



# GAS DESIGN STANDARD POLYETHYLENE GAS DISTRIBUTION SYSTEM DESIGN

A-90

Publication Date: 03/18/2020 Effective Date: 06/18/2020 Rev. 7

## Purpose and Scope

This gas design standard (GDS) provides design requirements for the Pacific Gas and Electric Company (PG&E or Company) polyethylene (PE) gas distribution system.

### 1 General Information

1.1. Connections within the PE system may be made with the following:

- A. Heat iron socket and butt fusion (reference GDS B-90, "Plastic System Socket and Butt Fusion Fittings").
- B. Heat iron saddle fusion (reference GDS B-90.1, "Plastic System Saddle Fittings").
- C. Electrofusion (reference GDS B-90.3, "Electrofusion Fittings and Tapping Tees").

**Note:** Molded butt fusion fittings are made to different specifications than PE pipe (fitting wall thickness may be greater than standard pipe wall thickness), and therefore are incompatible with mechanical fittings.

- D. Mechanical fittings (reference GDS B-91, "Transition Fittings for Polyethylene Pipe," and GDS B-91.1, "Polyethylene (PE) System Mechanical Fittings").

(1) Mechanical fittings are only allowed to be installed on the following PE materials:

- PE pipe
- Excess flow valves (EFV), including ½" molded EFVs
- Prefabricated gas service risers
- Prefabricated PE to steel transition fittings
- Electrofusion tapping tees with pipe pup
- PE valve with pipe pup

**Note:** Any connection to Aldyl-A pipe requires **only** mechanical or electrofusion fittings. Heat iron fusion is **not** allowed on Aldyl-A pipe.

- 1.2. Evaluate cathodic protection impacts of the design:
  - All isolated steel pipe, risers, valves, and fittings within a PE pipe system must be cathodically protected. Prefabricated risers, metallic components on plastic valves, tapping tees, and metallic bolts on plastic fittings do **not** need to be protected. Refer to Utility Manual TD-4180M, *Gas Transmission and Distribution Manual - Corrosion Control Volume*.
- 1.3. Ensure plastic mains or services are not subjected to temperatures greater than 120° F as described in GDS A-93, "Polyethylene Pipe Specifications and Design Considerations."
- 1.4. To deactivate a plastic service see GDS A-93.2, "Deactivation of Plastic Services."

## 2 Materials

Only pipeline components listed in the Company's GDSs, Engineering Material Specifications, Utility Bulletins, and Flash emails are allowed in construction of the gas system.

### 2.1. Pipe

#### A. Main Pipe Sizing:

- (1) Preferred pipe size is 2", 4", 6", or 8". PE pipe specifications and design are specified in GDS A-93.

#### B. Service Pipe Sizing:

- (1) New services must be 1" copper tubing size (CTS) or larger.
- (2) For fully replaced services, 1" CTS is the preferred minimum pipe size. When inserting or splitting, consider ½" pipe if adequate for service load and EFV sizing.
- (3) On applicant installed jobs, the Company may accept previously installed ½" CTS services and ½" CTS service stubs installed prior to May 1, 2010, if those services and stubs have the capacity to support the current customer loads, as approved by the local area engineer. See [Appendix 1](#) for the requirements that must be met to approve previously installed applicant installations.

**2.2. Fittings**

- A. Heat iron fusion fittings are listed in GDS B-90 and GDS B-90.1.
- B. Electrofusion fittings are listed in GDS B-90.3.
- C. Approved PE-to-PE mechanical connections are listed in GDS B-90.1, GDS B-91, and GDS B-91.1.
- D. Make PE-to-steel, PE-to-copper, or PE-to-cast-iron transition joints using the approved transition fittings shown in:
  - (1) GDS B-54, "Compression Couplings"
  - (2) GDS B-91, "Transition Fittings for Polyethylene Pipe"
  - (3) GDS, B-91.1, "Polyethylene (PE) System Mechanical Fittings"
  - (4) GDS B-91.4, "Cast Iron to Steel Insulated Transition Couplings"
  - (5) GDS B-91.5, "Cast Iron to Polyethylene Transition Fittings"

**2.3. Risers**

- A. Prefabricated risers are listed in GDS A-91, "Prefabricated Risers."

**2.4. Valves**

- A. EFVs are listed in GDS A-93.3, "Plastic Excess Flow Valves."
- B. PE valves are listed in GDS F-90, "Polyethylene (PE) Valves."
- C. Do not install metallic valves in a PE system.

**2.5. PE Pipe Locating**

- A. For locating wire requirements see GDS A-90.2, "Locating Wire Installation for Direct Burial Plastic Mains and Services," and GDS A-90.3, "Locating Wire Installation for Inserted Plastic Mains and Services."

