

SECTION 33 11 00.13**HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS****PART 1: GENERAL**

1.01 SECTION INCLUDES

Furnishing and installing up to 16-inch high density polyethylene (HDPE) pipe and fittings for water distribution, wastewater collection, force mains, service lines, and transmission mains.

1.02 SUBMITTALS

Submit manufacturer's product data, installation instructions, and certification for all materials to be furnished in accordance with Section -Submittals. Submit classification and gradation test results for materials to be used for pipe embedment and backfill.

PART 2: PRODUCTS

2.01 MATERIALS

- A. Products supplied under this Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation the Contractor identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify AW immediately. Stop installing piping in the area of suspected contamination until direction is provided by the AW Project Manager.
- B. Pipe and fittings shall be made from the same resin meeting the requirements of the PPI material designation PE 3408 with an ATSM D3350 minimum cell classification of PE 345464C.
- C. The material shall have a minimum Hydrostatic Design Basis (HDB) of 1,600 psi at 73 degrees F.
- D. All materials which come in contact with water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.

2.02 PIPE

- A. All pipe and fittings shall be manufactured in ductile iron pipe sizes (DIPS) only in accordance with AWWA Standard C906.
- B. The pipe 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 pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.
- C. Permanent identification of water piping service 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. The nominal pipe diameter is specified on the Drawings. The DR (dimension ratio) and the pressure rating of the pipe shall be as noted on the Drawings.
- E. The minimum pressure rating will be 200 psi.
- F. HDPE may be deflected subject to approval by AW. The following table shows maximum deflection based upon the allowable strain of the pipe wall. Potential flow restrictions, surge and other non-trench stability and pipe strain issues may reduce the values shown here per the AW Project Manager recommendations. The bend radius multiplier determines the minimum radius of the pipe curvature and is calculated by multiplying the outside diameter of the pipe by the multiplier from the appropriate DR used. Bending radius allowed by the manufacturer can vary. Verify the multiplier with the manufacturer. In no case shall the radius be less than 125% of the manufacturer's permitted multiplier.

HDPE pipe Dimension Ratio (DR)	Allowable deflection (percent)	Bend Radius Multiplier
32.5	8.1	50
26.0	6.5	45
21.0	5.2	40
19.0	4.7	37.5
17.0	4.2	32.5
15.5	3.9	30
13.5	3.4	27.5
11.0	2.7	25

2.03 FITTINGS

- A. Plain end butt fused fittings 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 AW.
- 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 shall comply with ASTM D3261.
- D. Mechanical (compression) fittings used with polyethylene pipe shall be specifically designed for, or tested and found to be acceptable for, use with polyethylene pipe.

PART 3: EXECUTION

3.01 PACKAGING, HANDLING, AND STORAGE

- A. The manufacturer shall ensure that the interior of all pipe is clean and install plastic cleanliness plugs in all pipes to keep the pipe interiors clean. The manufacturer shall package the pipe in a manner designed to ensure that it arrives at the project neat, clean, intact, and without physical damage. The transportation carrier shall use appropriate methods and intermittent checks to assure that the pipe is properly supported, stacked, and restrained during transport such that the pipe is not nicked, gouged, or physically damaged.
- B. Inspect pipe and appurtenances for defects prior to installation in the trench. Set aside defective, damaged or unsound material and hold material for inspection by AW.
- C. 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.

- D. 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 by butt fusing or the use of electrofusion fittings.

3.02 PIPE INSTALLATION

- A. Refer to Section - Piping - General Provisions and referenced drawings that are part of these Contract Documents. Trenching shall be performed in accordance with Section - Excavation Backfill and Compaction for Utilities and embedment materials shall be in accordance with Section - Utility Backfill Materials.
- B. Remove all dirt and foreign matter from pipe before lowering into the trench. Do not place debris, hand tools, clothing or other materials in the pipe. Keep pipe clean during and after laying.
- C. Maximum pipe bending radius shall be in conformance with the manufacturer's recommendation for the specific diameter and dimension ratio (DR) of the pipe. Whenever possible, changes in direction shall be accomplished by bending the pipe in lieu of installing a fitting, except as approved by AW Project Manager.
- D. Place tracer wire in accordance with Section – Tracer Wire. The wire shall be contiguous except at test stations, valve boxes, and where splicing is required. All splices shall be encased. Wire insulation shall be highly resistant to alkalis, acid and other destructive agents found in soil.
- E. Prevent flotation of sealed pipe during work stoppages.
- F. HDPE pipe will not be employed with directional drilling through rock and other abrasive conditions unless it is encased.

3.03 PIPE AND FITTING JOINING

- A. Butt fusion procedures shall be in accordance with the manufacturer's recommendations. Surfaces must be clean and dry before joining. The fusion equipment operator shall be fully trained in the use of the respective equipment, and certified/qualified in accordance with the requirements of the manufacturer's recommendations. The wall thicknesses of the adjoining pipes shall have the same DR at the point of fusion.
- B. Butt fusion equipment shall be equipped with a Data Logger to record and document key parameters of each fusion process including heater

temperature, fusion pressure, melt time, hold time, etc. Information from the Data Logger shall be collected and filed daily. A record of each fused joint including a graph of the fusion cycle shall be submitted to AW Project Manager.

