SECTION 09801

MANHOLE LINING

PART 1 - GENERAL

1.01 WORK OF THIS SECTION

A. The Work of this section includes the lining of new and existing sewer manholes. The CONTRACTOR shall coordinate his work so as not to interfere with the existing sanitary sewer service. Lining shall consist of preparing the interior surface of each manhole, application of repair mortar where needed to restore damaged surfaces, application of epoxy primer, and polyurethane lining and all incidentals necessary to complete the work contained in these technical provisions in accordance with District Standards and SSPWC Section 500- 2.4, latest edition.

B. The CONTRACTOR shall furnish all traffic control, labor, materials, tools, and equipment necessary to complete all work in accordance with these Contract Documents and at the direction of the AGENCY.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01015 – General Requirements

B. Section 01300 – Record Drawings and Submittals

C. Section 02960 – Temporary Bypass Pumping

D. Section 03460 – Precast Concrete Manholes

E. Section 09900 – Painting and Coating

F. EVMWD Standard Drawings

1.03 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with the requirements set forth in the standard specifications.

B. The CONTRACTOR shall submit copies of manufacturer's technical data and installation instructions for protective coating system required.

C. The Contractor shall submit copies of manufacturer's written instructions for recommended maintenance practices. Include the following information:

1. Product name and number.
2. Name, address and telephone number of manufacturer and local distributer.
3. Detailed procedures for routine maintenance and cleaning.
4. Detailed procedures for repairs.

1.04 QUALITY ASSURANCE

A. Packaging: The CONTRACTOR shall store all products to be used in their original packaging. The packaging shall indicate the manufacturer and product contained.

B. All products to be used in the work covered by this section of the specifications shall be delivered, stored, and handled in accordance with the product manufacturer's written recommendations.

C. Manufacturer and applicator both shall demonstrate a minimum of five (5) years of experience and five (5) successfully completed projects of similar magnitude and nature as this project. Experience and project references shall include project name, project number where applicable, agency or AGENCY, contact name, phone number, and project description. All Applicators shall be certified or licensed by the protective coating materials manufacturer.

D. Provide each component of protective coating produced by a single manufacturer, including recommended underlayment and resurfacing compound, filler compounds and corrosion resistant lining.

E. Upon completion of the Work under this Section, submit a statement to the DISTRICT, signed by Contractor and the protective Coating Applicator stating that the installed protective coating complies with the requirements of the Specifications, and that the installation and materials comply with the manufacturer's printed recommendations related to the condition of installation and use.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material in manufacturer's original unopened and undamaged packages. Clearly identify manufacturer, brand name, manufactured date or lot number on each package. Packages showing indications of damage that may affect condition of contents are not acceptable.

B. Store materials in original packaging under protective cover and protect from damage. Stack and store all containers including fillers at temperatures recommended by the manufacturer.

C. Handle materials in such a manner as to prevent damage to products or finishes.

1.06 JOB CONDITIONS

A. Maintain proper substrate and air temperature before, during and after installation as required by Manufacturer and detailed in Manufacturer's technical data sheets and installation instructions or in writing from the Manufacturer. Provide adequate ventilation during application and curing periods.

PART 2 - PRODUCTS

2.01 MANHOLE PROTECTIVE LINING

A. Mortar repair materials used for existing manholes to be rehabilitated shall be in accordance with the standard specifications.

2.02 MANUFACTURER

A. The lining material shall be a two-component, 100% solid, non-solvent hybrid polyurethane coating, with a shore “D” hardness of 57 at 77 degree Fahrenheit, such as Zebron #386 as manufactured by Zebron Corporation, Newport Beach, CA

B. Sauereissen SewerGard No.210, Sauereisen, Pittsburg, PA (412) 963-0303.

C. SprayWall, Sprayroq, Irondale, AL (205) 957-0020

D. Utilithane Polyurethane, Prime Coating Incorporated, Tustin, CA (714) 963-4303

E. Raven 405, Raven Lining Systems, Kansas City, KS (800) 321-0906

F. Or approved equal

2.03 MATERIAL

A. Zebron, Zebron #386

1. Polyurethane Coatings: High performance, plural component, 3-1 ratio,100 percent solids polyurethane coating.
2. Physical Properties:
    a. Color: Cream.
    b. Specific Gravity (ASTM D792):
    c. Series 300: 1.3 (10.84 lbs. per gal.)
    d. Tensile Strength (ASTM D638): 2500 psi at 77 degrees F (25 degrees C).
    e. Elongation (ASTM D638): Recoverable; 67 percent at 77 degrees F (25 degrees C).
    f. Flexibility (ASTM D792): No effect bending 0.5 mm plate coated with 20 mils over 8 mm diameter mandrel.
    g. Compressibility (ASTM D695): 4200 psi.
    h. Surface Hardness: 60 to 70, Shore "D".
    i. Abrasion Resistance (ASTM D4060): 2.12 oz. (60 mg).
    j. Thermal Conductivity (ASTM C177): 0.000723 cal. per sec. cm2 per degree C per cm at 20 degrees C (0.175 btu per hr. ft. degree F per ft. at 77 degrees F).
    k. Permeability (ASTM E96):

(1) Type 386: 0.262 gms per m2 per 24-hrs; 0.0358 U.S. perms.

(2) Type 396: 0.193 gms per m2 per 24-hrs; 0.0264 U.S. perms.

3. Underlayment (Surface Patch): Lean concrete mix, unless otherwise recommended by the coatings manufacturer.

4. Apply coatings in strict accordance with manufacturer's instructions.

a. Use techniques best suited for substrate and type of material being applied.

b. Provide adequate ventilation to prevent the build-up of fumes or objectionable odors during application.

c. Maintain proper personnel equipment including respirators which are mandatory for applicators engaged in spray-on coating.

d. Protect adjacent areas against damage from coating operation.

e. Provide coating systems which are compatible with substrates indicated.

5. Application:

a. Apply materials at not less than manufacturer's recommended spreading rate, to establish a total coating thickness as indicated, or, if not indicated, as recommended by the manufacturer.

(1) Total Coating Thickness: Not less than 125 mils DFT.

b. Apply first-coat of material to surfaces that have been cleaned, pretreated or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

c. Prepare surfaces between each subsequent coat in accordance with manufacturer's directions.

d. Apply additional coats until final coat is of uniform finish, color, appearance, and overall specified thickness has been achieved.

e. Ensure that edges, corners, crevices, and similar features receive a coating thickness equivalent to that of flat surfaces.

f. Coat surfaces behind movable equipment same as similar exposed surfaces. Coat surfaces behind permanently-fixed equipment before final installation of such equipment.

g. Provide a final finish free of holidays, voids, sags, and other surface imperfections.

B. Sauereissen SewerGard No. 210X.

1. SewerGard No. 210X shall be a complete system for substrate repair, water infiltration prevention and epoxy based corrosion protection including:

a. Cementitious resurfacing/ underlayment compound is required, and shall be installed to fill surface irregularities and large voids in the prepared concrete substrate; minimum application thickness 1/8”.

b. Epoxy filler compound to fill all voids and bug holes in NEW concrete to provide a properly prepared and uniform surface for the epoxy lining.

c. 100% solids epoxy, moisture tolerant, polymer lining designed specifically for municipal wastewater exposure at a thickness of 125 mils.

d. The applicator shall supply all accessory components such as sealers, infiltration control products or other compounds or products as recommended by the protective lining manufacturer for maximum protective lining adherence to substrate and long-term service performance.