### 3 PE Pipe System Design

#### 3.1. PE Pipe Placement

- A. See GDS A-04, "Cover and Clearance Requirements for Transmission Lines, Distribution Mains, and Service Lines," for depth of cover and clearance requirements.
- (1) Plastic pipe is susceptible to buckling and crushing at specified depths due to the effects of soil stresses. Plastic pipe may **not** be installed at a depth greater than 10', unless the installation is evaluated for fill-stress effects and is approved by the appropriate senior gas distribution engineer.
- B. The appropriate engineer should consider the following when determining whether to parallel or replace existing main for capacity jobs:
- Condition/Age of pipe
  - Leak history
  - Leak survey issues with having adjacent pipes
  - Additional relocation work during road reconstruction
  - Cost to transfer services

#### 3.2. Gas Service Placement

- A. Gas service is normally installed in a straight line at a right angle to the main, traversing from the main to the meter.
- (1) Offsets, diagonal runs, and bends should be avoided wherever possible.
- (2) Where avoidable, service should **not** be installed under driveways or customer-paved areas.
- B. When an applicant changes the service-point location (flop lots), take one of the following actions:
- (1) For short-side service stubs:
- Cut off the service stub at the main per GDS A-93.2, and install a new service.
- (2) For long-side service stubs:
- IF the street is not yet paved,  
  
THEN cut off the service stub at the main per GDS A-93.2, and install a new service.

## 3.2 (continued)

- IF the street is paved and the walls of the new building are still opened,  
  
THEN use the existing service-point location and have the applicant re-plumb the houseline to the original service-point location.
  - IF the street is paved and the walls of the new building are closed,  
  
THEN consult the local area engineer to determine the change in service lay-out.
- C. The final grade level for a prefabricated riser must be at or below the red burial line indicated on the riser as described in GDS A-91.

## 3.3. Typical Subdivision Design for PE Pipe

- A. [Figure 1](#) shows a typical subdivision design - infill and [Figure 2](#) shows a typical subdivision design - end of system growth.
- B. The appropriate senior gas distribution engineer must specify main-line rib sizes and tie-in locations.
- C. **Do not** terminate gas distribution facilities at the end of a development to clear paving or other improvements unless the applicant requests an extension to serve adjacent future development. Terminate these facilities approximately 5' past the last service, or to the next property line within the project area, unless approved by the appropriate senior gas distribution engineer.
- D. To make sharp turns or offsets (smaller than the minimum bend radius in [Table 2](#)), install full-opening heat fusion fittings per GDS B-90, or electrofusion fittings per GDS B-90.3.

3.3 (continued)

