

**SECTION 02536****PRECAST MANHOLES & COVERS****PART 1 - GENERAL****1.01 SCOPE OF WORK:**

This section includes minimum construction requirements for standard sewer manholes and precast concrete wet wells. It also includes precast concrete manhole sections with bell and spigot joints with masonry transition to covering, anchorage, coating/lining and accessories.

**1.02 REFERENCES:**

Unless otherwise indicated, all materials, workmanship and practices shall be in accordance with the current editions of the following standards:

- A. Florida Building Code
- B. ACI 318, Building Code Requirements for Reinforced Concrete; ACI 350 Code Requirement for Environmental Engineer Construction Structures.
- C. PCI MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products.
- D. ASTM C62 - Specification for Building Brick (Solid masonry units made from Clay or shale).
- E. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- F. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

**1.03 SUBMITTALS, INSPECTIONS:**

Submit the following information for approval. Fabrication shall not begin until submission has been approved.

- A. Satisfactory evidence that plant and production methods meet the requirements of PCI MNL 116 for the Quality Control of the Precast Plant, Concrete Batch Plant and Testing Lab.
- B. Submit Design mix to the Engineer prior to fabrication.
- C. Complete shop drawings of both concrete structure and castings and showing all dimensions, reinforcement data, concrete strengths, etc. If of a non-standard design or if required by the Engineer of Record submit design calculations and data. All computation shall bear the seal of a Professional Engineer registered in the State of Florida.
- D. Manhole and Wet Wells: The WASD shall have the option of witnessing the manhole wet well pour, reinforcing or formwork prior to fabrication. Provide the Engineer a schedule of the manhole fabrication at the preconstruction meeting.

- E. Provide a rebar cutting lists for Pump Station Wet Wells. The rebar cut list is not required for standard manholes.
- F. Cylinder breaks shall be done for each lot in accordance with FDOT Standards (max of 50 structures per LOT). The manufacturer shall maintain records of the cylinder breaks for each design mix. The 28 day concrete cylinder break reports shall be submitted to the Department once the 28 day before the project closeout.

#### 1.05 QUALIFICATIONS:

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience. United Concrete Products, Landmark Precast, Concrete Products of the Palm Beaches, TJ Precast, US Concrete Products or Approved equal.
- B. Quality Control Plan approved by the FDOT. The testing laboratory and batch plant shall be included in the FDOT Quality Control Plan.
- C. The Precast Manufacturer shall have a stamp from the Quality Control Manager on each completed precast structure. The Quality Control Manager Stamp shall indicate that the manhole was constructed in accordance with ASTM C478 and Municipality Standards and the date that the structure was fabricated.

#### 1.06 TRANSPORTATION

- A. The precast concrete structure shall cure for a minimum of 72 hours. Transport of the precast structure to the jobsite is not allowed during the 72 hour curing period.
- B. Comply with all applicable requirements of FDOT Section 450-16 Handling, Storage, Shipping and Erection.

### **PART 2 - PRODUCTS**

#### 2.01 MATERIALS:

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

- A. Properties:
  - 1. Reinforcement of Grade 60 bars. (Pump Station Wet Wells require rebars not wire mesh reinforcing).
  - 2. Concrete 4,000 psi.
  - 3. Water Cement Ratio: 0.40 to 0.34 Standard Manholes, 0.34 Pump Station Wet Wells.
  - 4. Waterstops: Ribbed PVC Waterstop with centerbulb.

- B. Cement shall be Type II with a **maximum aggregate size of #57**. Aggregate shall be **well graded** to produce a less porous and stronger concrete.

1. **Gravity Sewer System Manholes:** In sanitary sewage applications, all manholes receiving the discharge of a force main, connecting to a major sewer line or interceptor sewer terminal manhole within a 350 foot radius of the pump station, drop manholes, or where called for in the plans and/or specifications shall have a concrete protective coating or a antimicrobial admixture in the concrete mix.