2. Types of protective lining system components for the corrosion protection work required, including surface treatment of prepared surfaces prior to coating application, shall include, but are not necessarily limited to trowel or gun applied, fast setting, high-early strength cementitious resurfacing/underlayment compounds, epoxy formulation filler compound for new construction application, corrosion-resistant, moisture tolerant, 100% solids epoxy, spray or trowel applied, monolithic protective lining and miscellaneous materials.

3. Underlayment Resurfacing Compound: Cementitious resurfacing products shall be used for surface leveling, large bug holes, and for general concrete patching and shall be installed and cured according to Manufacturer's written guidelines as outlined in product technical data sheets. All voids must be completely filled and existing substrate covered in its entirety so that the finish of underlayment resurfacing compound should is uniform in appearance. Apply a "broom" finish to resurfacing compound at time of installation to create adhesion profile.

4. Properties: Sauereisen No. F-121 Trowel Grade

Application Time:	
Working Tine at 70F	30 minutes
Initial Set at 70F	3 hours
Color	Tan
Compressive Strength:	
@24 hours	3500 psi
@5 hours	2500 psi
@28 hours	6000 psi
Density:	
Mix Ratio (Powder to Water, by Weight)	9:1
Abrasion Resistance (ASTM C-704) Volume Loss, cm^5	5.14 cm^5
Volume Loss, %	0.65%
Freeze-thaw Durability Factor (ASTM C666-A)	87.2

5. Underlayment shall be a fast-setting, high early strength, Portland/Calcium Aluminate-based resurfacing material. Underlayment shall be trowelable formulation, except where Applicator recommends alternate use of sprayable, castable or gunite formulations by the same manufacturer for intended service application. Underlayment Resurfacing Compound shall to be applied to the entirety of the interior surface to fill all irregularities to provide uniform surface for the application of the epoxy corrosion resistant lining system. The underlayment may be substituted with the Epoxy Filler Compound or High Build Epoxy Filler Compound based upon contractor recommendation and site conditions at time of installation.

6. Epoxy Filler Compound: Epoxy filler, where required, shall be used for filling small bug holes, static cracks and joints, and for general concrete patching, in NEW concrete and to provide a uniform, void free surface for epoxy lining application

   a. Properties: Sauereisen Epoxy Filler Compound No. 209 Color Off White

Compressive Strength	10,000 psi
Density (ASTM C-905)	87.2 pcf
Flexual Strength (ASTM C-580)	4000 psi
Modulus of Elasticity (ASTM C-580)	$5.2x10^4$
psi Tensile Strength (ASTM C-307)	2200 psi
Bond Strength to Concrete (ASTM D-4541)	Concrete
Failure Moisture Absorption (ASTM C-413)	<0.25%
Shrinkage (ASTM-531)	<0.2%
Working Time	15 min @ 70F
Topcoat	3 hrs @ 70F

   b. Filler Compound shall be an epoxy formulation specifically designed to fill voids, irregularities and air pockets in NEW concrete surfaces. The filler compound shall be applied to the interior substrate to provide a uniform surface for the application of the epoxy corrosion resistant lining system. Filler compound shall be confirmed by the Manufacturer as compatible with any underlayment materials and with the protective coating. The filler compound may be substituted with the Underlayment Resurfacing Compound based upon contractor recommendation and site conditions at time of installation.

7. Epoxy Lining Protective Coating: Epoxy lining protective coating shall be spray applied to the entire interior surface of the sewer manhole including the walls from the manhole base up through the bottom of the manhole lid frame, and the manhole bench from the wall to the channel low flow line and cured on the properly prepared surface in accordance with Manufacturer's written guidelines as outlined in product technical data sheets. The epoxy lining should not overlap the manhole lid frame.

   a. Properties: Sauereisen SewerGard No. 210X

Adhesion (ASTM D4541)	Concrete Failure
Application Time (ASTM C308 modified), Working Time at 70F	30 minutes
Bond Strength to Concrete (ASTM D7234)	Concrete Failure
Bond Strength by Slant Shear (ASTM C882-99)	700psi ($49.2kg/cm^2$)
Modified Compressive Strength (ASTM D695)	15,500psi ($1089.7kg/cm^2$)
Components	2 parts

Elongation (ASTM D638)	12.9%
Flexural Strength (ASTM D700) @28 days	8000psi ($562.4kg/cm^2$)
Maximum Service Temperature (Dry)	150F (65C)
Mix Ratio (By Volume)	1 part A (Harder): 3 Parts B (Resin)
Modulus of Elasticity (ASTM D700)	5.1 x 104psi
Permeability (ASTM D790)	1.32×10^{-10}
Shore D (ASTM D638)	95
Tensile Strength @7 days (ASTM D638)	4300psi ($302.3kg/cm^2$)
Recommended Thickness	100-125 mils

b. Epoxy lining shall be a self priming (to concrete), 100% solids, spray-applied epoxy polymer protective coating material specifically designed to protect concrete surfaces in wastewater structures subjected to municipal wastewater service conditions, including associated abrasive physical attack and chemical attack mechanisms related to hydrogen sulfide and organic acids generated by microbial sources. (Note: an alternate trowel applied formulation of the identical resin and hardener system with different fillers may be applied at the specified thickness when approved in writing by the Manufacturer.)

C. Sprayroq, SprayWall

1. Spraywall material shall be solvent-free rigid polyurethane material application.

2. Existing Products

a. Cementitious patching and repair materials should not be used unless their manufacturer provides information as to its compatibility and procedures for topcoating with the approved coating. Project specific submittals should be provided including application, cure time and surface preparation procedures which permit optimum bond strength with the approved coating.

b. Remove existing coatings prior to application of the new protective coating. Applicator is to maintain strict adherence to applicable NACE and SSPC recommendations with regard to proper surface preparation and compatibility with existing coatings.

3. Repair Materials

a. Repair materials shall be used to; fill voids, bugholes, structurally reinforce and/or rebuild surfaces, etc. as determined necessary by the manufacturer and protective coating applicator. Repair materials must be compatible with the specified coating and shall be applied in accordance with the manufacturer’s recommendations.

b. The following products may be accepted and approved as compatible repair basecoat materials for approved topcoating for use within the specifications:

(1) 100% solids, solvent-free grout specifically formulated for approved topcoating compatibility. The grout manufacturer shall provide instructions for trowel or spray application and for approved topcoating procedures.

(2) Factory blended, rapid setting, high early strength, non-shrink cementitious or epoxy repair mortar that can be troweled or pneumatically spray applied may be approved if specifically formulated to be compatible for approved topcoating. Such repair mortars should not be used unless their manufacturer provides information as to its suitability for topcoating with the approved topcoating. Project specific submittals should be provided including application, cure time and surface preparation procedures which permit optimum bond strength with the approved coating.

(3) In the case of excessive infiltration, a hydraulic cement or plug may be used to stop the flow of the infiltration. Approved manufacturer's include "The Strong Company, Inc.", or approved equal. The hydraulic cement shall be compatible with the spray applied resin coating.

4. Protective Coating Material

a. The resin based material shall be used to form the sprayed structurally enhanced monolithic liner covering all interior surfaces of the structure, including benches and inverts of manholes. The finished liner shall be 100% Solids polyurethane and conform to the minimum physical requirements listed below. The physical requirements must be verified by an independent, certified, third party testing laboratory within the last five years and must be submitted with the submittals.

