

SECTION 822 PROTECTIVE COATING

822-1 SCOPE OF WORK: The Contractor shall provide surface preparation and protective coatings, complete and in place, in accordance with the Contract Documents.

822-2 GENERAL:

- a. References - The following is a list of standards which may be referenced in this Section:
 1. American Water Works Association (AWWA):
 - i. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines—Enamel and Tape—Hot-Applied.
 - ii. C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
 - iii. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
 - iv. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
 2. Applicable sections of NACE International (NACE)(approved for field performance testing).
 3. NSF International (NSF): 61, Drinking Water System Components - Health Effects.
 4. Applicable standard of The Society for Protective Coatings (SSPC) (approved for field performance testing)
 5. ACI305R - Hot Weather Concreting.
 6. ACI 503R - Use of Epoxy Compounds for Coating Concrete.
 7. ASTM B 117 – Standard Practice for Operating Salt Spray Apparatus
 8. ASTM C 109 - Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
 9. ASTM C 579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
 10. ASTM C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
 11. ASTM C 868 - Standard Test Method for Chemical Resistance of Protective Linings
 12. ASTM D 1014 – Standard Practice for Conducting Exterior Exposure Tests of Paints and Coatings on Metal Substrates

13. ASTM D 4138 - Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means (approved for field performance testing)
14. ASTM D 4060 – 10 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
15. ASTM D 3359 Method B – Standard Test Methods for Measuring Adhesion by Tape Test (approved for field performance testing)
16. ASTM D4285 - Standard Test Method for Indicating Oil or Water in Compressed Air
17. ASTM D 7234 – Test Method for Pull-off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers (approved for field performance testing)
18. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers (approved for field performance testing)
19. ASTM D 4585 - Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation
20. ASTM D 4587 - Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
21. ASTM D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
22. ASTM D4285 - 83(2012) Standard Test Method for Indicating Oil or Water in Compressed Air
23. ASTM G 210 - Standard Practice for Operating the Severe Wastewater Analysis Testing Apparatus
24. International Concrete Repair Institute (ICRI) Technical Guideline No. 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting From Reinforcing Steel Corrosion (approved for field performance testing)
25. National Association of Corrosion Engineers International, NACE RP 0188 - Discontinuity (Holiday) Testing of Protective Coatings.
26. National Association of Pipe Fabricators, NAPF 500-03 – Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Location Receiving Special External Coatings and/or Special Internal Linings (approved for field performance testing)

b. Definitions

1. The term "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.
2. MDFT: Minimum Dry Film Thickness.

3. MDFTPC: Minimum Dry Film Thickness per Coat.
 4. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
 5. Mil: Thousandth of an inch.
 6. PSDS: Paint System Data Sheet.
 7. SFPG: Square Feet per Gallon.
- c. The following surfaces shall not be protective coated:
1. Concrete, unless required by items on the concrete coating schedule below or the Drawings.
 2. Stainless steel
 3. Machined surfaces
 4. Grease fittings
 5. Glass
 6. Equipment nameplates
 7. Platform gratings, stair treads, door thresholds, and other walk surfaces unless specifically indicated to be coated.
- d. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the Drawings are used to show or extend the limits of coating schedules, to show exceptions to the schedules, or to clarify or show details for application of the coating systems.

822-2.1 Compliance with Environmental Regulatory Requirements: Contractor shall comply with all current Federal, State, and Local environmental laws and regulations, including, but not limited to the laws and regulations of the U.S. Environmental Protection Agency (USEPA) and LA Dept. of Environmental Quality.

822-2.2 Protection of Work: The Contractor shall be responsible for any and all damage to his Work or the work of others during the time his Work is in progress.

822-2.3 Right of Rejection: The Owner shall have the right to reject all material or Work that is unsatisfactory, and require the replacement of either or both at the expense of the Contractor.

822-2.4 Pre-job Conference: Prior to commencing Work, a pre-job conference shall be held for the purpose of reviewing and clarifying the painting and coating requirements of the Project. The Contractor, coating applicator, Coating Manufacturer's representative, Engineer and Engineer's third party assurance inspector shall be present. This meeting shall be scheduled upon completion of coating shop drawing review but at least 7 days prior to surface preparation. A schedule of work to be accomplished will be established.

822-2.5 Warranty: In accordance with Section 4-6, Contractor shall provide a one (1) year warranty against failure of any kind of all coatings. Warranty period shall commence on the date of final acceptance. Failure of any coating during the warranty period shall be repaired by the Contractor who shall absorb all costs related to the accepted repair of the coating. All defective Work shall be

repaired in accordance with this Specification and to the satisfaction of the Engineer.

822-3 SUBMITTALS:

- a. **General:** Submittals shall be furnished in accordance with Subsection 5-8, unless indicated otherwise below.
- b. Submittals shall include the following information and be submitted at least 30 days prior to protective coating work:
 1. **Coating Materials List:** Six copies of a coating materials list showing the Manufacturer and the coating number keyed to the coating systems herein.
 2. **Coating Manufacturer's Information:** For each coating system to be used, the following data:
 - i. Coating Manufacturer's Paint System Data Sheet (PSDS) for each system proposed, including statements on the suitability of the material for the intended use.
 - ii. Technical and performance information that demonstrates compliance with the system performance and material requirements.
 - iii. Coating Manufacturer's instructions and recommendations on surface preparation and application.
 - iv. Colors available for each product (where applicable).
 - v. Compatibility of shop and field applied coatings (where applicable).
 - vi. Material Safety Data Sheet for each product used.
 3. **Reference Panels:**
 - i. Prior to start of surface preparation, furnish a 4-inch by 4-inch steel panel for each grade of sandblast specified herein, prepared to specified requirements.
 - ii. Provide panel representative of the steel used and prevent deterioration of surface quality.
 - iii. The panels will be used as a reference for quality control inspections by the engineer.
 4. Provide five (5) references that show that the coating subcontractor has previous successful experience with the indicated or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the painting subcontractor provided the protective coating.
- c. **Quality Control Submittals:**
 1. Factory Applied Coatings: Manufacturer's certification stating factory applied Coating system meets or exceeds specified requirements.
 2. If the manufacturer of finish coating differs from that of the shop primer, provide

both manufacturers' written confirmation that materials are compatible.

