

## **SECTION 33 05 39.41**

### **PERFECT PIPE SYSTEM HDPE LINED REINFORCED CONCRETE PIPE FOR SEWERS AND CULVERTS**

#### **PART 1 - GENERAL**

##### **1.01 DESCRIPTION**

This section includes materials, installation, and testing of Perfect Pipe - a gasketed high density polyethylene (HDPE) lined reinforced concrete pipe for sanitary sewers, provided in accordance with ASTM C76 and this specification.

##### **1.02 RELATED SECTIONS**

1. 33 05 61 Concrete Manholes
2. 22 13 00 Facility Sanitary Sewerage
3. 33 31 00 Sanitary Sewerage Piping

##### **1.03 SPECIFICATIONS AND STANDARDS**

- A. Except as otherwise indicated, the current editions of the following apply to the work of this Section.
  1. ASTM A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  2. ASTM C 1611: Standard Test Method for Slump Flow of Self Consolidating Concrete
  3. ASTM A 706: Specification for Low-Alloy Steel Bars Deformed and Plain Bars for Concrete Reinforcement
  4. ASTM C 150: Specification for Portland Cement.
  5. ASTM C 33: Standard Specification for Concrete Aggregates
  6. ASTM C 76: Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
  7. ASTM C 361: Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
  8. ASTM C 1619: Standard Specification for Elastomeric Seals for Joining Concrete Structures.
  9. ASTM F 477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

10. ASTM C 497: Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
11. ASTM C 655: Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe.
12. ASTM C 969: Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
13. ASTM C 1103: Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

#### **1.04 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 pipe dimensions, wall thickness, and joints.
- D. Submit certificate that cement complies with ASTM C 150, designating type.
- E. Submit test reports on physical properties of rubber used in gaskets.
- F. Submit mill test certificates identifying chemical and physical properties of each lot of reinforcing steel delivered.
- G. Submit concrete mix designs.
- H. For trenchless/jacking pipe, submit jacking load design strength.

#### **1.05 SPECIALS**

A special is defined as any piece of pipe other than a normal full length of straight section. This includes but is not limited to manhole sections, short pieces, bevels, and fittings.

#### **1.06 INSPECTION**

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

#### **1.07 QUALITY ASSURANCE**

The producer shall be Q-Cast certified by the American Concrete Pipe Association, as well as the NPCA or PCI Plant Certification and have been certified for a minimum of 3 years prior to and during production of the products for this project.

## **PART 2 – PRODUCTS**

### **2.01 SANITARY SEWER PIPE**

- A. Perfect Pipe System, 600mm to 1500mm diameter manufactured by American Concrete Products, 8707 N. 300<sup>th</sup> Street Valley, NE 68064. 402-331-5775, [www.amconco.com](http://www.amconco.com)
- B. A bid, to be acceptable, must be based on the specified pipe manufacturer in accordance with the engineering requirements set forth in this specification. The manufacturer shall furnish pipe and fittings in accordance with the terms and requirements of this specification and shall guarantee the finished products to be free from defective material and workmanship for a period of one year after the date of delivery by the purchaser.

### **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 C-76.
- B. Cement for the pipe shall conform to ASTM C 150, Type II.

### **2.03 JOINTS**

- A. Elastomeric gasket material shall be produced from EPDM 5055 rubber and designed to have a double sealing edge. The gasket shall be manufactured and tested in accordance with ASTM C-1619(4.) as Class "A".
- B. Each pipe section shall be manufactured with a thermoplastic connector factory-installed in the bell-end manufactured from Polypropylene Black (PP-B) resin.
- C. Installed joints shall be capable of holding constant internal pressure of 36 PSI.
- D. Jacking Applications:
  - 1. The outside of the joint shall be reinforced with a corrosion-resistant steel end-ring and a single "O" ring gasket, as deemed necessary by the manufacturer.
  - 2. Spigot ends shall be separated by a jacking packer, consisting of a suitable compressive material such as medium density fibreboard or a suitable engineered wood product.