Compressive strength:	ASTM D 695	> 18,000 psi
Tensile strength:	ASTM D 638	> 7,450 psi
Bond (Concrete):	ASTM D7234 Or Substrate Failure	> 200 psi
Bond (Steel):	ASTM D4541	> 1,000 psi
Flexural Modulus (Initial):	ASTM D 790	> 735,000 psi
Flexural Modulus (Long Term):	ASTM D 2990	> 529,000 psi
Density:	87 ± pcf	
Chemical Resistance:	ASTM D543	
Severe Municipal Sewer:	All types of service	
Successful Pass:	Sanitation District of L.A. County Coating	

b. When groundwater loading is not an issue and only a corrosion barrier is required, the rehabilitation lining shall be installed to the thickness necessary to qualify as a monolithic (void free) liner. The roughness of the substrate will dictate the thickness needed to create the monolithic liner and eliminate any opportunity for voids in the lining. The minimum value for coating thickness for corrosion protection for non-structural

rehabilitation shall be 125 mils and structural rehabilitation shall be a minimum of 250 mils or the design thickness determined by the proper design protocol.

D. Raven 405

1. Raven 405 material shall be ultra-high build, 100% solids, solvent free epoxy coating.

Test	Method	Result
Tensile Strength	ASTM D 638	>9,000 psi
Tensile Elongation	ASTM D 638	>6%
Compressive Strength	ASTM D 695	>18,000
Flexural Strength	ASTM D 790	>15,000
Hardness, Shore D	ASTM D 2240	87
Taber Abrasion, CS-17	ASTM D 4060, 1 kg load/1,000 cycles	57
Adhesion, Steel	ASTM D 4541	>2,500 psi
Adhesion, Concrete	ASTM D 7234	Substrate Failure
VOC	Calculated	0 g/l

2. Prior to application of the lining, all surfaces shall receive a 100% solids non-solvented, moisture tolerant epoxy primer as manufactured by Raven Lining Systems, or approved equal. Lining must have passed chemical resistance test of the SSPWC.

3. Prior to coating, the substrate must be prepared in a manner that provides a uniform, clean, sound, neutralized surface suitable for the specified coating. The substrate must be free of all contaminants, such as oil, grease, rust, scale or deposits. In general, coating performance is proportional to the degree of surface preparation.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Surface preparation shall be performed in accordance with the manufacturer's requirements to achieve required adhesion as specified hereon. All loose material, coatings, corroded concrete, and any rust shall be removed in its entirety. Damaged concrete exceeding ¼-inch in depth shall be repaired with mortar which is compatible with the approved lining system and meets the requirements for adhesion as set forth in this specification.

B. Contractor shall remove existing linings in their entirety prior to performing concrete rehabilitation and new lining application.

C. New and existing concrete structures to receive protective coating system must be capable of withstanding imposed loads. All oil, grease and chemical contaminants must be removed from the surface. Surfaces must be firm, free of standing water, form release agents and existing coating. Suitable surface preparation methods include abrasive blasting, hydro blasting, mechanical scrapping and hand tool grinding to remove surface contaminants.

D. When protective coatings are installed within polymer manholes with concrete bases the coatings shall only be installed onto the exposed potions of the concrete base per the requirements of this specification.

3.02 WATER TIGHTNESS

A. The end cuts of the liner inside the manhole shall be fully sealed to prevent water entering into the space between the host pipe and the liner.

3.03 LINING APPLICATION

A. The lining application shall be performed only by workers approved by the manufacturer as trained and experienced with the specified material. The lining shall be applied by high pressure airless equipment approved by the lining manufacturer. The equipment shall be in good working order to ensure correct proportioning and mixing of the components.

B. Protective coating systems shall be installed when ambient air and surface temperature is between 50F and 90F. Store material within a range of 60F to 85F range for 48 hours prior to use. Application and storage temperatures outside of this range will require written approval from the Manufacturer.

C. Application in direct sunlight and/or with rising surface temperatures will result in blistering of the materials due to expansion of entrapped air or moisture (out- gassing) in the concrete. In such cases, it will be necessary to postpone the application until later in the day when the temperature of the substrate is falling. Concrete surfaces that have been in direct sunlight must be shaded for at least 24hours prior to application and remain shaded until the initial set has taken place. Consult Manufacturer for application schedule guidelines specific to temperature conditions and possible sealer application recommendations to reduce out- gassing.

D. The lining shall be applied to a thickness of 125 mils (1/8-inch) in one continuous coat without seams, free from any holes or defects. The lining shall be installed from three (3) inches below the low-flow water level to the base of ring and cover. The lining shall be installed over dry concrete below the water level by using appropriate by-pass equipment. Coating in trough shall not be thicker than 125 mils to ensure smooth taper from trough to shelf. A mandrel shall be inserted into upstream and downstream pipe to insure the accessibility.

E. During lining application, the CONTRACTOR shall take wet gauge thickness readings as required to insure correct lining thickness.

F. Installed epoxy lining protective coating and shall be tested for pinholes after a minimum 24-hour cure at a temperature of 70F. Pinhole testing shall be accomplished in accordance with ASTM D4787 using a Tinker Razor Holiday Detector, San Gabriel, CA, Model AP/W, or an approved equal device. Test voltage of 100 volts/mil of coating thickness shall be applied. All pinholes shall be marked and repaired using manufacturer's approved Patch Kit, or other approved method.

G. Adhesion testing shall be performed on a minimum of 1 structure or 15 percent of all coated structures, whichever is greater. Adhesion testing shall be conducted after a minimum 24-hour cure of the Epoxy Lining Protective Coating at 70F. A minimum of two measurement

of bond strength of the protective coating to the substrate shall be made. Bond strength shall be measured in accordance with ASTM D7234-05. Prior to the pull test, the tester shall utilize a scoring device to cut through the coating until the substrate is reached. The pull tests in each structure shall meet or exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of coating material in the test hole. Any areas detected to have less than 200 psi bond strength to concrete shall be removed and/or repaired by the CONTRACTOR in accordance with the manufacturer's recommendations. All costs shall be borne by the CONTRACTOR.

H. The uniform lining shall be free from porosity, without bubbles or pinholes and uniform in color. All areas in question shall be removed and reworked and patched.

I. Before accepting the finished product, testing with a holiday or porosity detector shall be made by the CONTRACTOR, and any pinholes found shall be patched.

J. Application of the lining shall not take place when exposed to rain, fog or high winds. It is the CONTRACTOR's responsibility to insure protection of the work from the above-mentioned conditions.

3.04 ADJUSTMENTS AND CLEANINIG

A. At the completion of the Work, CONTRACTOR shall remove all materials and debris associated with the Work of this Section.

B. Clean all surfaces not designated to receive protective coating. Restore all other work in a manner acceptable to the DISTRICT.

C. All finished protective coating shall be protected from damage until Final Acceptance of the Work. Protective coating damaged in any manner shall be repaired or replaced at the discretion of Inspector. All costs shall be borne by the CONTRACTOR.

D. Clean all protective coating as recommended by the manufacturer to provide finished Work acceptable to AGENCY, just prior to Final Acceptance.

3.05 TEMPORARY FLOW THROUGH PLUG OR BYPASS SYSTEM

A. The CONTRACTOR shall be provide, install, maintain, and remove all temporary flow bypassing equipment and materials needed to complete the manhole rehabilitation work in accordance with the Contract Documents and the standard specifications. The CONTRACTOR shall be responsible for selection of all means and methods to bypass flows as necessary to perform the work. The CONTRACTOR shall also install a temporary rack at the manhole directly downstream of the manhole that the temporary bypass equipment is being used to prohibit the passage of any loose or unanchored equipment from entering the downstream sewer system.