3. Manufacturer's written instructions and special details for application of each system.
 4. Contractor's Quality Control Plan in accordance with subsection 822-4.
 5. Contractor's Daily Activity Reports in accordance with subsection 822-4.
- d. **Manufacturer's Certification:** For all coating systems, the Contractor shall require the coating manufacturer to certify in writing to the following:
1. The manufacturer's representative has provided on-site instruction in the proper surface preparation, use, mixing, application, and curing of the coating systems.
 2. The manufacturer's representative has personally observed and endorsed the start of surface preparation, mixing and application of the coating materials.
 3. Written certification from the selected coating product manufacturer must be provided for each of the specified coating systems. This certification shall clearly state the product, applicator and site specific service conditions when the manufacturer certifies their acceptance of the applicator. This certification is to be submitted with the coating product shop drawings. Shop drawings will be deemed incomplete without this certification.
- e. **Mockup:**
1. Before application of any coating or coating system, a performance mockup approved by the manufacturer shall be provided by the Contractor. The performance mockup shall finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of work, and special details. The mockup shall be subjected to all field performance testing stipulated.
 2. After Engineer review and Manufacturer approval, mockup area shall serve as a standard for similar work throughout the project.
 3. Accepted mockup area may remain as part of the Work.

822-4 QUALITY CONTROL: Quality control of the Work is solely the responsibility of the Contractor. The Engineer's third party quality assurance inspector and/or the manufacturer's representative are not meant to serve as the Contractor's quality control.

- a. The Contractor shall complete his own quality control such as spark testing (Low and High voltage), Dry Film Thickness, adhesion, and others in accordance with the manufacturer's recommendations prior to requesting a final inspection by the Engineer and manufacturer's representative.
- b. The Contractor shall submit a Quality Control Plan as part of the shop drawing review process including but not limited to the following:
 1. Provide documented evidence of qualified personnel.
 2. Surface preparation procedure such as methodology, abrasive media to be used, blast pressure and source

3. Methods and/or equipment for environmental and atmospheric controls.
 4. Protective coating application such as methodology, mixing, thinning, etc.
 5. Examination, measurements or tests to be conducted.
 6. Verification and acceptance criteria for individual tests.
 7. Mandatory inspection surveillance points, witness points, and hold points.
 8. Methods for documenting inspection findings.
 9. Methods to identify conformance or rejection of work in process.
 10. Methods to ensure that corrective actions are re-inspected.
 11. Criteria for final acceptance
- c. The Contractor is required to maintain daily (typed) activity reports. Copies of these reports shall be submitted to the Engineer on a weekly basis. Copies of these reports shall also be available onsite. Items including but not limited to the following shall be logged on a daily basis.
1. Personnel on site.
 2. Ambient conditions in close proximity of actual application including but not limited to humidity, ambient temperature, surface temperature and dew point starting at the commencement of the work, every two hours after and at the completion of the work.
 3. Surface conditions.
 4. Work performed.
 5. Batch numbers and amount of coating materials applied.
 6. Inspections made and actions taken to correct nonconforming work.

822-5 PRODUCTS:

822-5.1 General:

- a. **Suitability:** The Contractor shall use suitable coating materials as recommended by the Manufacturer. The materials used shall be designed, manufactured and intended for industrial, water, and wastewater industries.
- b. **Compatibility:** In any coating system only compatible materials from a single Manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.
- c. **Containers:** Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, expiration date, and name of manufacturer, all of which shall be plainly legible at the time of use.
- d. **Colors:** All colors and shades of colors of all coats of paint shall be as indicated or selected by the Owner. If not specifically indicated on Drawings, color shall be as designated below. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the Owner.

Raw Sewage Piping	Green or Gray
Sludge Piping	Brown
Gas Piping	Red
Potable Water Supply Piping	Blue
Non-Potable Water Piping	Orange

Gas or Liquid, Fuel	Red
Heating Piping and Ducts	Aluminum
Elect. Equip. and Conduits	Light Gray
Mechanical Equip., Exposed Interior & Exterior	Dark Gray
Mechanical Equip., Submerged or Intermittently Submerged	Black
Compressed Air Piping	White
Chlorine Gas or Solution Piping	Yellow
Plumbing Drains and Submerged Surfaces	Black
Structural Steel, Interior & Exterior	Pastel Green, Cream Blue, or as Directed
Safety Equipment or Cabinets	Jade Green
Pump Room, Walls and Ceilings	White
Masonry, Interior and Exterior	Pastel Green, Cream, Blue, or as Directed
Masonry and Concrete Normally Unexposed or Submerged	Black

e. **Products:**

1. To establish equality under Subsection 6-3, the Contractor shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or-equal" product that the material meets the indicated requirements and is equivalent or better in the following properties:
 - i. Quality
 - ii. Durability
 - iii. Resistance to abrasion and physical damage
 - iv. Life expectancy
 - v. Ability to recoat in future
 - vi. Solids content by volume
 - vii. Dry film thickness per coat
 - viii. Compatibility with other coatings
 - ix. Suitability for the intended service
 - x. Resistance to chemical attack
 - xi. Temperature limitations in service and during application
 - xii. Type and quality of recommended undercoats and topcoats
 - xiii. Ease of application
 - xiv. Ease of repairing damaged areas

xv. Stability of colors

2. Protective Coating Materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for water and wastewater services. The Contractor shall provide the Engineer with the names of not less than 10 similar applications of the proposed manufacturer's products that comply with these requirements.

822-5.2 Industrial Coating Systems:

- a. **System 1 – Alkyd Enamel:** High quality, gloss, long oil alkyd finish shall have a minimum solids content of 49 percent by volume. Primer shall be as recommended by manufacturer.