### **2.04 PRODUCT MARKING**

Plainly mark each length of pipe with the date of manufacture.

### **2.05 HDPE LINING**

- A. The interior of the pipe shall be lined with a High Density Polyethylene (HDPE) concrete protective liner (CPL) with a minimum thickness of 1.625mm. The CPL

shall have a minimum of (88 qty) anchors per square foot extruded as one homogeneous piece with pull-out strength of 250 N (56 lbs) per-anchor.

- B. HDPE pipe internal liner shall be 1.625mm thick HDPE AGRU Sure Grip® Concrete Protective Liner system.
- C. CPL shall be capable of resisting groundwater pressure up to 36 PSI.

## **PART 3 -EXECUTION**

### **3.01 INSTALLATION**

- A. General: Joints shall be installed in accordance with the pipe manufacturer's recommendations. Immediately before the pipes are joined, all spigot and bell surfaces shall be thoroughly cleaned and connector gasket surfaces shall be coated with lubricant. The interior recess of the HDPE-Lined spigot being homed shall be coated with lubricant. Home the spigot into the previously placed bell squarely and uniformly, with all surfaces fully entered in accordance with recommended rigging and placement instructions for HDPE-Lined RCP.
- B. Field-welding of pipe joints shall not be required for the Perfect Pipe System, HDPE-Lined RCP (600mm to 1500mm.)
- C. Service Lateral Connections: Laterals shall be connected to the Perfect Pipe system by core-drilling a hole through the concrete outer-wall and CPL, and inserting a junction fitting. The junction shall be sealed to the liner by an O-ring that is compressed against the liner as the fitting is tightened down. The internal space surrounding the fitting shall be filled with an expansive epoxy.
  - a. Approved Manufacturers:
    - i. Fabekun Junction fitting with an integrated adjustable socket 6-inch and 8-inch, by Schlüsselbauer Technologies.
- D. Pipe-to-Manhole Connections shall be accomplished in accordance with the following options:
  - a. Option 1: Perfect Pipe shall be laid from a precast manhole base (lined or unlined) with spigot-end stubbed through integrally-cast ASTM C-923 flexible connector.
    - i. Approved Manufacturers:
      - 1. A-Lock Products, Inc. compression connector.
  - b. Option 2: Perfect Pipe shall be laid from a precast manhole base, using the Perfect Pipe Connector. Perfect Pipe connector and precast manhole shall be supplied by Perfect Pipe manufacturer.

- c. Option 3: Perfect Pipe shall be laid from a cast-in-place manhole base. If the cast-in-place base is lined with HDPE, Polypropylene, or PVC then the Perfect Pipe HDPE liner shall be welded to the lined wall on the manhole using a fabricated returned-flange cap strip that is extrusion welded on both edges.

If the cast-in-place manhole bases is constructed using a PVC, FRP or Polycrrete the Perfect Pipe HDPE liner shall be transitioned to the liner inside the manhole base using a polyester backed HDPE smooth liner transition strip and a suitable two-part epoxy.

If the cast-in-place base is unlined, a Predl Systems FRP Bell can be fit over the pipe and embedded in the base wall being constructed in the field. The Perfect Pipe HDPE liner is welded to the polyethylene x FRP transition strip embedded in the Predl Bell.

### **3.02 FORMS**

The forms for the pipe shall be steel made with butt joints throughout, and the surfaces of the forms adjacent to the pipe walls shall be smooth and true. All forms shall be sufficiently tight with suitable gaskets provided at all form joints to prevent leakage of mortar. The forms shall be braced and sufficiently stiff to withstand, without detrimental deformation, all operations incidental to the placement and compaction of concrete within the form. The form shall be so constructed that the pipe, when manufactured, will have circular and cylindrical inner surfaces so that they may be stripped from the pipe without damage to the pipe or to its surfaces. Forms shall be cleaned and oiled before each filling. Defective forms and components shall be discarded or adequately repaired.