- C. The temperature of the heating tool surfaces shall be monitored daily with a temperature measuring device, such as, a thermometer or temperature indicating crayons, to assure the temperature measuring device on the equipment is in sound working condition and that the appropriate temperature range is maintained.
- D. Each HDPE joint shall be traceable to the fusion operator and equipment. Also, the fusion joint number and fusion operator ID shall be stenciled on the pipe.
- E. Mechanical (compression) joining of pipe and fittings is only permissible when joining polyethylene pipe to unlike materials. HDPE stiffeners shall be utilized with all mechanical (compression) fittings. Blocking must be provided at changes in direction for any mechanical fittings. Use of positive restrained joints fittings (non-friction type) is permissible when approved by AW Project Manager.

3.04 SERVICE CONNECTIONS

- A. Sidewall fused polyethylene hot-tapping tees shall be used for $\frac{3}{4}$ -inch and 1-inch service lines off mains 3-inches to 12-inches in diameter. For larger sized mains, polyethylene service saddles may be used, sidewall fused, and then tapped with a tapping tool or machine.
- B. For large mains (>12-inch), mechanical clamps or tapping saddles may be used provided they are designed for HDPE pipe and acceptable to the manufacturer of the pipe.

3.05 INCLEMENT WEATHER

- A. In inclement weather and especially in windy conditions, the fusion operation shall be shielded to avoid precipitation and excessive heat loss from wind chill.
- B. Butt, saddle or socket, fusion is not recommended below -4°F without special provisions such as a portable shelter or trailer or other suitable protective measures with auxiliary heating. When making a butt fusion joint with the ambient temperature below 3°F, the pipe ends shall be pre-heated using a heating blanket or warm air device to elevate the pipe temperature to improve the heating cycle starting condition.
- C. The heating tool shall also be stored in an insulated container to prevent excessive heat loss. Contractor shall remove all frost, snow or ice from the OD and ID of the pipe; all surfaces must be clean and dry prior to fusing.
- D. The time required to obtain the proper melt may increase when fusing in cold weather. Contractor shall maintain the specified heating tool surface temperature during the fusion process.
- E. The proper cycle time for any particular condition shall be determined by making a melt pattern on a piece of scrap HDPE pipe using the recommended standard heating time. If the melt pattern is incomplete, the Contractor shall increase the heating time by three (3) second intervals until a complete melt pattern is established. Each time the procedure is repeated, a new piece of scrap pipe shall be used.

3.06 VISUAL INSPECTION

- A. The Contractor shall perform visual examination of HDPE piping installations to satisfy that they conform to the applicable assembly and erection requirements including: alignment, routing, elevation, cuts or gouges exceeding 10% of wall thickness, flanged joints, bolting torque, bolt length, gaskets, and supports (if applicable.)
- B. All fused joints shall be examined by in-process examination for cleanliness, joint preparation, alignment, plate temperature, melt, joining, holding pressure and time, bead size (uniformly rounded and consistent in size all around the joint), storage of joining materials, and appearance of the finished joint.

3.07 BACK BEND TEST

- A. The Contractor shall perform a bend back test on a HDPE fusion joint to detect the presence of a 'cold fusion' on a weekly basis.
- B. The Contractor shall cut out a section of pipe with the butt-fusion joint at the center. The cut out section shall be at least two feet long, one foot on each side of the fusion joint. The Contractor shall cut out four one-inch wide straps lengthwise across the fusion joint. These cut out straps shall be located 90 degrees apart around the circumference of the pipe. Each strap shall be held at or near the ends and bent so that the inside wall faces outwards to obtain a smooth bending radius.
- C. A fusion joint shall be considered good if none of the straps break. Further, if one out of the four straps breaks, a fifth strap shall be cut from an area of the pipe near to which the broken strap was cut. If this strap does not exhibit break then the strap is considered good. Records shall be kept regarding where strap was cut as failures occurring in a consistent location can be an indication of fusion equipment problem. A very smooth break will indicate that cold material was brought together during the fusion process.
- D. The result of each bend back test shall be recorded and submitted to AW Project Manager for review.
- E. As an alternative to the back bend test, the contractor has the option of testing the tensile strength of the butt fused joint in accordance with ASTM D638. A specimen of pipe cut across the buff fused joint shall be used for this test.

3.08 PRESSURE TESTING AND DISINFECTION

- A. Pressure testing shall be conducted in accordance with the manufacturer's recommended procedure or as recommended by AW. Pressure testing shall use water as the test media. Pneumatic (air) testing is prohibited. Air must be completely removed before pressure testing. Under no circumstances shall HDPE pipe be pressure tested when the temperature of the pipe is above 80 °F.

END OF SECTION 33 11 00.13