NATURAL GAS DISTRIBUTION SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

Work Includes installation of 8", 6", 4" and 2" natural gas mains, 1" and 2" natural gas services, tracer wire, polyethylene valves and boxes, polyethylene fittings, excess flow valves, anode boxes, modification of existing natural gas house plumbing to accommodate relocation of gas meters, and all related equipment and fittings in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

A. Section 02200 Excavation, Backfill and Restoration

1.03 QUALIFICATION OF NATURAL GAS DISTRIBUTION SYSTEM CONTRACTOR

The Contractor performing work on the City of Palo Alto natural gas distribution system shall have a drug testing program in place per **PIPELINE SAFETY REGULATIONS Part 199 "Drug Testing Pipeline Safety" and Part 40 "Procedures for Transporting Workplace Drug Testing Programs**."

PART 2 -- MATERIALS

2.01 NATURAL GAS DISTRIBUTION SYSTEM MATERIALS

A. POLYETHYLENE PIPE

GENERAL

All polyethylene pipe supplied under this Section shall conform with the latest edition of ASTM D-2513, polyethylene fittings supplied under this Specification shall conform with the latest edition of ASTM D-2513 and ASTM D-3261 (Standard Specification for Thermoplastic Gas Pressure Systems) listed in Section I Appendix B of the latest edition of the Office of Pipeline Safety, Part 192, Title 49, Code of Federal Regulations and with the specifications stated herein.

1. All pipe shall be uniformly yellow in color medium density PE 2406 polyethylene extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.

3. Pipe dimensions and tolerances:

   The outside diameter and wall thickness shall be within the limits specified in Table 1.

Table 1: Dimensional Standards for Polyethylene Pipe and Tubing

Nominal Pipe/ Tubing Size	Average Outside Diameter (inches)	Outside Diameter Tolerance (inches)	Minimum Wall Thickness (inches)	Wall Thickness Tolerance (inches)	Out of Roundness Tolerance (inches)	Standard Dimension Ratio (unitless)
1" CTS	1.125	± 0.005	0.099	+ 0.008 - 0.000	-	11.5
2" IPS	2.375	± 0.006	0.216	+ 0.026 - 0.000	± 0.012	11.0

Nominal Pipe/ Tubing Size	Average Outside Diameter (inches)	Outside Diameter Tolerance (inches)	Minimum Wall Thickness (inches)	Wall Thickness Tolerance (inches	Out of Roundness Tolerance (inches)	Standard Dimension Ratio (unitless)
4" IPS	4.500	± 0.009	0.333	+ 0.047 - 0.000	± 0.015	13.5
6" IPS	6.625	± 0.011	0.491	+ 0.059 - 0.000	± 0.035	13.5
8" IPS	8.625	± 0.013	0.639	+ 0.077 - 0.000	± 0.040	13.5

Approved Manufacturers: CP CHEM Performance Pipe, CSR Poly Pipe Industries, or approved equal.

B. PE Fittings

1. All fittings shall be uniformly yellow in color. medium density PE 2406 polyethylene molded from one of the following: Performance Pipe Company Marlex HHM TR-418 Resin; or Ineos Fortiflex® K38-20-160 Resin.

2. Dimensions and tolerances:

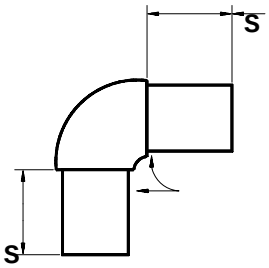
   Butt Fusion Fittings shall conform to the dimensions given in Table 2.

Table 2: Dimensional Standards for Polyethylene Butt Fusion Fittings

Nominal Fitting Size	Ave Outside Dia at Point of Fusion (inches)	Outside Diameter Tolerance (inches)	Minimum Wall Thickness (inches)	SDR (unitless)	Minimum Stub Length* (inches)
2" IPS	2.375	± 0.010	0.216	11.0	2.0
4" IPS	4.500	± 0.015	0.333	13.5	3.0
6" IPS	6.625	± 0.018	0.491	13.5	3.5
8" IPS	8.625	± 0.025	0.639	13.5	3.5

* as defined in Figure 1 (only applicable to tees, 45° and 90° ells).

Figure 1: Definition of Stub Length for Butt Fusion Fittings



STUB LENGTH-S

PORTIONS O.D. CONTROLLED TO MATCH PIPE O.D.

3. **Approved Manufacturers:** CP CHEM Performance Pipe, CSR Poly Pipe Industries, or approved equal.

D. Polyethylene Gas Valves

Polyethylene gas valves shall be manufactured by Flowserve Corp. (Nordstrom Valves), Friatec Gas Water, Inc., Kerotest Manufacturing Corp, or Broen, Inc. (Ballomax). The gas valves shall be manufactured within 6 months of date of sale to the City and in compliance with the requirements of ANSI/AMSE B16.40 “Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems”, ASTM 1996 Section 8 “Plastics”, Volume 08.04 “Plastic Pipe and Building Products” D-2513, and DOT Part 192.145 “Valves”.

