

**PERFECT LINED MANHOLE SYSTEM  
HDPE/FRP LINED PRECAST CONCRETE MANHOLES FOR SEWERS**

**PART 1 – GENERAL****1.01 SCOPE**

This section covers Perfect Lined Manhole system, a high density polyethylene (HDPE) lined reinforced concrete manholes with a fiber reinforced polymer (FRP) lined base section intended for use in sanitary sewers, storm sewers and water transmission lines where corrosion resistance or high abrasion resistance is required.

**1.02 SPECIFICATIONS AND STANDARDS**

ASTM C 33: Standard Specification for Concrete Aggregates

ASTM C 150: Specification for Portland Cement

ASTM C 443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gasket.

ASTM C 478: Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

ASTM C 497: Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile

ASTM C 990 (most current) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections using Preformed Flexible Joint Sealants

ASTM C 1619: Standard Specification for Elastomeric Seals for Joining Concrete Structures

ASTM A 1064: Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

ASTM D570: Standard Test Methods for Water Absorption of Plastics

ASTM D638: Standard Test Methods for Tensile Properties of Plastics.

ASTM D 968: Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM D7853: Standard Test Methods for Hydraulic Pullout Resistance of a Geomembrane with Locking Extensions Embedded in Concrete

ASTM D6365: Standard Test Methods for Nondestructive Testing of Geomembrane Seams using the Spark test.

**1.03 SUBMITTALS**

- A. Submit technical data in accordance with the General Conditions.
- B. Submit manufacturer's affidavit of compliance with referenced standards as modified herein.
- C. Submit cut sheets detailing manhole dimensions, wall thickness, and joints.
- D. Submit manufacturer's data and details of frames, grates, rings and covers.
- E. Submit test reports on all shop testing required herein and in referenced standards.
- F. Submit certificate that cement complies with ASTM C 150, designating type II-V.
- G. Submit mill test certificates identifying chemical and physical properties of each lot of reinforcing steel delivered.
- H. Submit concrete mix designs.

**1.04 SPECIALS**

A special is defined as any part of a manhole section that is not a standard part. Special sections require their own unique cut sheets and, in some cases, when requested by the engineer may require structural calculations.

**1.05 INSPECTION**

All manholes furnished under this specification are subject to inspection in the manufacturer's plant by the Owner's Representative.

**1.06 QUALITY ASSURANCE**

The producer shall be an NPCA Plant Certified.

**PART 2 – PRODUCTS****2.01 PERFECT LINED MANHOLE**

- A. Provide Perfect Lined Manhole System components which include monolithic base, risers, conical tops or flat lids and grade rings designed and manufactured in accordance with ASTM C478.

- B. Monolithic concrete base section shall be lined with prefabricated one-piece homogeneous fiber reinforced polymer (FRP) compound with a minimum thickness of 0.197-in (5mm)
- C. The sanitary sewer baseliner shall include:
  - a. Full flow channels with side walls to the crown of the pipe(s).
  - b. A non-skid pattern on inner bench surfaces.
  - c. Pipe connections with specified invert elevations and slopes for incoming pipes.
  - d. The standard vertical side wall (skirt) height above the bench shall be 2-in minimum.  
Other skirt heights, as agreed upon between the purchaser and the manufacturer.
- D. Riser sections to be lined with HDPE Perfect Liner sheets with a minimum thickness of 0.065-in (1.65mm).
- E. Manhole flat lids and cones to be lined with FRP.
- F. Manhole joints shall be assembled with a bell and spigot with SDV seal gaskets per ASTM C443. Joint sealing surfaces shall be free of dents, gouges, and other surface irregularities. The joints and complete assembly shall pass vacuum test per ASTM C1244.
- G. The minimum clear distance between two wall penetrations shall be 6 inches. Minimum clear distance between penetrations and joint seams shall be 3 inches.

## **2.02 BASIS OF DESIGN**

- A. Concrete sewer manholes shall be manufactured from self-consolidating concrete (SCC) with a minimum compressive strength of 4,000 PSI conforming to material and performance standards of ASTM C-478.
- B. Cement for the manholes shall conform to ASTM C-150, Type II-V. All sand and aggregate shall be nonreactive in an acid environment.
- C. Perfect Manhole system to support AASHTO HL-93 or HS-20 loads.

## **2.03 JOINTS**

- A. Elastomeric gasket material shall be produced from EPDM 5055 rubber and manufactured by D+S SDV Seal.
- B. Installed joints shall be capable of holding constant internal pressure of 30 PSI.

## **2.04 PRODUCT MARKING**

Plainly mark each manhole section with the manufacturer's name, project and customer name, date of manufacture, nominal diameter, section height and structure ID and concrete type.

**2.05 HDPE LINING**

- A. The interior of the manhole risers shall be lined with a High-Density Polyethylene (HDPE) concrete protective liner (CPL) with a minimum thickness of 1.65 mm. The CPL shall have a minimum of (94 qty) anchors per square foot extruded as one homogeneous piece.
- B. All edges of the HDPE CPL shall be covered with a EPDM liner clip manufactured by D+S Sealants.
- C. HDPE CPL shall be capable of resisting groundwater pressure up to 30 PSI.

**2.06 FRP LINING**

- A. The interior of the manhole base section and flow channels shall be coated prior to casting with a FRP factory spray coating a minimum of 0.197-in (5 mm) thickness.
- B. FRP coating shall have spray bonded embeds on the back side of the base liner section.
- C. When monolithically cast into the base shell the structure the FRP liner shall be capable of resisting groundwater pressure up to 30 PSI.
- D. At the discretion of the manufacturer the FRP coating may be used in all or part of the liner fabrication for the cone.

**PART 3 -EXECUTION****3.01 INSTALLATION**

- A. Segments to be manufactured with self-aligning segment joints.
- B. All segments to have external lifting devices.
- C. When segment is placed gasket to be secured around the spigot. Once in place the gasket must be equalized by pulling it away from the spigot 1-2" on all sides and releasing.
- D. Field-welding of joints shall not be required for the Perfect Liner Manhole System.
- E. Pipe-to-Manhole Connections shall be accomplished in accordance with the following options:
  - a. With direct drive boot connector for all pipe types

- b. Perfect connector when connecting Perfect Pipe to Perfect Lined Manhole
- c. Cast-in gasket when using 4-in through 52-in internal diameter pipes
- d. Other connection methods approved by a manufacturer

**F. Approved Connector Manufacturers:**

- a. Press-Seal Corporation, PSX Direct Drive compression connector.
- b. Hamilton Kent, Tylox compression connector.
- c. Vertex, Inc., V-0216 4" to 12", V-0226 14" to 52".

### **3.02 CAUSES FOR REJECTION**

Manhole can be rejected for any of the following reasons:

- A. Exposure of any wires and positioning spacers or chairs used to hold the reinforcement cage in position or steel reinforcement in any surface of the manhole.
- B. Tears in the liner greater than 2-in in width on any segment.
- C. Bubble voids on the exterior surface of the manhole exceeding 3/8" in diameter.
- D. Missing or bent external lifting devices.

### **3.03 MANUFACTURER**

- A. Manufactured by  
Geneva Pipe and Precast  
A Northwest Pipe Company  
1465 N. 400th Street, Orem  
UT 84057. 801-225-2416  
[www.nwpipe.com](http://www.nwpipe.com)

END OF SECTION