

**Perfect Pipe - HDPE Lined RCP
For Gravity Sanitary and Storm Sewer**

PART 1 - GENERAL**1.01 SCOPE OF WORK**

This specification covers materials, installation, and testing requirements for gravity sanitary sewers using Perfect Pipe.

Perfect Pipe (24" to 60") is a patented composite pipe system comprised of reinforced concrete pipe with cast-in HDPE liner, an internal coupler, and dual EPDM gaskets.

This specification is applicable to pipes installed in open trench and pipes installed with trenchless methods.

1.02 REFERENCE SPECIFICATIONS

Except as otherwise indicated, all reinforced concrete pipe shall conform to the applicable requirements of the following specifications, latest edition.

ASTM C33 Specification for Concrete Aggregates

ASTM C76 Standard Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

ASTM C150 Standard Specifications for Portland Cement

ASTM C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gasket

ASTM C497 Standard Methods of Testing Concrete Pipe, Manhole Sections or Tile

ASTM C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

ASTM C655 Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe

ASTM C1131 Standard Practice for Least Cost (Life Cycle) Analysis of Concrete Culvert, Storm Sewer, and Sanitary Sewer Systems

ASTM C1479 Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe using Standard Installations

ASTM D6365 Standard Practice For Nondestructive Testing Of Geo-membrane

Seams Using The Spark Test

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

1.03 SUBMITTAL DATA

- A. Material safety data sheets (MSDS).
- B. Submit drawings detailing pipe dimensions, wall thickness, and joints.
- C. Submit test reports on all shop testing required herein and applicable standards referenced in Sec 1.02 of this specification.
- D. Submit test reports on physical properties of EPDM used in gaskets.
- E. Submit mill test certificates identifying chemical and physical properties of each lot of reinforcing steel delivered.
- F. Submit concrete mix designs including compliance of ASTM C150 and cement type.
- G. Submit HDPE certificates with physical and mechanical properties.
- H. For trenchless/jacking pipe, submit jacking load design strength.
- I. Submit installation details.

1.04 INSPECTION

- A. All pipe furnished under this specification is subject to inspection in the Manufacturer's plant by the Owner's Representative.
- B. Perfect Pipe System shall be inspected and tested as required by the Engineer or a designated 3rd party firm that has been approved by the owner. The Engineer will be provided copies of all test reports.

1.05 QUALITY ASSURANCE

- A. The producer shall be NPCA Quality Certified.
- B. Factory Performed Thermoplastic Welding: All fabrication and welding must be done by AGRU Certified welders/fabricators in accordance with the published directives and QA/QC procedures of the liner manufacturer. When the welding is completed and spark tested per ASTM D6365, the finished concrete product will be

protected by a homogenous monolithic Thermoplastic Liner System that will provide excellent resistance to microbial attack, abrasion, and chemicals normally found in municipal sanitary sewer environments.

1.06 CAUSES FOR PIPE REJECTION

Pipe 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 pipe.
- B. Bubble voids (bug-holes) on the interior and exterior surfaces of the pipe exceeding 1/2 inch in depth unless packed with mortar or other approved material.
- C. Any chipped or broken joint that may affect intended joint performance as determined by the Manufacturer's Engineer.
- D. Any of the following cracks:
 - 1. A crack having a width of 0.01 inch or more throughout a continuous length of 1 foot or more.
 - 2. Any crack extending through the wall of the pipe and having a length in excess of the wall thickness.

1.07 GUARANTEE

The pipe liner Manufacturer shall warrant that the materials furnished are to be free from manufacturing defects in materials and workmanship for a period of 1 year from date of shipment.

PART 2 – PRODUCTS

2.01 SANITARY SEWER PIPE

- A. Acceptable Manufacturers:
 - 1. Geneva Pipe and Precast, A Northwest Pipe Company
 - 2. Approved Equal as determined by Engineer.
- B. Reinforced concrete pipe shall be manufactured per ASTM C76.
- C. To evaluate that the desired service life will be obtained if alternate piping materials are specified, a Least Cost Analysis of all piping material will be required. The

analysis shall follow the procedure as described in ASTM C1131. For analysis purposes, service lives of 100 years for HDPE lined RCP, 50 years for High Density Polyethylene and 50 years for Glass Fiber Reinforced Thermosetting Resin pipe shall be used.

