

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The work performed under this section includes, but is not limited to, the supply and installation of High Density Polyethylene (HDPE) Pipe, Tubing and fittings as shown.

1. Provide HDPE pipe and fittings complete with all necessary jointing facilities and materials, specials, mechanical joint adapter kits and other appurtenances required for installation in and completion of the water pipelines to be constructed.
2. Provide HDPE service tubing complete with all necessary jointing facilities and materials, and other appurtenances required for installation in and completion of the water services to be constructed.

A. Related Supplemental Sections:

1. HORIZONTAL DIRECTIONAL DRILLING

1.2 QUALITY ASSURANCE

A. Contractor's Qualifications:

1. CONTRACTOR or SUBCONTRACTOR performing any fusion (heat or electrofusion) on the HDPE pipe shall be able to provide evidence and references for satisfactory service in at least 3 projects of similar pipe diameter and with similar service types. These references may be asked for and approved before the contract is awarded.

1.3 SUBMITTALS

A. Shop drawings and manufacturer's literature for all CONTRACTOR supplied materials shall be promptly submitted to the OWNER for approval.

B. The following items shall be submitted before delivery of HDPE pipe, tubing or fittings:

1. Pipe: SDR11 Certification by the manufacturer that the HDPE material and pipe was manufactured and tested in accordance with American National Standards Institute (ANSI) / American Water Works Association (AWWA), C-906.
2. Service Tubing: Certification by the manufacturer that the HDPE material and tubing was manufactured and tested in accordance with ANSI/AWWA, C-901.

3. All water main piping and components shall be certified for conformance to ANSI / National Sanitation Foundation (NSF) International Standard 14, and NSF Standard 61, Drinking Water System Components – Health Effects, except Section 9, Mechanical Plumbing Product. The piping and components must display the ANSI/NSF 61 seal.
3. Manufacturer's installation instruction and literature to the CONTRACTOR so that manufacturer's recommended procedure and practice of installing pipe and fittings are followed.

1.4 MANUFACTURERS

- A. HDPE Pipe. HDPE pipe shall be as manufactured by Performance Pipe, North American Pipe Company, CSR Poly Pipe Industries, Charter plastics, W. L. Plastics, Flying W. Plastics, J.M. Eagle.

PART 2 PRODUCTS

2.1 PIPE MATERIAL

- A. HDPE Pipe. HDPE pipe shall conform to the latest edition of ANSI/AWWA C901 and C906. Material used in the manufacture of HDPE pipe shall conform to the HDPE Standard Code PE3408. All HDPE pipe SDR11 shall have the same outside diameter as DI pipe.
 1. **Dimensions.** The pipe shall have ductile iron pipe (DIP) equivalent outside dimensions for the nominal size indicated.
 2. **Working Pressure Rating (WPR).** The pipe shall have a wall thickness dimension ratio (DR) 11 for pipe 6-inch through 24-inch in diameter.
 3. **Pipe Identification.** Each pipe length shall be marked in accordance with AWWA C906 and shall be black in color with blue striping.
 4. **Pipe Section Lengths.** Pipe sections proposed to be fused together shall be a minimum of 20 feet in length unless otherwise approved by the OWNER.

2.2 FITTINGS

- A. Pipe Fittings. All standard fittings (tees, bends, etc.) shall be ductile iron conforming to ANSI/AWWA C110/A21. Ductile iron fittings shall be suitable for the 350 pound working pressures unless otherwise noted. The fittings shall be coated with an asphalt coating in accordance with ANSI/AWWA C110/A21.10 and lined inside with cement mortar and seal coated in accordance with ANSI/AWWA C104/A21.4. The cement mortar lining shall be double thickness.

1. All ductile iron fittings shall be connected to the HDPE main by a means of mechanical restraint as noted in Section 2.3. Mechanical Joints, including accessories, shall conform to ANSI/AWWA C111/A21.11. All mechanical joints shall be made with megalugs.

