SECTION 07110
ELASTOMERIC COATING FOR CONCRETE SURFACES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Furnishing and applying 100% solids elastomeric polyurethane as a protective coating on the inside of Digesters #6 and #7.

B. Coating shall be applied to the entire interior of the roofs of the new digesters, and all surfaces inside the digester within 10-feet below the top of the interior wall. Surfaces inside the digester include: walls, columns, and other surfaces.

1.02 REFERENCES

A. Where standards of surface preparation are described by citing SSPC specification numbers, reference is made to the “Steel Structures Painting Manual” Volume 2 published by the Steel Structures Painting Council.

1. SSPC-SP1: Solvent Cleaning
2. SSPC-SP2: Hand Cleaning
3. SSPC-SP3: Power Tool Cleaning
4. SSPC-SP5: White Metal Blast Cleaning
5. SSPC-SP6: Commercial Blast Cleaning
6. SSPC-SP7: Brush-off Blast Cleaning
7. SSPC-SP10: Near White Blast Cleaning

B. National Associate of Corrosion Engineers (NACE):

1. NACE-Std. PP0178-78 Design, Fabrication and Surface Finish Metal Tanks and Vessels Lined for Chemical Immersion Services
2. NACE-Std. RPO188-88 Discontinuity (Holiday) Testing of Protective Coatings
3. NACE-Std. RPO288-88 Inspection of Linings on Steel and Concrete

C. ASTM International (ASTM):

1. ASTM D4263-83 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
2. ASTM D2240 Standard Test Method for Rubber Property - Durometer Hardness

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit a complete schedule of materials to be used to the Engineer for review prior to ordering material. Include manufacturer's brand name, product name, materials test data, surface preparation requirements, application procedures and warranty of the coating system.
C. Submit a detailed list of all surfaces and equipment items to the Engineer for review prior to commencing work upon which the Contractor intends to apply protective coatings.

D. Submit a detailed work plan which has been favorably reviewed by the Engineer prior to the start of work to thoroughly describe the surface preparation and application procedures for the elastomeric coating system. The plan shall include:
   1. Equipment staging and handling of materials.
   2. Surface preparation and surface repairs.
   3. Disposal of sandblasting and/or waterblasting waste materials and slurries.
   4. Coating and application procedures.
   5. Control of environmental conditions during application.
   6. Monitoring and testing to ensure the coating is applied to the required thickness and is free of pinholes and holidays.
   7. Cleanup procedures.

E. If materials other than those listed are submitted, submit technical information on the proposed substitution. The Engineer may further require the Contractor to furnish test results from an independent paint laboratory comparing the proposed substitution with one of the named products, at no additional cost to the Owner.

F. Submit physical samples of the elastomeric protective coating system applied to concrete test pieces.

G. Submit applicator qualifications as noted in Section 07110, paragraph 1.04.

H. Submit certification of application licensing by the material manufacturer.

I. Submit manufacturer’s letter of declaration to maintain local permanent inventory and field technical services during the warranty period.

J. Manufacturer’s Certification: That products furnished meet applicable Air Quality Management District regulations as to allowable volatile organic compound (VOC) content for the place of application and use intended.

K. For expanded urethane submit certification that the product has been approved for use with the Ecosystem® expansion technology.

L. Submit manufacturer’s letter of declaration which certifies that the elastomeric polyurethane material submitted is Moca-free.

1.04 QUALITY ASSURANCE

A. Environmental Regulatory Requirements:
   1. All work, material, procedures, and practices under this section are to conform to requirements of the local Air Resources Board or Air Quality Management District having jurisdiction. Products specified herein are, to the best of the Design Engineer’s knowledge, in compliance with the applicable VOC\(^1\) levels allowable at the date these Specifications were issued for bid.
   2. The Air Resources Board or Air Quality Management District having jurisdiction may prohibit the sale or application of paints and enamels containing more than stipulated percentages of volatile organic solvents manufactured after a stated date. The Contractor to provide material specified meeting applicable regulations as to date of manufacture, or if not

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\(^1\) Measured in grams per liter by weight of coating as applied, excluding water and color added to be base tint.
available, to provide top of the line materials developed as replacements for specified materials and meeting applicable regulations as to VOC solvents content.

3. If the Contractor applies any coatings for which he has not submitted certificates indicating actual VOC content, or if he applies coatings that have been modified or thinned other than as recommended by manufacturer, he will be responsible for any fines, costs, remedies or legal actions that may result.

B. Applicator Qualifications:
1. Submit manufacturer’s letter of approval of the applicator.
2. Submit list of references for the applicator, including contact person and phone number:
   a. On a minimum of five similar projects of successful application of polyurethane systems completed more than five years before bid date.
   b. In addition, provide a list of references on current projects of a similar nature. References shall be for the expanded or non-expanded process as proposed by the applicator.
3. The applicator shall be an approved applicator for the expanded material by CO2 gas injection exclusively (Ecosystem® expansion technology) and/or the non-expanded (solid) material at the time of bid submittal.

C. Inspections:
1. The Owner will provide a third-party coating inspector qualified NACE III to provide inspection services for the coating application. The Contractor shall coordinate the work with the Owner to allow for inspections during work.

1.05 WARNINGS

A. Be advised that application of protective coating materials may be hazardous. Take all necessary precautions and safeguards to ensure the health and safety of workers and property, including breathing equipment and protective clothing.

B. Be advised that as a part of this work waterblasting and/or sandblasting is required. This may require the use of special equipment. Become familiar with the existing site conditions and take all steps necessary to protect adjacent facilities and personnel, at no additional cost to the Owner. In addition, sandblasting and painting is called for in, on or around mechanical equipment which may be damaged by grit, dust or painting overspray. Mask, wrap, enclose and provide all protection required to safeguard this equipment at no additional cost to the Owner.

C. Perform waterblasting and/or sandblasting activities in a manner that will not cause a nuisance to adjacent public and private property and equipment.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver all coating materials in unopened containers with manufacturer’s label, which must include name, batch number and date.

B. Storage and Protection: Store in an assigned area onsite with concurrence from the coating manufacturers. Maintain storage area clean and fire safe. Dispose of used rags, thinner and buckets daily.
C. In addition, Contractor shall protect the containers from direct sunlight, from
temperatures that are below 40°F, from temperatures that are above 100°F, and
from dampness.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Provide ambient temperatures recommended by manufacturer of material to
      be applied.
   2. Provide adequate ventilation.
   3. Provide 40- to 50-foot candles of illumination on all surfaces in areas to be
      painted including floors, walls and ceiling even though they do not require
      painting.
   4. Use temporary dust barriers to close off areas being painted from areas
      where other work is being performed.
   5. Provide testing of the area to control environmental conditions.

