SECTION 02300
POLYETHYLENE PIPE INSTALLATION
FOR WATER, GAS AND WASTEWATER

PART 1 GENERAL

1.01 DESCRIPTION

Work Includes fusion and installation of 1" through 16" medium and high density polyethylene services and mains, all appurtenances and all related equipment and fittings in accordance with the requirements of the Contract Documents.

RELATED WORK

A. Section 02200 Excavation, Backfill, Restoration and General
B. Section 02660 Water Distribution System
C. Section 02685 Natural Gas Distribution system
D. Section 02734 Sanitary Sewer Lateral
E. Section 02735 Polyethylene Sewer Pipe

1.02 POLYETHYLENE PIPE

Gas: 2406 medium density polyethylene (MDPE). Pipe wall thickness shall be SDR 11.5 for 1" CTS, SDR 11 for 2" IPS and SDR 13.5 for 4" through 8" IPS pipe. Refer to Section 2685 of these Standards for additional requirements.

Water: 4710 high density polyethylene (HDPE). Pipe wall thickness shall be SDR 9 for 2" IPS pipe and SDR 11 for 4" through 16" IPS pipe. Refer to Section 2660 of these Standards for additional requirements.

Wastewater: 3408 or 4710 high density polyethylene (HDPE). Pipe wall thickness shall be SDR 17. Refer to Section 2735 of these Standards for additional requirements.

1" CTS and 2" IPS pipe shall be supplied in coils. The coils shall be furnished in either 500 or 1000 foot lengths specified at the time of order (2" straight 20' or 40' lengths can be used for shorter services and connections). Pipe 4" IPS through 16" IPS shall be supplied in 40 foot or longer straight lengths. Straight lengths shall consist of a single length of pipe without couplings or any intermediate joints.

Pipe markings shall be in a color that contrasts with that of the pipe and space at intervals not exceeding 2 feet. All required markings shall be legible and so applied as

to remain legible under normal handling and installation practices. These markings shall consist of the Utility (GAS, WATER or SEWER), the designation (ASTM D2513-gas, ASTM D3350 – water and wastewater), ANSI/AWWA C906 and Cell Classification 445574E for water pipe, the manufacturer's name or trademark, the nominal pipe or tubing size (including the sizing system used, such as, IPS, CTS or OD), the type of material, SDR number, the month and year of manufacture, and identification of resin supplier (if other than pipe manufacturer), and manufacturer (P for Performance Pipe, or I for Ineos, etc.). In addition to other marking requirements stated in the specifications, for natural gas pipe and fittings markings shall contain identifier code in accordance with ASTM F2897-11A.

All pipe shall be made of virgin quality material and be homogeneous throughout and free of visible cracks, holes, foreign inclusions, blisters, dents, and other injurious defects. No reworked material shall be allowed. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

Polyethylene pipe shall be no older than 6 months from the date of manufacture to the date of shipment to CPA. All pipe shall be packaged in standard commercial coils or bundles that provide protection from shipping injuries and shipped with end caps. When storing the pipe on site, the Contractor shall protect pipe from direct sunlight by UV resistant cover.

1.04 POLYETHYLENE FITTINGS

All polyethylene fittings shall have butt end outlets. Molded and fabricated fittings shall have a pressure rating equal to the pipe.

Minimum pipe wall thickness for fitting butt outlets shall be equal to the pipe wall thickness .

All fittings shall be made of virgin quality material and be homogeneous throughout and free of visible cracks, holes, foreign inclusions, blisters, dents, and other injurious defects. No reworked material shall be allowed. The fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

Fittings shall be no older than 6 months from the date of manufacture to the date of shipment to CPA. All fittings shall be packaged in standard commercial cardboard boxes that provide protection from shipping injuries.

