

**BASIC GUIDE TO CORROSION PROTECTION FOR
MIAMI-DADE WATER AND SEWER DEPARTMENT PROJECTS**

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INTRODUCTION:

Purpose:

The information contained herein is presented for use as a basic guide to corrosion protection for Miami-Dade Water and Sewer Department projects. Most of the guidelines presented here are specific to this department and have been developed over the years in response to situations occurring in our own system of sewers. Corrosion is normally localized and is dependent on conditions such as soil conditions, site conditions, sewer gas exposure, saltwater exposure and other factors. Thus, the materials and practices specified may well vary from those used in other areas of the country.

The Miami-Dade Water and Sewer Department makes every effort to utilize the best possible material that can provide the longest useful life. This is done deliberately with the view to savings in the future cost of system failures, labor, maintenance, repairs and replacement. The Department exceeds the minimum industry standard in many cases for materials, equipment and construction methods.

The Department has always tried, where and when possible, to utilize materials, methods and systems that are well proven. This is done with the recognition that when we open the door to a material or process, there could be a failure that will not show up for several years. Thus, the Department can be confronted with a situation where a large amount of material is already installed in many places when a problem becomes apparent. Such a situation is very costly and creates great public inconvenience. For new products that are to perform a critical function or cannot be regularly observed, the Department will require a test application (normally for a one year period) to be done at the vendors cost as a condition for having it approved into the system upon a successful completion of the test.

UNDERGROUND PIPELINE

Ductile Iron

All pipes shall be ductile iron pipe conforming to ANSI/AWWA Standard C151/A21.51-09, "Ductile-Iron Pipe, Centrifugally Cast, for Water". The pressure class specified is the minimum permitted:

Size	Pressure Class
4-inch through 12-inch	350
14-inch through 20-inch	250
24-inch	200
30-inch through 54-inch	150

All Ductile Iron pipe and fittings shall be outside-coated with an asphaltic material applied by means of the airless spray method. The exterior coating shall comply with ANSI/AWWA C151/A21.51 for this type of coating, shall be smooth without pinholes, thin, bare or overly thick areas. Smoothness shall be such that when hand rubbed, no "sand paper" feeling will be experienced and such that the spigot area will readily slide through the gasket without pulling, tearing, rolling or otherwise disturbing the sealing capabilities of the gasket. Spigot ends shall be beveled prior to coating to an extent that will permit ready insertion of the spigot through the gasket area.

Ductile iron pipe within the saltwater intrusion areas where the installation is subject to groundwater level variation (East of I-95 or saltwater intrusion line), the Department shall

require the use of V-Bio Enhanced Polyethylene Encasement and ductile iron pipe with a zinc basecoat under the asphaltic topcoat. All ductile iron pipe and fittings shall be wrapped with the V-Bio Polyethylene Enhanced Encasement and have the zinc protective coating factory applied.

For corrosive soils encountered outside of saltwater intrusion areas during construction V-Bio Polyethylene Encasement shall be installed to protect the ductile iron main, fittings and valves.

Zinc Basecoat: The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m² of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The coating system shall conform in every respect to ISO 8179-1 "Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Ductile iron fittings shall also have a zinc protective coating sprayed on at the factory at a minimum of 3 mils.

The V-Bio Polyethylene Enhanced Encasement shall be accordance with AWWA C600 and ANSI/AWWA C105/A21.5, "Polyethylene Encasement of Ductile-Iron Pipe Systems". Color shall be blue for potable water, purple for recycled water, and green for sanitary sewage service. Polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than 8 mils. The inside layer of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a corrosion inhibitor and antimicrobial biocide to control galvanic corrosion. Product: V-Bio or approved equal.