The antimicrobial admixture in the concrete mix is specified below:

- a. An antimicrobial agent, Con<sup>MIC</sup>Shield<sup>®</sup>, or approved equal, shall be used to render the concrete uninhabitable for bacteria growth.
- b. Contractor shall mix the liquid antimicrobial additive with the total water content of the concrete mix design in a proportion of 1 gallon per cubic yard. In the case of repairs to damaged concrete a proportion of 2 gallons per cubic yard shall be utilized.
- c. In some instances all of the concrete in the structure will receive the additive and in other instances only a portion of the concrete will receive the additive. Hence, the Contractor shall apply the additive only as directed in the specific instance.
- d. Precast Plant shall submit a letter of certification to the Department, stating that the correct amount and correct mixing procedure was followed for all antimicrobial concrete.
- e. Con<sup>MIC</sup>Shield<sup>®</sup> antimicrobial additive shall be as manufactured by Con<sup>MIC</sup>Shield<sup>®</sup> Technologies, Inc.; 541 Tenth Street NW #233, Atlanta, GA 30318; Phone: (877)543-2094.

## 2. Pump Station Wet Wells

- a. Pump Station Wet Wells shall have 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. The Crystalline Waterproofing Admixture shall be used in lieu of painting the exterior of the structure with Bitumastic Coal-Tar Epoxy.
  - b. Do not use Con-Shield with the Crystalline Waterproofing Admixture
  - c. Concrete Protective Coating Preparation: The precast concrete structure with the Crystalline Waterproofing Admixture is required to cure for 28 days prior to application of the concrete protective coating. Prepare the interior wet well surface with an epoxy cement underlayment compatible with the concrete protective coatings approved for Pump Station Wet Wells, Epoxytec CPP, Tnemic 218 or approved equal.
- C. Minimum shell thickness of manholes shall be eight (8) inches.
- D. Lifting holes through the structure will not be permitted.

- E. Three to five courses of brick shall be constructed atop the manhole corbel for height adjustment. Manhole adjustment grade rings may be utilized in lieu of clay bricks.
- F. Precast Joints above Elevation +4.0. and Waterproofing
  - 1. Standard Manhole: Ram-Nek preformed plastic joint filler, Swellseal Hydrophillic Waterstop by Deneef, or approved equal. Apply Non-Shrink Grout both inside and outside of the joint. Wrap the outside Corbel and Exterior joint with a heat activated high shrink membrane.
  - 2. Pump Station Wet Wells: Ram-Nek preformed plastic joint filler, Swellseal Hydrophillic Waterstop by Deneef, or approved equal. Apply Xypex Concentrate Cementitious Slurry or approved equal to the exterior and interior of the joint between precast members for waterproofing.
- G. Holes for pipe connections, with a diameter equal to the outside dimension of the connecting pipe plus an additional 4-inches, shall be formed in the manhole walls. No cutting or chipping of the pre-formed holes, or cutting additional holes in the precast concrete walls will be permitted.
- H. The bottom slab shall be cast monolithically with the lower section and the longitudinal reinforcement extending into the slab. The free air drop of the mix shall not exceed five feet.
- I. No construction joints will be allowed below an elevation of four feet above mean sea level. Construction joints will be allowed above elevation+4.0, if adequate keyways and waterstops, approved by the Department (Ribbed PVC waterstop with centerbulb), are provided. The Department may approve an alternate joint method in cases of excessively deeper and heavy structures.
- J. Built-in ladders or climbing rungs will not be permitted in any sanitary sewer manhole and only in other structures where shown on the Plans and called for in the specifications.
- K. Openings shall be sealed with hydraulic cement non-shrink grout on both the exterior and interior of the structure.
- L. Furnish manholes with accessories listed under "Manhole Accessories", below.
- M. Lid and Frame: See Section 05550, "Castings".
- N. Waterproofing:
  - Xypex Crystalline Waterproofing Admixture C-1000R with red dye or approved equal, applied at 3% of the volume of Portland cement in the manhole by volume.
  - Rheomac 300D Admixture as manufactured by BASF with red dye applied at 2% of the volume of Portland cement in the manhole by volume.
  - The Crystalline Waterproofing Admixture may be used in lieu of painting the exterior of the structure with Bitumastic Coal-Tar Epoxy.
  - Note: The Engineer may accept certification from the precast fabricator in lieu of the red dye.