Fittings shall be molded except fittings larger than 12” which are allowed to be factory fabricated (unless molded fittings are available). Fabricated fittings shall be fabricated on machinery specifically manufactured for that purpose. Fabricated fittings shall be manufactured using Data Loggers recording heating iron face temperatures, fusion

pressure and a graphic representation of the fusion cycle. The Data Logger printout shall be part of the required submittal for the fabricated fitting. Fabricated fittings shall be manufactured by ISCO or approved equal. All fabricated fittings must be approved by the Engineer prior to installation.

Fittings shall be marked with the following: ASTM D3261 (Butt type); manufacturer's name or trademark; material designation (PE 2406 for gas); date of manufacture or manufacturing code; size (including the sizing system used, such as, IPS, CTS or OD). Where the fitting size does not allow complete marking, marking may be omitted in the following sequence: size, date of manufacture, material designation, manufacturer's name or trademark.

1.05. Electro Fusion Tapping Tees and Couplings

Electro fusion type polyethylene fittings shall conform with the latest edition of ASTM F1055 (Standard Specification for Electro fusion Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing) and be manufactured in accordance with the latest listed edition of ASTM D-2513 by Friatec Gas Water Inc. under the trade name of Frialen Safety Fittings or approved equal.

All electro fusion tapping tees will be DAA designated: 2" x 1", 4" x 1", 6" x 1", and 8" x 1" (IPS x CTS) and 4" x 2", 6" x 2", and 8" x 2" (IPS x IPS) - main size x outlet size.

Electro fusion couplings for gas used on the tapping tee outlets to connect the EFV with the 1" CTS and 2” IPS service lines shall have socket outlets.

All electrofusion couplings 2” and larger shall be 4710 HDPE SDR 11 and ANSI/NSF 61 listed.

3.01 POLYETHYLENE PIPE JOINING EQUIPMENT

All polyethylene pipe joining equipment to be used shall be certified by the City of Palo Alto to be in good working condition and suitable for the intended purpose prior to being brought on site. Any equipment without a City issued certification tag shall be removed from the site.

The Contractor shall have all equipment necessary to install the pipe and appurtenances referred to in the Plans and Specifications, including but not limited to:

A. Pipe Trailer

Contractor shall provide a trailer capable of transporting 40' or longer lengths of polyethylene pipe without damaging pipe.

B. Pipe Spool

Contractor shall provide a reel type spooling device capable of dispensing 500' long 2" polyethylene pipe coils. Spool can be trailer mounted or suspended from a truck or backhoe (SpeedReel).

C. Pipe Support Stands

Pipe support stands shall be utilized to support pipe during fusion joining, directional boring pull in, and while lowering of the pipe into the trench. Pipe support stands shall not be spaced greater than 15' apart for directional boring pull in. Pipe shall be supported with stands at all times and not placed on pavement to avoid scratching the pipe surface.

Additionally, manufactured pipe support stands outfitted with rollers shall be used at the pavement or plate edge where pipe is pulled into the trench/bore hole to avoid scratching of the pipe.

D. Pipe Cutter

Pipe cutter shall be guillotine style cutter outfitted with a ratchet drive or power driven designed to cut high density polyethylene pipe. No other cutting tools will be allowed unless approved by the Engineer.

E. Butt Fusion Machine

Contractor shall provide McElroy or approved equal butt fusion machine(s) capable of fusing the range of pipe sizes required in the contract/plans with the following features:

1. **Butt Fusion Machine.** Machine shall be the hydraulic fusion machine with built-in hydraulic pipe lift to assist with the pipe handling and incorporating centerline guidance system and DataLogger™ compatible, and capable of butt fusion of most fittings without special holders or removal of jaw.

2. **Facer.** Pipe facer that attaches to the butt fusion machine. Facer shall have sharp, properly aligned blades.

3. **Heating Iron.** Electrically powered heating iron with unscratched clean Teflon coated faces. Heating iron shall have a thermometer and temperature set screw for calibration.