1. Prime coat (DFT = 2 mils).
2. Finish coats (two or more, Total DFT = 4 mils).
3. Total system DFT = 6 mils.

Products must meet or exceed the following ASTM tests:

1. Primer Requirements:
 - i. Adhesion: ASTM D 3359 Method B – Requirement: No less than a rating of 5 or ASTM D 4541 Requirement: No less than a rating of 1000 psi on steel or no less than 350 psi (concrete failure) on concrete.
 - ii. Salt Fog: ASTM B 117 – Requirement: No blistering, cracking, rusting or delamination of film. No more than a 1/64" rust creepage at scribe after 1,500 hours exposure.
 - iii. Humidity: ASTM D 4585 – No blistering, cracking, rusting or delamination of film after 5,000 hours exposure.
2. Topcoat Requirements:
 - i. Exterior Exposure: ASTM D1014 Exposed at 45 degrees facing south, Florida exposure – Requirement: No more than 85% gloss loss after one year exposure.
 - ii. UV Exposure: ASTM D 4587 QUV (UVA Bulb, Cycle 4) – Requirement: No less than 90% gloss retention after 2,000 hours exposure.

- b. **System 7 – Acrylic Latex:** Single component, exterior grade, water based acrylic latex shall have a minimum solids content of 35 percent by volume. Prime coat shall be as recommended by manufacturer. The coating material shall be available in the ANSI safety colors.

1. Prime coat DFT = 2 mils, as recommended by manufacturer.
2. Finish coats (2 or more, Total DFT = 4 mils).
3. Total system DFT = 6 mils.

Products shall be suitable for application to the intended substrates including galvanized metal, aluminum, polyvinyl chloride (pvc), plastic, and fiberglass.

- c. **System 8 – Epoxy, Equipment:** Two component, polyamidoamine cured epoxy

coating material shall provide a recoatable finish that is available in a wide selection of colors. The coating material shall have a minimum solids content of 66 percent by volume and be resistant to service conditions of condensing moisture, splash and spillage of lubricating oils, and frequent washdown and cleaning.

1. Prime coat DFT = 3-5 mils.
2. Prime coat, where shop applied, DFT = 3-5 mils, universal primer.
3. Finish coats (2 or more), Total DFT = 6-10 mils.
4. Total system MDFT = 9-12 mils.

Products must meet or exceed the following ASTM tests:

1. Adhesion: ASTM D 3359 Method B – Requirement: No less than a rating of 5 or ASTM D 4541 Requirement: No less than a rating of 1000 psi on steel or no less than 350 psi (concrete failure) on concrete.
2. Abrasion: ASTM D 4060 (CS-17 wheel, 1,000 gram load) – Requirement: No more than 140 mg loss after 1,000 cycles.
3. Salt Fog: ASTM B 117 – Requirement: No blistering, cracking, or delamination of film. No more than 1% rusting on the plane and no more than 1/16” rust creepage at scribe after 6,700 hours exposure.
4. Humidity: ASTM D 4585 – No blistering, cracking, rusting or delamination of film after 10,000 hours exposure.

- d. **System 9 – Epoxy plus polyurethane top coat**: Two component, polyamidoamine cured epoxy coating material shall provide a recoatable finish that is available in a wide selection of colors. The coating material shall have a minimum solids content of 67 percent by volume and be resistant to service conditions of condensing moisture, splash and spillage of lubricating oils, and frequent washdown and cleaning. The top coat shall be a two component aliphatic polyurethane coating material. It shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering, and contain a minimum solids content of 66 percent by volume.

1. Ferrous Metal System:
 - i. Prime coat DFT = 3-5 mils.
 - ii. Prime coat, where shop applied. DFT = 3-5 mils
 - iii. Intermediate epoxy coat DFT = 3-5 mils.
 - iv. Top coat, polyurethane DFT = 2.5-3 mils.
 - v. Total system DFT = 8.5-12 mils.
2. Ductile Iron System:
 - i. Prime coat DFT = 4-6 mils.
 - ii. Prime coat, where shop applied. DFT = 4-6 mils

- iii. Intermediate epoxy coat DFT = 5-6 mils.
- iv. Top coat, polyurethane DFT = 2.5-3 mils.
- v. Total system DFT = 11.5-15 mils.

Products must meet or exceed the following ASTM tests:

- 1. Primer Requirements:
 - i. Adhesion: ASTM D 3359 Method B – Requirement: No less than a rating of 5 or ASTM D 4541 Requirement: No less than a rating of 1000 psi on steel or no less than 350 psi (concrete failure) on concrete.
 - ii. Salt Fog: ASTM B 117 – Requirement: No blistering, cracking, or delamination of film. No more than 1% rusting on the plane and no more than 1/16” rust creepage at scribe after 6,700 hours exposure.
 - iii. Humidity: ASTM D 4585 – No blistering, cracking, rusting or delamination of film after 5,000 hours exposure.
 - 2. Topcoat Requirements:
 - i. Exterior Exposure: ASTM D1014 Exposed at 45 degrees facing south, Florida exposure – Requirement: No more than 85% gloss loss after one year exposure.
 - ii. UV Exposure: ASTM D 4587 QUV (UVA Bulb, Cycle 4) – Requirement: No less than 90% gloss retention after 2,000 hours exposure.
- e. **System 10 – Acrylic, Concrete**: The acrylic coating material shall be a single component, industrial grade, high molecular weight, waterborne acrylic material with a solids content of at least 35 percent by volume. The filler-sealer shall be a two component epoxy masonry sealer for wet and exterior exposure, with a solids content of at least 64 percent by volume. Either a two component epoxy block filler or three component cementitious acrylic block filler that are suitable for interior and exterior exposure as recommended by the coating system manufacturer shall be used to fill holes and patch the concrete surface after abrasive blasting.