The valves shall be assembled to operate smoothly and provide gas tight seal. Each valve’s stem shall be equipped with the weather seal(s) protecting inner parts from ground water and foreign debris intrusion. All polyethylene valves shall be supplied with the Butt End outlets.

The polyethylene portion of the valve shall be one piece molded medium density PE-2406 polyethylene manufactured from Performance Pipe Company Marlex TR-418 Resin, Rigidex PC 2040Y, or FINATHENE 3802Y.

PE valves shall conform to the dimensions given in Table 3.

Table 3: Dimensional Standards for Polyethylene Valves

VALVE SIZE	SDR	MIN. PORT DIA. *	MIN. STUB LENGTH *
2"	11	1.80"	2.00"
4"	13.5	3.60"	3.00"
6"	13.5	4.80"	3.50"
8"	13.5	6.30"	3.50"

* as defined in Figure 2

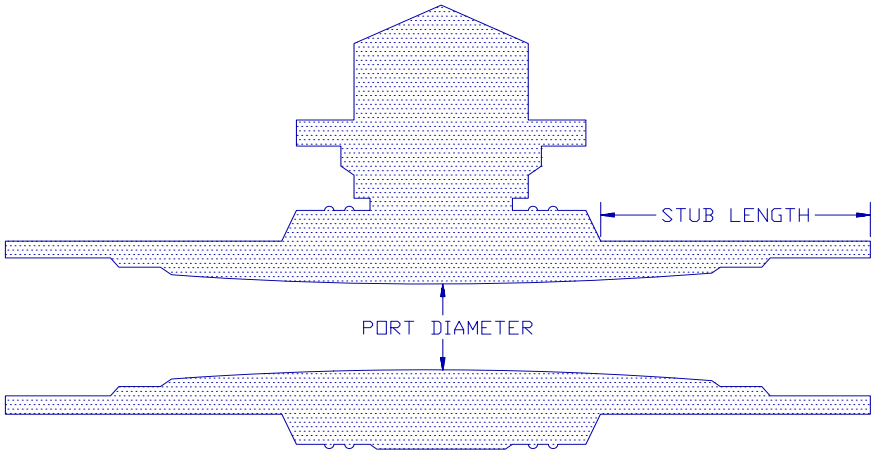


Figure 2: Definition of Dimensions for Polyethylene Valves

For purging at designated locations shall be used Flowserve Corp. (Nordstrom Valves) with integral polyethylene purge connections. These valves shall comply with all specifications for polyethylene gas valves of this section.

E. Gas Service Riser Anodeless

All risers must meet or exceed the latest editions of the following standards or requirements:

- DOT Code of Federal Regulations, Title 49, Part 192
- ASTM D2513 for polyethylene pipe, tubing, and fitting
- Pipe threads ANSI B1.20.1
- Cathodic disbondment testing per ASTM G8
- 100% factory leak tested

A. Prebent Risers:

1. **Anodeless 1" CTS X ¾" MPT PREBENT** - The ¾" casing pipe shall be fabricated from ASTM A53 schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mil minimum thickness); 60 inches long, 1.625" OD x 0.072" wall thickness ASTM A513 mechanical tubing with ¾" MPT nipple outlet and crimp gasket moisture seal. Additionally, the casing pipe shall be bent to a 10-inch minimum radius resulting in a min. 16" horizontal by 30" vertical configuration.

   A 10 inch long, 1" CTS (0.099 wall thickness) PE pigtail shall extend from the steel pipe casing. The 1" CTS carrier pipe shall be yellow medium density PE 2406 polyethylene extruded from one of the following Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.; SDR 11.5.

The transition from steel to PE shall occur within 6 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

2. **Anodeless 1" CTS X 1-1/4" MPT PREBENT** - The 1-1/4" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mils minimum thickness); 60 inches long, 1.625" O.D. x 0.072 wall thickness ASTM A513 mechanical tubing with 1-1/4" MPT nipple outlet, neoprene bushing crimped in place gasket moisture seal. Additionally, the casing pipe shall be bent to a 12-inch minimum radius resulting in a 30" horizontal by 30" vertical configuration.

   A 10-inch long, 1" CTS (0.099 wall thickness) PE pigtail shall extend from the steel pipe casing. The 1" CTS carrier pipe shall be yellow medium density ASTM D2513 PE 2406 polyethylene extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin; SDR 11.5.

   The transition from steel to PE shall occur within 6 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

3. **Anodeless 2" MPT X 2" IPS PREBENT** - The 2" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mil minimum thickness); 72 inches long, 2-3/8" MPT outlet and crimp gasket moisture seal. Additionally, the casing pipe shall be bent to a 24-inch minimum radius resulting in a 36" horizontal by 36" vertical configuration.

   A 10-inch long, 2" IPS PE pigtail shall extend from the steel pipe casing. The 2" IPS carrier pipe shall be yellow medium density PE 2406 polyethylene extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.; SDR 11.0.

   The transition from steel to PE shall occur within 6.5 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

4. **Anodeless 4" MPT X 4" IPS PREBENT** - The 4" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mil minimum thickness); 72 inches long, 4.5" MPT outlet and crimp gasket moisture seal. Additionally, the casing pipe shall be bent to a 36-inch minimum radius resulting in a 30" horizontal by 42" vertical configuration.