### **3.03 CURING**

- A. General: The manufacturer shall provide adequate facilities for curing the pipe. The enclosures shall be such that the temperature and humidity can be controlled to keep the pipe surfaces moist at all times and the temperature maintained continuously between 80F and 125F.

### **3.04 REINFORCEMENT**

- A. Pipe shall have concentric circular cage reinforcement conforming to the requirements of ASTM C-76 for open-cut installation, or ASTM C-361 for trenchless installation. When two reinforcement cages are used only the reinforcement on the outer cage need extend into the bell. Fabricate transverse reinforcements either as complete hoops, welded or lapped, or as a continuous helix.

### **3.11 SIZES AND DIMENSIONAL TOLERANCES**

- A. Pipe shall have a minimum wall thickness per ASTM C-76 for open-cut applications, or ASTM C-361 for microtunneling trenchless applications.

- B. Pipe shall be round and true and shall have smooth and dense finished surfaces. The internal diameter of any portion of each piece of pipe shall not vary more than  $\pm 1\%$  but in no case shall exceed  $3/8$  inch from the nominal diameter. The wall thickness shall not be less than that shown in the design by more than 5% or  $3/8$ " , whichever is less. A wall thickness more than that required in the design shall not be cause for rejection, as long as the reinforcement is properly placed. Reinforcement steel shall be accurately placed in the concrete wall of the pipe. The placement of all steel shall not vary from the position in the pipe wall shown in the drawings by more than  $\pm 1/4$  inch from the nominal shown in the drawings. Variations in laying lengths of two opposite sides of pipe shall not be more than  $3/8$  inch in any length of pipe except where beveled pipe is used. The underrun in length of a section of pipe shall not be more than  $1/2$  inch in any length of pipe.

### **3.12 TESTING**

- A. Installed pipe shall be tested in accordance with ASTM C-969, using either the Infiltration or Exfiltration method.
- B. Installed pipe shall be tested in accordance with ASTM C-1103, using either water or air.

### **3.12 CAUSES FOR REJECTION**

Pipe is 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.
- D. Bubble voids (bugholes) on the interior and exterior surfaces of the pipe exceeding  $1/2$  inch in depth unless pointed with mortar or other approved material.
- F. A deficiency greater than 6% from the specified wall thickness.
- G. A variation of the pipe barrel from the specified internal diameter in excess of 1%.
- H. A piece broken from the end projections of the pipe which has a circumferential length exceeding 60 degrees of the circle or extends into the body of the pipe or extends into the connector contact surfaces for a circumferential length in excess of 6 inches (measured at the midpoint of the gasket contact surface on the bell end and at the inner shoulder of the gasket groove at the spigot end). If two or more pieces are broken from an end projection, the total length of such broken pieces on any end shall not exceed 90 degrees of the circle, and there shall be a distance of at least 9 inches of sound concrete between breaks. The total length of broken pieces that extend into the gasket contact surfaces of gasketed joint pipe shall not exceed a circumferential length of 6 inches. If less than 9 inches of sound concrete exists between two individual breaks, the two breaks shall be considered as one continuous break. Repair of such defects not

exceeding the above limitations shall be made as approved by the Engineer. Unsound portions of end projections shall be removed, and if the pieces removed do not exceed the above limits, the pipe may be similarly repaired.

- I. 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.
  - 3. Any crack showing two visible lines of separation for a continuous length of 2 feet or more or an interrupted length of 3 feet or more anywhere in evidence, both inside and outside, except where such cracks occur during the external loading test.
  - 4. When required by the Owner's Representative, any crack 0.01 inch wide or wider that is not a cause for rejection shall be filled with neat cement grout composed of cement mixed with water to a fluid consistency.
- J. Failure to meet the size and dimensional tolerances stated herein.

### **3.13 REPAIR OF IMPERFECTIONS**

Repairs which are compatible with the methods of making pipe and fittings may be made on damaged sections. All repairs shall be subject to the approval of the engineer.

END OF SECTION