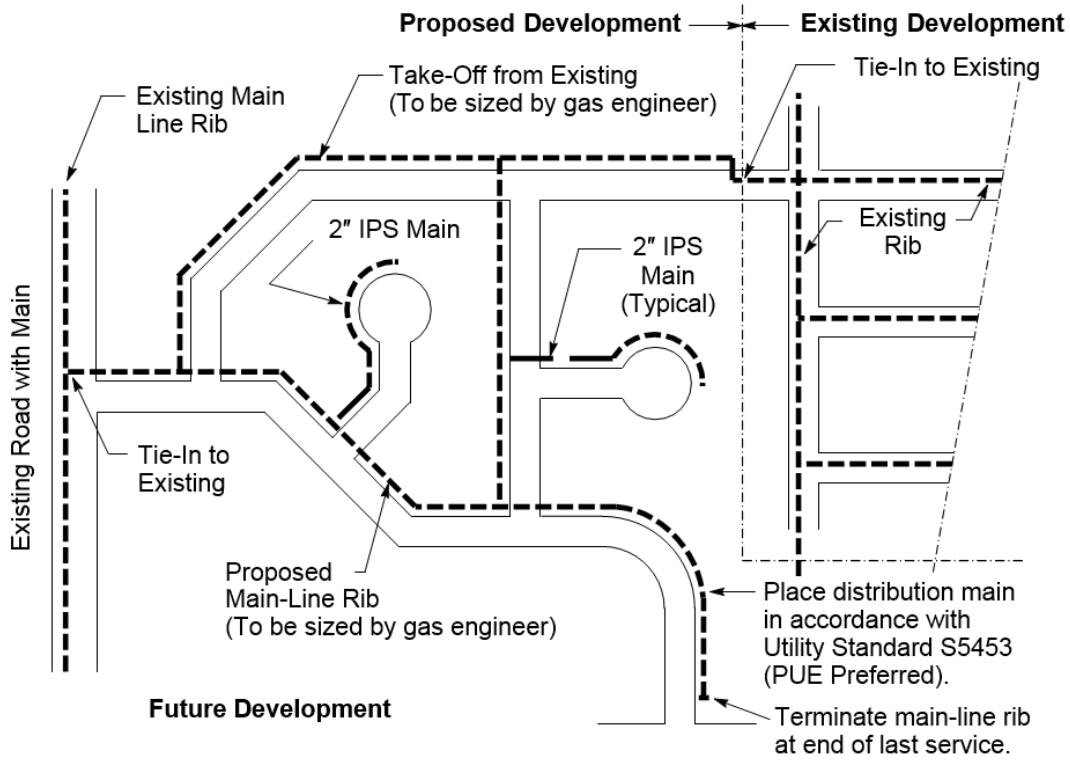


Figure 1. Typical Subdivision Design – Infill

- E. Place the gas facilities in the distribution trench per Utility Standard S5453, "Joint Trench." Placement in a public utility easement (PUE) is preferred.

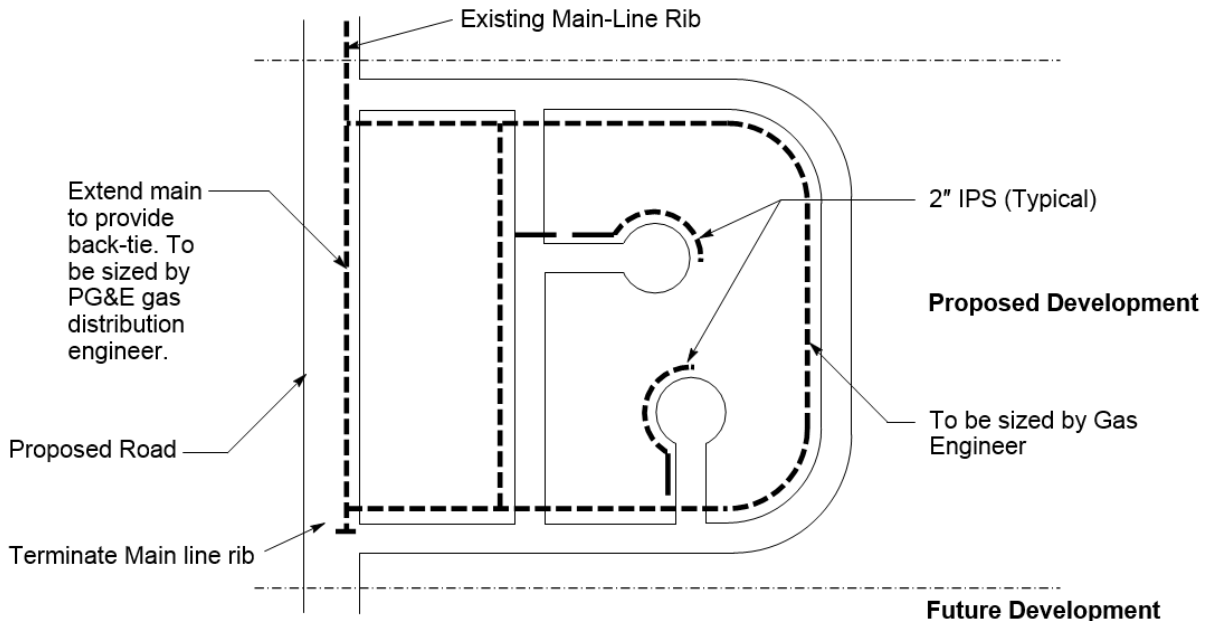


Figure 2. Typical Subdivision Design – End of System Growth

3.3 (continued)

- F. A subdivision design for end of system growth is shown in [Figure 2](#). Extend the distribution main along the proposed road to provide a back-tie to the proposed development.

3.4. Branch Services

- A. Branch services must be designed and installed as outlined in GDS A-42, “Standard Branch Service Installation.”
- B. Branching may be used to provide service to **no more** than two buildings. The meter installations must be located on the adjacent sides of the two buildings served. Where a branch-service installation is justified, a separate location for the gas meter and electric meter is permissible, if necessary.

3.5. Fault Line Crossings

- A. Avoid installing mains and services across fault lines whenever possible. Whenever it is necessary to install a main or service across a fault line, consider fault creep when designing the crossing and include appropriate precautions, such as the following:
  - (1) Installing shut off valves on the main on either side of the crossing.
  - (2) Minimizing the use of fittings and bends in the vicinity of the crossing.
  - (3) Using a large-diameter plastic casing to absorb deflection caused by fault creep.
- B. Contact distribution integrity management program (DIMP) personnel for assistance in designing fault line crossings.

**4 Construction Methods**

4.1. PE Joining Methods

- A. The preferred joining methods for each size pipe is shown in Table 1.