F. Electro Fusion Machine

The Contractor shall provide a Friatec universal electro fusion control box or approved equal, capable of storing a minimum of 100 fusion records, pipe alignment clamp, tapping tee alignment clamp, tapping wrench, pipe scraper, and all other tooling specified by the electro fusion machine manufacturer installation procedures.

G. Electric Generator

Contractor shall provide the necessary power supply to meet the power requirements as specified by the manufacturer of the fusion equipment. Generator shall be in new condition and have a minimum rated capacity of 5 kW for 8" and smaller and 10 KW for 10" and larger.

H. Pyrometer

The Contractor shall provide a pyrometer capable of testing the temperature of the heating iron, while at fusion temperature, to an accuracy of 0.5% (±3°F). The fusion temperature of the heating iron shall be verified each morning in the presence of the WGW Inspector. More frequent testing may be required at the discretion of WGW Inspector.

Note: The Contractor shall keep a binder on site containing the fusion procedures, names of approved fusers and serial numbers of the approved fusion equipment. All equipment must be in good working order and properly maintained during project installation. The City will inspect the preceding items and reject those not in compliance. The City shall have the right to reject any or all equipment judged inadequate to properly fuse polyethylene pipe and its fittings.

3.12 POLYETHYLENE PIPE INSTALLATION

The City will test the person(s) intending to fuse polyethylene pipe for the purpose of Certifying that person(s) to fuse on City piping. The fuser must recertify every 12 months. All polyethylene pipe fusions (butt, sidewall and electrofusion) must be performed by the person(s) qualified by the City for that specific project or within the last 12 months whichever is shorter. The person may only fuse pipe for the utility (water, gas or wastewater) they were certified by the City for. All fusions must be conducted in the presence of or with the prior approval of the City's WGW Inspector. Qualification testing is required for all Contractor employees that will be performing polyethylene pipe fusions. The Contractor will perform the qualification testing using his own equipment and materials, including but not limited to the equipment to be used in the field (generator, fusion machines, scrapers, etc.). The Contractor will schedule fusion testing two weeks prior to the start of Work. Notify WGW Inspector for scheduling.

A. Underground Clearance

Unless approved by CPA WGW Utilities Engineering, the Contractor shall maintain a minimum clear separation of 12 inches vertically to crossing utility lines and 48 inches horizontally to parallel utility lines, duct banks or adjacent foreign structures surfaces.

If horizontal separation is between 1' to 4', review and approval by WGW Engineering Department is required. Horizontal separation less than 1' is prohibited.

B. Location

1. Mains and services shall be located per WGW Utilities standard drawing WGW 01, unless otherwise specified on the Project Drawings.

2. Services shall be installed perpendicular from the main in the shortest straight line to the meter or clean out. Water meters, services and sewer laterals shall be installed 10' minimum from trees.

C. Handling of Polyethylene Pipe

Extreme care must be exercised when moving plastic pipe, support stands and rollers shall be used when fusing and lowering pipe into the trench or bore hole. **POLYETHYLENE PIPE SHALL NOT BE DRAGGED ON THE GROUND OR ON PAVED SURFACES**. Support stands/rollers must be used at all times that pipe is above paved surfaces/ground level including during directional boring pull-in.

D. Pipe Scratches or Cuts

Pipe that has scratches, notches, cuts or any other abrasions that exceed 10% of the pipe wall thickness shall be disposed of. The Contractor shall use pipe stands, rollers, spooling devices, or other means to avoid damaging the pipe during installation. Observe pipe during installation for scratches, gouges or other defects. If defects are present, remove and discard defective section of pipe. The WGW Inspector must be notified of all defects and subsequent repairs.

E. Snaking Pipe

Polyethylene pipe shall be installed in the trench by “snaking” method and additional pipe length shall be allowed for the possible thermal contraction of the pipe.

F. Maximum Pull Force

A commercially available weak link approved by the Engineer for the specific application shall be used, in accordance with manufacturer’s recommendations, between the puller and the pipe.