- 1. Prime coat (filler-sealer), applied in two coats to the entire surface and worked into the surface with a squeegee to achieve a smooth, void-free surface
- 2. Finish coats (2 or more), Total DFT = 6-8 mils.

Products must meet or exceed the following requirements:

- 1. Filler Surfacer Requirements:
 - i. Adhesion: ASTM D 7234 – No less than 300 psi per pull, three trials.
- 2. Topcoat Requirements:
 - i. Humidity: ASTM D 4585 – No blistering, cracking, loss of adhesion or color change after 2,000 hours exposure.
 - ii. Wind Driven Rain: Federal Test Method TT-C-555B, Section 4.4.7.3 – No water damage or dampness visible on back of light weight block after 48 hours.

- f. **System 11 – Aliphatic Polyurethane, Concrete:** Two component aliphatic polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering, and contain a minimum solids content of 66 percent by volume. The filler-surfacer shall be as recommended by the manufacturer and shall be used to provide a smooth surface for the epoxy intermediate coat. The filler-sealer is applied to the entire concrete surface and worked into the concrete surface with a wide blade putty knife or squeegee. The intermediate coat shall be a high-build epoxy coating with a minimum solids content of 67 percent by volume.

1. Surfacer = Filler-surfacer shall be applied to the entire surface and worked into surface defects and bugholes to achieve a smooth, void-free surface. (Total DFT = Minimum of 1/16" above highest peak of the substrate).
2. Intermediate coat = 4-6 mils.
3. Finish coat = 2-3 mils.
4. Total system DFT = 6-9 mils.

Top Coat Polyurethane Products must meet or exceed the following ASTM tests:

1. Adhesion: ASTM D 7234 – Requirement: No less than 300 psi per pull, three trials
 2. Abrasion: ASTM D 4060 (CS-17 wheel, 1,000 gram load) – Requirement: No more than 116 mg loss after 1,000 cycles
- g. **System 12 – Aliphatic Polyurethane, Fiber Glass:** Two-component aliphatic polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, and resistance to chemical fumes and severe weathering. A primer, tie coat, or mist coat shall be used as recommended by the manufacturer.
1. Prime coat (Tie coat).
 2. Finish coats (2 or more, Total DFT = 3 mils).

822-5.3 Submerged and Severe Service Coating Systems

- a. **System 100 – Amine Cured Epoxy:** High build, polyamine cured, epoxy resin shall have a solids content of at least 80 percent by volume, and shall be suitable for long-term immersion service in municipal wastewater.
1. Prime coat = 3-5 mils.
 - i. Note: Surface shall be scarified by blasting with fine abrasive if more than 60 days has elapsed between application of the prime coat and the intermediate coat (or between any subsequent coats).
 2. Intermediate coat = 5-7 mils.
 3. Finish coats = 5-7 mils.
 4. Total coats = 13-19 mils.

100% Epoxy Products must meet or exceed the following ASTM tests.

1. Adhesion: ASTM D 3359 Method B – Requirement: No less than a rating of 5 or ASTM D 4541 Requirement: No less than a rating of 1000 psi on steel or no less than 350 psi (concrete failure) on concrete.
 2. Abrasion: ASTM D 4060 (CS-17 Wheel, 1,000 gram load) – Requirement: No more than 120 mg loss after 1,000 cycles.
 3. Salt Fog: ASTM B 117 – Requirement: No blistering, cracking, rusting or delamination of film. No more than a 1/32” rust creepage at scribe after 1,500 hours exposure.
- b. **System 101 – Cold-Applied Tape**: Tape coating materials and procedures shall be in accordance with ANSI/AWWA C209. Prefabricated tape shall be Type II. The system shall consist of a primer layer, inner layer tape (50 mils), and an outer layer tape (30 mils). Total system DFT = 80 mils.
- c. **System 106 – Fusion Bonded Epoxy**: The coating material shall be a 100 percent powder epoxy, certified as compliant with NSF Standard 61, applied in accordance with the ANSI/AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines, except that the surface preparation shall be as specified in the coating system schedule of this Section. The coating shall be applied using the fluidized bed or electrostatic spray process.
1. Coating DFT = 16 mils.
 2. For coating of valves, DFT - 12 mils.
 3. Liquid Epoxy: For field repairs, the use of a liquid epoxy will be permitted, applied in not less than 3 coats to provide a Total DFT of 15 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the powder epoxy manufacturer.
- d. **System 108 – Epoxy, Concrete**: The coating material shall be a polyamine cured epoxy material suitable for long-term immersion in water and wastewater and for service where subjected to occasional splash and spillage of water and wastewater treatment chemicals. The finish coating material shall have a minimum solids content of 100 percent by volume. The filler-surfacer shall be either a minimum 85 percent solids amine-cured epoxy material with silica and inert fillers or an epoxy-modified cementitious surfacer as recommended by the coating system manufacturer.
1. Filler-surfacer, applied to the entire surface and worked into surface defects and bugholes to achieve a smooth, void-free surface. (Total DFT = Minimum of 1/16” above the highest peak of the substrate)
 2. Finish coat: New Sewer Manholes (2 or more, DFT = 60 – 80 mils)
 All other Structures (2 or more, DFT = 100 – 125 mils)

Products must meet or exceed the following ASTM tests:

1. Filler-surfacer Requirements:
 - i. Compressive Strength: ASTM C 579 – Requirement: No less than 5,000 psi.
 - ii. Tensile Strength: ASTM C 496 – Requirement: No less than 600 psi, 28

days.

- ii. Adhesion: ASTM D 7234 – No less than 300 psi per pull, three trials.

2. Epoxy Liner Requirements:

i. Chemical Resistance:

A. ASTM C 868 – Requirement: No blistering, cracking, softening, swelling or loss of adhesion or gloss after 60 days immersion in 25 percent sulfuric acid at 100°F, or

B. Severe Wastewater Analysis Testing Apparatus (SWAT) ASTM G 210 – Requirement: No blistering, cracking, checking or loss of adhesion. Initial impedance greater than 10.0 (log-Z) at 0.01 Hz (ohms cm²). No less than a final log-Z electrical impedance of 8.5 at 0.01 Hz (ohms cm²) after 28 days. (Thickness of tested sample to be no more than 20% greater than the maximum film thickness requirement outlined in the specification).