## 2.02 CLAY BRICK UNITS AND GRADE RINGS

- A. Clay brick shall be used in manhole construction. Clay brick shall conform to ASTM Standard C32, "Building Brick (Solid Masonry Units Made from Clay or Shale)". Bricks shall have true edges and sharp corners and shall have been cured for at least 14 days before being placed in any wall. Under no circumstances shall brick with holes be utilized anywhere in construction of a manhole or other structure unless specifically called out on the Plans or in the Specifications.
- B. Manhole adjustment grade rings may be utilized. Rings shall be made of 100% recycled HDPE and available in cone opening diameters of 24, 27, 30 and 36-inches. Slope adjustment shall be attained by rotation of "wedge" rings from 4.1% to 0% grade. Rings shall have been tested to withstand HS25 loading through at least 1,100,000 cycles without cracking or other damage. Rings shall not be damaged by hydrogen sulfide manhole conditions and shall be waterproof when assembled with approved butyl sealant. Ring shall weigh six pounds or less and be equipped with UV inhibitor. Rings shall have been in successful service in multiple locations within the US for at least ten years and shall be warranted for five years. Rings shall be LadTech, Inc. HDPE Recycled Adjusting Rings or approved equal.
- C. Exterior Shrink Membrane not required on the HDPE Grade Rings.

2.03 MORTAR AND GROUT: As specified in Section 04060 and 03600, respectively. Only Type II cement shall be used.

2.04 REINFORCEMENT: As specified in Section 03300.

2.05 SUMP: Where required, formed integrally with the base slab.

## 2.06 CONCRETE PROTECTIVE COATINGS (**Gravity Sewer Manholes**)

- A. For manholes standard manholes that do not have a concrete protective coating or an antimicrobial additive (ConShield) in the mix, coat the interior of the manhole with Bitumastic 300M or approved equal, 16 mils minimum thickness. The manholes with a concrete protective coating or ConShield anti-bacterial admixture shall not have Bitumastic on the interior of the manhole.

Locations that require a Concrete Protective Coating or the Con Shield Admixture:

- 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.
- B. All concrete protective coating systems shall be pre-approved by the Water and Sewer Department based on testing done within the WASD system. 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.

PREAPPROVED PRODUCTS LIST- concrete protective coatings (standard manholes)

