

ITEM 13

HIGH DENSITY POLYETHYLENE PIPE

1.0 DESCRIPTION. The Contractor shall furnish high density polyethylene (HDPE) pipe in accordance with these material specifications.

2.0 SUBMITTALS. The contractor shall submit the following information:

A. Reference Standards. Latest revisions:

1. ANSI/AWWA C906.
2. ANSI/AWWA C901.
3. ASTM D3350.
4. ASTM D3261- Butt Heat Fusion PE Fittings for PE Pipe & Tubing
5. ASTM D3035 - Standard Spec for PE Pipe Based on Controlled Outside Diameter
6. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based On Outside Diameter
7. ASTM F2620.

B. Shop Drawings.

1. All shop drawings submitted electronically for review and approval shall be returned within two weeks either approved or marked up for further design.
2. After examination of such drawings by the Engineer and the return thereof, the Contractor shall make such correction to the shop drawings as have been indicated and shall furnish the Engineer with electronic corrections.
3. Shop drawings shall be complete in details and indicate all materials as specified herein, including:
 - a. Pipe size.
 - b. Dimensionality.
 - c. Pressure Class per applicable standard.
 - d. Color.
 - e. Recommended minimum bending radius.
 - f. Recommended maximum safe pull force.
4. Manufacturer's catalog or general web-site information will not be sufficient to fulfill shop-drawing requirements.
5. Post-construction submittals, "as-recorded" data:
 - a. Fusion joint documentation containing the following:
 - i. Pipe size and thickness.
 - ii. Machine size.
 - iii. Fusion technician identification.
 - iv. Job identification.
 - v. Fusion joint number.

- vi. Fusion, heating, and drag pressure settings.
- vii. Heat plate temperature.
- viii. Time stamp.
- ix. Heating and cool down time of fusion.
- x. Ambient temperature.

C. Calculations. This section is not applicable.

D. Certifications.

1. Certification of Compliance for HDPE:
 - a. Obtained from the pipe manufacturer, stating that all HDPE pipe and associated fittings have been manufactured and tested in accordance with these specifications and the current standards.
 - b. Submit results of factory testing and inspection regardless of whether or not they were witnessed by the Engineer.
2. Certificates of Qualification for fusing HDPE:
 - a. Certification from pipe and/or the fusion machine manufacturer that Contractor is qualified to join, lay, and handle pipe.
 - b. Certificates of qualification for persons to be fusing HDPE pipe to verify that persons fusing pipe shall be certified under 49 CFR and have a minimum of 2 years of experience with fusing pipe of eight (8) inches or larger diameter.
 - c. Experience and training record of persons to be fusing.
 - d. Submit written certification from the pipe manufacturer and/or fusion machine manufacturer from a test-based certification program that the fusion technician has received training in the proper use of the fusion equipment and pipe/fusion machine manufacturer's recommended fusion procedures.
 - e. Written certification shall be submitted for each technician working on the project.
 - i. Technicians shall not be permitted to work on the project until proper certification is received.
 - f. Training or requalification shall have been obtained within 12 months prior to beginning work on the project.
 - g. The Contractor shall perform trial fusion welds and submit samples to the SCMSD for review prior to installation of the pipe.
 - i. Full penetration welds shall provide homogenous material across the cross section of the weld.
 - ii. The fusion machine employed for the trial welds shall be the same machine to be utilized for the installation work.