**Table 1. PE Pipe - Joining Methods**

Pipe/Tubing Size or Connection Type	Preferred Joining Methods <sup>1</sup>	Alternate Joining Methods <sup>2</sup>
½" CTS–1¼" Iron Pipe Size (IPS)	Electrofusion, Socket Fusion	Mechanical
2" IPS	Electrofusion, Socket Fusion, Butt Fusion	Mechanical
3"–8" IPS	Butt Fusion	Electrofusion
Saddle	Electrofusion, Heat Iron Saddle	Bolt-On Saddle

1. Heat iron saddle, socket, and butt fusion are not permitted on Aldyl-A pipe.  
 2. Consider for repairs and tie-in connections.

4.1 (continued)

- B. A 2" mechanical stab type fitting may only be used for main or service PE pipeline repair, riser replacement, hot tie-in connections (a connection between a new or replaced section of pipeline and an existing pipeline already pressurized with natural gas), and main or service capping (end cap only).

4.2. Typical Direct-Burial Plastic Main and Service Installation

- A. Unless approved by engineering personnel **do not** install direct-buried plastic pipe under structures subject to settlement that could cause damage to the pipeline, such as: retaining structures, walls or footings, or adjacent to pile.
- B. **Do not** install direct-buried plastic pipe in unpaved areas where substantial wheel or equipment loading may damage the pipe, unless approved by the appropriate senior gas distribution engineer .
- C. A warning tape must be installed in direct-burial installations per GDS L-16, "Gas Pipeline Underground Warning Tape."

4.3. Directional Changes

- A. Changes in pipe direction must be made with elbows, or tee fittings at street intersections (as illustrated in Attachment 1, "Illustration of a Direct Burial Main and Service Installation"). Roping may be used for directional changes at other locations, when necessary.
- B. Bends in roped PE pipe must be installed in the trench with a radius greater than the minimum recommended radius ([Table 2](#)). All bends must have a radius greater than: 20 times the pipe diameter for SDR 7 and 9, and 25 times the pipe diameter for SDR 10, 11, 11.5 and 13.5.
- C. There must be **no** fusion or mechanical joints within 3' of any bend.

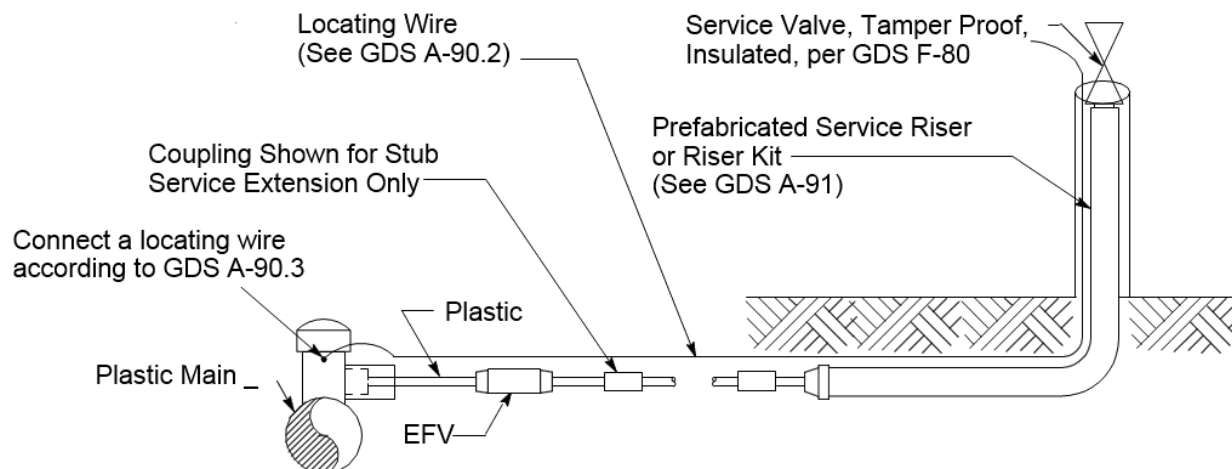
**Table 2. PE Pipe Minimum Bend Radius**

Nominal Pipe Size (Inches)	Minimum Bend Radius
½ CTS	15
1 CTS	28
1¼ IPS	42
2 IPS	60
3 IPS	84
4 IPS	114
6 IPS	168
8 IPS	216



## 4.3 (continued)

- D. Ensure that plastic pipe containing fusions or mechanical joints are installed in a straight alignment. Plastic pipe installations are in straight alignment if the bend radius of the pipe is greater than 150 times the pipe diameter.
- E. Figure 3 represents a typical lateral connection. See GDS B-90.1, and GDS B-90.3 for saddle fittings.



