APPENDIX A

TECHNICAL SPECIFICATIONS

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION:
Scope – This section specifies high density polyethylene pipe (HDPE) and fittings for water utility use as indicated on the Drawings, and as specified herein.

• Furnish, Install, and Test HDPE pipe as indicated and specified in this section, and as referred to in related sections, and the Construction Drawings.

• The primary installation method is burial. The means and methods, including the testing for acceptance shall conform to all applicable standards as noted herein with the intention of providing a leak-free system to the owner.

1.02 REFERENCES
A. To the extent referenced in this specification section, the standards and documents listed below are included, and made a part of this specification.

B. In the event of a conflict, the requirements of this specification section prevail.

C. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the bid date of the project.

ANSI/AWWA (www.awwa.org)
• ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service

• ANSI/AWWA C906-07 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission

• ANSI/AWWA C651 Standard for Disinfecting Water Mains


Plastics Pipe Institute, PPI (www.plasticpipe.org)
• PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)

• PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe

• PPI TR-34 Disinfection of Newly Constructed Polyethylene Water Mains

• PPI TR-41 Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping

NSF (www.nsf.org)

- NSF / ANSI 61 Drinking Water System Components–Health Effects

ASTM (www.astm.org)

- ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- ASTM F905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints
- ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
- ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
- ASTM F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
- ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
- ASTM F2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
- ASTM D 2239 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
- ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
- ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing
- ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
- ASTM D 3350-08 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

1.03 SYSTEM DESIGN PARAMETERS

A. The polyethylene system working pressure rating accommodates the normal operating pressure and the repetitive surges. The pressure rating applies at 80°F or less.

B. Per AWWA 901 and C906, the repetitive surge pressure allowance is one half the pressure class of the pipe, and the occasional surge over pressure allowance is equal to the pressure class of the pipe. Allowable Total Pressure during Recurring Surge conditions equals 1.5 times the pipe’s pressure class. Allowable Total Pressure during Occasional Surge conditions equals 2.0 times the pipe’s pressure class.

Table 1 gives the Pressure Class per AWWA C901, Pressure Rating and Allowable Total Pressure During
Recurring and Occasional Surge for PE4710 pipe at 80°F or less.

Table 1. Pressure Class per AWWA C901 for PE 4710 at 80°F or less

<table>
<thead>
<tr>
<th>Pipe Dimension Ratio (DR)</th>
<th>Pressure Class</th>
<th>Pressure Rating</th>
<th>Allowable Total Pressure During Recurring Surge</th>
<th>Allowable Total Pressure During Occasional Surge</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR 9</td>
<td>250 psi</td>
<td>250 psi</td>
<td>375 psi</td>
<td>500 psi</td>
</tr>
<tr>
<td>DR 11</td>
<td>200 psi</td>
<td>200 psi</td>
<td>300 psi</td>
<td>400 psi</td>
</tr>
<tr>
<td>DR 14.3</td>
<td>150 psi</td>
<td>150 psi</td>
<td>225 psi</td>
<td>300 psi</td>
</tr>
<tr>
<td>DR 17</td>
<td>125 psi</td>
<td>125 psi</td>
<td>185 psi</td>
<td>250 psi</td>
</tr>
<tr>
<td>DR 21</td>
<td>100 psi</td>
<td>100 psi</td>
<td>150 psi</td>
<td>200 psi</td>
</tr>
</tbody>
</table>

1.04 SUBMITTALS
A. Affirmation that product shipped meets or exceeds the standards set forth in this specification. This shall be in the form of a written document from the manufacturer attesting to the manufacturing process meeting the standards.

B. Manufacturers recommended fusion procedures for the products.

1.05 DELIVERY – STORAGE – HANDLING
A. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2 using approved strapping and equipment rated for the loads encountered. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger persons or property. Field storage is to be in compliance with AWWA Manual of Practice M55 Chapter 7.

B. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use.

PART 2 A – PRODUCTS FOR 3 INCH AND SMALLER PIPE PER AWWA C901
See Section 504 of the Standard Construction Specifications.