- B. HDPE Fittings. HDPE Fittings shall be made from the same resins and material designations, cell classifications, pressure class (minimum of 160 psi) and dimensions as the HDPE pipe. Permitted HDPE fittings are listed below:
 1. Electrofusion Service Saddle. For service connections to a HDPE main. Saddle must be fused (electrofusion) to the HDPE main, and may NOT be mechanically attached. Saddle shall also accommodate standard City of Carmel Water Utility corporations.
 2. Mechanical Joint Adapters. For mechanical connections on an HDPE mainline. MJ adapters shall be butt fused onto the HDPE main.
 3. Fuse – A Corp. For 1.5” or larger service or connections to a HDPE main.

- C. Stainless Steel Insert/Stiffener. All non fused connections shall require the use of stainless steel inserts inside the end of the HDPE pipe. Inserts shall be as follows:
 1. HDPE Pipe. At HDPE pipe connections to fittings and/or other pipe materials, the inside of the HDPE pipe shall be reinforced by inserting a two piece wedge style stainless steel stiffener/insert. Insert shall be properly sized and approved by the manufacturer for actual HDPE pipe diameter and wall thickness (DR) being utilized.
 2. HDPE Service Tubing. At HDPE pipe connections to fittings and/or other pipe materials, the inside of the HDPE pipe shall be reinforced by inserting a one piece seamless stainless steel insert. Insert shall be properly sized and approved by the manufacture for the actual HDPE tubing diameter and wall thickness being utilized. Insert length should not extend beyond the end of the compression fitting , have one end flared to ensure proper seating into end of HDPE tubing, and be designed for use with compression style connections

2.3 PIPE AND FITTING JOINTING/CONNECTIONS

- A. Butt Fusion. The Butt (or Heat) Fusion technique shall be used to join all HDPE pipe sections and connect HDPE fittings to the HDPE pipe. The joints shall conform to ASTM D2657 and shall be performed in strict accordance with the pipe manufacture’s recommendations. The butt fusion equipment should be capable of meeting all conditions recommended by the manufacturer, including but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 psi. The fusion joining shall produce a joint weld strength equal to or greater than the tensile strength of the pipe itself.

- B. Sidewall Fusion. The Sidewall (or Heat) Fusion technique shall be used to connect HDPE fittings to the HDPE pipe. The joints shall conform to ASTM D2657 and shall be performed in strict accordance with the pipe manufacture's recommendations. The sidewall fusion heating irons shall have an inside diameter equal to the outside diameter of the HDPE pipe and shall be ¼ inch wider than the size of the fitting being attached. The fusion joining shall produce joint weld strength equal to or greater than the tensile strength of the pipe itself.
- C. Pipe Mechanical Joining. Mechanical joining shall be used to make connections to ductile iron fittings and/or non HDPE pipe. Permitted methods of HDPE joining are listed below.
 - 1. HDPE to be joined using HARVEY TYPE ADAPTERS

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation Method

The HDPE pipe shall be installed using the horizontal directional drilling method as per Carmel Utility Standards practices noted below. Locations where pipe material transitions are required i.e. (HDPE/DIP) may be installed by open cut.

B. Pipe Joining

- 1. The HDPE pipe shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint. Threaded or solvent-cement joints and connections are not permitted. All equipment and procedures used shall be used in strict compliance with the manufacturer's recommendations. Fusing shall be accomplished by personnel trained as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.
- 2. Square the pipe ends by using the fusion machine facing tool. In the fusion machine, pipe ends shall meet squarely so that the entire area to be fused is covered. The pipe ends shall make firm contact without applying pressure to the heat plate. The heat plate temperature shall be as required by the pipe manufacturer's recommendations. The melt bead shall be according to pipe diameter and as recommended by the pipe manufacturer. Pipe ends shall be carefully moved away from heat plate once the appropriate melt bead is achieved. The pipe ends shall be joined quickly without slamming. The butt-fused joint shall be true alignment and shall have uniform roll back beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be watertight and

shall have tensile strength equal to that of the pipe. All joints shall be subject to acceptance by the Engineer prior to insertion.

3. All defective joints shall be cut out and replaced at no cost to the Owner. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent (10%) of the wall thickness, shall not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with procedures stated above. In addition, any section of pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the Engineer and/or the project representative shall be discarded and not used.