**Figure 3. Plastic Service Installation**

- F. For future lateral lines, install a minimum 3' stub with locating wire attached to an anode as described in GDS A-90.2.
- 4.4. Mechanical Insertion of PE Main and Service
- A. Refer to the documents below for information on specific casing applications and installations:
- (1) GDS A-75, "Gas Service and Mains in Plastic Casing," for the specific installation requirements for plastic pipe in a plastic casing.
  - (2) GDS A-33.1, "Plastic Gas Lines on Bridge Structures," for the specific installation requirements for plastic lines on bridge structures.
  - (3) GDS A-70, "Casings for Highway and Railroad Crossings," for casing size and other requirements for highway crossings.
- B. Do not transfer copper services to a new main or alter copper services (see Utility Standard TD-4801S, "Service Replacement Criteria").
- C. Plastic pipe is approved for inserting into existing mains and services. See GDS A-93.1, "Plastic Gas Distribution System Construction and Maintenance," for requirements.

4.4 (continued)

- D. Ensure that the minimum bend radius of PE pipe listed in [Table 2](#) is not exceeded during insertion into a casing.
- E. Provide for future laterals by installing stubs, or opening up the casing at appropriate locations (see [Figure 4](#), and [Figure 6](#)).
- F. Plug the space between the plastic and the casing pipe (see [Figure 5](#)) with casing plugs or cable protectors (see GDS A-70, and GDS A-73, "Casing Insulator and End Seals Selection Chart"), duct seal, or other suitable means not detrimental to PE pipe. See GDS A-75 for the plastic casing/sleeve sealing requirements.