Underground DIP Summary:

- Asphalt coating required for all underground pipe
- Saltwater intrusion areas require zinc coating and V-bio encasement
- AWWA C153 fittings are standard with C110 fittings used at the option of the Engineer in areas of heavy corrosion
- Ceramic epoxy lining required for sewage force mains
- Cement mortar lining required for potable water mains
- In corrosive soils outside of the saltwater intrusion area V-bio encasement is required. Zinc coated pipe and fittings may be used if identified by the Engineer in the Plans
- Automatic Air Release valves required at the high points of all sewer force mains.
- Aboveground pipe shall have a factory applied zinc primer and two coats of field applied two part epoxy coating acceptable to the Department.
- Field cuts shall have the interior ceramic epoxy liner coated at the ends
- Drilled openings for ARV's shall have the damaged ceramic epoxy liner repaired

Poly Vinyl Chloride Pipe

PVC C900 Sewage Force Main: PVC C900 is the recommended pipe material for force mains up to 12-inches. Sewer Force Mains in saltwater intrusion areas are required to use PVC C900. The fittings shall be ductile iron with the uses of C110 fitting being at the option of the Engineer.

Pipe 4-inches through 12 inches shall conform to AWWA C900, rubber-ring gasket bell end or plain end with elastomeric gasket coupling, DR 18 or as shown in the drawings, cast iron equivalent outside diameter, material cell classification 12454 per ASTM D1784, latest revision.

PVC C-900 force Mains shall use ductile iron fittings C110 or C153 as determined by the Engineer.

PVC Gravity Sewer: PVC C900 is required in well field protection areas. PVC SDR 26 heavy walled sewer pipe will be the minimum dimension allowed after Sept 2017.

High Density Polyethylene (HDPE) Pipe

HDPE pipe shall be used for directional drill and slip-line pipeline repairs. This work requires signed and sealed plans and calculations from Florida Registered Professional Engineer submitted by the Contractor. The minimum DR for pipe rating shall be provided by the Department in the project requirements.

Water Services: 1-inch high density polyethylene tubing used for services shall be CTS-O.D. Controlled with Standard Outside Dimension Ratio (SODR) of 9, pressure rating of 200 psi, nominal outside diameter of 1.125-inches, minimum wall thickness of 0.125-inches, PE 3608, all in conformance with ASTM D2737-12 "Polyethylene (PE) Plastic Tubing".

Prestressed Concrete Lined Cylinder Pipe

Pipe and fittings for 48-inch and smaller shall be prestressed concrete lined cylinder type and for 54-inch and larger shall be prestressed concrete embedded cylinder type. All the pipe and fittings shall conform to AWWA Standard C301, "Prestressed Concrete Pressure Pipe, Steel-Cylinder Type", except as otherwise modified herein. PCCP shall be custom designed and constructed for the particular application.

Summary:

- Minimum steel cylinder thickness – 12 Gauge unless otherwise required by the Engineer
- Design Pressure based on operating pressure of the transmission main
- Potable Water shall use a cement mortar epoxy
- Sewage Force Mains shall use a 360 degree Liner unless otherwise ordered by the Engineer
- Saltwater intrusion areas shall have a bitumastic exterior coating
- Exposed metal shall have a zinc coating
- Joints shall be snap ring or harness clamp
- Closures shall be encased in concrete
- Joints shall be sealed with grout
- ARV's required at the high points for sewage force mains

Bar Wrap Concrete Pipe

Bar Wrap concrete pipe may be used for potable water transmission mains. The design materials and workmanship for pipe shall conform to the requirements of AWWA C303. Lining and coating thickness for pipe shall be as specified in AWWA C303.

Summary:

- The cylinder shall comprise a minimum of 60% of the total steel area required for internal pressure by design
- The cylinder shall be a minimum 12 gauge steel
- Design Pressure based on operating pressure of the transmission main
- Potable Water shall use a cement mortar epoxy
- Exposed metal shall have a zinc coating
- Closures shall be encased in concrete

- Joints shall be sealed with grout
- Exterior mortar coating per AWWA C303

MANHOLES AND WET WELLS

Precast manholes shall conform to the requirements of ASTM C478, latest edition, the Miami-Dade Water and Sewer Department Standard Details.

