

SECTION 33 05 33

POLYETHYLENE UTILITY PIPE

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. SCOPE:

1. This Specification includes high density polyethylene pipe and fittings, including standards for dimensional, testing, quality, and acceptable fusion practice.

**1.2 REFERENCES**

A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of design, bid, or construction, whichever is earliest. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

C. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

<b><u>REFERENCE</u></b>	<b><u>TITLE</u></b>
<b>ANSI/AWWA C110/A21.10</b>	American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
<b>ANSI/AWWA C111/A21.11</b>	American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
<b>ANSI/AWWA C153/A21.53</b>	AWWA Standard for Ductile-Iron Compact Fittings for Water Service <b>AWWA C651</b> Standard for Disinfecting Water Mains
<b>AWWA C906</b>	Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 in. through 63 in. for Water Distribution and Transmission
<b>ASTM C923</b>	Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
<b>ASTM D3035</b>	Standard Specification for PE Pipe (DR-PR) Based on Controlled Outside Diameter
<b>ASTM D3261</b>	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

<b>ASTM D3350</b> Fittings Materials	Standard Specification for Polyethylene Plastics Pipe and Fittings
<b>ASTM F714</b>	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
<b>ASTM F1055</b>	Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
<b>NSF-14</b>	Plastics Piping System Components and Related Materials
<b>NSF-61</b>	Drinking Water System Components--Health Effects
<b>TR-33</b>	Plastic Pipe Institute – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe

#### 1.4 SUBMITTALS

A. Shop drawings and product data shall be submitted for Piping, Fittings, and Appurtenances. A manufacturer's certification shall be included, certifying that all materials furnished meet applicable standards as specified herein.

B. The following PRODUCT DATA is required from the pipe supplier and/or fusion provider:

1. Pipe Size
2. Dimensionality
3. Pressure Class per applicable standard
4. Color
5. Recommended Minimum Bending Radius
6. Recommended Maximum Safe Pull Force
7. Fusion technician qualification indicating conformance with this specification.
8. Pipe fusion and fusion services warranty information
9. Written procedural documentation for piping products including proper handling and storage, installation, tapping, and testing.
10. Fusion technician qualification indicating conformance with this specification.

C. The following AS-RECORDED DATA is required from the contractor and/or fusion provider to the owner or pipe supplier upon request:

1. Fusion report for each fusion joint performed on the project, including joints that were rejected. Specific requirements of the fusion technician's joint report shall include:
  - a. Pipe Size and Temperature
  - b. Machine Size
  - c. Fusion Technician Identification
  - d. Job Identification
  - e. Fusion Joint Number
  - f. Fusion, Heating, and Drag Pressure Settings
  - g. Heat Plate Temperature

- h. Time Stamp
- i. Heating and Cool Down Time of Fusion
- j. Ambient Temperature
- 2. Approved datalogger device report
- 3. As-recorded Information
  - a. The as-recorded plan and profile will reflect the actual installed alignment and reflect the horizontal offset from the baseline and depth of cover.
  - b. All fittings, valves, or other appurtenances will also be referenced and shown.

### 1.5 FUSION TECHNICIAN REQUIREMENTS

- A. Fusion Technician shall be fully qualified by the pipe supplier to install HDPE pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.
- B. A minimum of 10,000 feet of documented HDPE pipe fusion experience is required (greater than 4 inches in diameter), and shall be supplied to the Engineer.

### 1.6 WARRANTY

- A. The pipe shall be warranted for one year from the date of substantial completion.
- B. In addition to the standard pipe warranty, the fusion services shall be warranted for one year from the date of substantial completion.

### 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site to ensure uninterrupted progress of the Work.
- B. Handle all pipe, fittings, specials, and accessories carefully with approved handling devices. Handling devices shall include ropes, fabric, or rubber-protected slings and straps. Chains, cables, or hooks inserted into the pipe ends shall NOT be used. Two slings spread apart shall be used for lifting each length of pipe. Do not drop or roll material off trucks.
- C. Store pipes and fittings on heavy wood blocking or platforms so they are not in contact with the ground. Pipe supports shall be spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the supports.
- D. Stacking of pipe shall be limited to a height that will not cause deformation of the bottom pipes under anticipated temperature conditions.
- E. All ends of stored piping shall be securely capped/plugged to prevent entry of soil, debris, and vermin.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

A. Pipe shall be made from the same resin meeting the requirements of the Plastic Pipe Institute (PPI) material designation PE 4710 with an ASTM D3350 minimum cell classification of PE 445574C. Pipe shall have a manufacturing standard of ASTM F714. Pipe shall be AWWA C906 unless otherwise specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.

B. The material shall have a minimum Hydrostatic Design Basis (HDB) of 1,600 psi at 73 degrees F.

C. All materials which come in contact with water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.

### **2.2 HIGH DENSITY POLYETHYLENE PRESSURE PIPE**

A. HDPE pipe shall be manufactured in ductile iron pipe sizes (DIPS) and shall conform to AWWA C906 for standard dimensions, as applicable. Testing shall be in accordance with the referenced AWWA standards for all pipe types.

B. HDPE pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.

C. For potable water applications, a permanent identification of piping for potable water use shall be provided by co-extruding longitudinal blue stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed or painted on the outside surface shall not be acceptable.