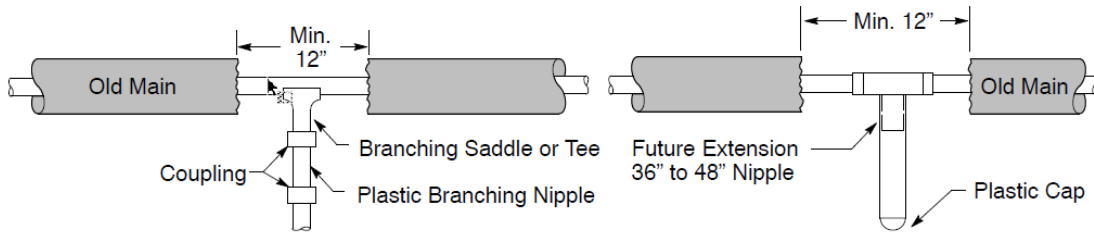


Figure 4. Laterals Off Plastic Main Insert

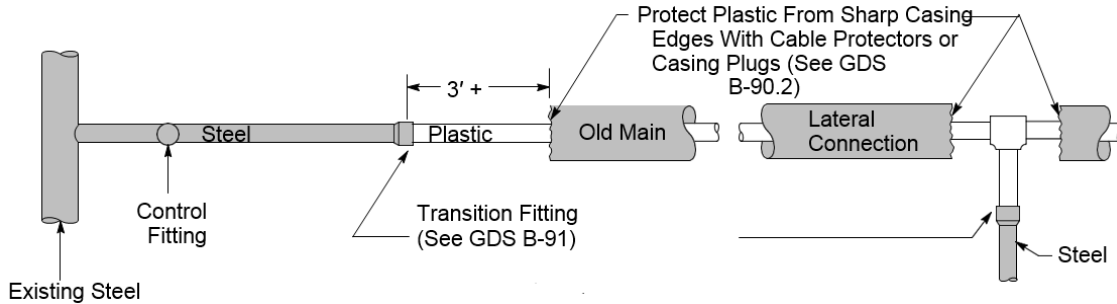


Figure 5. Tie-In to Steel

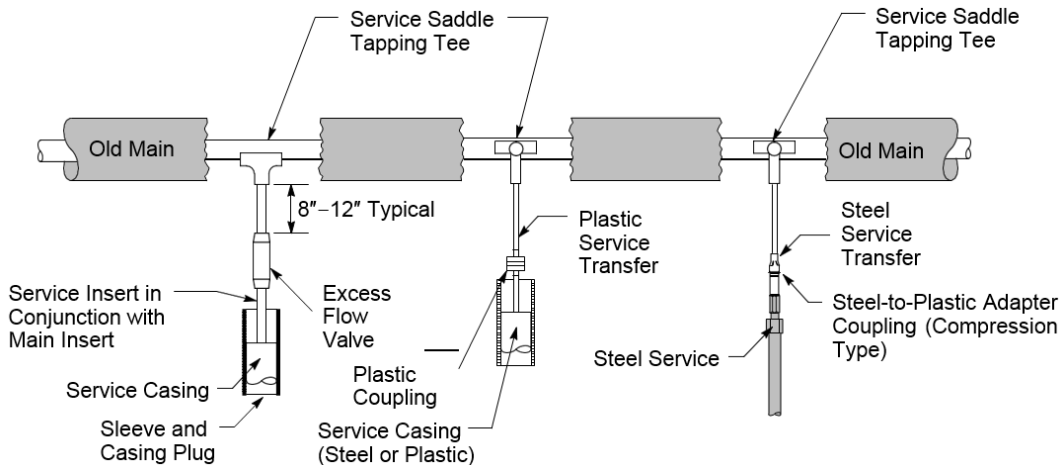


Figure 6. Service Connections Off Plastic Main Insert

4.5. Riser Insertion

- A. Details for service head adapter installation are provided in GDS B-91.
- B. Whenever possible, the service riser must be relocated outside of the building (see GDS A-91). This section is intended for use on service renewals where a new service riser cannot be relocated outside of the building. See [Figure 7](#).
- C. See Detail B for riser going directly straight into a building.
- D. See Detail C for riser coming up from underneath a building.

**Note:** Detail C (below) is for above grade vent penetrations only. For subsurface vent penetrations consult local engineering.