- D. General requirements for all RCP: All RCP shall be designed and manufactured with minimum wall C design.
- E. Provide grouting holes for micro-tunneling Perfect Pipe.

2.02 BASIS OF DESIGN

- A. Bell and spigot reinforced concrete sewer pipe shall be manufactured from self-consolidating concrete (SCC) with a minimum compressive strength of 6,000 PSI conforming to material and performance standards of ASTM C76.
- B. Cement for the pipe shall conform to ASTM C150.
- C. For pipe installed below the water table, calculations shall be performed by Design Engineer and submitted to check for possible flotation.

2.03 HDPE PERFECT LINER

- A. The interior of the pipe shall be lined with a HDPE Perfect concrete protective liner with a minimum thickness of 1.65mm.
- B. Perfect Liner shall be extruded as one homogeneous piece with a backpressure resistance of 30 psi.
- C. Liner shall be yellow in color.

2.04 JOINTS

- A. Elastomeric gasket material shall be produced from EPDM rubber and designed to have a double sealing edge. The Double-Tilting Edge gasket shall comply with applicable testing required by ASTM F477.
- B. Connector shall be manufactured from Polypropylene Black (PP-B) resin in DN250 – 600mm and Glass Fiber Reinforced Polypropylene Black (PP-GF) resin in DN700 – 1500mm.
- C. Joints shall be capable of meeting the requirements of ASTM C443.
- D. Joint for Perfect Pipe in Trenchless application:

1. The outside of the joint shall be reinforced with a steel bell band and an “O” ring gasket, as deemed necessary by the Manufacturer.
2. Packers: the contact surfaces of all pipe joints that transmit the axial (longitudinal) jacking forces shall be separated by a packing (cushion) made of:
 - a. Plywood
 - b. Particle board; or
 - c. Other low-modulus (compression resistant) materials.

2.05 PRODUCT MARKING

Plainly mark each length of pipe with the date of manufacture, class of the pipe, pipe diameter and manufacturer’s name.

2.06 ACCEPTANCE TESTING & REPAIRS

The following tests shall be required:

- A. Hydrostatic: The pipe barrel and pipe joint shall be subjected to an internal hydrostatic pressure per ASTM C443.
- B. Load Bearing Test: One Three-Edge-Bearing Test in accordance with ASTM C497 for the load to produce the 0.01 inch crack and the ultimate load. All Three-Edge-Bearing tests shall be run on pipe manufactured without liners.
- C. Concrete Strength: The compressive strength shall be determined according to ASTM C76 or C655.
- D. Pipe and liner is allowed to be repaired if made necessary because of occasional imperfections in manufacture or damage during handling. A repair procedure shall be submitted to the Engineer for approval prior to any repairs being made. All repaired pipe or liner will be inspected and considered acceptable if, in the opinion of the Engineer, the repairs are sound, properly finished and cured and conform to the requirements of the specifications.

PART 3 - INSTALLATION

3.01 PIPE LAYING

- A. Pipe shall be installed in accordance with ASTM C1479, the Concrete Pipe and Box Culvert Installation manual created by ACPA, and Section 7 of the Perfect Pipe Product Guide on “Installation Recommendations”.

- B. Preparation of bedding and backfill shall be as specified on the drawings and per the requirements of the references listed in 3.01A, above.
- C. Pipe shall be protected from lateral displacement by pipe embedment material installed as provided in the Drawings. Under no circumstances shall concrete pipe be laid in water and no pipe shall be laid in unsuitable weather or trench conditions. Pipe shall be laid with bell ends facing the direction of laying except when making closures.
- D. Pipe shall be laid to line and grade as shown on the plans.

3.02 CONNECTION TO PRECAST STRUCTURES

- A. When the standard connection cannot be made at a structure, the transition procedure and the connection shall be submitted to the Engineer for approval.

3.03 REPAIR OF IMPERFECTIONS

Repairs shall be compatible with the methods of making pipe. All repair methods will be submitted to the Engineer for approval.

END OF SECTION