PART 2 - PRODUCTS

2.01 COATING SYSTEM

A. The coating shall be Endura-Flex EF-1988 (expanded and/or non-expanded
   systems), as supplied by American Polymers for Endura-Flex Systems, Santa Fe
   Springs, CA, equivalent by Polibrid Coatings, Inc. of Brownsville, Texas.
   Certification shall be provided with the product submittal as described in
   Section 07110, paragraph 1.03.

B. Paints used in the elastomeric coating to be the product of one manufacturer.
   Concrete repair mortar shall be recommended and approved in writing by the
   elastomeric coating manufacturer.

C. The coating material shall be a 100% solids, aromatic, 100% Moca-free, MDI
   (Methylene Disocyanate) elastomeric polyurethane coating which contains no sand
   or silica fillers. The coating system shall be a two component 1A:2B ratio
   (1 Activator to 2 Base).

D. The elastomeric coating system shall be certified for use in contact with raw
   sewage and resistant to hydrogen sulfide corrosion.

E. The product shall be certified by an approved material testing laboratory to meet
   the following requirements on physical properties:

<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>Test Method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durometer Hardness @ 75°F, Shore D</td>
<td>ASTM D2240</td>
<td></td>
</tr>
<tr>
<td>30 minutes</td>
<td>85-90 Shore A</td>
<td></td>
</tr>
<tr>
<td>60 minutes</td>
<td>90-95 Shore A</td>
<td></td>
</tr>
<tr>
<td>4 hours</td>
<td>45-50 Shore D</td>
<td></td>
</tr>
<tr>
<td>24 hours</td>
<td>60-65 Shore D</td>
<td></td>
</tr>
<tr>
<td>48 hours</td>
<td>65-70 Shore D</td>
<td></td>
</tr>
<tr>
<td>Tensile Strength, PSI</td>
<td>ASTM D638</td>
<td>2800-3000 psi</td>
</tr>
<tr>
<td>Percent Elongation, @60 mils</td>
<td>ASTM D638</td>
<td>42%</td>
</tr>
</tbody>
</table>
### Physical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion Resistance</td>
<td>ASTM D4060-84</td>
<td>&lt;55 mg</td>
</tr>
<tr>
<td>1000 cycles; 1000 gms; CS-17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact Resistance, 80 mils</td>
<td>ASTM D2794</td>
<td>&gt; or = 35 psi</td>
</tr>
<tr>
<td>Elcometer Adhesion: Steel;</td>
<td></td>
<td>&gt;1500 psi</td>
</tr>
<tr>
<td>no primer; SSPC SP-5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tear Strength</td>
<td>ASTM D624</td>
<td>&gt;200 psi</td>
</tr>
<tr>
<td>Heat Aged 180°F, 30 days</td>
<td>ASTM D573</td>
<td>Durameter D65</td>
</tr>
<tr>
<td>60 mil film</td>
<td></td>
<td>Elongation 36%</td>
</tr>
<tr>
<td>Water Vapor Permeability @ 75-80 mils</td>
<td>ASTM D1653A</td>
<td>&lt;0.055 grams / 24 hrs/ft² (144 in²)</td>
</tr>
<tr>
<td>Pot Life @ 70°F</td>
<td></td>
<td>3-5 minutes</td>
</tr>
</tbody>
</table>

F. Surface repair and caulking materials shall be as recommended by the elastomeric coating manufacturer. Caulking material shall be a product of Sika Corporation or approved equivalent. Concrete repair mortar shall be as specified below in 2.02.

G. Provide manufacturer’s standard color. The color of the applied coating shall be uniform in color. The base and catalyst components shall be supplied in two different colors which will result in the specified color when they are mixed and metered.

H. Dry Film Thickness (DFT):

1. The maximum DFT shall not exceed the coating manufacturer’s recommendations (expanded or non-expanded).
2. The elastomeric coating material shall be applied in one or more coats as necessary to provide a minimum of 80 mils DFT (non-expanded).
3. The expanded system may be used in addition as an underlayment to the 80 mils of non-expanded material but not as a substitute for concrete repair mortar.

#### 2.02 CONCRETE REPAIR MORTAR

A. Fast setting, high early strength, polymer modified Portland Cement non-sag mortar. SikaTop 123 as manufactured by Silica Corporation; underlayment No. F-120 trowelable as manufactured by Saureisen, or equal.

#### 2.03 JOINT SEALING SYSTEM (SIKADUR COMBIFLEX)

A. Provide at joint between roof and wall. See details on structural drawings.

B. Joint sealing system shall be able to withstand corrosive environments such as the interior of anaerobic digesters while maintaining water tight seal.

C. Manufacturers: Sikadur Combiflex, as manufactured by Sika Corporation, is considered to conform to the requirements of this specification.
D. Materials:
1. Sikadur 31 Hi-Mod Gel resin adhesive:
   a. Component A shall be a modified epoxy resin of the epichlorohydrin
      bisphenol A Type containing suitable viscosity control agents and
      pigments. It shall not contain butyl glycidyl ether.
   b. Component B shall be primarily a reaction product of a selected amine
      blend with an epoxy resin of the epichlorohydrin bisphenol A Type
      containing suitable viscosity control agents, pigments, and accelerators.
   c. The ratio of Component A: Component B shall be 1:1 by volume.
2. Combiflex Hypalon sheeting:
   a. Hypalon sheeting shall be composed of Hypalon rubber. It shall be
      perforated along the bonding edge to provide a mechanical key. It shall
      have the ability to be vulcanized with an aromatic hydrocarbon solvent
      to permit its adhesion to an epoxy resin adhesive.
   b. The sheeting shall be supplied in 20 ft. rolls or 82 ft. rolls. It shall be
      available in 4, 8, and 12 inch widths, at 40 mils in thickness.
   c. The sheeting shall be supplied with a removable center expansion strip.
3. Activating solvent:
   a. The activating solvent shall be an aromatic hydrocarbon with a specific
      gravity of 0.86.