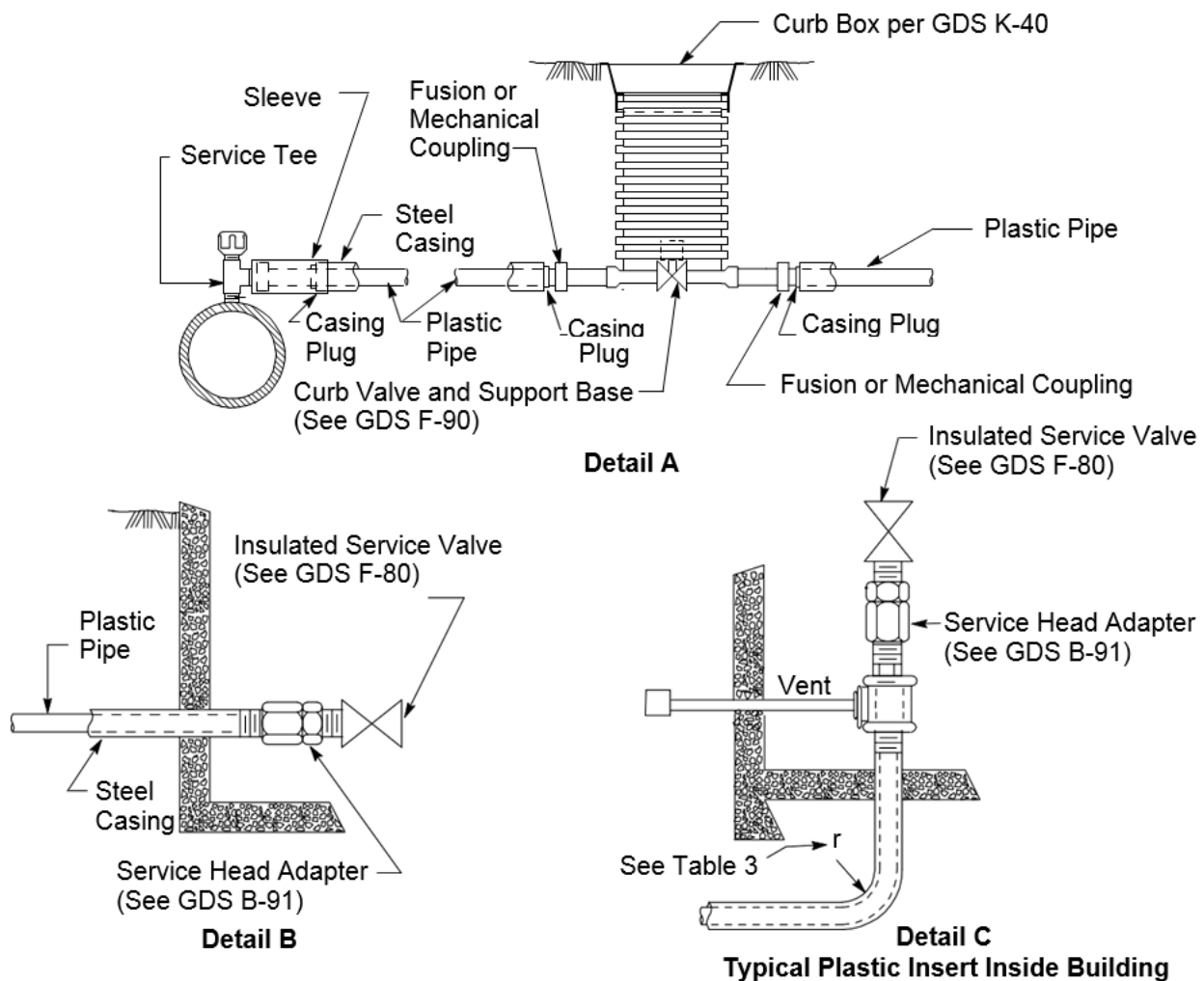


Figure 7. Typical Plastic Insert into Basement or Meter Box

## 4.5 (continued)

- E. Where possible, the sleeve should bridge the gap between the service tee and the casing pipe. The plastic pipe must be supported by well compacted sand or fine soil.
- F. For typical scenarios of Detail C, the following method can be used to vent service casing:
  - (1) Casing must be gas tight.
  - (2) Use minimum 3/8" outside diameter (OD) stainless steel tubing or minimum 1/4" nominal pipe size (NPS) steel pipe or approved flex hose as a vent pipe.
  - (3) Extend the vent to the outside of the building AND maintain the same clearances as regulator vent.
  - (4) Terminate the vent with insect-resistant fitting or screen.
  - (5) The vent line must be insulated where it passed through a wall, per GDS O-96, "Insulating Metal Gas Lines from Walls."
- G. **Do not** insert plastic pipe into a casing if the casing pipe radius is less than that shown in [Table 2](#).
  - (1) IF the radius is less than listed in [Table 2](#),  
  
THEN install a new riser with the proper bend radius.
- H. Install curb boxes so that external loads are not transmitted to the service. The valve box must **not** rest on the service pipe or casing.

## 5 Records

- 5.1. See GDS A-34, "Piping Design and Test Requirements," for leak test stamp requirements.
- 5.2. Retain records per the Record Retention Schedule.

## Target Audience

The following personnel: gas planners, estimators, new business inspectors, gas distribution engineers, maintenance and construction, general construction, materials inspectors, and personnel involved in PE pipe connection training and qualification.

## Definitions

NA

**Compliance Requirement / Regulatory Commitment**

Code of Federal Regulations (CFR) Title 49, Transportation, Part 192—Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards, Section 192.321, “Installation of plastic pipe”

**References**

ASTM F1973-08, Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems

Gas Design Standard A-04, “Cover and Clearance Requirements for Transmission Lines, Distribution Mains, and Service Lines”

Gas Design Standard A-15, “Code Numbers for Steel Pipe”

Gas Design Standard A-22, “Stainless Steel Tubing Specification”

Gas Design Standard A-33.1, “Plastic Gas Lines on Bridge Structures”

Gas Design Standard A-34, “Piping Design and Test Requirements”

Gas Design Standard A-42, “Standard Branch Service Installation”

Gas Design Standard A-44, “Service Connections to Cast Iron Main”

Gas Design Standard A-70, “Casings for Highway and Railroad Crossings”

Gas Design Standard A-73, “Casing Insulator and End Seals Selection Chart”

Gas Design Standard A-75, “Gas Service and Mains in Plastic Casing”

Gas Design Standard A-90, “Plastic Main and Service Installation”

Gas Design Standard A-90.2, “Locating Wire Installation for Direct Burial Plastic Mains and Services”

Gas Design Standard A-90.3, “Locating Wire Installation for Inserted Plastic Mains and Services”

Gas Design Standard A-91, “Prefabricated Risers”

Gas Design Standard A-93, “Polyethylene Pipe Specifications and Design Considerations”

Gas Design Standard A-93.1, “Plastic Gas Distribution System Construction and Maintenance”

Gas Design Standard A-93.2, “Deactivation of Plastic Services”

Gas Design Standard A-93.3, “Plastic Excess Flow Valves” Gas Design Standard B-14, “Standard Threaded Tee”

## References (continued)

Gas Design Standard B-15.1, "Threaded Bushing"

Gas Design Standard B-54, "Compression Couplings"

Gas Design Standard B-62, "Stainless Steel Tube Fittings"

Gas Design Standard B-90, "Plastic System Socket and Butt Fusion Fittings"

Gas Design Standard B-90.1, "Plastic System Saddle Fittings"

Gas Design Standard B-90.2, "Polyethylene (PE) System Accessories"

Gas Design Standard B-90.3, "Electrofusion Fittings and Tapping Tees"

Gas Design Standard B-91, "Transition Fittings for Polyethylene Pipe"

Gas Design Standard B-91.1, "Polyethylene (PE) System Mechanical Fittings"

Gas Design Standard B-91.4, "Cast Iron to Steel Insulated Transition Couplings"

Gas Design Standard B-91.5, "Cast Iron to Polyethylene Transition Fittings"

Gas Design Standard F-80, "Meter Valves"

Gas Design Standard F-90, "Polyethylene (PE) Valves"

Gas Design Standard J-15, "Gas Meter Locations"

Gas Design Standard J-16, "Gas Meter Room"

Gas Design Standard K-40, "Plastic Valve Box for 3/4" - 4" Valves"

Gas Design Standard L-16, "Gas Pipeline Underground Warning Tape"

Gas Design Standard O-96, "Insulating Metal Gas Lines from Walls"

Utility Manual TD-4180M, *Gas Transmission and Distribution Manual - Corrosion Control Volume*.