- ii. Impact: ASTM D 2794 – Requirement: No visible damage after 88 in-lbs.

- iii. Adhesion: ASTM D7234 No less than 300 psi per pull, three trials

- iv. Abrasion: ASTM D 4060 – Requirement: No more than 120 mg loss after 1,000 cycles.

- e. **System 109 – Coal Tar Epoxy**: Amine or polyamide cured coal tar epoxy coating material with 70% minimum volume solids content for exterior surfaces of buried concrete structures. A filler-surfacer shall be applied after abrasive blasting and prior to the finish coating as recommended by the manufacturer.

- 1. Finish coat (2 or more), MDFT = 16-20 mils.

822-5.4 Special Coating Systems:

- a. **System 200 – PVC Tape**: Prior to wrapping the pipe with PVC tape, the pipe and fittings first shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half-lapped, to a total thickness of 40 mils.

- b. **System 204 – Water-Retardant**:

- 1. Two coats (or single coat if manufacturer recommends in writing) of a clear, non-staining, silane-modified-siloxane masonry water-retardant material. The water-retardant system after application shall be provided with not less than a five-year warranty on the performance of the product.

- 2. Surfaces shall be cleaned with a chemical cleaner approved by the manufacturer and power wash. Surfaces shall be clean and dry before application of the material. Method and rate of application shall be in accordance with manufacturer's published instructions. A manufacturer's representative shall be present during applications if necessary for warranty.

- c. **System 205 – Polyethylene Encasement**: Refer to subsection 1016-2.3.1. Application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.

- d. **System 208 – Aluminum Metal Isolation**: Two coats of a high build polyamide epoxy paint. Total thickness of system DFT = 8 mils.

- e. **System 209 – Alkyd-Wood:** Industrial quality, gloss or semi-gloss, medium long oil alkyd coating material with a minimum solids content of 49 percent by volume. Primer shall be an alkyd primer as recommended by the manufacturer.
 - 1. Prime coat DFT = 3 mils.
 - 2. Finish coats (two or more, Total DFT = 3 mils).
 - 3. Total system DFT = 6 mils.
- f. **System 210 – Acrylic-Wood:** Single component, water-based acrylic latex coating material with a fungicide additive and a minimum solids content of 35 percent by volume. Primer shall be an alkyd primer as recommended by the manufacturer.
 - 1. Prime coat DFT = 2 mils.
 - 2. Finish coats (two or more, Total DFT = 6 mils).
 - 3. Total system DFT = 8 mils.
- g. **System 211 – Acrylic-Drywall:** Single component, water-based acrylic latex coating material with a fungicide additive and a minimum solids content of 35 percent by volume. Primer shall be a PVA sealer as recommended by the manufacturer.
 - 1. Prime coat DFT = 1.5 mils.
 - 2. Finish coats (two or more, Total DFT = 6 mils).
 - 3. Total system DFT = 7.5 mils.

822-6 EXECUTION:

822-6.1 Manufacturer's Services: The Contractor shall require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as may be necessary to resolve field problems attributable or associated with the manufacturer's products.

- a. Coating manufacturer's representative shall be present at site for each structure to be coated as follows:
 - 1. Manufacturer's representative shall attend the Pre-job Conference.
 - 2. All required inspection hold points as described in subsection 822-6.15(c)(5).
 - 3. To verify full cure of coating prior to coated surfaces being placed into immersion service.
 - 4. As required to resolve field problems attributable to or associated with manufacturer's product.
- b. Manufacturer's representative shall provide the Contractor and Engineer with documentation of site visit listing observations made and deficiencies, if any, that are to be corrected. Contractor shall submit documentation to Engineer.
- c. Contractor shall provide Manufacturer's representative with ample prior notice before

being required on site.

822-6.2 Workmanship:

- a. Skilled craftsmen and experienced supervision shall be used on all Work.
- b. Coating materials shall be applied evenly in strict accordance with manufacturer's recommendations.
- c. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough cleaning and an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to insure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.
- d. The Contractor shall protect the public and the Work against disfigurement by paint materials and damage caused by surface preparation. The Contractor shall be responsible for damage caused by the Contractor's operations to vehicles, persons or property, including plants and animals, and shall provide protective measures to prevent such damage. Paint stains that result in an unsightly appearance shall be removed or obliterated by the Contractor. All damage to surfaces resulting from the Work shall be cleaned, repaired, and refinished to original condition.
- e. All Work shall be subject to final acceptance by the Owner. The Contractor shall correct Work that does not comply with the Contract Documents. Acceptance is based on Contractor's documented evidence of compliance and successful field performance tests approved by the Engineer.

822-6.3 Storage, Mixing, and Thinning of Materials:

- a. **Manufacturer's Recommendations:** Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.
- b. **Shelf Life:** All protective coating materials shall be used within the manufacturer's recommended shelf life.
- c. **Storage and Mixing:** Coating materials shall be stored under the conditions recommended by the Material Safety Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

822-6.4 Preparation for Coating:

- a. **General:** All surfaces to receive protective coatings shall be cleaned as indicated prior to application of coatings. The Contractor shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Surfaces to be coated shall be dry and free of visible dust.

- b. **Protection of Surfaces not to be Coated:** Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations. All hardware, lighting fixtures, switchplates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The Contractor shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

- c. **Protection of Painted Surfaces:** Cleaning and coating shall be coordinated so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

822-6.5 Surface Preparation Standards:

- a. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:
 - 1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.
 - 2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.
 - 3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.
 - 4. White Metal Blast Cleaning (SSPC-SP5): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.
 - 5. Commercial Blast Cleaning (SSPC-SP6): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.
 - 6. Brush-Off Blast Cleaning (SSPC-SP7): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.
 - 7. Near-White Blast Cleaning (SSPC-SP10): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.
 - 8. Power Tool Cleaning to Bare Metal (SSPC-SP11): Removal of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted. The surface profile shall not be less than

1 mil (25 microns).