E. Performance Criteria:
1. Properties of the mixed uncured epoxy resin adhesive:
   a. Potlife: 30 minutes
   b. Consistency: non-sag (1/2-inch thick)
   c. Color: Gray
   d. Tack-Free Time to Touch: 2-3 hours (73F)

F. Properties of the Cured Epoxy Resin Adhesive:
1. Tensile Properties (ASTM D638) at 14 days:
   a. Tensile Strength: 3,300 psi (22.7 Mpa)
   b. Elongation at break: 0.9%
2. Compressive Properties (ASTM D695) at 28 days:
   a. Compressive strength: 16,000 psi (82.8 Mpa)
   b. Compressive Modulus of Elasticity, psi: 795,000 psi (5,485 MPA)
3. Flexural Properties (ASTM D790) at 14 days:
   a. Flexural strength (Modulus of Rupture): 6,100 psi (42 Mpa)
   b. Tangent Modulus of Elasticity in Bending: 1.67 x 10^8 psi (11,520 MPa)
4. Shear Strength (ASTM D732) at 7 days: 4,600 psi (31.7 Mpa)
5. Water Absorption (ASTM D570), 7-day, (24-hour immersion): 0.07%
6. Bond Strength (ASTM C882) Hardened Concrete to Hardened Concrete:
   a. 2-day (dry cure) Bond Strength: 2,200 psi (22.7 Mpa)
   b. 14-day (moist cure) Bond Strength: 2,900 psi (16.6 Mpa)
7. The epoxy resin shall conform to ASTM C881, and AASHTO M235.

G. Properties of the Hypalon Sheeting:
1. Tensile Properties (ASTM D 412):
   a. Tensile Strength: 1,000 psi (6.8 Mpa)
   b. Elongation at Break: 800%
   c. Tensile Set after Break: 400%
2. Tear Resistance (ASTM D 624) Die C:
   a. Resistance to Tear: 250 lb./inch
3. Low Temperature of Performance: Maintained to –40F
4. Ozone Resistance (3-month Exposure):
   a. Water/ozone (3 ppm) – No effect
   b. Air/ozone (2-300 ppm) – No effect

PART 3 - EXECUTION

3.01 INSTALLATION
   A. Surface preparation and application shall be in strict conformance with the manufacturer’s latest published installation instructions, specifications and recommendations, and performed under the guidance of manufacturer’s representative.
   B. Coating shall be applied to the entire interior of the roofs of the new digesters, and all surfaces inside the digester within 10-feet below the top of the interior wall. Surfaces inside the digester include: walls, columns, and other surfaces.
   C. Contractor shall provide a dry environment in which to work and install the coating system in accordance with manufacturer’s installation instructions and guidelines.

3.02 SURFACE REPAIRS
   A. All areas requiring repair and gaps requiring caulking shall be applied prior to applying elastomeric coating.
   B. All gaps up to 1/16-inch in width shall be sealed by “bridging” the gap with multiple spray passes.
   C. All gaps in size larger than 1/16-inch shall be filled using a caulk or repair mortar as recommended by the manufacturer’s representative.
   D. All rock pockets, spalled concrete and areas of corroding reinforcing shall be opened up to structurally sound material, cleaned and filled with concrete repair mortar in accordance with the manufacturer’s recommendations.
   E. Where concrete deterioration exceeds ½-inch, attach 2-inch x 2-inch x 10-inch gauge wire mesh to concrete prior to applying concrete repair mortar.
   F. Minimum Concrete Repair Requirements: Apply concrete repair where required to fill bugholes, gaps and pockets.
   G. Concrete surface repairs shall be inspected and approved by the third party inspector as being suitable to apply the elastomeric coating materials. Any defects or areas not properly prepared shall be done to the satisfaction of the third party inspector and/or the Owner at no additional cost to the Owner.

3.03 SURFACE PREPARATION
   A. Concrete surfaces to be coated shall be abrasive blasted, hydro blasted, or a combination of both in order to remove all loose, soft and contaminated concrete back to sound and structurally stable material as recommended by the manufacturer. All concrete surfaces to be coated shall exhibit the surface roughness that is equal to or greater than that of 80-grit sandpaper.
   B. Metal surfaces to be coated shall be abrasive blast cleaned to SSPC-SP5 condition.
C. The degree of surface preparation specified shall be that condition at the time lining materials are applied.

D. All surfaces to be coated shall be free of debris, water, oil, grease, and other types of oily substances. Surfaces showing evidence of such contaminants shall be cleaned and tested to the satisfaction of the Owner and third party inspector prior to a final abrasive or hydro blast cleaning and surface preparation.

E. All surfaces to be coated shall be completely dry, clean and contaminant free before application. Surface profile and dryness shall be verified in the presence of the Owner and third party inspector according to ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

3.04 APPLICATION

A. Concrete surfaces and metal components shall be coated:
   1. With the materials specified herein.
   2. By a certified applicator.
   3. In strict conformance with the manufacturer’s instructions and procedures.

B. Equipment for the coating application shall be a high pressure proportioning spray system specifically designed to mix components in the exact proportion required and to deliver mixed materials to the spray tip at the temperature specified by the coating manufacturer. All equipment, procedures, parameters and controls shall be approved by the third party inspector in the field prior to the start of work.

C. For the expanded system the equipment and the methods of expansion and application shall be in strict accordance with the Ecosystem® technology.

D. Thinning of material is strictly prohibited.

E. Prior to the first application, the third party inspector shall inspect and approve the surface condition and the Contractor’s spray equipment setup and material application.

F. All surfaces receiving the coating system shall be visually dry with substrate temperatures between 40°F and 120°F, and at least 5°F (3°C) above the dewpoint prior to starting the installation to prevent moisture entrapment. The relative humidity must be below 50%.

G. The temperature, dewpoint and relative humidity shall be determined with a sling psychrometer or an accepted procedure in accordance with ASTM E337. Readings shall be taken at the start of each work shift, every 4 hours during the coating application and at other times as requested by the third party inspector or the Owner. All environmental conditions shall be monitored and verified through the NACE procedures.

H. The coating system shall be applied as a liquid seamless system by spray to the concrete surface and metal components, allowing the material to conform to the profile of the substrates, creating a non-stressed, non-seamed monolithic film to specified thickness that is free of pinholes and holidays.

I. Wet film thickness shall be monitored throughout the installation by means of frequent measurements with a high range wet film thickness gauge.
J. Expanded material shall cover the surface roughness completely to provide a continuous surface free of projections prior to top coating with non-expanded material.

K. All layers of material (expanded and solid) shall be applied the same day. This procedure is to ensure minimization of contamination of the membrane. If the project is not completed, then at the end of the work day a 3- to 12-inch “returning edge” of material will be left tapered to the substrate for the start of the next work day. The “returning edge” shall be cleaned with MEK before proceeding to spay on the startup the following work day.