PART 2 B – PRODUCTS FOR 4 INCH AND LARGER PIPE PER AWWA C906

2B.01 – PIPE
A. Polyethylene pipe shall be made from HDPE material having a material designation code of PE4710 or higher. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE445474C. In addition, the material shall be listed as meeting NSF-61.

B. The pipe and fittings shall meet the requirements of AWWA C906.

C. HDPE pipe shall be rated for use at a pressure class of 200 psi. The outside diameter of the pipe shall be based upon the ductile iron pipe size (DIPS) sizing system.

D. HDPE pipe shall be of domestic manufacture.

2B.02 FITTINGS
A. Butt Fusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2B.01A. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified on the Construction Drawings. All fittings shall meet the requirements of AWWA C906.

Markings for molded fittings shall comply with the requirements of ASTM D 3261. Fabricated fittings shall be marked in accordance with ASTM F 2206.

B. Electrofusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2B.01A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the construction drawings. All electrofusion fittings shall be suitable for use as pressure conduits, and have nominal burst values of four times the Working Pressure Rating (WPR) of the fitting. Markings shall be according to ASTM F 1055.

C. Flange and Mechanical Joint Adapters (MJ Adapters) – Flange and Mechanical Joint Adapters shall have a material designation code of PE4710 or higher and a minimum Cell Classification as noted in 2B.01A. Flange and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206. Flange and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the construction drawings. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261. Fabricated (including machined) flange adapters shall be per ASTM F 2206. Bolts and nuts shall meet the requirements of Section 501 of the Standard Construction Specifications.

Van-Stone style, ductile iron (or stainless steel when specified), convoluted or flat-plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125, or AWWA C207 Class 150 Series B, D, or E. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure-class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. Back-up rings, bolts, and nuts shall be SAE Type 316 stainless steel when specified in the contract documents due to the presence of corrosive soils.

D. Electrofusion saddles for service connections shall be Transition Saddles (Corp Saddles) by Central Plastics Company or approved equal, with a brass threaded outlet with 1-inch or 2-inch AWWA/CC threads as appropriate.

E. All fittings, including bolts, nuts, back-up rings, retainer glands, gaskets and other accessories, shall be of domestic manufacture.

**2B.03 PIPE AND FITTING IDENTIFICATION**

A. The pipe shall be marked in accordance with the standards to which it is manufactured.

B. Color identification by the use of stripes on pipe to identify pipe service shall be required. Stripes or colored exterior pipe product shall be blue for potable water.

C. Tracer wire shall be placed parallel and above, but separate from the pipe and shall be 10 AWG or engineer approved equal. Tracer wire shall be connected to service line tracer wire. All tracer wire connections shall be made using water proof connectors. Water proof connectors shall be DBR direct bury connectors manufactured by 3M or approved equal. Tracer wire shall terminate in meter boxes and valve boxes.
PART 3 – EXECUTION

3.01 JOINING METHODS

A. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer’s recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.

B. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290 and PPI TN 34. The process of electrofusion requires an electric source, a transformer, commonly called an electrofusion box that has wire leads, a method to read electronically (by laser) or otherwise input the barcode of the fitting, and a fitting that is compatible with the type of electrofusion box used. The electrofusion box must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence of electrofusion training within the past year on the equipment to be utilized for this project.

C. Mechanical: Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and ductile iron fittings shall use flange or mechanical joint adapters and other devices in conformance with the PPI Handbook of Polyethylene Pipe, Chapter 9 and AWWA Manual of Practice M55, Chapter 6.

D. Joint Recording - The critical parameters of each fusion joint, as required by the manufacturer and these specifications, shall be recorded either manually or by an electronic data logging device when required in the contract documents. All fusion joint data shall be included in the Fusion Technician’s joint report.

3.02 INSTALLATION

See Section 204 of the Albany Standard Construction Specifications.

3.03 TESTING

A. In addition to the requirements of Section 505 of the Standard Construction Specifications, Hydrostatic leakage testing shall comply with ASTM F 2164, ASTM F 1412, AWWA Manual of Practice M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.

B. Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.

3.04 CLEANING AND DISINFECTING

See Section 505 of the Albany Standard Construction Specifications.