   A 12-inch long, 4" IPS PE pigtail shall extend from the steel pipe casing. The 4" IPS carrier pipe shall be yellow medium density PE 2406 polyethylene extruded from one of the following: Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.; SDR 11.0.

The transition from steel to PE shall occur within 6.5 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

B. Straight Risers:

1. **1" CTS X ¾" MPT STRAIGHT** - Anodeless Service Risers shall be straight with an overall length of 70 inches. The ¾" casing pipe shall be fabricated from ASTM A53 Schedule 40, Grade A steel pipe. The casing shall also conform to the following requirements: gray fusion bonded epoxy coated (8 mils minimum thickness); 60 inches long, 1.625" OD x 0.072" wall thickness ASTM A513 mechanical tubing with ¾" MPT nipple and crimp gasket moisture seal.

   A 10 inch long, 1" CTS (0.099 wall thickness) PE pigtail shall extend from the steel pipe casing. The 1" CTS carrier pipe shall be yellow medium density PE 2406 polyethylene extruded from one of the following Performance Pipe Company Marlex HHM TR-418Q Resin or Ineos Fortiflex® K38-20-160 Resin.; SDR 11.5.

   The transition from steel to PE shall occur within 6 inches of the threaded end. Risers shall include insulation between the steel casing and the PE carrier pipe by means of an o-ring/air space configuration or by the use of a sleeve made of non-heat conducting materials. The casing pipe shall have indication of ground level.

Approved Manufacturers: R.W. Lyall & Company, Inc. (www.rwlyall.com), Georg Fischer (Central Plastics Company www.centralplastics.com), Continental Industries, Inc (www.conind.com), Perfection Corporation (www.perfectioncorp.com).

F. Valve Boxes

All valve boxes for 2" through 8" valves shall be Christy G5 Traffic Valve Box with G5C non-locking type metal traffic type lid marked "GAS".

Corrugated 10" pipe shall be used as extension for 6" and 8" valves. Valve supports shall be supplied for 2" valve sizes only and be manufactured by C. P. Test Services Inc., model FPKPV2.3 or approved equal.

G. Tracer Wire

All tracer wire shall be 10 AWG solid copper wire coated with .45 mils Type HMW - PE yellow insulation. The wire shall meet all requirements of the latest version of ASTM D1351 and ASTM B8. Tracer wire shall be UL listed as direct burial wire at temperatures between -40° C and 75° C for circuits not exceeding 600 volts. The surface of the insulation shall be durably marked, at intervals not exceeding 24 inches, with only the following information: maximum working voltage "**600 VOLTS**", wire type, manufacturer's name or trademark, AWG size or circular mil area, UL required markings, and at the Contractor's option "**CAUTION CPA GAS LINE**".

H. Meter Valve

Meter valves shall meet all applicable parts of D.O.T./CFR TITLE 49 PART 192 and ASME/ANSI B16.33. All meter valves shall be insulated 3/4", 1-1/4", or 2" Mueller H-11179 or equal with a 3/4", 1-1/4", or 2" steel plug.

I. Anode Boxes

Anode box shall be Christy G5 Traffic Box with G5C non–locking type metal traffic lid marked "ANODE".

J. Steel Pipe - Gas Carrier

Steel pipe shall be schedule 40 grade B A53 seamless steel pipe with a 30 mil extruded polyethylene coatwrap.

K. Steel Pipe - Fittings

All welded fittings shall be schedule 40 and comply with ASTM A-234 WPB (materials) and ANSI B36.10 (dimensions).

All threaded fittings shall be IPT, BLK., conforming to ASTM A-197.

L. Casing

Steel Casing - shall be steel pipe, schedule 40, grade A106.

Polyethylene Casing - shall be high density HDPE 3408 polyethylene pipe (SDR 9.3) with cell classification of 345464C, D or E per ASTM D3350.

M. Casing Insulators

Commercial available casing insulators with a minimum of 4 plastic runners, each runner a minimum of 1/4" high, shall be installed at 5 feet maximum intervals on the steel gas main prior to insertion. Insulators shall be sized to center the gas main in the casing.

N. Cable Protectors

When inserting the pipe into the casing, the Contractor shall use a suitable cable protector on the casing end to protect the pipe and or pipe coating from damage. Cable protectors shall be left in place after pipe insertion is completed.

O. Casing End Seals

End seals shall be Link Seal™ or approved equal capable of forming a watertight seal at the ends of the casing.

P. Excess Flow Valves (EFV)

GENERAL: Polyethylene natural gas excess flow valves (EFV) shall be manufactured by either UMAC Inc., Perfection Co., or Dresser. The excess flow valves shall be manufactured within 6 months of date of sale to the City and be in compliance with CFR Title 49 DOT Part

192.381 and MSS SP-115: Excess Flow Valves. All EFVs shall be tested in accordance with ASTM F 1802-97: Standard Test Method for Performance Testing of Excess Flow Valves.

The design of excess flow valves shall incorporate a bypass to allow the valve to automatically reset and resume normal operation after repairs are made to the severed gas line. Each valve shall be fixed or anchored to the interior of the fitting to preclude movement of the valve.

