MODEL SPECIFICATION
PE 4710 HIGH DENSITY POLYETHYLENE (HDPE) PIPE, TUBING, FITTINGS AND FUSION TOOLS ¾"-65"
Water/Wastewater Service, Distribution and Transmission

PART 1 - GENERAL

1.1 SUMMARY

A. This specification covers the material, joining, installation and quality assurance for HDPE pipe, tubing, fittings, machines and fusion tools for Water/Wastewater Service, Distribution and Transmission.
B. All worked performed shall be in accordance with approved engineering construction plans and under the guidance of a licensed professional engineer.
C. All worked performed shall be in accordance to all applicable standards and specifications listed herein and shall conform to all local, state, and federal codes. The reference standards utilized shall be of the latest edition and/or revision.
D. All worked performed shall be completed by an experienced, licensed, and bonded contractor that has a minimum of 20 years' experience with HDPE water/wastewater service, distribution and/or transmission projects.
E. All work performed shall be inspected by an Authorized Representative of the Project Owner and shall have the authority to halt construction if these specifications or any applicable standards herein are not being followed.

1.2 QUALITY ASSURANCE

A. Qualification of Manufacturers
   1. The pipe, fitting and machine manufacturer shall be ISO Certified in accordance with the current edition of ISO 9001 and shall have manufacturing and quality control facilities that are capable of producing and assuring the quality of the pipe and fittings required by the specification herein.
B. Qualification of Supplier
   1. The pipe, fitting, machine and fusion tool supplier shall have at least 20 years of experience distributing pipe, fitting, machine and tools and shall have extensive experience with state and local engineering firms, municipalities, and contractors.
C. Markings
   1. Markings of pipe and fittings shall conform to applicable AWWA and ASTM standards listed herein and shall include the name of the manufacturer, material, size, DR, sizing convention, Pressure Class/Pressure Rating, production codes and time/date/location of manufacture for tracking and traceability.
D. Product Inspection

1. The Customer or Authorized Customer's Representative reserves the right to conduct an in-plant inspection during, pre or post production of pipe, fittings and/or machines.
   a. Any inspection results that do not meet the quality requirements per applicable and listed Reference standards listed herein shall result in rejection and be replaced at no cost to the Customer by the Manufacturer.
2. The Customer or Authorized Customer's Representative may conduct additional testing of pipe, fitting, or machine at the Customer's expense upon delivery.
   a. All retesting of pipe, fitting and machines shall be performed per applicable and listed Reference Specification herein.
   b. Any retesting results that do not meet quality requirements per applicable and listed Reference Specification herein shall result in rejection and be replaced at no cost to the Customer by the Manufacturer.

E. Transportation
1. Prevent damage to pipe, fitting, machine and tools during transportation, handling, and storage as recommended by the manufacturer. Pipe shall be transported using appropriate methods with intermittent checks to ensure proper stacking support and restraint.

1.3 JOINING

A. Fusion
1. Fusion between plain end pipe and/or fitting shall conform to ASTM F2620 for Butt, Saddle and Socket Fusion or ASTM F1290 for Electrofusion and Procedures recommended by the Pipe and/or Machine Manufacturer. Any modifications shall be approved by the Project Engineer on Record or his Approved Representative and in accordance with all applicable local, state, and federal codes.
2. Butt Fusion of Unlike Wall Thickness shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than One (1) Standard DR.

B. Alternate Joining Method
1. Connections between plain end HDPE pipe and/or fitting or to alternate piping materials may be joined by means of the following:
   a. Flange Connection with Flange Adapter and Backup Ring
   b. Mechanical Joint Adapter
   c. Mechanical Coupling
2. Joining of Pipe and Fittings by the means of the Alternative Joining Method shall comply with the manufacturer's recommendation. Any modifications shall be approved by the Project Engineer on Record or his Approved Representative and in accordance with all applicable local, state and federal codes.
3. Bolt torque values for proper seating and long term sealing when utilizing mechanical flange connections shall conform to PPI-TN 38.

C. Fusion Joint Qualification
1. Destructive Joint testing

a. Interval of testing shall be at the discretion of the Project Engineer on Record or his Approved Representative.

2. Non-Destructive Joint testing
   a. A datalogging device shall be used to record and document key parameters of the fusion process for real-time, post and historical analysis.
3. Hydrostatic Leak Test
   a. Leak testing shall be performed as described in ASTM F2164: Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.

D. Machine Qualification
1. Routine Machine Inspection
   a. Machines and tools utilized to join pipe and/or fittings shall be routinely inspected and maintained by a local and certified service center and shall meet the manufacturers specification before use.
   b. Machines and tools shall have a written record of routine inspection and maintenance available at the request of the project engineer, owner or operator.