1. **Available Manufacturers: The manhole coating products below have passed the WASD testing protocol and have been approved for use for rehabilitation of standard manholes. The manhole rehabilitation products shall be used as a complete system with no third party products used unless approved in writing by the coating manufacturer. A one year warranty on the complete coating system from the project completion is required.**
    - a. Uroflex as manufactured by Epoxytec International
    - b. PPC as Manufactured by Polymorphic Polymers Corporation
    - c. SP15 Spray Mortar, Sewer Guard HBS 100 Epoxy Liner by BASF
    - d. Permaform MS-10,000 Fortified with ConShield or Cor-Guard Epoxy
    - e. SprayRoq, Spray Wall and SprayShield GT Coating
    - f. GEOKRETE System as manufactured by Quadex
    - g. Mainstay DS-5 High Build Epoxy, Mainstay ML-72 Restoration Mortar
    - h. GML Coating System: Green Monster Epoxy, GML-30 and GML-60 Epoxy Cement
    - i. Raven Lining System: Raven 405 Epoxy, Raven 755 Epoxy Mortar
  2. The manhole chimney shall utilize a flexible concrete protective coating. The acceptable flexible interior coatings for the manhole Chimeny are Epoxytec Urosecal, Uroflex or Geokrete.
- C. Due to the probability of sewer gas generation, all manholes receiving the discharge of a force main, connecting to a major sewer line or interceptor sewer, drop manholes, or within a 350-foot radius of the terminal manhole immediately upstream of the pump station shall be either constructed of concrete containing Con<sup>MIC</sup>Shield<sup>®</sup> antimicrobial additive or lined on all interior concrete surfaces with a pre-approved concrete protective coating or approved equal. Concrete protective coating system shall fully protect openings, such as for pipes, to insure that corrosive attack cannot take place at these locations. Protective system design for these areas will be checked as shop drawings. Note that boot systems are not accepted by the Department.
- Since the proprietary grouts used to close the annular area between the manhole wall and pipe entering or leaving the manhole are not compatible to the addition of Con<sup>MIC</sup>Shield<sup>®</sup> these areas require liner or coating (as acceptable to the Engineer) protection even in manholes constructed of concrete containing this material.
- D. All manhole exterior surfaces, from finished grade to base, shall be coated with Carboline Bitumastic 300M, 2 coats 16 mils minimum thickness or have Xypex/BASF Crystalline Waterproofing Admixture, applied at 2 to 3% of the volume of portland cement in the manhole by volume. The Crystalline Waterproofing Admixture may be used in lieu of painting the exterior of the structure with Bitumastic Coal-Tar Epoxy.
  - E. If Con<sup>MIC</sup>Shield<sup>®</sup> anti-microbial agent is used, interior coating and liners can be eliminated except as specified above.

2.07 CONCRETE ADDITIVE AND PROTECTIVE COATINGS (Pump Station Wet Wells)

- A. Waterproofing Additive: Xypex Crystalline Waterproofing Admixture or approved equal, applied at 3% of the weight of Portland cement in the manhole by volume. The concrete protective coating shall be applied a minimum of 28 days after the casting of the reinforced concrete structure in order for new concrete to cure.
- B. Epoxy Cement Underlayment to smooth and prepare concrete surface Epoxytec Ceramico, Tnemic 218 or approved equal.
- C. Preapproved Concrete Protective Coating for Pump Station Wet Wells
  - 1. Uroflex Coating System as manufactured by Epoxytec International
  - 2. PPC as Manufactured by Polymorphic Polymers Corporation
  - 3. or approved equal

2.08 MANHOLE ACCESSORIES:

All new sanitary sewer manholes shall be furnished with the following items. Where existing manholes will be modified or are scheduled to be refurbished, rehabilitation shall also include the following items unless otherwise approved by the Department.

- A. Provide concrete protective coating system for manholes installed in locations identified to have high levels of sewer gas.
- B. Provide high density polyethylene manhole infiltration inserts in accordance with Section 02625, unless the Department requires the installation of stainless steel insert.
- C. Exterior Shrink Membrane on Corbel and Exterior Joint; On all manholes (excluding the HDPE grade rings) install a heat activated, high shrink membrane, on the manhole's exterior, at each section joint and from the cast iron frame to the corbel section. Membrane shall be Wrapid Seal, by Canusa Corrosion Protection and Sealing, or approved equal with the following properties:

PRODUCT COMPONENT	PROPERTY	TEST STANDARD	UNIT	RESULTS
ADHESIVE	Softening Point	ASTM E28	Deg. C (Deg. F)	100 (212)
	Lap Shear Strength	DIN 30 672	N/cm <sup>2</sup> (psi)	8 (12)
BACKING	Tensile Strength	ASTM D638	MPa (psi)	20 (2900)
	Elongation	ASTM D638	%	600
	Hardness	ASTM D2240	Shore D	46
	Abrasion Resistance	ASTM D1044	mg	45
SLEEVE	Peel Strength	ASTM D1000	N/cm <sup>2</sup> (psi)	15 (9)
	Water Absorption	ASTM D570	%	0.05

	Low Temp. Flexibility	ASTM D2671D	Deg. C (Deg. F)	-40 (-40)
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**PART 3 - EXECUTION**

**3.01 EXCAVATION:**

- A. Refer to Section 02314, "Excavation, Backfill and Fill for Structures" for specific procedures, requirements and testing methods appurtenant to the work under this Section.
- B. Excavation shall extend to a level 12-inches below the level of the outside bottom of the base slab. If necessary, provide sheeting and shoring for the excavation.
- C. Backfill resulting excavation with drainfield limerock or specified bedding material to a level to receive the structure at the proper elevation.