G. Butt Fusions

1. All butt fusions must be performed by the person(s) certified by the City to butt fuse in the presence of the City's WGW Inspector. Contractor’s supervisor shall be present during all pipe fusions to insure that all required procedures are adhered to and to witness the quality of each joint. Fusion certified Contract employees found to not be following manufacturer’s guidelines or performing fusions with inadequate/defective equipment will have their fusion certification revoked and will not be allowed to perform fusions for the remaining duration of the contract.

2. Pipe fusion shall be conducted in accordance with the manufacturer's recommended fusion procedure and in compliance with ASTM F2620, PPI Technical Report TR-33 and accordance with the "City of Palo Alto, Polyethylene Gas Pipe Training Procedures", see Appendix E.

   Ambient temperature shall be between 55° F and 85° F prior to pipe fusion; otherwise pipe shall be protected from direct sunlight and cooled down until the ambient temperature falls within the above temperature range.

3. Fusion joints shall be allowed to cool for the times recommended by the pipe manufacturer prior to any movement of the fused joint.

4. Gas pipe used for Railroad crossings shall be 4710 HDPE joined by butt fusion in accordance with the Manufacturer's recommended/certified procedures in accordance with the applicable section of DOT CFR 49 Part 192, paragraph 192.283. The Contractor shall be responsible for Caltrain (PCJPB) permits and ensuring that personnel have received proper training in accordance with the Manufacturer's recommended procedures and in compliance with DOT CFR Part 192 paragraph 192.285.

5. All fusions shall be made using a Data Logger recording heating iron face temperatures, fusion pressure and a graphic representation of the fusion cycle. The Data Logger printouts shall be reviewed by inspector prior to pipe being pulled in and submitted to the City WGW Utilities Inspector at the end of each day.

H. Inspection

1. The City will provide a polyethylene certified Inspector at the job site. The Inspector has the right to reject any fusions not meeting City requirements. The Contractor shall replace all fusions not meeting City requirements at its own expense.

2. The Contractor shall also designate a polyethylene certified supervisor who will be present on site at all times to observe pipe fuser(s). The Contractor's supervisor will be responsible for inspecting all fusions performed. The City will test and certify this supervisor. Said supervisor must be present on job site at all times fusions are being performed to inspect, guide, advise, and supervise their own qualified fusers on site.

3. At the City's discretion the Contractor will remove fusion(s) and supply it to the City for testing to insure quality control.

4. Records of all electro and butt fusions shall be downloaded and provided to the City on a daily basis in electronic format and weekly in paper format.

5. Any failure recorded by the fusion equipment must be immediately brought to the attention of City's Inspector to avoid the City requiring the contractor to remove fusions to the last recorded acceptable fusion.

6. The fusion number corresponding to each joint shall be written on the pipe at the fusion location with an indelible marker.

7. Fusion number shall also be noted on the Contractor's record drawing at the exact location of the fusion.

8. The City's Inspector will observe plastic fusions and reject all connections which are deficient. All fusions must be conducted in the presence of or with the prior approval of the City's WGW Inspector. The City's Inspector will review the Data Logger or non-destructively test plastic fusions and reject all connections that are deficient. The contractor will replace all fusions failing non-destructive testing at his expense. The contractor will replace all fusions failing visual inspection or non-destructive testing at his expense.

I. Sealing Installed Piping

Contractor shall seal open piping with butt fusion end caps or with an approved manufacturer end cap at the end of each workday. No open pipe ends will be allowed at the end of the day.

J. Marker Balls shall be placed above all fittings, taps, changes in main alignments and other locations as determined by the Engineer.

K. Minimum Bending Radius

The minimum bend radius for polyethylene water pipe SDR 9 is twenty (20) times and for SDR 11 is twenty five (25) times the outer pipe diameter. If fusions, fitting, or flange are present or to be installed in the bend, the minimum bend radius shall be one hundred (100) times the outer pipe diameter.

END OF SECTION