L. The spray application shall be according to the principles of good workmanship outlined in SSPC-PA1-82, and shall provide a finish which is continuous, uniform in thickness, and free of pored, pinholes, holidays or other defects.

M. Coating terminations shall be completed in such a way so as to protect the lining and to eliminate leading edges. Saw cut approximately 1/8-inch wide and ¼-inch deep shall be required for concrete substrates. Coating shall terminate at and “key” into the saw cut. There shall be no overspray beyond the saw cut.

N. Protrusions shall be verified by the manufacturer’s agent as compatible with the coating relative to adhesion. All protrusions shall be prepared so as to exhibit a roughened surface and shall be free of grease or dust or other contaminants. Protrusions shall be coated to the specified mil thickness as required.

O. Expansion joints where existing and filled with a joint sealant shall be isolated from the lining so as to ensure that the coating does not bond to the joint sealant. A polyethylene tape shall be applied so as to bridge the joint and cover the sealant. No more overlap than necessary should occur onto the concrete by the tape.

P. Repairs of holidays, pinholes, or damaged areas shall be accomplished through the hand mixing of the materials specified in small quantities and applied in a trowel-on fashion. All areas to be coated where the coating has exceeded the recoat window shall undergo surface preparation. Surfaces to be repaired shall be roughened and cleaned free of contaminants prior to coating.

3.05 CURING OF COATING SYSTEM

A. The finished coating shall be protected from damage during curing and shall be cured as recommended by the coating manufacturer for a minimum of three (3) days before the coated area is put in service. Recommended environmental conditions shall be maintained and monitored during curing.

B. After the 3-day cure time the third party inspector shall verify that the coating system has reached cure as evidenced by durometer hardness tests meeting the requirements for specified hardness prior to placing the digesters in service.

3.06 JOINT SEALING SYSTEM INSTALLATION

A. Install in strict conformance with manufacturers installation procedures and recommendations.

3.07 FIELD QUALITY CONTROL AND TESTING

A. The Contractor shall provide quality control and testing to self-monitor the work and demonstrate the work meets the requirements as described in these specifications.
B. The Owner will provide third party inspection and field testing services from an independent coating inspection and testing service.

C. The third party inspector shall be present at all times during surface preparation and coating applications.

D. Upon completion of the protective coating system installation, the surface of the coating shall be cleaned in order to permit inspection and testing.

E. Inspection and testing shall follow NACE procedures.

F. Visual inspection of the entire coating shall verify that the color is a uniform color. Color variations can mean incorrect ratio application or improper mixing. Coating shall be free of pinholes, blisters and holidays. The coating shall be free of sags, runs, and drips.

G. Durometer reading shall be within those stated by the latest manufacturer’s published data sheets.

H. Dry Film Thickness (DFT) readings shall measure as equal to or greater than the minimum specified.

I. High voltage spark testing shall show a pinhole-free (spark-free) lining. Voltage shall be a minimum of 100 volts per mil. A known “Void” shall serve to verify proper operation of the spark testing equipment. If necessary, a void will be created for the purposes of ensuring proper adjustment of the equipment. Spark testing should take place as soon as the lining has achieved a durometer reading of 50D. All pinholes and voids in the coating detected by spark testing procedure shall be repaired per manufacturer’s recommended procedure.

J. Adhesion tests shall be performed by the Contractor at two locations in each digester to demonstrate to the Owner that the coating adhesion to the areas selected are equal to or greater than that which the paint manufacturer’s literature states may be achieved. An “Elcometer Adhesion Tester” is to be used to accomplish this demonstration.

K. All deficiencies in film integrity and thickness shall be repaired per the manufacturer’s instructions and to the satisfaction of the Owner.

L. The third party inspector will perform its own testing. The appropriate equipment and necessary support if requested, is to be provided by the Contractor. Any deficiencies in film integrity and thickness shall be repaired per the manufacturer’s instructions and to the satisfaction of the Owner.

3.08 TESTING SUPPORT

A. Provide scaffolding, ladders, lighting and labor as required to facilitate the Owner’s check. Repair any areas damaged during and by the testing operation.

3.09 CLEANING AND COMPLETION

A. At the completion of this portion of the work, remove all debris, remove all paint and stains from work for which paint finish is not intended, touchup all marred surfaces, and leave all structures in a clean condition, ready for use.

B. Refinish all damaged or imperfect coating to the satisfaction of the Owner prior to final acceptance of the facility.
3.10 WARRANTY

A. Per Specification Section 01700.

END OF SECTION
SECTION 09960

PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Coat or paint all facilities and equipment which are part of this Contract, except:
      a. Metal completely embedded in concrete (except aluminum).
      b. Piping buried in ground or encased in concrete.
      c. Galvanized grating, galvanized bolts, and galvanized grating frames.
      d. Chain-link fence and galvanized fence gates.
      e. Rubber.
      f. Stainless steel.
      g. Bronze, brass.
      h. Nameplates and grease fittings.
      i. Factory finished electrical panels.
      j. Fusion Bonded Epoxy Pipe inside the Digesters
      k. Aluminum or galvanized ductwork enclosed inside furred ceiling spaces.
      l. Aluminum handrail and aluminum guardrail.

B. The Contractor is to base this bid on using the products specified. If the products specified are not available in formulations that meet applicable regulations on volatile organic compounds (VOC) levels at time of application, the Contractor is to submit for review, products of equivalent quality and function that comply with regulations in effect at that time. A reasonable difference in cost of material between the first named items specified and the products that are required to meet regulations that change after the bid date and are in effect at the time of application may be approved for payment by Change Order.

C. Related Sections Including Work Provided in this Section:
   1. Section 10400: Identifying Devices
   2. Section 15050: Piping, Valves and Accessories

1.02 REFERENCES

A. Where standards of surface preparation are described by citing SSPC specification numbers reference is made to the “Steel Structures Painting Manual” Volume 2 published by the Steel Structures Painting Council.

B. ASTM International (ASTM):
   1. ASTM D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
   3. ASTM D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
4. ASTM F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

1.03 DEFINITIONS

A. Dry Film Thickness (DFT): The prime coat and the sum of all fully cured applied coats for the paint system.

B. Exterior Surface: Surface that is not inside a building or structure and is exposed to the weather. Epoxy surfaces that are affected by the ultraviolet rays from the sun shall be considered an exterior surface if the sun can shine on the surface.