Each valve shall have an affixed tag, identifying the EFV's capacity range and flow direction, and be individually packaged and supplied with the operating instructions. An additional stainless steel tag or washer shall be included in the package indicating the size and flow capacity of the valve, which will be attached to the gas riser.

MATERIAL: The polyethylene portion of EFV shall be one piece molded medium density PE-2406 polyethylene manufactured from Performance Pipe Company Marlex TR-418 Resin or Solvay Fortiflex® K38-20-160 Resin.

APPROVED MODELS (shall be designed for electro fusion applications):

- ***UMAC***

  Model 41, 1" CTS Series 700
  Model 41, 1" CTS Series 1800
  Model 41, 1" CTS Series 2600
  Model 41, 2" IPS Series 5500
  Model 41, 2" IPS Series 10,000

- ***Perfection (Powell Flow Limiter)***

  1" CTS Powell 800 dwg 51523
  1" CTS Powell 1800 dwg 51258T

- **Dresser**

  Polyethylene Sticks:

  Style 480, 1" CTS (Low Capacity)
  Style 480, 1" CTS (Medium Capacity)

Table 4: EFV Trip and Load Information

EFV Models	Inlet Pressure (PSIG)	Pressure Drop at Typical Load (PSIG)	Minimum Trip Point (SCFH)	Service Length Protected (FT)
Model 41, 1" CTS, Series 700	10	0.6	700	2105
Powell 800, 1" CTS, dwg 51523	10	0.35	800	1600
Dresser Style 480, 1" CTS, Low Capacity	10	0.4	624	2172
Powell 1800, 1" CTS, dwg 51258T	10	1.1	1600	261
Dresser Style 480, 1" CTS, Medium Capacity	10	0.45	1073	710
Model 41, 1" CTS, Series 1800	10	0.44	2000	258
Model 41, 1" CTS, Series 2600	10	0.9	2600	127
Model 41, 2" IPS, Series 5500	10	1.3	5500	1332
Model 41, 2" IPS, Series 10,000	10	0.51	10,000	

PRESSURE DROP: An average pressure drop across EFV at an inlet pressure of 10 psig shall not exceed: for 1" CTS - 0.6 psig @ 425 scfh, 0.8 psig @ 1250 scfh, 0.9 psig @ 1400 scfh, and 1.3 psig @ 5500 scfh.

DIMENSIONS: 1" EFV shall be 1" CTS SDR 11.5 with 0.099" min. wall thickness with a minimum length of 10". 2" EFV shall be 2" IPS SDR 11 with 0.216" min. wall and a minimum length of 10". Valves shall be supplied with plain pipe ends.

Q. Marker balls shall be 3M yellow, Omni yellow or approved equal.

R. **Meter Boxes**

Curb meter installation in sidewalk or planting strip will be allowed only when there is no above ground location on property (the building occupies the entire property or underground parking garage prohibits above ground installation) All meter boxes shall be supplied and installed by the Contractor when box replacement is required or a new service is installed. Boxes shall be supplied with self closing reading lids. Box and lid shall have a minimum Tier 5 rating (per ANSI/STCE 77 2010) for sidewalk and planting strip applications. Meter boxes shall not be installed in driving lanes of public or private streets. Lids shall have "GAS" marked on them.

For installation in areas subject to vehicular traffic, meter box and lid shall have H-20 load rating.

2.02 WORK MATERIALS TO BE FURNISHED BY THE CITY.

The City will provide gas meters.

2.03 WORK MATERIALS TO BE FURNISHED BY THE CONTRACTOR.

Work materials supplied by the Contractor shall include but not be limited to:

1. All polyethylene pipe, electro fusion tapping tees, excess flow valves, valves, valve boxes, valve extensions, valve supports, anode boxes, 2" through 8" PVC end caps, tracer wire, Nicotap # 3519J single type, electrical tape, risers, insulated meter valves, end plugs, electro fusion couplings, aquaseal, molded PE fittings, marker balls, casing insulators, casing end seals and weld rod, meter and regulator vaults.

2. Expendable Concrete Materials. Materials required to install and finish Portland cement concrete, such as form lumber, tie-wire, nails, etc.

3. Concrete. All Portland cement concrete including reinforcing steel, wire mesh, etc.

4. Temporary and Permanent Fencing including traffic barricades required to provide a barrier between vehicular/pedestrian movements and excavations.

5. Trench Backfill Sand. All backfill sand shall be clean imported sand, rock and salt free. Bay sand shall not be accepted.

6. Paving Material. All materials required for temporary and permanent street repairs including base materials.

7. Landscaping Materials. All landscaping materials, plants and surface improvements that are damaged due to this Work.

8. Traffic Control Materials. All materials damaged by Work required to direct vehicular and pedestrian traffic including striping, loop detectors, reflectors, etc.

9. Drilling fluids and bentonite.

2.04 MANUFACTURER'S TESTING

A Minimum Burst Pressure Tests, conducted in accordance with the latest edition of ASTM D1599 (Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings), shall be performed by the manufacturer to determine the short term rupture strength of the pipe and fittings furnished. The minimum short term burst pressure shall be that required to develop a minimum hoop stress value of 2520 psi. This test shall be performed on each lot of pipe ordered. A lot shall mean all material covered by a single item on a CPA order. Fittings shall be tested at the frequency specified in the latest edition of ASTM D2513, Annex A2., Section A2.3, Fittings Tests. Manufacturer shall provide test data for each lot of pipe as requested by the CPA.