3.0 MATERIALS. Only materials approved by the Stark County Metropolitan Sewer District may be used for this project.

A. HDPE Pipe – General.

1. All piping shall be ductile iron pipe size (DIPS) and made from resin compound conforming to cell classification PE4710 per ASTM D3350.
2. All pipe shall have a minimum dimension ratio (DR) 11 and Pressure Class 200 psi, with the ends being designed for one of the joint types as specified herein.
3. Testing and inspection of pipe supplied under this specification shall be as set forth in AWWA C906.
4. Pipe shall be marked as follows:
 - a. Nominal pipe size.
 - b. Dimension Ratio, Standard Dimension Ratio, or Schedule.
 - c. ASTM D1248 followed by the hydrostatic design basis of psi (e.g., PE 4710);
 - d. Extrusion production-record code and AWWA/ASTM standard designation number.
 - e. Trademark or manufacturer name.
 - f. Cell Classification may also be included.
5. Pipe shall be manufactured with 100% virgin resin.
 - a. Pipe shall also have no recycled plastics content.
 - b. Pipe shall not consist of any rework compound, even that obtained from the manufacturer's own production using the same formulation.
6. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.
7. Uniformity shall be met as commercially practical in color, opacity, density, etc.
8. All HDPE pipe shall be black in color with green permanent stripes extruded into the outer pipe length. All pipe and fittings shall be approved by the Engineer.
9. The Sanitary Engineer, at his option, may send his inspector to observe the manufacture and testing of materials supplied for this specification and, as such, the manufacturer shall give ample notice of a production run.
10. Density - The density shall be 0.947-0.964 gms/cc when, tested in accordance with ASTM D1505.
11. Melt Flow - Melt Flow shall be no greater than 0.11 gms/10 min. When tested in accordance with ASTM D1238 - Condition E.
12. Flex Modulus - Flex Modulus shall be greater than 110,000 psi when tested in accordance with ASTM D790.
13. Tensile Strength at Yield - Tensile strength at yield shall be greater 3,200 psi when tested in accordance with ASTM D638.
14. Slow crack growth shall be greater than 500 hours when tested in accordance with ASTM F1473.
15. Hydrostatic Design Basic shall be 1,600 psi at 23° C when tested in accordance with ASTM D2837.
16. Fittings: . The fittings supplied under this specification shall be molded from a polyethylene compound having a cell classification equal to or exceeding the cell classification of the pipe supplied under this specification.

- a. Molded and Fabricated Fittings; All molded fittings and fabricated fittings shall be ductile iron pipe size (DIPS), fully pressure rated to match the pipe SDR pressure rating to which they are made.
- b. All fittings shall be molded or fabricated by the manufacturer. No Contractor fabricated fittings shall be used unless approved by the Engineer.
- c. The manufacturer of the HDPE pipe shall supply all HDPE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the Drawings and specified herein.
- d. All fittings shall be installed using butt fused fittings, thermo-fused fittings/ couplings, or flanged adapters and must be approved by the Engineer. Taps shall be per plan.
- e. All transition from HDPE pipe to ductile iron or PVC shall be made per the approval of Engineer and per the HDPE pipe manufacturer's recommendations and specifications. Stiffeners are required with flange restraints.
- f. Unless otherwise directed by the Engineer and in gravity pipe applications, pipe of dissimilar materials shall be connected with stainless steel shielded sewer couplings.
- g. Gaskets shall meet ASTM C1173-91, 300 Series stainless steel shear ring with a minimum thickness of 0.012", 316 grade stainless steel nut and bolt tightening clamps, shear ring and clamps to meet all requirements of ASTM A167.
- h. Transitional sizes shall utilize a one-piece gasket.
- i. Stainless steel sewer coupling shall be manufactured by: Mission Rubber Company MR Series, Fernco Inc. RC Series, or Engineer-approved equivalent.
- j. Electrofused fittings: The Contractor shall follow the electrofusing instructions as outlined by the manufacturer.
 - i. The instructions shall be communicated to the engineer for review.
 - ii. If the manufacturer of the electrofused fittings includes a bar code for instructions and electrofuser programming, the Contractor shall use this method to install all fittings.
- k. The Contractor shall at a minimum address the following:
 - i. The pipe is round and the ends are squarely cut.
 - ii. The pipe is scraped and degreased to ensure no contaminants or oxidation products will inhibit the weld.
 - iii. The pipe is properly aligned and clamped.
 - iv. The fusion instructions are followed according to the fitting manufacturer including fusion time, voltage and cooling time.