C. Pressure Testing

1. Under no circumstances shall HDPE pipe be pressure tested when the temperature of the pipe is above 80 degrees Fahrenheit.
2. HDPE pipe holds pressure by developing stress in its walls, thus the pipe will increase slightly in diameter when under high pressures. The procedure for pressure testing HDPE main should take in account the expansion of the HDPE main. The recommended procedure is to:
 - a. Initially pressurize the main to the standard test pressure (150 psi) and let a majority of the main expansion take place, which should occur in 2 – 3 hours.
 - b. After the above expansion time period, the main should be pressurized again to test pressure (150 psi) and the Pressure Test is conducted for the two (2) hour period. The HDPE pipe will continue to expand during the test itself and the following table contains maximum allowances for this expansion.

Allowance for Expansion under Test Pressure

(U.S. Gallons per 100 ft. of pipe)

NOMINAL PIPE DIA.	TWO HOUR TEST
4	0.25
6	0.60
8	1.00
12	2.30

3. Under no circumstances shall the HDPE main remain under test pressure (125 psi) for longer than eight (8) hours. If the test is not completed due to leakage, equipment failure, etc., the HDPE shall be allowed to “relax” for eight (8) hours prior to re-testing.

HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. The work specified in this Section documents the approved construction methods, procedures, and materials for Horizontal Directional Drilling (HDD).

1.2 QUALIFICATIONS

- A. The contractor or sub-contractor performing the HDD work shall be a company that has been in continuous operation in this area of work for at least three (3) years.
- B. The contractor or sub-contractor shall have performed at least five (5) HDD projects of similar pipe diameter and length in the last three (3) years.

PART 2 PRODUCTS

2.1 MATERIALS

- A. See Related Sections for pipe materials approved for the project.

2.2 EQUIPMENT REQUIREMENTS

- A. The Contractor shall ensure that appropriate equipment is provided to facilitate the installation. Equipment shall be matched to the size of pipe being installed and shall have appropriate torque and thrust/pullback capacity for the diameter and length of the intended drilling sections. The Contractor will ensure that the drill rod can meet the bend radius required for the proposed installation.

2.3 DRILLING FLUIDS

- A. A mixture of bentonite clay or other approved slurry and potable water shall be used as the cutting and soil stabilization fluid. The viscosity shall be varied to best fit the soil conditions encountered. Water shall be clean and fresh. No other chemicals or polymer surfactant is to be used in the drilling fluid without the written consent of the Engineer and after a determination is made that the chemicals to be added are not harmful or corrosive to the facility and are environmentally safe.

- B. The Contractor shall identify the source of fresh water for mixing the drilling mud. The Contractor shall be responsible for approvals and permits required for such sources as streams, rivers, ponds, or fire hydrants. Any water source other than potable water may require a pH Test.
- C. Monitoring of the drilling fluids such as the pumping rate, pressures, viscosity, and density is required during the pilot bore, back reaming, and pipe installation stages, to ensure adequate removal of soil cuttings and the stability of the bore hole. Relief holes can be used as necessary to relieve excess pressure down hole. To minimize heaving during pullback, the pull back rate is determined in order to maximize the removal of soil cuttings without building excess down hole pressure. Excess drilling fluids shall be contained at entry and exit points until they are recycled or removed from the site. Entry and exit pits shall be of sufficient size to contain the expected return of drilling fluids and soil cuttings.
- D. The Contractor shall ensure that all drilling fluids are disposed of or recycled in a manner acceptable to the appropriate local, state, or federal regulatory agencies. When drilling in suspected contaminated ground, the drilling fluid shall be tested for contamination and disposed of appropriately. Any excess material shall be removed upon completion of the bore.
- E. Restoration for damage to any transportation facility or non-transportation facility caused by heaving, settlement, escaping drilling fluid (fracout) or the directional drilling operation, is the responsibility of the Contractor. Any pavement heaving or settlement damage requires restoration/replacement of the pavement per applicable City standards.

