of pipe shall not exceed 1.5 per 100 square feet of surface area.~~

~~1) Two or more minor repairs within a 6-inches diameter circle will be considered a single repair.~~
~~2) Repairs for adhesion testing will not be included in the total number of repairs.~~

~~Major repairs shall not exceed three per pipe joint and the combined area shall not be greater than 40 percent of the pipe. Pipes exceeding the maximum number or size of coating defects shall be stripped of coating, reblasted, and recoated. Pipe arriving in the field with defects or repairs exceeding the maximum number or size of coating defects will be returned to the shop for recoating at the CONTRACTOR'S expense.~~

~~4.15.4.2.B Minor Repairs:~~

~~1) Surface Preparation:~~

~~(a) Clean and feather the defect by power tool sanding with 80 grit or coarser sandpaper to roughen the existing coat and feather the edges of the defect for a minimum of 2-inches around the defect.~~

~~2) Shop repair Materials:~~

~~(a) Single use polyurethane coating kits using single use packaging that controls mix ratio.~~
~~(b) Tapecoat Protal 7125 fast cure epoxy~~
~~(c) Coating Manufacturer's polyurethane coating repair products subject to Engineer approval.~~

~~3) Field Repair Materials:~~

~~(a) Heat applied coating materials; CRP Patch, Canusa; PERP Patch, Tyco Adhesives, or approved equal.~~
~~(b) Tapecoat Protal 7125 fast cure epoxy~~
~~(c) Single use polyurethane coating kits using single use packaging that controls mix ratio.~~
~~(d) Coating Manufacturer's polyurethane coating repair products subject to Engineer approval.~~

4) Clean and feather the defect by power tool sanding with 80 grit or coarser sandpaper to roughen the existing coating and feather defect edges minimum of 2-inches.

5) Apply a single coat of the specified patch coating material at the specified coating thickness.

6) Repair coating adhesion shall be 50 percent of the specified coating adhesion.

4.15.4.2.C Major Repairs:

1) Surface Preparation:

(a) The metal surface and surrounding coating shall be abrasively blasted in accordance with SSPC-SP10, near white metal, or to equal in cleanliness and profile as the original surface preparation. Existing coating shall be feathered and roughened to the equivalent of 40 grit sandpaper.

2) Shop Repair Materials:

(a) Same material as the pipeline coating or lining and shall be applied by using plural component spray equipment.

3) Field Repair Materials:

(a) Same material as the pipeline coating or lining and shall be applied by using plural component spray equipment.
(b) Heat shrink sleeves as specified for pipeline joints.

One coat of the specified original coating material shall be applied over the repaired surface at the specified thickness. Repair adhesion shall be equal to the specified coating adhesion.

4.15.5 Measurement and Payment

Measurement and payment for this item will be based on the lump sum price bid. Payment will include full compensation for material, surface preparation, application, testing, etc. in accordance with the specifications, Plans and /or instructions of the OWNER.