B. HDPE Pipe (for either HDD or Open-Cut Installation).

1. Pipe shall be manufactured by:
 - a. PLEXCO Division of Chevron Chemical Company,
 - b. DRISCOPIPE as manufactured by Phillips Products Co., Inc.,
 - c. ISCO pipe as manufactured by ISCO Industries,
 - d. SCLAIRPIPE as manufactured by Dupont of Canada.
 - e. Charter Plastics as manufactured by Charter Plastics, Inc.

- f. Engineering approved equal.
- 2. Pipe shall be extruded with plain ends.
 - a. The ends shall be square to the pipe and free of any bevel or chamfer.
 - b. There shall be no bell or gasket of any kind incorporated into the pipe.
- 3. Pipe lengths shall be assembled in the field with butt-fused joints. ASTM D2657 and the pipe manufacturer's written instructions shall apply.
- 4. Pipe shall be manufactured in a standard 20', 30', or 40' nominal lengths. For gravity applications, where approved, 20' maximum lengths shall be installed.

C. Tracer Wire.

- 1. Shall be Snakebite by Copperhead Industries, LLC or approved equal.
- 2. Provide for installation of two (2) direct drilling/bore tracer wires.
 - a. One (1) primary and one (1) duplicate/secondary.
- 3. Tracer wire shall be direct burial #12 AWG Solid (0.0808" diameter) hard drawn solid extra-high-strength copper clad steel core conductor horizontal drill tracer wire with a 30-volt rating and minimum 30 mil HDPE insulation jacket thickness complying with ASTM D1248 as manufactured by Copperhead or approved equal.
- 4. THHN wire shall not be approved for tracer wire.
- 5. Tracer wire shall have 21% conductivity and an average wire tensile break load of 1150 lb. minimum.
- 6. Tracer wire color shall be green.
- 7. Tracer wire shall be a single continuous wire from access point to access point except where approved for spliced in repairs or replacement connections.
- 8. All engineering approved spliced in connections or replacement connections shall be made with moisture displacement connectors by same manufacturer.
- 9. Tracer wire accessories shall include:
 - a. Access Points at every termination of the wire, each access point shall include:
 - i. Two terminal light duty switchable lid (ground switch) attached to a companion base.
 - ii. Locking cover.
 - iii. Encapsulated magnet to facilitate detection.
 - iv. Lid color shall be green.
 - v. Both lid and base shall be non-corrosive.
 - vi. Ground switch when "off" may be used to ground locator transmitter.
 - vii. Set screws shall be used to secure all wire and anti-corrosion gel shall be supplied to protect all electrical connections.
 - b. Grounding rods in the quantity and locations as determined by the tracer wire manufacturer.
 - i. Grounding rod shall be capped with a non-corrosive material and include at least 20 feet of approved tracer wire for grounding.
 - ii. A connector shall be supplied for splicing, filled with a non-hardening, dielectric, moisture displacing silicon for corrosion protection.
 - c. Waterproof connectors as necessary to prevent cutting the main tracer wire.

- d. Accessory products shall be supplied by the same manufacturer as the tracer wire.

D. Polyethylene Tape Marker.

1. The contractor shall furnish 3" wide printed polyethylene blue "SEWER" tape where open-cut installation is utilized.

4.0 EXECUTION.

A. Pipe Installation. Refer to Item 18 – Horizontal Directional Drill or Item 15 Open Cut Pipe Installation.

B. Fusion Process.

1. Fusible 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 recommendations.
2. Fusible pipe will be fused by qualified fusion technicians, as documented by the pipe supplier.
 - a. Training records for qualified fusion technicians shall be available to the Engineer upon request.
3. Each joint fusion shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine.
 - a. Joint data shall be submitted as part of the "as-recorded" information, in accordance with this specification.
4. The fusible pipe will be installed in a manner so as not to exceed the recommended bending radius.
5. Where pipe is installed by pulling in tension, the recommended Safe Pulling Force, according to the pipe supplier, will not be exceeded.
6. Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process.
 - a. Fusion machines must incorporate the following properties, including the following elements:
 - i. Heat plates shall be in good condition with no deep gouges or scratches within the pipe circle being fused.
 - ii. Plates shall be clean and free of any contamination. Heater controls shall properly function, and cord and plug shall be in good condition.
 - iii. 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 recommendations.
 - iv. Carriage shall travel smoothly with no binding at less than 50 psi.
 - v. Jaws shall be in good condition with proper inserts for the pipe size being fused.
 - vi. Insert pins shall be installed with no interference to carriage travel.