Utility Procedure TD-4110P-03-F01, "Leak Repair, Inspection, and Gas Quarterly Incident Report"

Utility Procedure TD-4634P-01, "Polyethylene Service Splitting"

Utility Standard GS I.S. 463-4, "Cover and Clearance Requirements for Transmission Lines, Mains and Service Lines"

Utility Standard S0470, "Design and Construction of Gas Distribution Facilities"

References (continued)

Utility Standard S5453, "Joint Trench"

Utility Standard TD-4801S, "Service Replacement Criteria"

Work Procedure WP4170-02, "Squeezing Polyethylene (PE) pipe"

### **Appendices**

[Appendix 1, "Application of New Installation and Design Requirements to Qualified Delayed Applicant-Installed Work"](#)

### **Attachments**

Attachment 1, "Illustration of a Direct Burial Main and Service Installation"

### **Revision Notes**

Revision 7 has the following changes:

1. Incorporated content from Utility Bulletin TD-A-93.1B-001, "Mechanical Fittings Connections Use Clarification" to clarify what connections mechanical fittings can be used on.
2. Added guidance for fully replaced services, 1" CTS is the preferred minimum pipe size but to consider ½" pipe when inserting or splitting if adequate for service load and length.
3. Updated Table 1 to clarify preferred joining methods and alternate joining methods for PE pipe.
4. Clarified definition of hot tie-in for 2" stab fittings.
5. Added guidance on parallel main installations for capacity jobs.
6. Updated guidance on methods used to vent casings on risers.
7. Removed old plastic pipe stamp and referenced GDS A-34 for leak test stamp requirements.
8. Removed table for bend radius in riser casing, as Table 2 will be adequate table to use for that scenario.

**Asset Type:** Distribution Services

**Function:** Design, Construction, and Maintenance

**Document Contact:** [Gas Design Standard Responsibility List](#)

**Appendix 1 – Application of New Installation and Design Requirements to Qualified Delayed Applicant-Installed Work**

Page 1 of 2

This appendix clarifies how to apply various new installation and design requirements to qualified delayed applicant-installed gas projects, where the gas distribution main backbone and service stubs were installed and inspected, but the service completions have not been completed for many months or years.

**Note:** This **does not** apply to any “at-risk” projects.

1. The Company has encountered delayed applicant-installed projects (e.g., subdivisions) where the gas distribution main backbone and service stubs were installed and inspected, but the service completions have not been completed for many months or years, and the system has not been pressurized, energized, and accepted by the Company. These projects must meet the following criteria:
  - Job designs were previously approved by the Company.
  - Contracts were executed by the applicant with the Company for the project.
  - Company has inspected the work to date on the project.
2. Current installation and design requirements must be applied when a delayed project is actually pressurized and placed in service.
3. This appendix addresses the following new requirements:
  - Pipe locating requirements
  - One-inch diameter services
  - 1000-foot maximum spacing between Electrolysis Test Stations (ETS)
  - Locating wire gauge requirements for plastic pipe installations
  - Pressure testing
4. Locating Requirements
  - A. Applicant installers are required to mark dead end gas mains, and gas service stubs as described in GDS A-90.2, and GDS A-90.3.
5. One-inch services
  - A. The Company will accept previously-installed ½” services, and ½” service stubs installed prior to May 1, 2010, if those services and stubs have the capacity to support the current customer loads.



**Appendix 1 – Application of New Installation and Design Requirements to  
Qualified Delayed Applicant Installed Work**

Page 2 of 2

- B. The gas service stub must be at least 1" in diameter if any of the following conditions exists:
- Customer gas load conditions require a larger size gas service. For example, 1" EFVs and services are required for service lengths of 122' or longer, per GDS A-93.3. Note that GDS A-93.3 also directs that EFVs are not to be installed on stub completions
  - Branch services
  - Changed or new customer gas loads that exceed the capacity of the previously designed service
3. 1000' maximum spacing between ETS boxes
- Applicant installers are required to install ETS boxes every 1000'(or closer) in accordance with GDS A-90.2.
4. Locating wire gauge requirements for plastic pipe installations
- The Company will accept 14-gauge locating wire on existing plastic pipe service installations, installed prior to August 1, 2009, as long as the wire passes continuity tests. Applicant installers are not required to replace existing 14-gauge wire (that pass continuity tests) with 10-gauge on plastic services, and service stubs that have already been installed. However, all new plastic services and service stubs must be installed with 10-gauge wire in accordance with GDS A-90.2 and GDS A-90.3.
5. Pressure Test
- Main and stubs are required to be tested per GDS A-34.