

SECTION 02620
HIGH DENSITY POLYETHYLENE PRESSURE PIPE

PART 1 -- GENERAL

1.1 SECTION DESCRIPTION

- A. This section includes material and performance standards and Contractor responsibilities associated with the furnishing of all materials, equipment, labor and incidentals required to provide and install complete and make ready for operation all High Density Polyethylene (HDPE) pipe as shown on the drawings or as specified herein.
- B. This specification governs the material, pipe, fittings, heat fusion and general construction practice for HDPE pipe.

1.2 RELATED SECTIONS

- A. Section 02320, Trenchless Installation of Pressure Mains by Directional Boring.

1.3 QUALITY AND WORKMANSHIP

- A. The pipe and fitting manufacturer's production facilities shall be open for inspection by SLCU or designated agents. During inspection, the manufacturer shall demonstrate that he has facilities capable of manufacturing the pipe and fittings required by this specification, that a quality control program meeting the minimum requirements of D3035, and ASTM F-714 is in use, and that facilities for performing the tests required by this specification are in use. Incoming polyethylene materials shall be inspected for density, melt flow rate, and contamination. The final product shall be tested in accordance with AWWA C901 or C906.
- B. SLCU or the Engineer may request certification that the pipe produced is represented by the quality assurance data. Additionally, test results from the manufacturer's testing which show the pipe does not meet appropriate ASTM standards of manufacturers representation will be cause for rejection of the pipe represented by the testing. These tests may include density and thickness measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D-3350, 10.1.9.
- C. SLCU or the Engineer may request certified lab data from the manufacturer to verify the physical properties of the materials supplied under this specification or at his own expense may take random samples for testing by an independent laboratory.
- D. SLCU or the Engineer may request certified lab data to verify the physical properties of the compounded materials supplied under this specification, or have random samples tested by an independent laboratory. Such testing will be at expense of the party requiring verification testing. Requests for verification must be submitted in writing and mutually acceptable arrangements made.

- E. Polyethylene pipe and fittings may be rejected in whole or in part by the Engineer for failure to meet any of the requirements of this specification.

1.4 PIPE PACKAGING, HANDLING, STORAGE

- A. The manufacturer shall package the pipe in a manner designed to deliver the pipe to the project neatly, intact, and without physical damage. The transportation carrier shall use appropriate method and intermittent checks to insure the pipe is properly supported, stacked, and restrained during transport such that the pipe is not nicked, gouged, or physically damaged.

PART 2 -- PRODUCTS

2.1 MATERIAL

- A. Materials used for the manufacture of polyethylene pipe and fittings shall be very high molecular weight, high density ethylene/hexene copolymer PE 3408 polyethylene resin meeting the listed physical property and pipe performance requirements:
 1. The pipe shall be extruded from pre-compounded resin. In plant blending of resin is unacceptable.
 2. The pipe shall meet all requirements of AWWA C906, latest revision.
 3. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific product. Said certification shall include a stress life curve per ASTM D-2837. The stress regression testing shall have been done in accordance with ASTM D-2837, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi, as determined in accordance with ASTM D-2837.
 4. Further, the material shall be listed by PPI (the Plastics Pipe Institute, a division of the Society of the Plastics Industry) in PPI TR-4 with a 73 Degrees F hydrostatic design stress rating of 800 psi, and a 140 Degrees F hydrostatic design stress rating of 400 psi. The PPI Listing shall be in the name of the pipe manufacturer, and shall be based on ASTM D-2837 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.
 5. The manufacturer's certification shall state that the pipe was manufactured from one specific resin in compliance with these specifications. The certificate shall state the specific resin used, its source, and list its compliance to these specifications.

2.2 PIPE EXTRUSION

- A. The pipe shall be extruded using a melt homogenizing/plasticating extruder and

"appropriate" die. The extruder screw design should be customized for the HDPE being processed to minimize melt fracture of the molecular structure thus reducing the molecular weight and changing some physical properties from resin to pipe. The resin should be processed at its melt temperature of 500 Degrees F to 525 Degrees F. The die will have an internally cooled mandrel and an externally cooled bushing. This die will cool the pipe to its solidification point such that it exits the die to specification size, shape, and wall thickness with a polished surface for smooth flow offering a Hazen Williams "C" factor of C=155.

2.3 PIPE AND FITTINGS

A. Pipe

1. Pipe supplied under this specification shall have a DI (Ductile Iron) OD unless otherwise specified. The SDR (Standard Dimension Ratio), and the pressure rating of the pipe supplied shall be as specified by the Engineer. Pipe shall be a minimum SDR 11 for pressure pipe.
2. The pipe shall be produced with the nominal physical properties outlined in Part 2, and to the dimensions and tolerances specified in ASTM F-714. Additionally, the pipe shall be inspected per industry accepted manufacturer standards for:
 - a. Diameter
 - b. Wall Thickness
 - c. Concentricity
 - d. Quick Burst Pressure and Ductility
 - e. Joint Length
 - f. Straightness
 - g. Quality
 - h. Toe-In
 - i. Overall Workmanship Inspection on ID & OD
 - j. Print Line
3. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, voids, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index and other physical properties throughout.