B. The CONTRACTOR shall submit a plan to the AGENCY for approval before beginning work describing the flow bypassing equipment to be used, how it is to be installed, maintained, and removed, including any precautionary measures. Submittal shall show how the CONTRACTOR will monitor and prevent the obstruction of flow in the flow bypass equipment and shall also include the equipment and procedures that will be used to prohibit the passage of any loose or unanchored equipment from entering the sewer system.

All products, equipment, and materials used to complete the Work shall be able to withstand the active sewer conditions and shall be able to handle flows specified in the Contract Drawings.

END OF SECTION

SECTION 09811

FUSION BONDED EPOXY LINING AND COATING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes materials, application, and testing of one part, fusion-bonded, heat cured, thermosetting, 100% solids epoxy lining and coating on metallic surfaces including steel, cast iron, and ductile iron such as pipe, equipment (e.g., valves, fittings, couplings), and structural steel. The generic term “coating” as used herein refers to either interior lining or exterior coating.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The work of the following Specifications, Divisions, or Sections apply to the work of this Section. Work of other Sections of the Specification, not referenced below, shall also apply to the extent required for proper performance of this work.

1. Section 01300 – Shop Drawings and Submittals
2. Section 15064 – Steel Pipe and Fittings

1.03 SUBMITTALS

A. Submit the following in accordance with Specification Section 01300:

1. Manufacturer's catalog literature and product data sheets, describing the physical and chemical properties of the epoxy coating. Describe surface preparation, application and curing procedures.

1.04 QUALITY ASSURANCE

A. Submittals shall be made in conformance with standard specifications.

B. Submit catalog data for all highline materials and components.

PART 2 - PRODUCTS

2.01 PIPING AND EQUIPMENT SURFACES

A. Pipe and equipment to be coated shall be new and free of salts, oil, and grease to the coating applicator.

2.02 SHOP APPLIED EPOXY COATING

A. Lining and coating shall be 100% solids, thermosetting, fusion-bonded, dry powder epoxy resin. Provide: Scotchkote 134 or 206N, Lilly Powder Coatings "Pipeclad 1500 Red," H.B. Fuller 1F-3003, or District approved equal.

B. Epoxy lining and coating shall meet or exceed the following requirements:

Hardness (Minimum)	Barcol 17 (ASTM D 2583) Rockwell 50 ("M" Scale)
Abrasion Resistance (Minimum)	1,000 cycles: 0.05 gram removed 5,000 cycles: 0.115 gram removed ASTM D 1044, Tabor CS 17 wheel, 1,000 gram weight
Adhesion (Minimum)	3,000 psi (Elcometer)
Tensile Strength	7,300 psi (ASTM D 2370)
Penetration	0 mil (ASTM G 17)
Adhesion Overlap Shear, 1/8-inch steel panel, 0.010 glue line	4,300 psi (ASTM D 1002)
Impact (Minimum Value)	100 inch-pounds (Gardner 5/8-inch diameter tup)

2.03 FIELD APPLIED EPOXY COATING FOR COATING REPAIR

A. Use a two-component, 80% solids, liquid resin, such as Scotchkote 306 or District approved equal.

PART 3 - EXECUTION

3.01 SHOP APPLICATION OF FUSION BONDED – GENERAL

A. Do not apply fusion-bonded epoxy to aluminum, brass, bronze, copper, plastic, rubber, or stainless steel surfaces.

B. Grind surface irregularities, welds, and weld spatter smooth before applying the epoxy. The allowable grind area shall not exceed 0.25 square foot per location, and the maximum total grind area shall not exceed 1 square foot per item or piece of equipment. Do not use any item, pipe, or piece of equipment in which these requirements cannot be met.

C. Remove surface imperfections, such as slivers, scales, burrs, weld spatter, and gouges. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4-inch.

D. Uniformly preheat the pipe, item, or piece of equipment prior to blast cleaning to remove moisture from the surface. The preheat shall be sufficient to ensure that the surface temperature is at least 5°F above the dew point temperature during blast cleaning and inspection.

E. Sandblast surfaces per SSPC SP-5. Protect beveled pipe ends from the abrasive blast cleaning.

F. Apply a phosphoric acid wash to the pipe, item, or piece of equipment after sandblasting. The average temperature, measured in three different locations, shall be 80°F to 130°F during the acid wash procedure. The acid wash shall be 5% by weight phosphoric acid solution. The duration in which the acid is in contact with the surface shall be determined by using the average temperature as tabulated below:

Pipe Temperature (°F)	**CONTACT TIME (SECONDS)**
80	52
85	45
90	36
95	33
100	**28**
105	24
110	21
130	10

After the acid wash has been completed, remove the acid with demineralized water having a maximum conductivity of 5 micro-mhos/cm (micro-Siemens/cm) at a minimum nozzle pressure of 2,500 psi.

G. Do not allow oxidation of surfaces to occur prior to coating. Do not permit surfaces to flash rust before coating.

H. Apply lining and coating by the electrostatic spray or fluidized bed process. Heat and cure per the epoxy manufacturer's recommendations. The heat source shall not leave a residue or contaminant on the metal surface.

I. The cured lining or coating shall be smooth and glossy, with no graininess or roughness. The lining or coating shall have no blisters, cracks, bubbles, underfilm voids, mechanical damage, discontinuities, or holidays.

3.02 SHOP APPLICATION – PIPE AND FITTINGS

A. In addition to the above requirements, apply lining and coating per AWWA C213 except as modified herein.

B. Grind 0.020-inch (minimum) off the weld caps on the pipe weld seams before beginning the surface preparation and heating of the pipe.

C. Minimum dry film thickness of lining or coating shall be 12 mils.

D. Linings shall be certified to be holiday free.

3.03 SHOP APPLICATION – VALVES AND EQUIPMENT

A. Minimum dry film thickness of lining or coating shall be 8 mils minimum.

B. Linings shall be certified to be holiday free.

3.04 SHOP TESTING OF LINING AND COATING – GENERAL

A. Test linings and coatings with a low-voltage wet sponge holiday detector in accordance with AWWA C213, Section 5.3.3. If the number of holidays for flat or smooth surfaces such as pipe is one per 10 square feet of coating surface, repair and retest. If the number of holidays for valves, couplings, and fittings is 3 or less per item, repair and retest. Repair by applying the coating manufacturer's recommended repair compound to each holiday. If the number of holidays or pinholes exceeds these allowable quantities, remove the entire lining or coating and recoat the pipe or item and retest.

B. Measure the coating thickness at three locations on each item or piece of equipment or pipe section using a coating thickness gauge calibrated at least once per eight-hour shift. Record each measured thickness value. Where individual measured thickness values are less than the specified minimum thickness, measure the coating thickness at three additional points around the defective area. The average of these measurements shall exceed the specified minimum thickness value, and no individual thickness value shall be more than 2 mils below or 4 mils above the specified minimum value. If a section of the pipe, item, or piece of equipment does not meet these criteria, remove the entire lining or coating and recoat the entire item or piece of equipment.

C. Check for coating defects on the weld seam centerlines. There shall be no porous blisters, craters, or pimples along the peak of the weld crown or insufficient thickness of coating.

D. The District's Representative will conduct an independent inspection of the lining and coating in the field for compliance with the above criteria. Coated items failing this inspection will be cause for rejection.

3.05 FIELD REPAIRS

A. Patch scratches and damaged areas incurred while installing fusion bonded epoxy coated items with a two-component, 80% solids (minimum), liquid epoxy resin.