B. Sustained Pressure Tests shall be performed to ensure that the pipe and fittings supplied have passed the sustained pressure test outlined in the latest edition of ASTM D1598 (Standard Test Method for Time-To-Failure of Plastic Pipe Under Constant Internal Pressure). The minimum sustained pressure shall be that required to produce a minimum hoop stress value of 1320 psi. Testing frequency shall meet or exceed that called for in the latest edition of ASTM D2513, Annex A2. Manufacturer shall provide test data for each lot of pipe or fittings as requested by the CPA.

2.05 SUBMITTALS AND QUALITY CONTROL

A. The Manufacturer shall submit to CPA a written quality control procedure conforming to the latest edition of ASTM D2513, Annex A2., which shall be subject to approval by CPA.

B. The Manufacturer shall permit CPA representatives to tour extrusion facilities for the purpose of evaluating manufacturer's capabilities. The tour shall be during extrusion of a CPA order or if prior to order placement during the extrusion of a similar material.

C. The Manufacturer shall certify that the plastic pipe and or fittings supplied meet all the requirements of this Specification. When requested by CPA the Manufacturer shall supply certification for all items ordered, failure to do so shall be cause for order rejection.

2.06 INSPECTION

CPA reserves the right to inspect each order upon delivery and, at the option of CPA, reject any items not meeting this Specification.

PART 3 -- EXECUTION

3.02 POLYETHYLENE PIPE INSTALLATION - MAINS

A. Minimum Cover

Gas mains shall be installed with a minimum cover of 30", as measured vertically from the top of pipe to the top of pavement.

B. Underground Clearance

Unless otherwise specified a minimum of 12 inches vertically and 24 inches horizontally shall be maintained between the pipe surface and other utility lines or adjacent foreign structures. In the event that it is not possible to maintain required vertical clearance from other structures, the Contractor shall case the gas main in steel pipe or concrete at the discretion of the City's representative.

C. Gas Pipe Bedding

Trench shall be free of debris, sharp rocks, etc. before adding the sand bed for the new gas main. Sand bed shall have a minimum thickness of 4" below and 12” above the gas main.

I. Tracer Wire Connections

One tracer wire shall be installed with the pipe. All tracer wire connections shall be made with Nicotap lateral splice sleeve wrapped with aqua seal and electrical tape. All Nicotap fittings must be installed with tooling specified by the manufacturer, the use of pliers or other crimping devices will not be allowed. Tracer wires from the four pipelines feeding into an intersection will be terminated at an anode box located by the north valve. Tracer wire shall have knots tied in the wire as follows: north wire - no knot attached to terminal 1 of the anode box; east wire - one knot attached to terminal 2; south wire - two knots attached to terminal 3; west wire - three knots attached to terminal 4. Each wire shall extend a minimum five feet

above grade. The Drawings detail installation requirements. Tracer wires from steel gas mains inserted into casings shall be extended to the closest “westerly” anode box with four knots tied.

J. Valves

Valves shall be installed at the marked locations. Valve supports are required for 2" valves only. Valves shall be installed with the operating nut on top, facing vertically up. The City will not accept valves that are cocked or oriented in any direction except up.

K. Valve Boxes

All valve boxes for 2” through 8” valves shall be Christy G5 Traffic Valve Box with G5C non-locking type metal traffic type lid marked “GAS”.

Corrugated 10" pipe shall be used as extension for 6" and 8" valves. The Drawings detail installation requirements.

L. Anode Boxes

Anode boxes shall be installed at locations shown on plans or as directed by the project inspector. Anode boxes shall be installed in the same manner as valve boxes.

M. Pressure Test

The Contractor will conduct air pressure tests at 100 psig on all main lines and services for a minimum time of 24 hours. The City will provide a pressure chart recorder to document all air tests. The pressure shall not decrease during the test period. Tests shall be performed on each block of main installed after service installation is completed.

O. Boring

All underground utilities shall be located and potholed prior to the start of boring. One tracer wire shall be attached to all pipe prior to insertion in the borehole. All pipe ends shall be sealed with a butt fusion end cap or similar fitting prior to pulling into a borehole.

P. Sealing Installed Piping

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

Q. Marker Balls

Marker Balls shall be placed above all fittings, tapping tees, change in main alignments and other locations as determined by the Engineer.

3.03 GAS MAIN INSERTION

When inserting a Polyethylene pipe in an existing (to be abandoned) main the Contractor shall follow the following procedures to minimize gas service disruption:

1. Install all new 1” PE services.

2. Perform all required house plumbing modifications.
3. Pressure test the entire length of pipe to be inserted before insertion for a minimum period of 24 hours at 100 psig with air.

3.04 GAS HOUSE LINES

All materials and installation methods must comply with the latest City adopted version of UPC.