**3.02 GENERAL INSTALLATION**

- A. The precast base shall be set level, with the walls plumb on the graded crushed rock bedding.
- B. If any surfaces of structures are exposed to view and to a depth of 6 inches below grade, the Contractor shall fill all depressions and all air holes with mortar, dampen surfaces, and apply an approved bonding agent then spread slurry, consisting of one part cement and one and one-half parts sand, by damp loose volume, on the surface with clean burlap pads and sponge rubber floats. The Contractor shall remove any surplus by scraping and then rubbing with clean burlap. Finish surface shall be suitable to receive paint.

**3.03 INSTALLATION OF MANHOLES**

- A. Place base slab and manhole sections plumb and level. Coat exterior of precast structure with Bitumastic 300M or approved equal. Install heat activated, high shrink membrane, on the manhole's exterior, at each section joint and from the cast iron frame to the corbel section.
- B. During all backfilling operations, the backfill level shall be kept even on all sides of the structure. Exercise every precaution to prevent damage to, or unplanned loading of, the structures and its appurtenances.
- C. Lay clay brick in running bond. A minimum of three and a maximum of five courses shall be constructed atop each manhole corbel. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work. Stucco inside and out with 3/4-inch of mortar.
- D. Set cover frames and covers level without tipping, to correct elevations.
- E. Exterior surfaces of all structures shall be painted prior to the installation as specified elsewhere herein.



- F. Openings shall be sealed with non-shrink grout. No expanding grout shall be allowed.
- G. After satisfactory installation and testing, all interior concrete surfaces of the new manhole shall be seal coated in accordance with Section 2.06-A.
- H. The invert channels of the manhole shall be formed of brick or brick rubble thoroughly bedded and covered with sand-cement grout, accurately shaped to a semi-circular bottom conforming to the lower half of the connecting sewer pipe. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer or entering branch shall be a smooth curve with radius as long as practicable.
- I. It shall be the Contractor's responsibility to assure that the frames and covers are set to match proposed finish paving grades at the manhole locations.
- J. Gravity sewers shall connect to the manholes in accordance with Standard Details SS 7.0 and Section UC-250 "Gravity Sewer Systems".

### 3.04 ALTERNATE INSTALLATION

Installation methods given below in this Section shall only apply if permission is granted by the Engineer of Record to use the "Alternate Method of Construction" as specified elsewhere herein. All provisions of that Section shall be applied to the installation of the structures with the specific modifications as follows:

#### A. Excavation

Excavation shall be carried to a depth of two feet below the bottom of the base slab.

#### B. Special Bedding

1. Bedding shall be crushed stone or gravel meeting the requirements of ASTM Standard C33 "Concrete Aggregates", latest edition, gradation 67.
2. The bedding shall be placed in the excavation from cut bottom to the level of the bottom of the slab. Thereafter it shall be thoroughly rammed and tamped by use of a crane and weight or other means suitable to the Engineer of Record to provide a stable base for the structure. Tamping and, if necessary, additional filling shall be carried on until the Engineer of Record is satisfied that a suitably stable base has been created for the structure.

#### C. Backfill

1. After the structure is installed, special bedding material as specified immediately above shall be carefully hand or machine tamped around the structure up to a level of no more than eighteen inches above the water level. Thereafter the procedures and materials specified for backfill and compaction, shall be used to complete the installation.

2. During all backfilling operations the backfill level shall be kept even on all sides of the structure and the Contractor shall exercise every precaution to prevent damage to, or unplanned loading of, the structure or its appurtenances.

END OF SECTION