B. Wire brush or sandblast the damaged areas per SSPC SP-10. Lightly abrade or sandblast the lining or coating on the sides of the damaged area before applying the liquid epoxy coating.

C. Apply a two-part epoxy coating to damaged linings and coatings to flat surface areas smaller than 9-square-inches. Repaired areas shall overlap the base coating a minimum of 1/2-inch. Apply the liquid epoxy coating to the minimum dry-film thickness specified for the component, or 8 mils minimum, unless otherwise specified in individual product specifications.

D. If a damaged area exceeds 9-square-inches, remove the entire lining and coating and recoat the entire item or piece of equipment and retest.

END OF SECTION

SECTION 09867

POLYETHYLENE SHEET OR TUBE ENCASEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, application, and inspection of polyethylene sheet or tube encasement for buried steel and iron pipe, fittings, couplings, valves, and appurtenances.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 01300 – Contractor Submittals

Section 15062 – Ductile Iron Pipe and Fittings

Section 15080 – Miscellaneous Piping Specialties

Section 15100 – Resilient Wedge Gate Valves

1.03 SUBMITTALS

Submit manufacturer's catalog literature and product data sheets describing the physical, chemical and electrical properties of the encasement material in accordance with Section 01300.

PART 2 - MATERIALS

2.01 POLYETHYLENE MATERIAL

The encasement shall consist of a clear polyethylene sheet or tube at least 8 mils in thickness and conforming to AWWA C105.

2.02 PLASTIC ADHESIVE TAPE

Tape for fastening and sealing encasement seams shall be 2-inch wide plastic adhesive tape such as Calpico Vinyl Tape, Polyken 900 or approved equal.

PART 3 - EXECUTION

3.01 TUBE ENCASEMENT OF BURIED PIPE, FITTINGS, AND VALVES

A. Pipe, fittings, and valves shall be double-wrapped. Cut polyethylene tube 2 feet longer than the length of pipe to receive the encasement. Prior to placing the pipe into the trench, raise the pipe section and slip the polyethylene tube over the spigot end of the pipe. Bunch up the tube in accordion fashion between the spigot end and the supporting sling.

B. Lower the pipe section into the trench and seat the spigot end into the bell of the previously installed pipe. Provide a shallow hole at the bell to facilitate the joint overlap.

C. Remove the sling from the pipe. Raise the pipe from the bell end about 3 or 4 inches and slip the bunched up polyethylene tube along the full length of pipe. Leave one foot of bunched up polyethylene tube at each end of the pipe for joint overlap.

D. To make the joint overlap, pull the polyethylene tube from the bell end over the pipe joint to the spigot end. Fold the tube around the pipe and secure with three circumferential wraps of plastic adhesive tape or a plastic tie strap. Then pull the bunched up polyethylene tube on the spigot end over the wrapped pipe joint to the bell end. Fold tube and secure with tape or a plastic tie strap as previously described.

E. Pull the loose polyethylene tube on the pipe snugly around the pipe barrel. Fold the excess material over at the top of pipe and secure the fold with 6-inch long strips of plastic adhesive tape at 3 feet on center.

F. Polyethylene sheet will not be allowed as a substitute for tube when required for installation on buried pipe.

3.02 SHEET ENCASEMENT OF BURIED VALVES

Wrap valves by pulling the bunched up polyethylene tube (where installed) from the adjacent pipe over the bells or flanges of the valve. Secure the tube to the valve body with plastic adhesive tape strips wrapped around the valve body. Then wrap the valve with a flat sheet of polyethylene. Place the sheet under the valve and fold in half. Extend the sheet to the valve stem and secure the sheet in place with plastic adhesive tape. Apply the second layer and secure with tape. Pour concrete anchor and support blocks after the wrap has been properly placed.

3.03 SHEET ENCASEMENT OF BURIED FITTINGS, COUPLINGS, AND APPURTENANCES

A. Wrap buried ferrous metal pipe fittings, couplings, adapters, and appurtenances with polyethylene sheet. Overlap the adjoining pipe or fitting a minimum of one-foot and secure in place with plastic adhesive tape. Apply a second layer and secure with tape around the barrel of the connecting pipe to prevent the entrance of soil. Pour concrete anchor and thrust blocks after the wrap has been placed.

B. Wrap base elbows and risers of hydrants and backflow prevention assemblies with 2 layers of polyethylene sheet and secure with plastic adhesive tape. Extend the wrap to the finish ground level of the assembly. Pour concrete anchor and support blocks after the wrap has been placed.

3.04 REPAIR OF POLYETHYLENE MATERIAL

Repair polyethylene material that is damaged during construction. Use polyethylene sheet, place over damaged or torn area, and secure with plastic adhesive tape.

END OF SECTION

SECTION 09868

COLD APPLIED WAX TAPE COATING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and application of a three-part, cold applied wax tape coating system for buried fittings and valves. The coating system shall conform to AWWA C217 and as specified herein.

1.02 RELATED SECTIONS

A. Section 01300 – Record Drawings and Submittals

B. Section 09867 – Polyethylene Sheet or Tube Encasement

1.03 SUBMITTALS

Submit manufacturer's catalog data sheets and application instructions in accordance with the Section 01300.

PART 2 - MATERIALS

2.01 PRIMER

A. Primer shall be a blend of petroleums, plasticizers, and corrosion inhibitors having a paste-like consistency. The primer shall have the following properties:

Color:	Brown
Pour Point:	100°F to 110°F
Flash Point:	350°
Coverage:	1 gallon/100 square feet

B. Primer shall be Trenton Wax Tape Primer or approved equal.

2.02 WAX TAPE

A. Wax tape shall consist of a synthetic-fiber felt saturated with a blend of microcrystalline wax, petrolatums, plasticizers, and corrosion inhibitors forming a tape coating that is easily formable over irregular surfaces. The tape shall have the following properties:

Color:	Brown
Saturant Pour Point:	115°F to 120°F

Thickness:	50 to 70 mils
Tape Width:	6 inches
Dielectric Strength:	100 volts/mil

B. Wax tape shall be Trenton No. 1 Wax Tape or approved equal.

2.03 PLASTIC WRAPPER

A. Wrapper shall be a polyvinylidene chloride plastic with three 50-gauge plies wound together as a single sheet. The wrapper shall have the following properties:

Color:	Clear
Thickness:	1.5 mils
Tape Width:	6 inches

B. Plastic wrapper shall be Trenton Poly-Ply or approved equal.

2.04 POLYETHYLENE ENCASEMENT

See Section 09867.

PART 3 - EXECUTION

3.01 WAX TAPE COATING APPLICATION

A. Surfaces shall be clean and free of dirt, grease, water, and other foreign materials prior to the application of the primer and wax tape.

B. Apply primer by hand or brush to all surfaces of the pipe, fitting, flanges, and bolts to be wrapped by wax tape. Work the primer into all crevices, around bolts and nuts, into the threads, and completely cover all exposed metal surfaces. Extend the primer coating beyond the indicated limits of application a minimum of 3 inches onto adjacent surfaces of the piping.

C. Apply the wax tape immediately after the primer application. Work the tape into the crevices around fittings or flanges. Cut short lengths of tape, place over each bolt head and nut, and work the tape into the crevices. Wrap the wax tape spirally around the pipe and across fittings or flanges. Use a minimum overlap of 55 percent of the tape width.