3.05 INSTALLATION - SERVICES

A. Tapping Tee Installation

1. Contractor shall install tapping tees at the locations marked by the City. Bell holes shall be excavated, if installing the gas mains by boring methods, at each tapping tee installation site to provide an adequate work area for installation and inspection of tapping tees. The tapping tees shall be installed in accordance with Appendix E " Polyethylene Pipe Fusion Training Procedures and Certification", by the person(s) qualified by the City to install tapping tees. Tapping tee fusions must be conducted in the presence of or with the prior approval of the City's WGW Inspector. **TAPPING TEES SHALL ONLY BE INSTALLED ON THE TOP OF THE GAS MAIN.**

2. The main shall be tapped after the tapping tee outlet coupling has cooled for the time period specified in Appendix A and the service line has been soaped and pressure tested. The manufacturer supplied tapping wrench or fitting shall be the only tool used for turning the tapping tee cutter to avoid tapping the backside of the main or loss of the cutter into the main, allen wrenches shall not be used.

3. Tapping tee cutter shall be moved back to the top of the tee tower prior to seal cap installation.

B. Service Pipe Installation with Excess Flow Valves

1. All services must be installed with boring type devices, approved by the Engineer, except in cases where ground conditions or existing underground utility congestion precludes it. Open cut trenching of services must be approved by the Engineer.

2. Excess flow valves shall be installed on all service lines, where commercially available, 12” from the outlet of the tapping tee connected by electrofusion couplings. Care shall be taken to insure that the excess flow valve is installed with the arrow pointing towards the riser (away from the tapping tee).

3. A 1" cap shall be attached in accordance with the "City of Palo Alto, Polyethylene Gas Pipe Training Procedures" by a qualified person(s) in the presence of or with the prior approval of the City's Inspector, to the end of the 1" service pipe and a tracer wire attached to the service pipe prior to inserting the pipe into the bore hole. Services shall be one continuous polyethylene pipe with no fusion joints.

4. A qualified person shall make all connections between the excess flow valve and the service line by electro fusion couplings in accordance with the "City of Palo Alto, Polyethylene Gas Pipe Training Procedures" in the presence of or with the prior

approval of the City's Inspector.

5. A qualified person shall connect by electrofusion the service line to the service riser in accordance with the "City of Palo Alto, Polyethylene Gas Pipe Training Procedures" in the presence of or with the prior approval of the City's Inspector.

6. The Contractor shall install a meter valve, by-pass assembly (if indicated on a construction drawing), and end plug on each service riser. Stop cock shall be installed with operating shut off nut facing away from structure and having regulator at its left side as per Utility Standards for WGW Drawing # STD. GD-02 and 03.

7. MARKING GAS SERVICE LINE. The contractor shall be required to mark the gas service line on the sidewalk. The marking shall be triangular shape engraved on the sidewalk; the base of the triangle shall be parallel to the curb and its vertex shall be located on the gas service line and pointing toward the house along the alignment of the gas service piping. The marking must be placed at the time of service installation by attaching a line locator device to the tracer wire to insure that the marking is located above the pipe location.

8. House line: All materials and installation methods must comply with the latest City adopted version of UPC.

C. Minimum Cover

Gas services shall be installed with 24" minimum cover, as measured vertically from top of pipe to top of pavement or below existing grade.

D. Maximum Cover

Gas services shall not be installed any deeper than 30" below existing grade unless directed by Engineer.

E. Service Leak Testing

Prior to tapping the main, the contractor will conduct air pressure tests at 100 psig on service lines for a minimum time of 15 minutes. The pressure shall not decrease during the test period. Air pressure shall be held until after soap testing. Soap test the service connection by brushing a liquid soap and water solution around the tapping tee base at the main, both ends of the outlet coupling, the outlet connection of the excess flow valve, and the pipe to riser connection in the customer’s yard, and at the meter valve inlet and outlet. If any leaks appear, the City’s Inspector will direct repair procedures.

F. Surface Restoration

Once the City’s Inspector noted the location of the service pipe in the customer’s property, the Contractor shall restore the customer’s surface improvements to the preconstruction condition.

3.06 STEEL PIPE INSTALLATION

A. Welding

All steel gas carrier pipe shall be butt welded per Part 192 Subpart E by a welder qualified under Part 192 Subsection 192.227 and certified by the City.

B. Wrapping of Welds

Primer (Royston Roybond 747) and 30 mil minimum thickness wrapping tape shall be applied over welded joints and any other bare metal surface of the pipe. Complete wrap shall be two thicknesses of cold wrap tape covering the metal in all places (50% overlap of the cold wrap tape) and overlapping the plant coat wrap by a minimum of 2 inches. Manufacturer's primer shall not be applied to polyethylene pipe.

3.07 SYSTEM PRESSURE TEST

The Contractor will conduct an air pressure test at 100 psig on all lines, including services and mains, for a minimum time of 24 hours. Test will only be performed on Monday-Thursday. The City will provide a pressure chart recorder to document the system air test. The pressure shall not decrease during the test period.

All customer piping shall be inspected and approved by the building inspection division before gas service is instituted. Gas meters will be installed within three working days after the building inspection division passes the building gas piping and releases a set tag for the gas meters to the Utilities Department.