822-6.6 Metal Surface Preparation (Ungalvanized):

- a. The minimum abrasive blasting surface preparation shall be as indicated in the coating system schedules included at the end of this Section. Where there is a conflict between these specifications and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.
- b. Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this Section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers, NACE Standard TM-01-70 - Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive and TM-01-75 - Visual Standard for Surfaces of New Steel Centrifugally Blast Cleaned with Steel Grit.
- c. All oil, grease, welding fluxes, and other surface contaminants shall be removed by solvent cleaning per SSPC-SP1 - Solvent Cleaning prior to blast cleaning.
- d. All sharp edges shall be rounded or chamfered and all burrs, and surface defects and weld splatter shall be ground smooth prior to blast cleaning.
- e. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. Abrasives for submerged and severe service coating systems shall be clean, hard, sharp cutting crushed slag. Automated blasting systems shall not be used for surfaces that will be in submerged service. Metal shot or grit shall not be used for surfaces that will be in submerged service, even if subsequent abrasive blasting is planned to be one with hard, sharp cutting crushed slag.
- f. The abrasive shall not be reused unless an automated blasting system is used for surfaces that will be in non-submerged service. For automated blasting systems, clean oil-free abrasives shall be maintained. The abrasive mix shall include at least 50 percent grit.
- g. The Contractor shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.
- h. Compressed air for air blast cleaning shall be supplied at adequate pressure from well-maintained compressors equipped with oil and moisture separators that remove at least 95 percent of the contaminants.
- i. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another approved method prior to painting.
- j. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.
- k. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.
- l. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC-SP2 or SSPC-SP3 be used.
- m. Shop applied coatings of unknown composition shall be completely removed before

the indicated coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started.

- n. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

822-6.7 Surface Preparation for Galvanized Ferrous Metal:

- a. Remove all soluble and insoluble contaminants and corrosion. Remove all storage stains per Section 6.2 of ASTM D6386. Abrasive blasting all surfaces per ASTM D 6386 to achieve a uniform anchor profile of 1.0 - 2.0 mils.
- b. Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer.

822-6.8 Surface Preparation of Ferrous Surfaces with Existing Coating, Excluding Steel Reservoir Interiors:

- a. **General:** All grease, oil, heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The generic type of the existing coatings shall be determined by laboratory testing.
- b. **Abrasive Blast Cleaning:** The Contractor shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not indicated in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, with the remaining thickness of existing coating not to exceed 3 mils.
- c. **Incompatible Coatings:** If coatings to be applied are not compatible with existing coatings the Contractor shall apply intermediate coatings per the paint manufacturer's recommendation for the indicated coating system or shall completely remove the existing coating prior to abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.
- d. **Unknown Coatings:** Coatings of unknown composition shall be completely removed prior to application of new coatings.
- e. **Water Abrasive or Wet Abrasive Blast Cleaning:** Where specified or where job site conditions do not permit dry abrasive blasting for industrial coating systems due to dust or air pollution considerations, water abrasive blasting or wet abrasive blasting may be used. In both methods, paint-compatible corrosion inhibitors shall be used, and coating application shall begin as soon as the surfaces are dry. Water abrasive blasting shall be done using high-pressure water with sand injection. In both methods, the equipment used shall be commercially produced equipment with a successful service record. Wet blasting methods shall not be used for submerged and severe service coating systems unless indicated.

822-6.9 Concrete and Concrete Block Masonry Surface Preparation:

- a. Surface preparation shall not begin until at least 30 days after the concrete or masonry has been placed.
- b. All oil, grease, and form release and curing compounds shall be removed by detergent

cleaning per SSPC-SP1 before abrasive blast cleaning.

- c. Concrete, concrete block masonry surfaces and deteriorated concrete surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface equivalent to the surface of the No. 80 grit flint sandpaper.
- d. If acid etching is required by the coating application instructions, the treatment shall be made after abrasive blasting. After etching, rinse surfaces with water and test the pH. The pH shall be between neutral and 8.
- e. Surfaces shall be clean and as recommended by the coating manufacturer before coating is started.
- f. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device.

822-6.10 Plastic, Fiber Glass and Non-ferrous Metals Surface Preparation:

- a. Plastic and fiber glass surfaces shall be sanded or brush off blast cleaned prior to solvent cleaning with a chemical compatible with the coating system primer.
- b. Non-ferrous metal surfaces shall be solvent-cleaned SSPC-SP1 followed by sanding or brush-off blast cleaning SSPC-SP7.
- c. All surfaces shall be clean and dry prior to coating application.

822-6.11 Architectural Concrete Block Masonry:

- a. The mortar surfaces shall be cured at least 14 days before surface preparation work is started.
- b. Dust, dirt, grease, and other foreign matter shall be removed prior to abrasive blasting.
- c. The masonry surfaces shall be prepared in accordance with the material manufacturer's printed instructions.

822-6.12 Shop Coating Requirements:

- a. Unless otherwise indicated, all items of equipment, or parts of equipment which are not submerged in service, shall be shop primed and then finish coated in the field after installation with the indicated or selected color. The methods, materials, application equipment and all other details of shop painting shall comply with this section. If the shop primer requires topcoating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.
- b. All items of equipment, or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating work performed in the field.
- c. For certain pieces of equipment it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the indicated quality in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after

installation. The Contractor shall require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.

- d. For certain small pieces of equipment the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.
- e. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 2 months before being topcoated, or less time if recommended by the coating manufacturer.
- f. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions.
- g. The Contractor shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment shop drawings.