D. Work the tape into the crevices and contours of irregularly shaped surfaces and smooth out so that there is a continuous protective layer with no voids or spaces under the tape.

E. Overlap the completed wax tape coating installation with the plastic wrapping material. Wrap spirally around the pipe and across fittings or flanges. Use a minimum overlap of 55 percent of the tape width and apply two layers or applications of over-wrap. Secure plastic wrapper to pipe with adhesive tape.

3.02 POLYETHYLENE ENCASEMENT

A. Wrap the completed wax tape coating system with polyethylene sheet per Section 09867 and secure around the adjacent pipe circumference with adhesive tape.

END OF SECTION

SECTION 09900

PAINTING AND COATING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials and application of painting and coating systems for the following surfaces:

1. Submerged Metal
2. Exposed Metal
3. PVC, CPVC and FRP
4. Metal in Contact with Concrete
5. Plaster, Wood, Masonry and Drywall

B. This section does not include coating steel tanks and reservoirs.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01300 - Contractor Submittals

B. Section 15064 – Steel Pipe

C. Section 15100 – Resilient Wedge Gate Valves

1.03 REFERENCE SPECIFICATIONS, CODE AND STANDARDS

A. Air Pollution Control District, San Diego Division

Rule 66.1 Miscellaneous Surface Coating Operations and Other Processes Emitting Volatile Organic Compounds

B. American Society for Testing and Materials

ASTM D2697	Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings
ASTM D4258	Standard Practice for Surface Cleaning Concrete for Coating
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

C. National Sanitation Foundation

NSF61 Drinking Water System Components - Health Effects

D. The Society for Protective Coatings

SSPC PA-1 Shop, Field, and Maintenance Painting of Steel
SSPC SP-1 Solvent Cleaning
SSPC SP-2 Hand Tool Cleaning
SSPC SP-3 Power Tool Cleaning
SSPC SP-5 White Metal Blast Cleaning
SSPC SP-6 Commercial Blast Cleaning
SSPC SP-7 Brush-Off Wet Blast Cleaning
SSPC SP-8 Pickling
SSPC SP-10 Near-White Metal Blast Cleaning
SSPC SP-11 Bare Metal Power Tool Cleaning

E. National Association of Corrosion Engineers

SP0188 Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

1.04 SUBMITTALS

A. Submit coating manufacturer's data sheets for the products to be applied in accordance with Section 01300. Data sheets shall show the following information:

1. Percent solids by volume.

2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.

3. Recommended surface preparation.

4. Recommended thinners.

5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.

6. Application instructions including recommended equipment and temperature limitations.

7. Curing requirements and instructions.

B. Submit color swatches.

C. Submit certificate identifying the type and gradation of abrasives used for surface preparation.

D. Certification that all paints and coatings comply with San Diego Air Pollution Control District’s requirements.

E. Material safety data sheets for each coating material, solvent, cleaning agent, and other potentially hazardous material to be used.

F. Coatings Schedule. At least 30 working days before the start of shop or project site coating work, submit a schedule of coating products to be used. The list shall indicate the manufacturer's brand name of each material to be used, the surfaces to which each material is to be applied, and the method of holiday testing.

G. Application procedures and quality control inspection plan with hold points for the application of shop applied coating and for field-applied coating on joints.

H. At least 30 working days before the start of coating work at the project site, submit a plan to protect existing previously painted surfaces, detailed procedure for abrasive blasting, and plan to contain and dispose of blasting products and debris.

1. Overspray and Paint Protection Plan. Submit detailed procedures to prevent overspray damage to existing structures and protection of existing paint from damage during installation and welding operations.

2. Submittals for equipment or items to be prepared and painted in the shop or manufacturing plant shall include information in accordance with this section. Coordinate the material compatibility certifications, color, and time to recoat requirements with the manufacturers and with the proposed field coatings.

I. Abrasive blast media shall be in compliance with federal, state and local regulations, including Title 17 California Code of Regulations, Sections 92000-92530; Abrasive Blasting. Abrasives used for dry unconfined abrasive blasting are to have current certification by the California Air Resources Board (CARB). Provide the following information for all abrasives to be used for dry, unconfined abrasive blasting.

1. The manufacturer's name or identifiable trade name.

2. The grade or brand name of the abrasive.

3. Verification that the abrasives are CARB certified for dry unconfined blasting.

J. Provide a NACE Certified CIP Level III Peer Reviewed Coating Inspector (NACE Level III Coating Inspector), from the start of surface preparation, to the coating application, to the final curing and inspection. The NACE Level III Coating Inspector shall provide instruction, guidance, and inspection to the Contractor for all aspects of surface preparation, coating application, and final coating inspection including repair and touch up.

1. Submit name and certification number of the NACE Level III Coating Inspector.

K. Inspection Reports and Records. All reports for painting and coating shall be signed by the NACE Level III Coating Inspector certifying compliance with the Contract Documents. Inspection reports for field applied coatings shall be submitted within two days after the work has been performed.

L. Qualifications. Submit a list of names and qualifications, including years of experience applying coating systems used in this specific project, for each individual worker performing application and mixing.

1. Employ trained, experienced applicators, trained by NACE or SSPC, certified quality control inspectors, and trained coating mixer/helpers.

2. These workers shall work under the direction of qualified and experienced supervisors.

3. Supervisors shall have a minimum two years recent, continuous experience supervising industrial maintenance coating application operations similar to the operations required to complete this project.

4. Applicators and mixer-helpers shall be trained and certified by the coating manufacturer for all coating products used on this project.

1.05 DELIVERY, STORAGE AND HANDLING

A. All materials shall be in the original sealed containers. They shall not be opened or used until the Construction Manager has physically inspected contents and obtained necessary data from information printed on containers or label. Materials exceeding storage life recommended by the manufacturer shall be rejected.

B. All coating materials shall be stored in enclosed structures to protect them from weather and excessive heat or cold. Coatings materials shall be stored at a temperature between 50 degrees F and 100 degrees F in a well ventilated area at all times, unless the manufacturer's requirements are more stringent. Take measures to prevent any fire hazards associated with storage of the materials.

1.06 EQUIPMENT AND TOOLS

A. Compressed-air units used in cleaning, abrasive blasting, and painting shall be equipped with oil and water separators. Separators shall be placed as close as practical to the application equipment.

B. Application equipment shall be thoroughly cleaned whenever changing the type of paint or color.

1.07 QUALITY CONTROL

A. Quality control procedures and practices shall be utilized to monitor all phases of surface preparation, application and inspection. Procedures or practices not specifically defined herein may be utilized provided they meet recognized and acceptable professional standards and are accepted by the Construction Manager.

B. The NACE Level III Coating Inspector shall provide to the Construction Manager daily project progress reports which include the type of coating work conducted and significant coating's preparation and application data to include, but not be limited to ambient temperature, surface temperature, relative humidity, dew point, anchor profile, coatings mixture, dry film thickness, coating adhesion, holiday testing, and coating cure.

C. The NACE Level III Coating Inspector shall ensure that coated surfaces are properly prepared and that the coating is applied in accordance with the manufacturer's recommendations and verification statement that all work is in compliance with Contract Documents.

D. All mixing, thinning, application, and testing of coatings shall be accomplished in the presence of the NACE Level III Coating Inspector. Work accomplished in the absence of required inspection may be required to be removed and replaced under the proper inspection.

E. Test thickness of coatings and paints with a non-destructive film thickness gauge. An instrument such as a Tooke Gage, or equal, shall be used if destructive testing is deemed necessary by the Construction Manager or the NACE Level III Coating Inspector. Testing shall be accomplished in conformance with SSPC-PA 2, "Measurement of Dry Paint Thickness with Magnetic Gages" except as modified herein.