3.08 POLYETHYLENE PIPE FUSION QUALIFICATION REQUIREMENTS

A. General Conditions

The Contractor shall have qualified persons to perform the polyethylene pipe joining as per Appendix E of these standards and **PIPELINE SAFETY REGULATIONS PART 192 Subpart F.**

B. Qualification Testing

The City will test the person(s) intending to fuse polyethylene pipe for the purpose of Qualifying that person(s) to fuse on City piping. Said person(s) will be deemed the Qualified Fuser(s) and shall be the only person(s) performing fusions on the job site. 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. The Contractor will schedule fusion testing two weeks prior to the start of Work. Notify WGW Construction Supervisor, (650) 496-6960, for scheduling.

3.09 DESIGN STANDARDS

Polyethylene service piping is currently the only material installed in the C.P.A. gas system (medium density PE - 2406).

A. LOCATION

1. Gas mains shall be located two (2) feet off the lip of gutter on the north and east side of streets, unless otherwise specified on the Project Drawings. Gas mains shall be twenty-four (24) inches minimum from any parallel utility line or as determined by the

City. Gas mains and services shall have a minimum one (1) foot vertical clear space from any crossing utility lines or other underground facilities.

2. Gas services shall come perpendicular from the gas main in the shortest straight line to the gas meter.

3. Above ground gas meters shall be installed on private property adjacent to the building. Curb meters' installation shall only be allowed with the approval of the Engineer. The meter location and installation shall be as specified in the project documents.

   No meter or regulator shall be installed inside of a building, garage, carport, crawlspace, or in any other enclosed area with walls on more than two sides or under a roof structure. The Owner is responsible for installing meter by-pass, concrete meter pad, concrete walkway for meter access, and bollards when required by the City.

B. DEPTH OF PIPE

Minimum depths are to be provided to the finished street surfaces, unless otherwise specified on the Drawings, are as follows:

1. Gas mains shall be installed with a minimum cover of thirty (30) inches, as measured vertically from the top of pipe to the top of pavement.

2. The depth of new gas services shall be a minimum of twenty-four (24) inches unless the gas service serves more than one gas meter; then the minimum depth shall be thirty (30) inches.

3. Unless otherwise specified a minimum of 12 inches shall be maintained between the pipe surface and other utility lines or adjacent foreign structures. In the event that it is not possible to maintain 12 inches clearance from other structures, the Contractor shall case the gas main in steel pipe or concrete at the discretion of the City's representative.

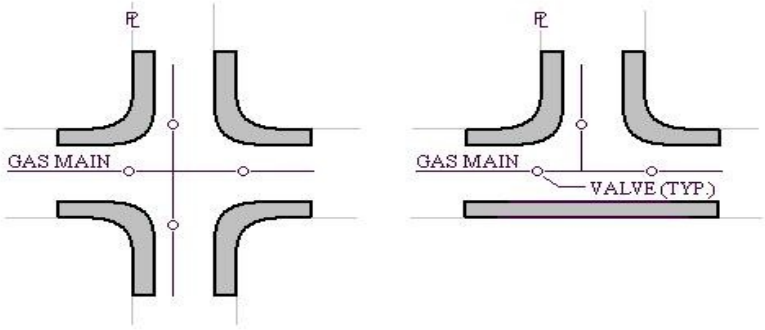
C. MINIMUM SIZE OF NEW MAINS AND SERVICES

1. The minimum new gas main size is 2" (I.D.= 1.917"), SDR 11.0.

2. The minimum service size for new construction is 1" (I.D.= 0.919"), SDR 11.5.

D. VALVES

Four valves shall be installed at each intersection and three valves shall be installed at each tee (at the property line extensions as shown on Figure 3) or as shown on the construction drawings or directed/approved by the Engineer.



Install four valves at each gas main intersection

Install three valves at each gas main tee

Figure 3

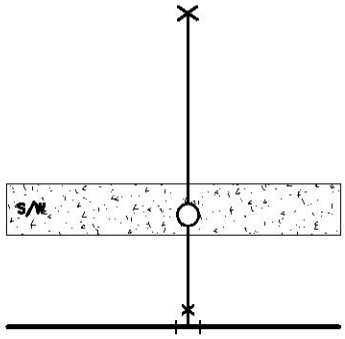


Figure 4

Valves will be required on all gas services 2" and larger (as shown on Figure 4). Placement of valve shall be in the sidewalk or in unimproved areas at locations approved by the Engineer.

E. LOAD

The maximum connected load shall be used for design purposes, e.g., the total shown on the submitted load sheet plus any anticipated future load when available. Coincidence or diversity factors shall not be used when designing gas services.

F. CALCULATING SERVICE SIZE

The sizing of gas services shall be based on the High Pressure Mueller Equation (applicable for 1 psi and greater) where the length of the service is doubled to account for fittings and a factor of safety.

Note: the absolute pressure (psia) must be used when performing calculations with the Modified High Pressure Mueller Equation. The standard barometric pressure correction is 14.7 psia.

G. AVAILABLE PRESSURE

1. The standard C.P.A. delivery pressure is 7" w.c. (Water Column), equivalent to 0.217 psig. Non-standard delivery pressures above 7" w.c. will be limited to 1, 2, 3 and 5 psig. Approval from the Engineering Manager is required for any delivery pressures greater than 7" w.c.