C. Interior Surface: Surface that is inside a building and will not be exposed to direct sunlight.

D. Stripe Coat: Coating applied to the edge, corner, welds or bolts, which is applied prior to application of additional system coats.

E. Submerged - Surfaces that are under water or the vertical extension of those walls that are partly under water during normal operating conditions.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Prior to ordering material, submit a complete schedule of materials to be used. Include manufacturer's brand name, product name, and designation number for each coat of each system to be used.

C. Prior to commencing work, submit a detailed list of all surfaces and equipment items upon which the Contractor intends to apply protective coatings.

D. Provide the following information on each paint product:
   1. Abrasion resistance, ASTM D4060, 1 kg load at 1000 cycles, CS-17 wheel.
   2. Impact-resistance, ASTM D2794, direct and reverse.

E. If materials other than those listed are submitted, submit additional information to fully define the proposed substitution. The Engineer may further require the Contractor to furnish additional test results from an independent paint laboratory comparing the proposed substitution with one of the named products, at no additional cost to the Owner. For substituted materials, provide a list of references, including contact person and phone number, where proposed substitute paint system has been used in similar exposures. Provide a minimum of five references (no duplicate owners or agencies).

F. Provide Material Safety Data Sheets (MSDSs) for all products.

G. Manufacturer's Certification: That products furnished meet applicable Air Quality Management District regulations as to allowable VOC content for the place of application and use intended.

H. Submit a full range of the manufacturer's standard and let down finish colors for review and selection by the Engineer. After final colors have been selected, submit two 8-1/2-inch x 11-inch samples on cardboard of each color indexed as to
manufacturer and color designation. Color chips ¾-inch x 1-1/2-inch may be used for pipe color codes.

I. Submit four pipe and equipment color code charts, 11 x 14 inches in size, with typed labels and using color chips. Upon favorable review, frame charts and mount under glass, suitable for hanging in work areas.

1.05 QUALITY ASSURANCE

A. Environmental Regulatory Requirements:
   1. All work, material, procedures, and practices under this Section shall conform to requirements of the local Air Resources Board or Air Quality Management District having jurisdiction. Prime or finish coat painting done in locations other than the project site shall be in accordance with air quality regulations in effect at the place the coating is applied. Products specified herein are, to the best of the Design Engineer's knowledge, in compliance with the applicable VOC\(^1\) levels allowable at the date these Specifications were issued for bid.
   2. The Air Resources Board or Air Quality Management District having jurisdiction may prohibit the sale or application of paints and enamels containing more than the stipulated percentages of volatile organic solvents manufactured after a stated date. Provide material meeting applicable regulations effective at the date of manufacture, or if not available, provide top of the line materials developed as replacements for specified materials and meeting applicable regulations as to VOC solvents content.
   3. If the Contractor applies coatings that have been modified or thinned other than as recommended by manufacturer, he will be responsible for any fines, costs, remedies or legal actions that may result.

1.06 WARNINGS

A. Be advised that application of paint, epoxy and protective coating materials may be hazardous. Take all necessary precautions to ensure the safety of workers and property.

B. Be advised that as a part of this work abrasive blasting is required. This may require the use of special equipment. Become familiar with the existing site conditions and take all steps necessary to protect adjacent facilities and personnel, at no additional cost to the Owner. In addition, abrasive blasting and painting is called for in, on or around mechanical equipment, which may be damaged by grit, dust, or painting overspray. Mask, wrap, enclose and provide all protection required to safeguard this equipment at no additional cost to the Owner.

C. Perform abrasive blasting activities in a manner that will not cause a nuisance to adjacent public and private property and equipment.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver all coating materials in unopened containers with manufacturer’s label, which must include name, batch number and date and VOC content.

B. Store in an assigned area onsite with concurrence from the coating manufacturers. Maintain storage area clean and fire safe. Dispose of used rags, thinner and buckets daily. Store solvents in closed approved storage containers.

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\(^1\) Measured in grams per liter by weight of coating as applied, excluding water and color added to be base tint.
C. Submerge solvent soaked rags in water.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Provide ambient temperatures recommended by manufacturer of material to be applied.
   2. Provide adequate ventilation.
   3. Provide 40- to 50-foot candles of illumination on all surfaces in areas to be painted including floors, walls and ceiling even though they do not require painting.
   4. Use temporary dust barriers to close off areas being painted from areas where other work is being performed.

1.09 COLORS AND SAMPLES

A. Contractor shall follow Owner’s color schedule and pipe color requirements shown in Table 1 and Table 2 included at the end of this section. Before starting work, obtain favorably reviewed color schedule. If coating manufacturers other than those indicated in Table 1 are used then the color shall be matched to the manufacturer colors listed in Table 1.

B. Colors are to be factory mixed, using light-fast colorants proportioned by accurate measurement into proper type base. All coatings must be formulated to perform in the climate and environment to which they will be exposed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Paints used in each system to be the product of one manufacturer.

B. Shop applied prime coats shall be compatible with the systems included in these specifications.

C. Substituted coating systems shall be of the same generic type as those specified.

D. Coating systems shall not contain lead.

E. Abrasives shall not be classified a hazardous material under California Title 22.

F. Materials: Paints and protective coatings listed in the Paint Systems and the Schedule in Part 3 of this Section refer to the following manufacturers and are specified as levels of quality.

G. Abbreviations:
   1. Carboline (CAR)
   2. Devoe (DV)
   3. Dulux/ICI (ICI)
   4. Sherwin Williams (SW)
   5. Kop Coat (K)
   6. Tnemec Co. (T)
   7. Roto Metals (RG)
   8. Protecto Wrap (PW)
   9. Tapecoat (TC)
   10. Chemical Products Co. (ZRC)
2.02 PAINT SYSTEMS

System 1: General Ferrous Exposed to Atmosphere

**Interior**

1st Coat - bare metal
High Solids Epoxy (T) Series 135
DFT = 5-6 mils
(CAR) Carbogaurd 890

Finish Coat
High Solids Epoxy (T) Series V69
DFT = 5-7 mils
(CAR) Carbogaurd 890

Total DFT = 12 mils

**Exterior**

1st Coat - bare metal
High Solids Epoxy (T) Series 135
DFT = 5-6 mils
(CAR) Carbogaurd 890

Finish Coat
Aliphatic Polyurethane (T) Series 1075
DFT 3-4 mils
(CAR) Carbothane 134 VOC