B. Pipe Performance

1. The pipe shall be in compliance with the physical and performance requirements of Part 2.1 of this specification. Specifically, the pipe will be extruded from resin meeting specifications of ASTM D-3350 with a cell classification of PE:355434C; and ASTM D-1248 pipe grade resin type III, Class C, Category 5, grade P34 polyethylene compound. The pipe shall exhibit the short term tensile and compressive physical properties listed in

Part 2.1, and the pipe shall provide the long term endurance characteristics recognized by: the compressed pipe ring environmental stress crack resistance greater than 5000 hrs; the slow crack growth resistance greater than 32 days; the impact strength (toughness) greater than 144 in-lb/in notch; and rotary fatigue endurance at \pm 1600 psi bending stress with $F_o > 100,000$ cycles.

C. Fittings

1. The standard HDPE fittings shall be standard commercial products manufactured by injection molding or by extrusion and machining, or, shall be fabricated from PE pipe conforming to this specification. The fittings shall be fully pressure rated by the manufacturer to provide a working pressure equal to the pipe for 50 years service at 73.4 Degrees F with an included 2:1 safety factor. The fittings shall be manufactured from the same resin type, grade, and cell classification as the pipe itself. The manufacture of the fittings shall be in accordance with good commercial practice to provide fittings homogeneous throughout and free from cracks, holes, foreign inclusions, voids, or other injurious defects. The fitting shall be as uniform as commercially practicable in color, opacity, density and other physical properties. The minimum "quick-burst" strength of the fittings shall not be less than that of the pipe with which the fitting is to be used.

2.4 JOINING

- A. Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 500 Degrees F, alignment, and 150 psi interfacial fusion pressure.
- B. Butt fusion joining shall be 100% efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe. Socket fusion shall not be used. Extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications, nor in fabrications where shear or structural strength is important. Flanges, unions, grooved-couplers, transition fittings and some mechanical couplers may be used to mechanically connect HDPE pipe without butt fusion. Connection method shall be approved by the Engineer. Refer to the manufacturer's recommendations.

2.5 PIPE MARKING

- A. During extrusion production, the HDPE pipe shall be continuously marked with durable printing following this format or an equal type format designating the same information:
 1. Nominal Size and OD Base 10" DI

2.	Dimension Ratio	SDR 11
3.	Pressure Rating	160 psi
4.	Type	(Trade Name)
5.	AWWA Designation	AWWA C906
6.	Material Classification	PE3408
7.	Certification Bases	ASTM F714
8.	Pipe Test Category	C3
9.	Plant	<u>P...for Pryor</u>
10.	Extruder Number	#5
11.	Date	06 Oct 89
12.	Operator Number	55
13.	Shift Letter	A
14.	Resin Supplier Code	P
15.	NSF - PW	NSF - PW
16.	Four, Co-extruded color stripes	Blue

EXAMPLE: 10" DI SDR 11, 110 psi (Trade Name) PE 3408 ASTM F-714 NSF-pw C3 P5 06FEB89 55A P

- B. Permanent identification of piping service shall be provided by co-extruding four equally spaced color stripes into the pipe outside surface. The striping material shall be the same as the pipe material, excepting color.
- C. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The handling of the pipe shall be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.
- D. Sections of pipe having been discovered with cuts or gouges in excess of 10% of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method.
- E. Fused segments of pipe shall be handled so as to avoid damage to the pipe. When

lifting fused sections of pipe, chains or cable type chokers are not acceptable. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections. Care must be exercised to avoid cutting or gouging the pipe.

PART 3 -- EXECUTION

3.1 GENERAL

- A. HDPE may be constructed by standard open trench procedures or trenchless directional boring methods.
- B. Open Trench Construction methods are stated herein this specification.
- C. Trenchless directional boring methods/procedures are stated within Specification 02320.

3.2 OPEN TRENCH INSTALLATION

- A. Construction and installation shall be performed in compliance with the manufacturers Design Guidelines and Installation Guidelines, and this specification.
 - 1. Trench Construction - Trenching should be done in accordance with ASTM-D-2321 - Section 7.
 - 2. Embedment Material - Embedment materials should be Class I, Class II, or Class III materials as defined by ASTM-D-2321 - Section 6. The use of Class IV and Class V materials for embedment is not recommended and shall be done only with the approval of the Engineer.
 - 3. Bedding - Bedding of the pipe shall be performed in accordance with ASTM-D-2321 - Section 8. Compaction rates should be as specified in ASTM-2321. Deviation from the specified compaction rates should be done only with the approval of the Engineer.
 - 4. Haunching and Initial Backfill - Haunching and initial backfill shall be as specified in ASTM-D-2321 - Section 9 using Class I, Class II, or Class III materials. Materials used and compaction rates shall be as specified by the Engineer.
 - 5. Special Conditions - ASTM-D-2321 - Section 11.2, Minimum Cover for Load Application, Section 11.3, Use of Compaction Equipment, and Section 11.4, Removal of Trench Protection shall apply unless directed otherwise by the Engineer.
 - 6. Testing - Gravity flow pipelines shall be tested in accordance with requirements of SLCU and requirements and specifications of the Engineer of Record. HDPE pressure pipe shall be tested in accordance with the requirements of SLCU and the specification and requirements of the Engineer of Record and the manufacturer's recommendations, or in

accordance with the guidelines and procedures taken from PPI Technical Report TR 31/9-79, or latest edition.

**** END OF SECTION ****