F. Coating integrity of all coated surfaces shall be holiday tested with an inspection device approved by the Construction Manager and in accordance with NACE RP0188-06. Perform testing in the presence of the NACE Level III Coating Inspector and the Construction Manager. Mark all holidays, repair in accordance with the manufacturer's printed recommendations, and retest. The final coating shall be 100 percent holiday-free with no pinholes or other irregularities.

G. Furnish inspection devices in good working condition for detection of holidays and measurement of dry-film thickness. Dry film thickness gauges and holiday detectors shall be available at all times during painting and coating activities. Inspection devices shall be operated by, or in the presence of the Construction Manager with location and frequency basis determined by the Construction Manager.

H. Acceptable devices for ferrous metal surfaces include, but are not limited to, Tinker and Rasor Models AP and AP-W holiday detectors, or equal, and Positest unit, Positector unit, iQuanix unit, or equal, for dry film thickness gauging. Operate inspection devices in accordance with the Contract Documents and the manufacturer's instructions.

I. Dehumidification equipment or other alternate ventilation systems shall be approved by the NACE Level III Coating Inspector and the Construction Manager. Operate equipment on a continuous basis during all blasting, coating and curing operations, including shifts during which no work is being accomplished. Monitoring devices approved by the NACE Level III Coating Inspector shall be used to ensure continuous operation.

J. Submit material safety data sheets for each coating.

PART 2 - MATERIALS

2.01 PAINTING AND COATING SYSTEMS

A. Coating products shall conform to San Diego Air Pollution Control District Rule 67.0, where products cannot contain more than 250 grams per liter of volatile organic compound (VOC) per gallon of coating product as applied. The following index lists the various painting and coating systems by service and generic type.

PAINT COATINGS SYSTEM INDEX

No.	Title	Generic Coating
	Submerged Metal Coating System	
5.	Submerged or Intermittently Submerged Metal, Potable or Recycled Water	Epoxy

No.	Title	Generic Coating
	Exposed Metal Coating Systems	
10.	Exposed Metal, Corrosive Environment	High Build Epoxy (2 Coat System) with Polyurethane Topcoat
15.	Exposed Metal, Atmospheric Weathering Environment	Acrylic
20.	Exposed Metal, Exterior	Epoxy with Urethane Topcoat
	PVC, CPVC and FRP Coating System	
41.	PVC, CPVC and FRP, Ultraviolet Exposure	Polyurethane
	Metal in Contact with Concrete Coating System	
51.	Aluminum and Concrete	Epoxy
	Plaster, Wood, Masonry and Drywall Coating System	
60.	Plaster, Wood, Masonry and Drywall	Acrylic Latex

B. These systems are specified in detail in the following paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

2.02 SUBMERGED METAL COATING SYSTEM

System No. 5 - Submerged Metal, Potable or Recycled Water:

Type: Epoxy

Service Conditions: For use with steel structures, piping, valves, or equipment in potable or recycled water.

Surface Preparation: SSPC SP-10.

Coating System: Apply the manufacturer's recommended number of coats to attain the specified minimum coating thickness. Products: Devoe Bar-Rust 233H, Tnemec N140 or 100, Sherwin-Williams Tank Clad HS B62-80, PPG AQUAPON® LT NSF Low Temperature Epoxy Coatings 95-172, or District approved equal; 12 mils total. Color of topcoat: white. Each coat shall be different color than the one preceding it.

2.03 EXPOSED METAL COATING SYSTEMS

A. System No. 10 - Exposed Metal, Corrosive Environment:

Type: High-build epoxy finish coat having a minimum volume solids of 60%, with an inorganic zinc prime coat and a pigmented polyurethane finish coat having a minimum volume solids of

52%.

Service Conditions: For use with metal structures, pipes, or valves subjected to water condensation; chemical fumes; and chemical contact.

Surface Preparation: SSPC SP-10.

Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 12 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec 90E-92, Devoe Catha-Coat 304 or 304V, International Interzinc 22HS, Ameron 9HS, Sherwin-Williams Zinc-Clad II Plus, PPG METALHIDE® 28 Inorganic Zinc-Rich Primer 97-672, or District approved equal.

Intermediate Coat: Tnemec 104, ICI Devoe Devran 224HS or 231, International Interseal 670HS, Ameron 385, Sherwin-Williams Macropoxy 646 B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or District approved equal; 5 mils.

Finish Coat: Two-component pigmented acrylic or aliphatic polyurethane recommended by the manufacturer for overcoating a high-build epoxy coating. Apply to a thickness of at least 2 mils. Products: Tnemec Series 1075, ICI Devoe Devthane 379, International Interline 990HS, Ameron 450HS, Sherwin-Williams Hi-Solids Polyurethane B65-300, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or District approved equal.

B. System No. 15 - Exposed Metal, Atmospheric Weathering Environment:

Type: One component acrylic enamel having a minimum volume solids content of 35% with an acrylic inorganic zinc primer.

Service Conditions: For use on interior and exterior metal and piping subject to sunlight, weathering, and water condensation.

Surface Preparation: SSPC SP-10.

Prime Coat: Sherwin-Williams Zinc Clad II Plus primer, ICI Devoe Inorganic Zinc 304V, Tnemec 90E-92, or District approved equal applied to a minimum dry-film thickness of 3 mils.

Finish Coats: Two or more coats of Sherwin-Williams Sher-Cryl B66–300, ICI Devoe Devflex 659, Tnemec Series 28 or 29, or District approved equal. Apply sufficient coats to provide a total minimum dry-film thickness of 8 mils. Thickness of any individual coat shall not exceed 4 mils.

C. System No. 20 - Exposed Metal, Exterior:

Type: High-build epoxy prime coat with a pigmented high-build aliphatic or acrylic polyurethane finish coat.

Service Conditions: For use on exterior metal piping appurtenances, such as valve box lids, hydrant heads, and guard posts.

Surface Preparation: SSPC SP-10.

Prime Coat: Two-component high-build epoxy. Apply to a thickness of 8 mils. Products: Ameron

400, ICI Devoe 235, Tnemec 104, International Interseal 670HS, Sherwin-Williams Macropoxy 646 B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or District approved equal.

Finish Coat: Two-component pigmented high-build polyurethane. Apply one or more coats to a total thickness of 5 mils. Products: Ameron "Amershield," ICI Devoe Devthane 359, Tnemec Series 1075, International Interthane 990HS, Sherwin-Williams Hi-Solids Polyurethane B65-300 series, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or District approved equal.

2.04 PVC, CPVC AND FRP COATING SYSTEM

System No. 41 - PVC, CPVC and FRP, Ultraviolet Exposure:

Type: Epoxy primer with a minimum volume solids of 54% and a pigmented Polyurethane enamel having a minimum volume solids of 52%.

Service Conditions: PVC or CPVC piping and FRP exposed to sunlight.

Surface Preparation: SSPC SP-1. Then lightly abrade the surface with medium-grain garnet paper.

Prime Coat: One coat of Tnemec Series N69 Epoxoline, International 7510, Ameron 385, ICI Devoe Devran 224HS, Sherwin-Williams Macropoxy 646 B58 series, PG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or District approved equal. Apply to a minimum dry-film thickness of 4 mils.