Total DFT = 9 mils

System 2: Galvanized Metal Surface Repair

One Coat:
To be left unpainted: Eutectic-type repair (TW) Gal-Viz (RG) ReGalv

To be painted:
High zinc content (ZRC) Cold Galv. Compound (CRC) Zinc It

System 3A: Submerged Ferrous Metal [Not for Potable Water]

Two coats
Epoxy (T) Series 69
DFT = 12 mils
(A) Amercoat 385

System 4: Bleeding Surfaces: (Not buried)

Not Used

System 5: Prefinished Machinery Coating (Other than prime coat)

One coat
Aliphatic Polyurethane (T) Series 74
DFT = 2 mils
(A) Amershield

System 6: Exposed Galvanized Steel

1st Coat(s)
High Solids Epoxy (T) Series 135
(A) Amerlock 400

2nd Coat
High Solids Epoxy (T) Series V69
(A) Amerlock 400

Finish coat – exterior surfaces
Aliphatic Acrylic (T) Series 1075
(A) Amercoat 450HS

System 7: Miscellaneous Service Coating

One full brush coat
Coal Tar (T) 46-40 Tnemecol (K) Bituplastic #33
System 8: Buried Valves
Not used

System 10: PVC Pipe
First Coat Primer (ICI) “Gripper”
Second and Third Coat Exterior Semi Gloss Enamel
Or
2 Coats Waterborne Acrylic (Semi Gloss) (ICI) Devflex 4206 (T) Series 1029

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Perform surface preparation in accordance with paragraph 3.02 below and the latest revision of the following requirements or manufacturer's requirements, whichever is more stringent:


2. Hand Tool Cleaning: Remove dirt, dust, loose rust and foreign matter and abrade in accordance with specification SSPC-SP 2, "Hand Tool Cleaning."

3. Power Tool Cleaning: Remove dirt, dust, loose rust and foreign matter and abrade in accordance with specification SSPC-SP 3, "Power Tool Cleaning."

4. Solvent Clean: Solvent clean metallic surfaces to be painted to remove all oils or grease in accordance with specification SSPC-SP 1, "Solvent Cleaning." Use solvents recommended by manufacturer of paint to be used in each area. In addition, lightly hand sand copper piping.

5. Abrasive Blast: Conform to the requirements of SSPC-SP 10, "Near White Blast Cleaning." Paint all blasted surfaces within 8 hours of blasting unless the Engineer gives specific permission to do otherwise. Remove all weld spatter by grinding or chipping prior to sandblasting.

6. Commercial Blast Cleaning: Conform to the requirements of SSPC-SP 6. Paint all blasted surfaces within 8 hours of blasting unless the Engineer gives specific permission to do otherwise. Remove all weld spatter by grinding or chipping prior to cleaning.

7. Brush-Off Blast Cleaning: Conform to the requirements of SSPC-SP 7 to remove material from the surface that can cause early failure of the coating system specified as well as to obtain a suitable surface roughness and to enhance adhesion.

8. Light Scour: Prepare by abrading in accordance with SSPC-SP-3, Power Tool Cleaning to impart a 1.0 to 1.5 mil profile uniformly to the surfaces.

3.02 APPLICATION

A. All steel coating application to be done in accordance with the latest revision of SSPC-PA: When successive coats of paint of the same colors are specified, tint
Alternate coats sufficiently to produce enough contrast to indicate complete coverage of the surface.

B. Apply all material in strict accordance with manufacturer's instructions for the specific material to be coated. Apply first coat immediately after surface preparation. Keep all paints at a consistency and applied in accordance with the printed directions of the manufacturer. The painting shall be done by hand, spray or roller as approved by the Engineer in conformance to individual paint manufacturer's recommendations. The Engineer and paint supplier will review all surfaces to be painted on the job prior to application of any coatings. Once the Contractor begins undercoating or priming, this will be his guarantee that the surface is acceptable to paint. All painted surfaces are to be free from drips, ridges and brush marks. The following stipulations also apply:

1. Thinning permitted only when recommended by the manufacturer and only with thinner recommended for use with the particular product.
2. The use of additives to improve working characteristics or to lengthen or shorten set time is prohibited.
3. Items difficult or impossible to paint after installation are to be painted before installation and touched up after installation.
4. Apply each coat to a uniform, even coating; lay material on in one direction and finish at right angles. Allow material to thoroughly dry between coats. Scuff, sand and remove all runs, sags, overspray, surface roughness and other defects between each coat. Dust and wipe surface clean before applying next coat.
5. Cutting in is to be sharp and straight, free from overlaps or fuzzy edges. Redo any imperfect work.
6. Apply not less than the number of coats or dry film thickness specified. Apply additional coats if required for uniform coverage, full hiding, and to achieve film continuity. Finished work to be uniform in color, full coverage, smooth and free of sags and brush marks.
7. Do not apply coating when temperature is below 55°F or when the temperature of the surface to be painted is less than 4°F over the dew point temperature. Perform coating operations only under favorable environmental conditions. Take all steps necessary to protect and completely cure the work. Correct defective work to the full satisfaction of the Engineer.
8. Apply the last finish coat on all work after all major construction is complete and the work areas have been cleaned up and are dust free.

3.03 Pipe Identification

A. The Contractor shall paint and identify piping in accordance with the Owner’s Pipe Color Codes included in Table 1 and Table 2 at the end of this section. Colors shall be special mixed as needed to comply with this schedule.

3.04 Field Quality Control

A. Pinhole and Continuity Testing:
1. After the application of the prime and finish coats of protective coating systems on metal surfaces, perform continuity and pinhole checking by means of a low voltage electrical resistance meter and check thickness with a magnetic thickness gauge to determine that pinhole free condition and specified film thickness of the paint system has been achieved over all of the
painted surfaces. Testing shall be done with the Owner present and observing the test. Repair all deficiencies in film integrity and thickness in accordance with the manufacturer's instructions.

2. The Owner or an independent testing consultant may perform its own continuity and pinhole checking and thickness checks in addition to the Contractor's required tests. The appropriate equipment and necessary support, if requested, is to be provided by the Contractor. Repair any additional deficiencies in film integrity and thickness per the manufacturer's instructions and to the satisfaction of the Engineer.

3. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE FACT THAT PAST USE OF THIS INSTRUMENT HAS DEMONSTRATED THAT THE PAINTER MUST APPLY AT LEAST TWO AND USUALLY THREE OR MORE STRIPE COATS ALONG ALL EDGES AND ANGLES AND CREVICES FORMED BY JOINING MEMBERS IN ADDITION TO THE COATS SPECIFIED IN ORDER TO ACHIEVE A PINHOLE FREE SURFACE.