822-6.13 Application of Coatings:

- a. The application of protective coatings to steel substrates shall be in accordance with SSPC-PA1 - Paint Application Specification No. 1.
- b. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The Contractor shall schedule such inspection with the Engineer in advance.
- c. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.
- d. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.
- e. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.
- f. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.
- g. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.
- h. Coatings shall not be applied under the following conditions:
 - 1. Temperature exceeding the manufacturer's recommended maximum and minimum allowable.
 - 2. Dust or smoke laden atmosphere.

3. Damp or humid weather.
 4. When the substrate or air temperature is less than 5 degrees F above dewpoint.
 5. When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dewpoint within 8 hours after application of coating.
 6. When wind conditions are not calm.
- i. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Dept. of Commerce, Weather Bureau psychrometric tables.
 - j. Unburied steel piping shall be abrasive blast cleaned and primed before installation.
 - k. Sealing cut ends of coated or lined pipe and/or coating field repairs to pipe and fittings shall be performed in accordance with the manufacturer's recommendations.
 - l. The finish coat on all work shall be applied after all concrete, masonry, and equipment installation is complete and the work areas are clean and dust free.

822-6.14 Curing of Coatings:

- a. General: The Contractor shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section; whichever is the most stringent, prior to placing the completed coating system into service.
- b. Ventilation: In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.
- c. Forced Air Ventilation of Steel Reservoirs and Enclosed Hydraulic Structures: Forced air ventilation is required for the application and curing of coatings on the interior surfaces of steel reservoirs and enclosed hydraulic structures. During application and curing periods, continuously exhaust air from a manhole in the lowest shell ring, or in the case of an enclosed hydraulic structure, from the lowest level of the structure using portable ducting. After all interior coating operations have been completed, provide a final curing period for a minimum of 10 days, during which the forced ventilation system shall operate continuously. For additional requirements, refer to the specific coating system requirements in Section 822-5 above.

822-6.15 Shop and Field Inspection and Testing:

- a. General: The Contractor shall give the Engineer a minimum of 3 days advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.
- b. All such work shall be performed only in the presence of the Engineer, unless the Engineer has granted prior approval to perform such work in its absence.
- c. Inspection: Inspection by the Engineer, or the waiver of inspection of any particular portion of the Work, shall not relieve the Contractor of its responsibility to perform the Work in accordance with these Specifications.
 1. Applicator shall be responsible for and maintain an active site specific quality control program, monitored by the applicators inspector who shall be

knowledgeable of coating inspection methods, test procedures and corrective measures for items found to be in nonconformance. The site specific quality control program shall insure and document compliance with the job specifications in all facets of surface preparation, coating/lining application, cure and final inspection.

2. The applicator shall provide the Engineer with documentation of inspections and testing performed. The documentation shall include weather conditions at the start and end of each application, test results and specific locations examined to confirm.
3. Audits may be performed by the Engineer or a third party designated by the Engineer to confirm that inspections have been performed in a thorough and proper manner.
4. Applicator shall correct work that is not acceptable, verify corrective actions have been completed and submit documentation of such inspection prior to requesting a follow-up audit.
5. Contractor's Inspector Responsibilities:
 - i. Verify that surface preparation and application of coatings or coating systems are as specified at all specific inspection hold points as outlined below and other points as directed by the Engineer:
 - A. Completion of Surface preparation.
 - B. Completion of first coat.
 - C. Completion of second coat.
 - D. Completion of each subsequent coat.

Note 1: Nonconformance discovered during quality control inspection may at the Engineer's discretion require additional coating performance inspection hold points and/or testing to establish compliance.

Note 2: Applicator shall notify the Engineer in writing 48 hours prior to the required inspection hold point.

Note 3: Staging and/or scaffolding used for the work shall not be removed before the work has been examined and approved by all parties.

- ii. Verify coatings and other materials are as specified.
- iii. Verify compressor air supply is clean and free of contaminants prior to start of blast cleaning per ASTM D4285 blotter test.
- iv. Verify Dry Film Thickness (DFT) of each coat and total DFT of each coating system are as specified using wet film and dry film gauges. DFT measurements shall be performed per SSPC PA-2 including gage calibration to compensate for surface profile. DFT is the thickness of record. Destructive testing may be required to measure DFT.
- v. Verify each coating is properly cured in accordance with manufacturer's instructions.

- vi. Coating Defects: Visually examine coatings for film characteristics or defects that would adversely affect performance or appearance of coating including dust, dirt or overspray inclusions, runs, sags, pinholes, blisters, finish coat overspray, mud cracks, and even in color and appearance.
 - vii. Daily Reports: The Contractor is required to maintain typed daily activity reports that are to be submitted to the Engineer on a weekly basis in accordance with subsection 822-4.
- d. Scaffolding shall be erected and moved to locations where requested by the Engineer to facilitate inspection. Additional illumination shall be furnished to cover all areas to be inspected.
 - e. The Contractor shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gages shall be made available for the Owner's use at all times while coating is being done, until final acceptance of such coatings. The Contractor shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the Engineer.
 - f. Testing Equipment:
 - 1. Provide magnetic type dry film thickness gauge to test coating thickness specified in mils.
 - 2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities.
 - 3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness.
 - g. Testing:
 - 1. Evaluation of blast cleaned surface preparation work will be based upon visual comparison of the blasted surfaces with SSPC-Vis1 photographic standard samples available from SSPC.
 - 2. Measure coating thickness specified in mils with a magnetic type, dry film thickness gauge, in accordance with SSPC PA 2. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.
 - 3. Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE RP0188.
 - 4. Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE RP0188.
 - 5. All other approved applicable field performance testing.

6. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

h. Unsatisfactory Application:

1. If the item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.
4. Damaged Coatings, Pinholes, and Holidays:
 - i. Feather edges and repair in accordance with recommendations of paint manufacturer.
 - ii. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
 - iii. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

822-6.16 Coating System Schedules – Ferrous Metals:

a. **Coating System Schedule, Ferrous Metal - Not Galvanized:**

	Item	Surface Prep.	System No.
FM-1	All indoor surfaces, except those included below.	<p><u>For Ferrous Metal:</u> Commercial blast cleaning SSPC-SP6</p> <p><u>For ductile pipe:</u> Clean as required to remove all soluble surface contaminants. Abrasive blast all surfaces to be coated in accordance with NAPF 500-03-04 to remove all insoluble surface contaminants and to achieve a minimum surface profile of 1.5 mils.</p>	(8) Epoxy
FM-2	All outdoor surfaces, except those included below.	<p><u>For Ferrous Metal:</u> Commercial blast cleaning SSPC-SP6</p> <p><u>For ductile pipe:</u> Clean as required to remove all soluble surface contaminants.</p>	(9) Epoxy plus polyurethane topcoat

		Abrasive blast all surfaces to be coated in accordance with NAPF 500-03-04 to remove all insoluble surface contaminants and to achieve a minimum surface profile of 1.5 mils.	
FM-3	Surfaces of equipment and ferrous surfaces submerged or intermittently submerged in utility water or wastewater including all surfaces lower than 2 feet above high water level in hydraulic structures, and all surfaces inside enclosed hydraulic structures and vents (excluding shop-coated valves, couplings, pumps).	<p><u>For Ferrous Metal:</u> White metal blast cleaning SSPC-SP5.</p> <p><u>For ductile pipe:</u> Clean as required to remove all soluble surface contaminants. Abrasive blast all surfaces to be coated in accordance with NAPF 500-03-04 to remove all insoluble surface contaminants and to achieve a minimum surface profile of 1.5 mils.</p>	(100) amine-cured epoxy
FM-6	Buried small steel pipe.	Removal of dirt, grease, oil	(200) PVC tape
FM-7	Ferrous surfaces in water passages of all valves 4-inch size and larger, exterior surfaces of submerged valves.	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-8	Ferrous surfaces in water passages and submerged surfaces of all pumps which have discharge size of 4 inches or larger.	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-9	Ferrous surfaces of sleeve-couplings.	Solvent cleaning SSPC-SP1, followed by white metal blast cleaning SSPC-SP10	(106) fusion-bonded epoxy
FM-10	All ferrous surfaces of sluice gates, flap gates, and shear gates, including wall thimbles.	White metal blast cleaning SSPC-SP5	(100) amine-cured epoxy
FM-11	Buried surfaces that are not indicated to be coated elsewhere.	Near white metal blast cleaning SSPC-SP10	(100) amine-cured epoxy
FM-19	Buried pipe couplings, valves, and flanged joints (where piping is ductile or	Brush-off blast cleaning SSPC-SP7	(205) polyethylene encasement

cast iron, not tape-coated), including epoxy-coated surfaces.

- b. **Coating System Schedule, Ferrous Metal - Galvanized:** Pretreatment coatings, barrier coatings, or washes shall be applied as recommended by the coating manufacturer. All galvanized surfaces shall be coated, except for chain link fencing.

	Item	Surface Prep.	System No.
FMG-1	All exposed surfaces indoors and outdoors, except those included below.	Solvent cleaning SSPC-SP1 Followed by SSPC-SP7	(7) Acrylic latex

822-6.17 Coating System Schedule, Non-ferrous Metal, Plastic, Fiber Glass:

- a. Where isolated non-ferrous parts are associated with equipment or piping, the Contractor shall use the coating system for the adjacent connected surfaces. Do not coat handrails, gratings, frames or hatches. Only primers recommended by the coating manufacturer shall be used.

	Item	Surface Prep.	System No.
NFM-1	All exposed surfaces, indoors and outdoors, except those included below.	Solvent cleaned SSPC-SP1	(7) Acrylic latex
NFM-3	Aluminum surfaces in contact with concrete, or with any other metal except galvanized ferrous metal.	Solvent cleaned SSPC-SP1	(208) aluminum metal isolation
NFM-6	Buried non-ferrous metal pipe.	Removal of dirt, grease, oil	(200) PVC tape

822-6.18 Coating System Schedule – Concrete:

	Item	Surface Prep.	System No.
C-1	All indoor surfaces where indicated in Contract Documents.	Per Section 822-6.9	(10) acrylic, concrete
C-2	Interior surfaces of pump station wet wells, and various wastewater treatment plant structures as indicated in Contract Documents. Note: The floors and the bottom six (6) inches of the interior wet well walls only are <u>not</u> required to be coated.	Per Section 822-6.9	(108) epoxy, concrete

C-3	Interior surfaces of new wastewater manholes and as indicated in Contract Documents.	Per Section 822-6.9	(108) epoxy, concrete
C-4	Buried exterior surfaces of various wastewater treatment plant structures as indicated in Contract Documents.	Per Section 822-6.9	(109) coal tar epoxy, concrete
C-5	Buried exterior surfaces of as indicated in Contract Documents.	Per Section 822-6.9	(109) coal tar epoxy, concrete

822-6.19 Coating System Schedule – Concrete Block Masonry:

	Item	Surface Prep.	System No.
CBM-1	All surfaces, indoors and outdoors, where indicated in Contract Documents.	Per Section 822-6.9	(10) acrylic, concrete

822-6.20 Coating System Schedule – Miscellaneous Surfaces:

	Item	Surface Prep.	System No.
MS-1	Wood, indoors and outdoors.	Per manufacturer's printed instructions	(209) alkyd-wood

822-7 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS:

- a. **Warranty Inspection:** A warranty inspection may be conducted during the eleventh month following completion of all coating and painting work. All personnel present at the Pre-job Conference shall attend this inspection. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the Engineer. The Engineer may, by written notice to the Contractor, reschedule the warranty inspection to another date within the one-year correction period, or may cancel the warranty inspection altogether. If a warranty inspection is not held, the Contractor is not relieved of its responsibilities under the Contract Documents.

822-8 MEASUREMENT AND PAYMENT: No measurement or direct payment will be made for protective coatings.