- vii. Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
 - viii. The machine shall be equipped with an electric or gasoline engine powered facing unit to square and trim the pipe ends smooth and provide full surface contact with the heating plate.
 - ix. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled with a temperature gauge and be capable of maintaining 500°F with a tolerance of 10°F. Fusion temperature shall be as recommended by the pipe manufacturer.
7. Joint strength shall be equal to or greater than the tensile strength of the pipe and shall indicate a ductile rather than brittle fracture when tested.

C. Data Logger.

- 1. The current version of the pipe supplier's recommended and compatible software shall be used.
- 2. Protective case shall be utilized for the hand-held wireless portion of the unit.
- 3. Datalogger operations and maintenance manual shall always be with the unit.
- 4. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

D. Other Equipment.

- 1. Other equipment specifically required for the fusion process shall include the following:
 - a. Pipe rollers shall be used for support of pipe to either side of the machine.
 - b. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement and /or windy weather.
 - c. Fusion machine operations and maintenance manual shall always be kept with the fusion machine.
 - d. Facing blades specifically designed for cutting HDPE pipe.
 - e. The heater plate shall be equipped with suitable means to measure the temperature of plate surfaces and to assure uniform heating such as thermometers or pyrometers.
 - f. External and Internal Bead removers shall be McElroy Manufacturing, Inc. or equal.

E. Joint Recording.

- 1. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.
- 2. The fusion data logging and joint report shall be generated by software developed specifically for the fusion of pipe.
- 3. The software shall include pipe based dimensional data and pipe based interfacial pressure relationships.

4. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

5.0 ELECTRICAL. This section is not applicable.

6.0 QUALITY ASSURANCE. The items covered under this section of the Specification is intended to be the materials as described above. All material used on this project shall be new and unused unless otherwise specified and all workmanship shall be of the best quality.

A. Testing.

1. Hydrostatic testing; Hydrostatic or low pressure air-testing of projects will be conducted as the project is being installed. This includes but is not limited to, all mainline between structures, future mainline stubs, and laterals.
2. The contractor shall be responsible for furnishing all equipment and labor for the hydrostatic or low pressure air test at no additional cost to the County.
3. Hydrostatic shall be in accordance with SCMSD Appendix "B".
4. For gravity lateral applications, where directed by the SCMSD, CCTV in accordance with Item 40 may be required by the Contractor.

B. Observation.

1. SCMSD designated representative will visually observe the work performed. The representative will notify the Engineer of any discrepancies with the contract documents in the course of the contractor performing the work. The progress observations by the SCMSD do not waive any rights or remedies, nor divest the Contractor of any responsibility for contract compliance or liability for damage.
2. All pipe will be subject to inspection and approval by the County after delivery of material to the job site. Any pipe or fittings found to be unsatisfactory or otherwise damaged shall not be approved for use, returned and replaced at the Contractors expense.

C. Warranty.

1. The Contractor shall guarantee all materials and workmanship for a period of one (1) year from the acceptance of the piping after successfully passing all testing requirements above.
2. The Contractor, at their costs, shall be responsible to repair any defects or failures, due to workmanship reported to the Contractor after the testing procedures and/or within the one (1) year warranty period.
3. All repairs shall be made within one (1) week of notification of said defect/failure.
4. In addition to the one (1) year warranty as specified above the Contractor shall provide a two (2) year maintenance bond on the entire system equal to the amount of the Contract.

7.0 MEASUREMENT. This section is not applicable.

8.0 PAYMENT. The unit price stipulated for provision of all labor, material, and equipment necessary for HDPE pipe installation, as specified herein shall be as follows:

<u>Item</u>	<u>Unit</u>	<u>Description</u>
13	EA	6" HDPE House Assembly
13	LF	—" HDPE Force Main

END OF SECTION