B. Adhesion Testing: Where there is a question of paint or coating adhesion to surfaces, demonstrate to the Engineer's satisfaction that the coating adhesion to the area in question is equal to or greater than that which the paint manufacturer literature states may be achieved by his product. An "Elcometer Adhesion Tester" is to be used by the Contractor to accomplish this demonstration.

C. Continuity, Pinhole and Adhesion Testing Support: Provide scaffolding, ladders, lighting and labor as required to facilitate the Engineer's check. Repair any areas damaged during and by the testing operation.

3.05 CLEANING AND COMPLETION

A. At the completion of this portion of the work, remove all debris, remove all paint and stains from work for which paint finish is not intended, touchup all marred surfaces, and leave all buildings and structures in a clean condition, ready for use.

B. Refinish all damaged or imperfect painting to the satisfaction of the Engineer prior to final acceptance of the facility.

C. Finish work, except waterproofing mastics, is to present an even, pleasing and uniform color and appearance. Surfaces exhibiting coatings with shadows, streaks, overlap marks, sags, drips, roughness or non-uniform sheen will be considered as improperly applied and will not be considered acceptable.

D. Leave all machinery nameplate data tags clean and readable and all grease fittings clean and usable.

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Surface Preparation</th>
<th>Paint System</th>
<th>Note (see below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General ferrous exposed to atmosphere</td>
<td>Bare Metal: Commercial Blast, Shop Primed: Power Tool Cleaned</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Galvanized metal surface repair</td>
<td>Hand Tool Cleaning</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Submerged ferrous metal</td>
<td>Abrasive Blast</td>
<td>3A</td>
<td>3</td>
</tr>
</tbody>
</table>

Exposure Surface Preparation

<table>
<thead>
<tr>
<th>Paint System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare Metal: Commercial Blast, Shop Primed: Power Tool Cleaned</td>
</tr>
</tbody>
</table>

Note: See below for further details.
Exposure | Surface Preparation | Paint System | Note (see below) |
--- | --- | --- | ---
Prefinished machinery coating | Hand Tool Cleaning | 5 | 5 |
Exposed galvanized steel | Solvent clean, Hand Tool Cleaning, Light Scour | 6 | 6 |
Metal mounted in contact with concrete | Hand Tool Cleaning | 7 | 7 |
Factory finish coated items not requiring field painting | Touch-up | - | 9 |
PVC Pipe | Solvent Clean, Hand Tool Cleaning, Light Scour | 10 | 10 |

3.06 SPARE PAINT

A. Furnish one-gallon (minimum) container of each type and color of finish product used. Label containers. Each product shall have a minimum of 11 months of shelf life at project completion.

3.07 APPLICATION SCHEDULE

A. Provide coatings in accordance with the following exposure schedule:

Notes to Application Schedule

1. These surfaces include, but are not limited to: general miscellaneous ferrous metal; machinery; pumps; supports; valve handwheels and stands; valve bodies; piping systems; structural steel; steel elements; except where other systems in this schedule are more specifically applicable.
2. Use galvanize-repair paint to repair-galvanize surfaces to be painted. Use eutectic-type repair to repair-galvanize surfaces to remain unpainted.
3. Apply this system to both ferrous metal and galvanized metal submerged in or suspended over water or sludge. These surfaces include but are not limited to machinery parts, piping, valves, brackets and supports, and miscellaneous supports, braces, and pump columns.
5. All piping, valves, pumps, drives, machinery, and equipment that have factory finish coats that will be exposed to atmosphere. This system provides for color uniformity with rest of field coat items.
6. Exposed galvanized pipe supports, galvanized piping, other galvanized steel items except those specifically excluded, and other non-ferrous metal items.
7. Coat metal items, which are surface, mounted on concrete surfaces. Coat such metal items only on the contact surfaces unless otherwise specified; specifically include electrical panels, control cabinets, fixtures and guardrail components.
8. Not Used.
9. All panels and equipment with factory finishes identified elsewhere as not requiring field paint, damaged during shipping, storage, or installation: touch-up in the field in a manner compatible with the factory coating with respect to paint type, color, and texture. Touch-up fusion epoxy-coated items only with material provided by the fusion epoxy fabricator. If more than 5% of the surface requires touchup, return the items to the fabricator for recoating.
10. All PVC pipe except for buried PVC pipe.
Table 1: Plant Color Schedule

<table>
<thead>
<tr>
<th>Pipe Color Code</th>
<th>Devoe Paint Color</th>
<th>Tnemec</th>
<th>Sherwin Williams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Specifications for Colors Listed in Table 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>Devoe 9700 Safety Green</td>
<td>SC07 Safety Green</td>
<td>SW4085 Safety Green</td>
</tr>
<tr>
<td>Yellow</td>
<td>Devoe 9400 Safety Yellow</td>
<td>SC01 Safety Yellow</td>
<td>SW4084 Safety Yellow</td>
</tr>
<tr>
<td>Dark Blue</td>
<td>Devoe 4752 Cobalt Blue</td>
<td>PL10 Indigo</td>
<td>SW4058 Blueprint</td>
</tr>
<tr>
<td>Brown</td>
<td>Devoe 7370 Warm Brown</td>
<td>EN13 Terra Cotta</td>
<td>SW4001 Belt Brown</td>
</tr>
<tr>
<td>Charcoal</td>
<td>Devoe 3201 Mist Gray</td>
<td>EN14 Slate Gray</td>
<td>SW4020 Zephyr</td>
</tr>
<tr>
<td>Blue</td>
<td>Devoe 9800 Safety Blue</td>
<td>SC06 Safety Blue</td>
<td>SW4086 Safety Blue</td>
</tr>
<tr>
<td>Red</td>
<td>Devoe 9000 Safety Red</td>
<td>SC09 Safety Red</td>
<td>SW4081 Safety Red</td>
</tr>
<tr>
<td>Black</td>
<td>Devoe 9900 Black</td>
<td>IN06 Black</td>
<td>Black</td>
</tr>
<tr>
<td>Tan</td>
<td>YB15 Botany Beige</td>
<td>SW4015 Torque Tan</td>
<td></td>
</tr>
</tbody>
</table>