Finish Coat: One coat of Tnemec Series 1075, International Interthane 990HS, Ameron 450HS, ICI Devoe Devran 379, Sherwin-Williams Hi-Solids Polyurethane B65-300 series, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or District approved equal. Apply to a minimum dry-film thickness of 3 mils

2.05 METAL IN CONTACT WITH CONCRETE, COATING SYSTEM

System No. 51 - Aluminum insulation from Concrete and Carbon Steel:

Type: High solids epoxy or phenolic epoxy having a minimum volume solids of 80% (ASTM D2697).

Service Conditions: Coat areas of aluminum grating, stairs, framing, structural members, or aluminum fabrications in contact with concrete or carbon steel with this system.

Surface Preparation: Preparation: Solvent or steam cleaning per SSPC SP-1; do not use alkali cleaning. Then dust blast.

Coating System: Apply three or more coats of Ameron 400, Tnemec Series 135, ICI Devoe Bar-Rust 233H, Sherwin-Williams Macropoxy B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or District approved equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

2.06 PLASTER, WOOD, MASONRY AND DRYWALL COATING SYSTEM

System No. 60 - Plaster, Wood, Masonry and Drywall, Normal Exposure:

Type: Acrylic latex coating having a minimum volume solids of 40%.

Service Conditions: For use in coating weather-exposed or enclosed concrete masonry, drywall, wood, and plaster.

Surface Preparation: Surfaces shall be dry, clean, and free of contaminants.

Prime Coat: Self-priming.

Finish Coats: Two coats of Tnemec Series 6, Tneme-cryl, 2 mils each; two coats of ICI Dulux Professional, 2 mils each; two coats of Sherwin-Williams Metalatex B42 series, 2 mils each; two coats of PPG PITT-TECH® Int/Ext Satin DTM Industrial Enamel 90-474 series, 2 to 3 mils each, or District approved equal.

2.07 ABRASIVES FOR SURFACE PREPARATION

A. Abrasives used for preparation of iron and steel surfaces shall be one of the following:

1. 16 to 30 or 16 to 40 mesh silica sand or mineral grit.

2. 20 to 40 mesh garnet.

3. Crushed iron slag, 100% retained on No. 80 mesh.

4. SAE Grade G-40 or G-50 iron or steel grit.

B. Abrasives used for preparation of copper and aluminum surfaces shall be one of the following:

1. Crushed slag, 80 to 100 mesh.
2. Very fine silica sand, 80 to 100 mesh.

C. In the above gradations, 100% of the material shall pass through the first stated sieve size and 100% shall be retained on the second stated sieve size.

PART 3 - EXECUTION

3.01 WEATHER CONDITIONS

A. Do not paint in the rain, wind, snow, mist, and fog or when steel or metal surface temperatures are less than 5 degrees F above the dew point.

B. Do not apply paint when the relative humidity is above 85% or the temperature is above 90 degrees F or when temperature of metal to be painted is above 120 degrees F.

C. Do not apply paints if air or surface temperature is below 40 degrees F or expected to be below 40 degrees F within 24 hours.

D. Do not apply epoxy, acrylic latex, and polyurethane paints on an exterior or interior surface if air or surface temperature is below 60 degrees F or expected to drop below 60 degrees F in 24 hours.

3.02 SURFACE PREPARATION

A. Remove oil and grease from metal surfaces in accordance with SSPC-SP 1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before sandblasting.

B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges in accordance with SSPC SP-2 and SSPC SP- 3. Grind 0.02 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of ¼ inch.

C. Neutralize welds with a chemical solvent that is compatible with the specified coating materials. Use clean cloths and chemical solvent. Wipe dry with clean cloths. Do not leave a residue on the cleaned surfaces.

D. Do not abrasive blast or prepare more surface area than can be coated in one day. Remove all sharp edges, burrs, and weld spatter. Do not abrasive blast PVC, CPVC, or FRP piping or equipment. Do not abrasive blast epoxy, enamel coated, or fusion-bonded epoxy pipe that has already been factory coated, except to repair scratched or damaged coatings.

E. Surface preparation shall conform with the SSPC specifications as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off-Blast Cleaning	SP-7
Pickling	SP-8
Near-White Blast Cleaning	SP-10

F. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning" or similar words are used in these specifications or in paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC (Society for Protective Coatings), surface preparation specifications listed above.

G. Dust blasting is defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. Etch the metal surface to clean the surface of any contamination or oxide and to provide a surface profile for the coating.

3.03 ABRASIVE BLAST CLEANING

A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.

B. After abrasive blast cleaning and prior to application of coating, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within eight hours. Reclean any blast cleaned surface not coated within the specified time period prior to the application of primer or touch-up coating. Do not apply coating over damp or moist surfaces.

C. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate

and constitute a nuisance or hazard.

D. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.04 SHOP PRIMING

Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.05 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.

B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of trisolium phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by means of scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.

C. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

D. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

E. Use repair procedures on damaged primer which protects adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles, and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.

F. After abrasive blast cleaning of damaged and deflective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.

G. Surfaces that are shop primed with inorganic zinc primers shall receive a field touch-up of organic zinc primer to cover all scratches or abraded areas.

H. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

3.06 PAINTING SYSTEMS

A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as

recommended by the paint manufacturer for the particular coating system.

B. Deliver paints to the jobsite in the original, unopened containers.

3.07 PAINT MIXING

A. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touchup painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.08 COATING PROCEDURES

A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.

B. Stir, strain, and keep coating materials at a uniform consistency during application. Apply each coating evenly, free of brush marks, sags, runs, holidays, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.

E. Apply coating systems to the specified minimum dry-film thicknesses as measured from above the peaks of the surface profile.

F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Reclean surfaces by blast cleaning that have surface colored or become moist prior to coating application.

G. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. The brush coat shall be done prior to and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

3.09 SURFACES NOT TO BE COATED

Do not paint the following surfaces unless otherwise noted on the Drawings or in other Specification sections. Protect during the painting of adjacent areas:

A. Cement mortar coated pipe and fittings or concrete surfaces.

B. Stainless steel.

C. Metal plates/nameplates or letters.

D. Fencing.

E. Copper tubing, red brass piping and PVC piping except where such piping occurs in rooms where the walls are painted or required for color coding.

F. Electrical fixtures except for factory coatings.

G. Grease fittings.

H. Buried pipe unless specifically required in the piping specifications.

I. Fiberglass items.

J. Aluminum handrails, stairs and grating, unless in contact with concrete.

3.10 PROTECTION OF SURFACES NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

3.11 SURFACES TO BE COATED

A. Coat mechanical equipment as described in the various mechanical equipment specifications. Color shall match the color of the connecting piping.

B. Coat aboveground and exposed piping or piping in vaults and structures as described in the various piping specifications. Color shall be as indicated or as selected by the District.

C. Coat valves as described in the various valve specifications. Aboveground valves or valves in vaults and structures shall match the color of the connecting piping.

D. Coat aluminum surfaces in contact with concrete per System No. 51.

E. Coat exposed surfaces of enclosures, guard posts, marker posts, fire hydrants, valve boxes, and test boxes as described in the particular specifications for the above items.

3.12 DRY FILM THICKNESS TESTING

A. Measure coating thickness specified for metal surfaces with a magnetic-type dry-film thickness gage. Test the finish coat (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide detector as manufactured by Tinker and Rasor or K-D Bird Dog. Provide dry-film thickness gage as manufactured by Mikrotest or Elcometer. Check each coat for the correct dry-film thickness. Do not measure within eight hours after application of the coating.

B. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Hand or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps or other imperfections.

END OF SECTION