E. Operator Qualification
1. The fusion operator shall be thoroughly familiar with and trained per the applicable standards on the equipment being used to join pipe and/or fittings.
   a. Fusion operator shall be able to provide evidence of fusion qualification training as requested by the project inspector, engineer, or owner.
2. Operator training and recertification interval shall be completed in accordance to the following schedule or as mandated by any applicable local, state and federal codes, whichever comes first:

a.	Distributor Fusion Technicians	Butt Fusion	4 years
b.	Distributor Fusion Technicians	Electrofusion	4 years
c.	Contractor Technicians	Butt Fusion	2 years
d.	Contractor Technicians	Electrofusion	2 years
e.	Agency Technicians	Butt Fusion	2 years
f.	Agency Technicians	Electrofusion	2 years

3. All Fusion Operator Training and Certification process shall be instructed by a local certified fusion qualification trainer familiar with state, local and federal standards.

1.4 INSTALLATION

A. General
1. Installation and Operation of pipe, fitting and machine shall conform to the engineering plans, drawings, specifications, and manuals as advised by the Project Engineer on Record or his Approved Representative and in accordance with all applicable local, state and federal codes.

B. Handling and Delivery
1. Prevent damage to pipe, fitting and machine during transportation, handling, and storage as recommended by the manufacturer. Pipe, fitting, and machine shall be

handled using appropriate and safe methods to insure the proper restraint and controlled movement.

C. Burial
   1. Burial and Embedment techniques regarding including soil type and particle size shall be in accordance with ASTM D2774 and AWWA M55 or as advised by the Project Engineer on Record or his Approved Representative.
      a. Pipe shall be laid on grade and on a stable foundation using preferably Class I material or per applicable specification. Excess groundwater shall be removed from the trench before laying the foundation or bedding for the pipe. All ledge rock, boulders and large stones shall be removed.
      b. During embedment placement and compaction, care shall be taken to ensure that the haunch areas below the pipe springline are completely filled and free of voids.

C. Shear and Bending Loads
   1. Connections shall be protected where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe, and where pipes enter or exit casings or walls.
      a. The area surrounding the connection shall be embedded in properly placed and compacted backfill, preferably in combination with a protective sleeve or other mechanical structural support to protect the polyethylene pipe against shear and bending loads per ASTM D2774 and AWWA M55.

D. Safety
   1. All necessary precautions shall be taken to ensure a safe working environment in accordance with all applicable local, state, and federal codes.

PART 2 – PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall meet NSF/ANSI Standard 61.
B. HDPE pipe and fittings shall be made in accordance to Iron Pipe Size (IPS) convention.
C. Product substitution per commercial availability may be approved at the discretion of the Project Engineer on Record or his Approved Representative and in accordance with all applicable local, state, and federal codes.

2.2 PIPE

A. HDPE pipe shall be manufactured in accordance with AWWA C901 and ASTM D3035 for sizes 3/4" - 3" IPS diameters. Pipe sizes 4" IPS and larger shall be manufactured to the requirements of ASTM F714 and AWWA C906.
B. HDPE pipe shall be manufactured from materials meeting the requirements of AWWA D3350 and listed in PPI -TR4.
   1. Black PE Material Shall Conform to ASTM3350 with a minimum Cell Classification listed of 445574C with a standard grade HDB rating of 1600 psi at 73°F.

2. Gray PE Material Shall Conform to ASTM3350 with a minimum Cell Classification listing of 445574E with a standard grade HDB rating of 1600 psi at 73°F.
3. PE Compound used in potable water service applications shall be classified as CC3 HDPE Material per ASTM D3350 and shall be Bi-Modal for pipe wall thicknesses up to 3".
4. Black HDPE pipe, except colored pipe with cell classification designation of "E", shall include 2-3 percent carbon black for ultra-violet protection.
5. HDPE Pipe shall utilize resin with a PENT Value of >10,000 hrs
6. HDPE Pipe shall be made of virgin material and shall not contain recycled compound. Rework material generated in the manufacturer's own plant may be blended with virgin resin of the same cell classification to manufacture new pipe.

C. Markings of pipe shall conform to applicable AWWA and ASTM standards herein and shall include the name of the manufacturer, material, size, DR, sizing convention, Pressure Class/Pressure Rating, production codes and time/date/location of manufacture for tracking and traceability.
   1. Stripes marked on pipe are optional per intended application. Standard product may be manufactured solid black with no stripes. Gray color interior and/or exterior pipe may be utilized to help aid in inspection visibility
      a. Blue color stripes – Potable Water
      b. Green color stripes/Gray Interior – Wastewater
      c. Purple color stripes – Reclaimed Water
      d. Red color stripes – Firewater/FM