For items not listed in Table 2

| Equipment | Devoe 9800 Safety Blue | SC06 Safety Blue | SW4086 Safety Blue |
| MCC | Devoe 2301 Mist Gray | EN14 Slate Grey | SW4020 Zephyr |
| Motors | Devoe 9800 Safety Blue | SC06 Safety Blue | SW4086 Safety Blue |
| Valve-operators | Devoe 9400 Safety Yellow | SC01 Safety Yellow | SW4084 Safety Yellow |
| Hand Wheels | Devoe 9400 Safety Yellow | SC01 Safety Yellow | SW4084 Safety Yellow |
| Pipe Supports | Devoe 2301 Mist Gray | EN14 Slate Grey | SW4020 Zephyr |
| Manways | Color of Fluid Inside | Color of Fluid Inside | Color of Fluid Inside |
| Catwalks | Devoe 2301 Mist Gray | EN14 Slate Grey | SW4020 Zephyr |
| Doors | YB-15 Botany Beige | SW4015 Torque Tan |
| Electrical Conduit | Match to background. If no background reference available, see below. | |
| Exterior Trim | Devoe 3501 White | 11WH White |
| Exterior Walls | Blue Cove | No match in provided chart |
| Exterior Trim | YB-15 River Sand | No match in provided chart |
| Interior Walls & Ceilings | WH-01 White | Extra White |
| Doors & Trim | YB-15 Botany Beige | SW4015 Torque Tan |
| Interior Waynes Coat | GB21 Steel Blue | SW4060 Off Shore |

Notes:
1. Paint Colors from other manufacturers shall be matched appropriately to listed Devoe, Sherwin Williams, or Tnemec Colors.
2. Safety colors shall match OSHA Spec 1910144 Marketing of Physical Hazards.
<table>
<thead>
<tr>
<th>Service Fluid</th>
<th>Color</th>
<th>Pipe Marker Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler Feed Water</td>
<td>Dark Blue</td>
<td>BOILER FEED WATER</td>
</tr>
<tr>
<td>Chemical Drain</td>
<td>Charcoal</td>
<td>CHEMICAL DRAIN</td>
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<tr>
<td>Chlorine Solution</td>
<td>Yellow</td>
<td>HYPOCHLORITE</td>
</tr>
<tr>
<td>Domestic Cold Water</td>
<td>Light Blue</td>
<td>DOMESTIC COLD WATER</td>
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<tr>
<td>Drain</td>
<td>Charcoal</td>
<td>DRAIN</td>
</tr>
<tr>
<td>Digested Sludge</td>
<td>Tan</td>
<td>DIGESTED SLUDGE</td>
</tr>
<tr>
<td>Exhaust Gas</td>
<td>Yellow</td>
<td>EXHAUST GAS</td>
</tr>
<tr>
<td>Engine Jacket Water</td>
<td>Dark Blue</td>
<td>ENGINE JACKET WATER</td>
</tr>
<tr>
<td>Ferric Chloride</td>
<td>Yellow</td>
<td>FERRIC CHLORIDE</td>
</tr>
<tr>
<td>Ferric Chloride Solution</td>
<td>Yellow</td>
<td>FERRIC CHLORIDE SOLUTION</td>
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<tr>
<td>Fuel Oil</td>
<td>Red</td>
<td>FUEL OIL</td>
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<tr>
<td>Fuel (Diesel)</td>
<td>Red</td>
<td>DIESEL FUEL</td>
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<tr>
<td>Flotation Thickener Underflow</td>
<td>Tan</td>
<td>FLOTATION THICKENER</td>
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<td>Grit</td>
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<tr>
<td>Heat Reservoir Return</td>
<td>Dark Blue</td>
<td>HEATING WATER</td>
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<td>Heat Reservoir Supply</td>
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<td>Hypochlorite Solution</td>
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<td>Instrumentation Air</td>
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<td>Engine Lube Oil</td>
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<td>Natural Gas</td>
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<td>NATURAL GAS</td>
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<td>Polymer Solution</td>
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<td>POLYMER SOLUTION</td>
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<td>Primary Sludge</td>
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<tr>
<td>Primary Scum</td>
<td>Tan</td>
<td>PRIMARY SCUM</td>
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<tr>
<td>Process Water</td>
<td>Red</td>
<td>NO 4 WATER</td>
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<tr>
<td>Raw Wastewater (interior)</td>
<td>Charcoal</td>
<td>RAW WASTEWATER</td>
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<tr>
<td>Raw Wastewater (exterior)</td>
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<td>RAY WASTEWATER</td>
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<tr>
<td>Return Activated Sludge</td>
<td>Tan</td>
<td>RETURN ACTIVATED SLUDGE</td>
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<tr>
<td>Service Air</td>
<td>Orange</td>
<td>SERVICE AIR</td>
</tr>
<tr>
<td>Sanitary Drain</td>
<td>Charcoal</td>
<td>SANITARY DRAIN</td>
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<tr>
<td>Secondary Effluent</td>
<td>Charcoal</td>
<td>SECONDARY EFFLUENT</td>
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<tr>
<td>Sludge Gas High Pressure</td>
<td>Yellow</td>
<td>SLUDGE GAS HIGH PRESSURE</td>
</tr>
<tr>
<td>Sludge Gas Low Pressure</td>
<td>Yellow</td>
<td>SLUDGE GAS LOW PRESSURE</td>
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<tr>
<td>Service Fluid</td>
<td>Color</td>
<td>Pipe Marker Legend</td>
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<tr>
<td>Sample</td>
<td>Color of Fluid Being Sample</td>
<td>SAMPLE</td>
</tr>
<tr>
<td>Secondary Scum</td>
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</tr>
<tr>
<td>Secondary Sludge</td>
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<td>Service Water</td>
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<tr>
<td>Tank Drain</td>
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<td>TANK DRAIN</td>
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<td>THICKENED SLUDGE</td>
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<td>Vacuum</td>
<td>White</td>
<td>VACUUM</td>
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<tr>
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<td>VENT PIPE</td>
</tr>
<tr>
<td>Waste Activated Sludge</td>
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<td>WASTE ACTIVATED SLUDGE</td>
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<tr>
<td>Well Water</td>
<td>Dark Green</td>
<td>WELL WATER</td>
</tr>
<tr>
<td>Exhaust Air Duct</td>
<td>Tan</td>
<td>FOUL AIR</td>
</tr>
<tr>
<td>Fresh Air Supply Duct</td>
<td>Tan</td>
<td>FRESH AIR</td>
</tr>
<tr>
<td>Fresh Air Supply Duct (buried)</td>
<td>Tan with green stripping</td>
<td>FRESH AIR</td>
</tr>
</tbody>
</table>

END OF SECTION