2. When designing gas services the C.P.A. design pressure at the main is 3.5 psig.

3. Pressure losses across the meter and regulator shall be found from the manufacturer's specifications, for residential services use 0.5 psig pressure loss across the meter and regulator.

PART 4 --NATURAL GAS HOUSE PLUMBING

Part 4 is only for City gas main replacement projects (CIP work) where the gas meter needs to be relocated as part of the CIP. Any other gas house plumbing (any piping downstream of the gas meter) is solely the responsibility of the property owner.

4.01 DESCRIPTION

The work to be performed shall consist of furnishing all tools, equipment, materials, supplies, manufactured articles, transportation and services (including fuel, power, and essential communication), labor, and other operations necessary for the modification of existing natural gas house plumbing to accommodate relocation of gas meters including: obtaining required permits, installation of new house gas pipes, new shut off valves and flexes, subsequent pressure testing of the entire house gas plumbing system, and passing required inspections - for houses located in Palo Alto for the City of Palo Alto. The work shall be complete and performed in strict accordance with the Contract Specifications, and in compliance with all applicable codes and standards. All work, materials, and services not expressly shown or called for in the Contract Documents, which may be necessary for the complete and proper construction of the Work in good faith, shall be performed, furnished, and installed by the Contractor as though originally so specified or shown, at no increase in cost to the City.

4.02 QUALIFICATIONS OF WORKMEN

Journeyman Plumbers shall be licensed plumbers completely familiar with the design and application of work described.

4.03 MANUFACTURER'S RECOMMENDATIONS.

All equipment, materials, devices, etc., shall be installed in a manner meeting the manufacturer's recommendations for the particular item. Prior to the start of work, the Contractor shall obtain and deliver copies to the Engineer of all installation manuals, brochures, and procedures that the manufacturer issues for the items supplied. The Contractor shall be held responsible for all installations contrary to the manufacturer's recommendations, unless otherwise approved by the Engineer. If any item or piece of equipment or material is found to be installed not in accordance with the manufacturer's recommendations, or as otherwise directed by the Engineer, the Contractor shall make all necessary changes and revisions to achieve such compliance at the Contractor's expense.

4.04 EXISTING GAS PLUMBING

The modification of the existing gas plumbing shall be performed by the contractor only after receiving written approval from the Engineer. With the Engineer's authorization the Contractor shall perform all repairs and modifications required for code compliance of existing customer owned natural gas plumbing.

The Contractor shall remove and dispose of all abandoned gas plumbing materials.

The Contractor shall not modify the existing gas plumbing until the WGW inspector verifies the new stubout location.

4.05 TESTING OF CUSTOMER OWNED GAS PIPING

Contractor shall pay for all testing and retesting required to show compliance with the Contract Specifications, Codes, Regulations, and all other applicable laws.

A. SYSTEM PRESSURE TEST

The Contractor will conduct air pressure test in accordance with the latest adopted version of the UPC and as required by the City Building Inspector. The pressure shall not decrease during the test.

Other inspections and tests required by the City Building Inspector, codes, ordinances, or other legally constituted authority shall be the responsibility of and shall be paid for by the Contractor.

Testing of the existing gas house plumbing shall be performed prior to connecting the new supply line.

B. TESTING:

Testing will be in accordance with the City of Palo Alto’s Building Department requirements.

C. CONTRACTOR'S CONVENIENCE TESTING:

Inspection and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor and all related costs borne by the Contractor.

D. SCHEDULE FOR TESTING:

1. Testing shall be scheduled with the Building Department in advance.

2. At least 48 hours notice shall be provided to the Engineer, when testing is required.

3. Testing involving City personnel shall not be scheduled on Fridays.

4.06 COOPERATION WITH THE BUILDING DEPARTMENT:

Building Inspectors shall have access to the Work at all times and all locations where the Work is in progress. Contractor shall provide such access to enable the Building Department to perform its functions properly.

A. Revising schedule: When changes of construction schedule are necessary during construction, Contractor shall coordinate all such changes with the Building Department as required.

B. Adherence to Schedule: When the Building Department is ready to inspect, but is prevented due to incompleteness of the Work, all extra charges for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the City.

4.07 COORDINATION WITH CUSTOMERS

The Contractor is responsible for coordinating access to private property with the homeowners**.**

The Contractor shall notify the property owner/ resident at least 14 days in advance of performing work. Prior to starting work at a specific location the Contractor shall schedule the work with the homeowner or resident, as the customer's presence during the work is required.

The Contractor shall relight all pilot lights the same day (before 5:00 P.M.) after the City installs the new gas meter and regulator.

No residence shall be shall be left out of service overnight. Each residence shall be reconnected and all pilot lights re-lit before 5:00 P.M. each day.

4.08 RESTORATION

The contractor shall restore all existing improvements and landscaping at each location to the pre-construction condition as soon as practical after completing the work at each house location, but in no case later than 24 hours after Work is complete. The Contractor shall include restoration in the appropriate bid items; no separate payment will be made for restoration.

END OF SECTION