Standard Manholes require coatings in the following applications:

- 1 Manholes receiving the discharge of a force main.
- 2 Manholes within a 350 foot radius of a pump station wet well.
- 3 Drop manholes (if a drop connection is added to an existing manhole the existing manhole shall be rehabilitated with a concrete protective coating).
- 4 Any manhole location determined by the Engineer to have the probability of generating large quantities of sewer gas.

Approved Coating for Standard manholes:

- a. Uroflex Coating System as manufactured by Epoxytec International
- b. PPC as Manufactured by Polymorphic Polymers Corporation
- c. SP15 Spray Mortar, Sewer Guard HBS 1000 Epoxy Liner by BASF
- d. M-301 Epoxy as manufactured by Warren Environmental
- e. Permaform MS-10,000 Fortified with ConShield, Cor+Gard
- f. SprayRoq, Spray Wall and SprayShield GT Coating
- g. Agru Sure Grip Liner with Cretex on the Chimney
- h. ConShield in the precast mix
- i. Raven 405 FS, as manufactured by Raven Lining System

Approved Coatings for Pump Station Wet Wells:

- a. Uroflex Coating System as manufactured by Epoxytec International
- b. PPC as Manufactured by Polymorphic Polymers Corporation
- c. or approved equal

Summary for Corrosion Protection:

- Water Cement Ratio: 0.40 to 0.34 Standard Manholes, 0.34 Pump Station Wet Wells
- Reinforcement of Grade 60 bars. (Pump Station Wet Wells require rebars not wire mesh reinforcing)
- Only products that have had a successful test application within the Miami-Dade Water and Sewer Department system and approved by WASD forces shall be allowed
- Pump Station Wet Wells are required to have a Xypex/BASF Crystalline Waterproofing Admixture or approved equal, applied at 2 to 3% of the weight of portland cement in the wet well by volume
- Standard Manholes shall have the exterior of the manhole coated with a 16 mil bitumastic coat or use a Crystalline Waterproofing Admixture
- Openings shall be sealed with hydraulic cement non-shrink grout on both the exterior and interior of the structure

CONCRETE AND METAL STRUCTURE RESTORATION

The success of any rehabilitation is dependent on how well the surface preparation is performed. See Section 03721 Preparation for Resurfacing Concrete and Section 03732 Concrete Repair for guidelines, testing and standards.

The concrete protective coating system used shall have a cement underlayment approved by the coating manufacturer for application with the product. The Contractor shall not use any underlayment that may void the manufacturer's warranty. The epoxy cement used shall have written approval from the coating manufacturer.

Contractor's performing rehabilitation work should have a NACE Certified Coating Inspector be available upon request. The Contractor's NACE Certified Coating Inspector shall be available upon request to provide the WASD Engineer information on surface preparation, rehabilitation methods, patching, coating application and testing.

Summary for Corrosion Protection:

- Concrete cast with a lower Water Cement Ratio. 0.34, will be denser and more resistant to corrosion
- Concrete surface preparation shall produce a surface that is thoroughly cleaned to produce a clean interior surface free of all coatings, sand, rock, sludge or other damaging materials
- Metals shall be cleaned of rust to near white metal
- Metals shall use a zinc based primer
- Coatings at Treatment Plants or Pump Stations shall be selected by the Engineer or Plant Superintendents based on previous on pervious successful applications
- Coating applicators shall have certification from the industrial coating manufacturers supplying the product

STRAY CURRENTS

The Engineer shall field locate any possible locations where stray current can cause corrosion for underground pipeline. Items that can cause stray currents are high voltage electrical transmission lines, electric rail lines (Metro-Rail, Metro Mover), substations and other electrical utilities. It is the responsibility of the Engineer to identify and provide measures at these locations. Cathodic Protection may be used where regular maintenance can be easily accomplished.

COATINGS AND PAINTS

See Section 09900 paints.