D. Acceptable HDPE pipe manufacturers
   1. WL Plastics
   2. Performance Pipe
   3. JM Eagle
   4. Approved Equal

2.3 FITTINGS

A. HDPE fittings shall be manufactured in accordance to AWWA C901 and ASTM D3261 and Electrofusion fittings shall comply with ASTM F1055.
   1. Black PE Material Shall Conform to ASTM3350 minimum Cell Classification 445574C with a standard grade HDB rating of 1600 psi at 73°F.
   2. HDPE fittings and appurtenances shall have the same pressure rating as the pipelines to which they are attached. Any modifications shall be approved by the agency, Project Engineer on Record or his Approved Representative and in accordance with all applicable local, state and federal codes.
   3. Fittings shall be Molded where commercially available.
   4. All 2"-3" diameter HDPE 90° and 45° Elbows shall be seamless long radius sweep bends unless limited by application space or agency approval.

B. Each fitting shall be clearly labeled to identify its material code designation, size, DR, name of manufacturer and production codes.

C. HDPE Flange Adaptors

1. Made with sufficient through-bore length to be clamped in a butt-fusion machine and fused directly to pipe or fittings. Short stub end flanges are not permitted.
2. Faced with a concentric or spiral pattern for 1/8" full face gasket installations.

E. Flange Adaptor Backing Rings
1. Epoxy Coated DR-7 Backing Rings shall be used for 2"-3".
2. Shall comply with AWWA C901 IPS pipe diameters and ASME 125/150.
   a. The Contractor shall verify bolt patterns of Backing Rings and the mating flanges.
3. Shall consist of convoluted ductile iron (ASTM A536 65-45-12).
4. Shall be fusion-bonded epoxy coated per AWWA C116, except NSF-61 certification is not required.
5. Bolting materials shall conform to Flange Bolting as Specified by the Agency.

E. Acceptable manufacturers
1. Molded Fittings
   a. Performance Pipe
   b. Integrity Fusion Products
   c. AGRU America
   d. Georg Fischer Central Plastics
2. Fabricated Fittings
   a. Specified Fittings
   b. Plasson USA
   c. Pipestar International (Sweeps)
   d. Georg Fischer Central Plastics
3. Electrofusion Fittings
   a. Integrity Fusion Products
   b. Plasson USA
   c. Strongbridge International
   d. Georg Fischer Central Plastics
4. Flange Adaptor Backing Rings
   a. Improved Pipe Products
   b. Integrity Fusion Products
   c. Specified Fittings
   d. Georg Fischer Central Plastic

2.4 MACHINE

A. Machines utilized to join and repair pipe and fittings shall be obtained from a manufacturer's approved machine supplier with at least 20 years of experience with state and local engineering firms, municipalities, and contractors

B. Datalogging device shall be used to record and document all fusion process in compliance with ASTM F3124 and shall be available to the project owner, agency, and or engineer upon request.
1. Information obtained from the Data Logging device shall include Time, Pressure, Temperature, Joint ID, Operator, and Pipe/Fitting information.

2.5 STANDARDS AND REFERENCES

A. HDPE pipe and fitting manufacturing, installation and fusion shall conform to the following standards as applicable and referenced herein. Unless otherwise noted, the most current revision of the listed standards shall apply.
1. Pipe and Fitting
   a. AWWA C901: Polyethylene (PE) Pressure Pipe and Fittings ¾"-3" (19 mm-76 mm), for Water Service
   b. AWWA C906: Polyethylene (PE) Pressure Pipe and Fittings 4"-65" (100 mm-1,650 mm), for Waterworks

c. ASTM D3035: Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter ¾"-3" (19 mm-76 mm)
d. ASTM F714: Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter 4"-65" (100 mm-1,650 mm)
e. NSF/ANSI 61: Drinking Water System Components – Health Effects
f. ASTM D3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
g. ASTM D3261: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic (Molded) Fittings for Polyethylene (PE) Plastic Pipe and Tubing
h. ASTM F2206: Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, and Sheet, Plate or Block Stock
i. ASTM D2683: Standard Specification for Socket Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
j. ASTM F1055: Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
k. AWWA M55: PE Pipe–Design and Installation, Manual of Water Supply Practices
l. Plastics Pipe Institute (PPI) Handbook of Polyethylene Pipe
m. Pipe Chart, HDPE Potable Water Pipe PE 4710, P & F Distributors

2. Fusion
   a. ASTM F2620: Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
   b. ASTM F3124: Standard Practice for Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings
   c. ASTM F1290: Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
   d. PPI TR-33-12: Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
   e. PPI, MAB-1-2015: MAB Generic Electrofusion Procedure for Field Joining of 12 Inch & Smaller Polyethylene (PE) Pipe
   f. PPI, MAB-2-2017: MAB Generic Electrofusion Procedure for Field Joining of 14 Inch to 30 Inch Polyethylene (PE) Pipe

END OF SECTION