

**PART 1: GENERAL**

- 1-1 DESCRIPTION: This specification governs the material, pipe, fittings, joining methods and general construction practice for High Density Polyethylene (HDPE) piping systems.
- 1-2 QUALITY ASSURANCE: References, American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), Federal Specifications (FS), International Standards Organization (ISO), and manufacturer's printed recommendations.

**PART 2: MATERIALS**

- 2-1 PIPE: Pipe shall be manufactured from a PE 3608 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D 3350 with a minimum cell classification of 345464C. Pipe shall have a manufacturing standard of ASTM F 714 and be manufactured by an ISO 9001 certified manufacturer. 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. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
- 2-2 FITTINGS:
- A. BUTT FUSION FITTINGS: Molded butt fusion fittings shall be in accordance with ASTM D 3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. Fabricated fittings shall be manufactured using a McElroy Datalogger to record fusion pressure and temperature. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained as part of the quality control. The fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
- B. ELECTROFUSION FITTINGS: Electrofusion Fittings shall be PE3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350 and be the same base resin as the pipe. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055.

- C. **FLANGED AND MECHANICAL JOINT ADAPTERS:** Flanged and Mechanical Joint Adapters shall be PE 3608 HDPE, Cell Classification of 345464C as determined by ASTM D 3350 and be the same base resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D 3261. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.
- D. **MECHANICAL RESTRAINT:** Mechanical restraint for HDPE may be provided by mechanical means separate from the mechanical joint gasket sealing gland. The restrainer shall provide wide, supportive contact around the full circumference of the pipe and be equal to the listed widths. Means of restraint shall be machined serrations on the inside surface of the restrainer equal to or greater than the listed serrations per inch and width. Loading of the restrainer shall be by a ductile iron follower that provides even circumferential loading over the entire restrainer. Design shall be such that restraint shall be increased with increases in line pressure.  
Serrated restrainer shall be ductile iron ASTM A 536 with a ductile iron follower; bolts and nuts shall be corrosive resistant, high strength alloy steel.  
The restrainer shall have a pressure rating of, or equal to that of the pipe on which it is used or 150 PSI which ever is lesser. Restrainers shall be JCM Industries, Sur-Grip or pre-approved equal.

Nominal Size	Restraint Width	Serrations per inch
4", 6"	1-1/2"	8
8" 10 & 12"	1-3/4"	8

Pipe stiffeners shall be used in conjunction with restrainers. The pipe stiffeners shall be designed to support the interior wall of the HDPE. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed of 304 or 316 stainless steel to the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE. Stiffeners shall be by JCM Industries or pre-approved equal.

### PART 3: EXECUTION

#### 3-1 GENERAL:

- A. **PIPE & FITTINGS:** Size as indicated on the plans. Install as shown in accordance with manufacturer's recommendations.

### 3-2 JOINING:

- A. **BUTT FUSION:** 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 400-450 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. All field welds shall be made with fusion equipment equipped with a McElroy Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records.
- B. **SIDEWALL FUSION:** 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:** Bolted joining may be used where the butt fusion method cannot be used. Flange joining will be accomplished by using a HDPE flange adapter with a ductile iron back-up ring. Mechanical joint joining will be accomplished using either a molded mechanical joint adapter or the combination of a Sur-Grip Restrainer and Pipe Stiffener as manufactured by JCM Industries, Inc. Either mechanical joint joining method will have a ductile iron mechanical joint gland.
- D. **OTHER:** Socket fusion, hot gas fusion, threading, solvents, and epoxies may not be used to join HDPE pipe.
- 3-3 **QUALITY AND WORKMANSHIP:** The pipe and/or fitting manufacturer's production facility shall be open for inspection by the owner or his designated agents with a reasonable advance notice. During inspection, the manufacturer shall demonstrate that it has facilities capable of manufacturing and testing the pipe and/or fittings to the standards required by this specification.
- 3-4 **PIPE PACKAGING, HANDLING & STORAGE:** 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

carriers shall use appropriate methods and intermittent checks to insure the pipe is properly supported, stacked and restrained during transportation such that the pipe is not nicked, gouged, or physically damaged.

Pipe shall be stored on clean, level ground to prevent undue scratching or gouging. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The pipe shall be handled in such a manner that it is not pulled over sharp objects or cut by chokers or lifting equipment.

Sections of pipe having been discovered with cuts or gouges in excess of 10% of the pipe wall thickness shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the heat fusion joining method.

Fused segments of the pipe shall be handled so as to avoid damage to the pipe. Chains or cable type chokers must be avoided when lifting fused sections of pipe. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections.

#### PART 4: CONSTRUCTION PRACTICE

- 4-1 TRENCH CONSTRUCTION: Trenching shall be done in accordance with ASTM D 2774.
- 4-2 EMBEDMENT MATERIAL: Embedment materials shall be Class I, Class II, or Class III materials as defined by ASTM D 2321, Section 5. The use of Class IV and Class V materials for embedment is not recommended and should be done only with the approval of the engineer. Class I crushed stone and Class II well-graded gravels are preferred. The embedment material shall have an installed density of at least 85% Standard Proctor Density through compaction or consolidation.
- 4-3 BEDDING: The pipe bedding shall be constructed in accordance with ASTM D2321, Section 5, Table 2.
- 4-4 HAUNCHING AND INITIAL BACKFILL: Haunching and initial backfill shall be as specified in ASTM D 2774 using Class I, Class II or Class III materials. Materials and compaction shall be specified by the engineer.

#### PART 5: TESTING

- 5-1 GRAVITY PIPELINES: Gravity flow pipelines shall be tested to the requirements and specifications of ASTM F 1473.

- 5-2 PRESSURE PIPELINES: Pressure testing shall be conducted in accordance with ASTM F 2164, Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure. The HDPE pipe shall be filled with water, raised to test pressure and allowed to stabilize. The test pressure shall be 1.5 times the operating pressure at the lowest point in the system. In accordance with section 9.8, the pipe shall pass if the final pressure is within 5% of the test pressure for 1 hour. For safety reasons, hydrostatic testing only will be used.

PART 6: MEASUREMENT AND PAYMENT

- 4-1 HDPE PIPE, FITTINGS AND ACCESSORIES: Payment will be included under the bid item to which the work relates.

END

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