PART 3 EXECUTION

3.1 GENERAL CONSTRUCTION REQUIREMENTS

- A. The pipe shall be installed in the location and to the line and grade designated on the drawings.
- B. Provide for testing and cleanup as soon as practicable, so these operations do not lag far behind pipe installation. Perform preliminary cleanup and grading operations immediately after backfilling.
- C. All surfaces shall be finish graded to original contours and ground cover.
- D. All materials delivered to the project shall be neatly stored. Excavated material, which is not removed from the immediate work site, shall be stockpiled so as to cause as little inconvenience to the property owners as possible. Driveways and street crossings must be kept clear.
- E. Excavation for entry, recovery pits, slurry sump pits, or any other excavation shall be carried out in accordance with City Standard Specifications for applicable work. Sump areas or holding tanks are required to contain drilling fluids.

F. After completing installation of the product the work site shall be restored. The work site shall be cleaned of all excess slurry left on the ground. Removal and final disposition of excess slurry or spoils as the product is introduced shall be the responsibility of the CONTRACTOR.

G. Excavated areas shall be restored in accordance with the City Standard Specifications. The cost of restoring damaged pavement, curb, sidewalk, driveways, lawns, storm drains, landscape, and other facilities is borne by the CONTRACTOR.

H. If underground utilities and/or structures not shown on the Drawings are encountered, notify the OWNER and do not proceed until instructions are obtained. Notify the OWNER if springs or running water are encountered.

3.2 SPECIFIC REQUIREMENTS

A. Back Ream Hole Diameter

The back ream hole diameter shall be no greater than the sum of the maximum product outside diameter (OD) plus six inches (6").

B. Testing

When there is any indication a pipe has sustained damage and may leak, the work is to be stopped and the damage investigated. The City may require a pressure test. The testing may consist of one of the following methods but shall always meet or exceed City's testing requirements:

1. Manufacturer's pressure testing recommendations for the type of pipe being installed are followed. The City's Representative shall be notified and be present during the test for review of the test results for compliance. The pressure test shall be performed within twenty-four (24) hours. A copy of the test results shall be furnished to the City's Representative. If the pipe is not in compliance with specifications, the City may require it to be filled with flowable fill.
2. Product carrier pipes installed without a casing must meet pressure requirements set by the Owner. A copy of the test results shall be furnished to the City's Representative. If the pipe is not in compliance with specifications the City may require it to be filled with flowable fill.

C. Locating and Tracking

The Contractor shall describe the method of locating and tracking the drill head during the pilot bore. The City recognizes walkover, wire line, and wire line with surface grid verification, or any other system as approved by the Engineer, as the accepted methods of tracking directional bores. The locating and tracking system

shall be capable of ensuring that the proposed installation is installed as intended. The locating and tracking system shall provide information on:

1. Clock and pitch information.
 2. Depth.
 3. Battery status.
 4. Position (x,y).
 5. Azimuth, where direct overhead readings (walkover) are not possible (i.e. subaqueous or limited access transportation facility.)
 6. Alignment readings or plot points shall be taken and recorded every five (5) feet.
 7. Before commencement of a directional drilling operation, proper calibration of the equipment (if required) shall be undertaken.
- D. All facilities shall be installed in such a way that their location can be readily determined by electronic designation after installation. For non-conductive installations this shall be accomplished by attachment of tracing wire, as per City of Carmel Technical Specifications.

3.3 QUALITY CONTROL

- A. A representative of the Contractor must be in control of the operation at all times. The representative must have a thorough knowledge of the equipment and the procedures to be performed, and must be present at the job site during the installation.
- B. The City must be notified forty-eight (48) hours in advance of starting work. The installation shall not begin until the City's representative is present at the job site and agrees that proper preparations have been made.

3.4 TESTING AND CLEANUP

- A. Provide for testing and cleanup as soon as practicable, so these operations do not lag far behind pipe installation. Perform preliminary cleanup and grading operations immediately after backfilling.
- B. All surfaces shall be finish graded to original contours and ground cover.
- A. All surplus excavated material shall be disposed of off-site in a legal manner by the Contractor.