D. For wastewater applications, a permanent identification of piping for wastewater use shall be provided by co-extruding longitudinal green stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed or painted on the outside surface shall not be acceptable.

E. Pipe shall be marked as follows:

1. Nominal pipe size
2. HDPE
3. Dimension Ratio
4. The letters PE followed by the polyethylene grade in accordance with ASTM
5. NSF-61 mark verifying suitability, when used for potable water service
6. Extrusion production-record code
7. Trademark or trade name
8. PPI material designation

F. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.

## 2.3 CONNECTIONS AND FITTINGS FOR PRESSURE APPLICATIONS

A. Plain end butt fused fittings and electrofusion couplings shall be used when joining polyethylene materials. Mechanical (compression) fittings shall be used only when joining polyethylene materials to different piping materials and approved by the Owner's Representative.

B. The fittings shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added. The fittings shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.

C. Butt fusion fittings: Fittings shall be PE 4710 HDPE, Cell Classification of PE 445574C as determined by ASTM D3350. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans.

D. Electrofusion fittings: Fittings shall be PE 4710 HDPE, Cell Classification of PE 445574C as determined by ASTM D3350. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans.

E. Ductile Iron Fittings: Ductile iron fittings meeting AWWA C110, latest edition may be used. Adequate joint restraint methods are required and shall be submitted to the Owner's Representative for approval.

F. Flanged and Mechanical Joint Adapters: Flanged and Mechanical Joint Adapters shall be PE 4710 HDPE, Cell Classification of PE 445574C as determined by ASTM D-3350. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D-3261. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Joint restraint methods are required to be submitted to the Owner's Representative for approval.

G. Thermal Restraint Fittings: electrofusion thrust restraints with concrete encasement shall be installed along the length of the pipe when no restraint is provided by any other means. Joint restraint may not be sufficient in longer runs of piping where cold flow is more likely to occur. Contractor shall provide thermal restraint in

accordance with the manufacturer's recommendations, subject to the approval of the Owner's Representative.

H. Service Connections: All services shall be installed with saddle fusion, tees with electrofusion joints, or sidewall fusion. No mechanical saddles will be allowed.

## PART 3 EXECUTION

### 3.1 DELIVERY AND OFF-LOADING

- A. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Owner or Owner's Representative.
- B. Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify Owner or Owner's Representative immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color, and type.
- C. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23, and all of the pipe supplier's guidelines shall be followed.
- D. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.
- E. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.
- F. If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to ensure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from trucks.

### 3.2 HANDLING PIPE

- A. Store pipe in a manner that will not result in damage or deformation to the pipe. If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.
- B. Prepare pipe on a relatively smooth surface, free of sharp rocks, sticks or debris. Utilize cribbing, pipe stands, rollers or other equipment as necessary to support the pipe. Pipe shall be stored and stacked per the pipe supplier's guidelines.
- C. Lift and move piping using ropes, slings or straps. Do not use unprotected chains, hooks or clamps to lift pipe.
- D. When lifting and moving pipe, provide a minimum of two points of support. Do not support pipes at butt-fused joints.
- E. Sections of pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and rejoined at the Contractor's expense.
- F. Plug all pipes at end of each workday. Provide a watertight plug to prevent entry of foreign materials into the pipe.
- G. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the Owner or Owner's Representative.

### 3.3 JOINING PIPE

- A. At start of each day, the Contractor shall complete fusion weld tests in accordance with manufacturer's recommendations to verify that fusion equipment is operating properly.
- B. Pipe ends shall be joined using butt fusion methods. Join pipe and fittings using butt fusion or socket or saddle fusion methods. Fusion methods shall comply with both pipe and fusion equipment manufacturers requirements.
- C. Join pipe and mechanical joint or flanged fittings in accordance with both fitting and pipe manufacturer requirements. Provide pipe stiffeners, wedge type retainer glands and clamp type joint restraint system
- D. Pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and  
in accordance with this specification and pipe supplier's guidelines.
- E. Pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.
- F. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.
- G. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:
  - 1. HEAT PLATE -Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.
  - 2. CARRIAGE – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.
  - 3. GENERAL MACHINE -Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
  - 4. DATA LOGGING DEVICE – An approved datalogging device with the current version of the pipe supplier's recommended and compatible software shall be used. Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.
- H. Other equipment specifically required for the fusion process shall include the following:
  - 1. Pipe rollers shall be used for support of pipe to either side of the machine.
  - 2. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's recommendations.
  - 3. An infrared (IR) pyrometer for checking pipe and heat plate temperatures.
  - 4. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.
  - 5. Facing blades specifically designed for cutting the pipe material shall be used.
- I. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be

generated by software developed specifically for the butt-fusion of the pipe material used. The software shall register and/or record the parameters required by the pipe supplier and these Specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report

### 3.4 FUSION JOINTS

A. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite 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 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 psi. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. Contractor shall have at least one person on-site, certified by the pipe manufacturer, to perform butt-fusion welding of the HDPE pipe and electrofusion of the fittings and saddles.

B. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.

C. Mechanical joining will be used where the butt fusion method cannot be used. Mechanical joining will be accomplished by either using a HDPE flange adapter with a Ductile Iron back-up ring or HDPE Mechanical Joint adapter with a Ductile Iron back-up ring.

D. Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

END OF SECTION 33 05 33