Purpose and Scope

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

1 General Information

1.1. Joining PE

A. See Appendix A, “Polyethylene Joining Method and Approved Material References,” for approved joining methods and materials.

B. Standard heat iron fusions are not allowed on Aldyl-A material. Use only electrofusion or mechanical fittings with Aldyl-A material.

C. Mechanical fittings are not allowed on molded butt fusion fitting such as 3-way tees, 90° elbows, 45° elbows, end caps, reducers, branch saddles, PE valves with molded ends, and tapping tees without pipe pups.

Exception: 1/2” excess flow valves (EFVs) have molded ends but are made to pipe tolerances and are compatible with mechanical fittings.

1.2. Transitions from PE to steel

A. Take precautions to protect the PE pipe at the point of transition when welding the steel end.

CAUTION

Protect the transition joint from excessive heat when welding or PE pipe could become damaged.

(1) Never shorten the steel portion of a transition fitting. Heat from welding can damage the PE pipe if the steel is cut.

(2) Protect the transition joint from excessive heat. Do not weld, thermite weld, or heat the body of the fitting; only butt welding of the steel end is permitted.

B. During this welding, protect the PE part of the heat-fusion transition fitting from overheating by wrapping the midpoint of the steel part of the fitting with wet cloth to remove heat. Keep the cloth wet. After completing the weld, leave the wet cloth on the fitting until the steel pipe is cool enough to touch.
1.2 (continued)

C. Adequately support the plastic pipe adjacent to the transition fitting. Support the exposed PE pipe with well-compacted sand or fine soil.

1.3. Riser installation


   (1) Repair any coating damage on risers in accordance with applicable coating/wrap standards.

   (2) Install sun shields on all prefabricated risers and riser kits. Shields must extend from 1" below the top of the riser or below the bypass to ground level or below.

   (3) Do not paint a sun shield.

1.4. Thermal expansion

A. When installing PE pipe, ensure that all plastic lines are slack before completing final tie-ins to allow for thermal expansion and contraction.

1.5. Marking new service installations

A. All new or replaced services must have the curb (or street) marked indicating the location of the new or replaced service. This marking provides identification and location of the gas service pending the update of the service installation by mapping.

B. IF the local municipalities or agencies have requirements that restrict marking the services,

   THEN note the restriction on the gas service record (GSR), per Utility Procedure TD-9500P-14, “Gas Service Records.”

2. Construction Materials

2.1. Pipe

A. Check the production date on the pipe.

   (1) Yellow medium density polyethylene (MDPE) pipe more than 3 years old must be scrapped.
2.2. Fittings

A. Refer to Appendix A for approved fittings.

B. Fittings and risers stored indoors, or stored outdoors but are covered, have an indefinite storage life. Only the PE portion of the riser outside of the riser casing requires a cover. The riser casing itself can be exposed to the elements.

3 Construction Methods

3.1. PE pipe handling

A. Verify the print line on the pipe or tubing and document the date of manufacture, the manufacturer's name, and the standard dimension ratio (SDR) or wall thickness.

B. Handle PE pipe carefully to eliminate the possibility of damage during loading, unloading, and storage operations.

   (1) During transport, the pipe must be supported to minimize movement and must be located away from any source of heat, such as equipment or vehicle exhaust.

      a) Protect pipe against ropes or other securing devices.

      b) Do not use chains to secure the pipe.

      c) Do not place supplies or other equipment on top of the pipe.

C. String coils of plastic pipe by hand or from a reel.

   (1) Coils of 4" diameter pipe and larger must be strung from an approved trailer designed for large-diameter, coiled PE pipe as described in GDS M-17.2, “Large Diameter PE Coil Pipe Trailers and Accessories.”

      a) Coils must not be rolled over sharp objects OR pulled over rough surfaces.

      b) String straight lengths by lifting the pipe from the truck to the ground.

      c) The pipe must be protected from rocks or other abrasive material during this operation and must not be dropped from a height.
WARNING

Observe proper safety precautions during field bending of pipe.
Considerable force may be required to field bend pipe.

IF the pipe is released during bending,
THEN the pipe may spring back forcibly.

(2) Coiled PE pipe is confined with bands at intervals within the coils. As the pipe is uncoiled, take precautions to avoid kinking the pipe. Do not uncoil the pipe faster than the bands can be cut.

D. Carefully inspect PE pipe for debris, kinks, gouges, scratches, punctures, and other imperfections after each of the handling operations and before and during installation.

E. New PE pipe must be rejected, and installed pipe replaced, if defects or damages exceed 10% of the wall thickness of the pipe. Pipe wall thicknesses are listed in GDS A-93, “Polyethylene Pipe Specifications and Design Considerations.”


CAUTION

Damage to the PE pipe can result from welding (weld or thermite weld) too close without protecting the pipe with a heat-resisting baffle or wet rags.

F. To minimize the possibility of sparks or hot material coming into contact with the plastic pipe, do not perform welding on pipe immediately adjacent to plastic pipe.
3.2. Control static charge build-up in PE.

**WARNING**

Discharge of static electricity can cause shocks or ignite a gas-air mixture. Apply static grounding in all situations where gas is present or anticipated.

A. Static-electric charges can build up on both the inside and outside surfaces of PE pipe. Localized, static-electric buildup occurs because PE pipe does not readily conduct electricity. See Utility Procedure WP4170-01, “Grounding Polyethylene (PE) Pipe to Control Static Electricity,” for static-grounding procedures and requirements.

3.3. Depth of cover for main and service

A. Refer to GDS A-04, “Cover and Clearance Requirements for Transmission Lines, Distribution Mains, and Service Lines,” for depth of cover requirements.

3.4. PE pipe pressure control (squeeze-off)

A. Squeeze off PE pipe to extend or repair it. PE pipe is flexible and can be squeezed shut without damaging the pipe or reducing its pressure rating, provided the proper tools and procedures are used.


3.5. Purging plastic mains and services

A. Remove static-electric charges by grounding the pipe whenever the pipe is purged. Refer to Utility Procedure WP4170-01.

B. Purge plastic mains and services according to the provisions specified in GDS A-38, “Purging Gas Facilities,” as applicable.

C. Follow purging instruction in GDS A-93.3, “Excess Flow Valves,” if the service has an excess flow valve.

3.6. Gauging requirements/continuity of service

A. It is Company policy to maintain uninterrupted service to customers during the construction, reconstruction, or maintenance of facilities as described in Distribution & Customer Service (DCS) Standard D-S0454, “Gas Mains, Maintaining Continuity of Service During Construction.”
3.7. Backfill requirements

A. Bedding must provide firm, continuous support under and around the PE pipe, and provide support for spans across gaps and holes. The backfill must be free of sharp objects, rocks, and large clods. The bedding materials used for support must be well-compacted. To prevent differential settlement, take extra care to provide proper compaction under pipes and fittings at branch and transition locations. Provide imported bedding for the pipe if the trench bottom is not smooth (refer to Engineering Material Specification [EMS] EMS-4123, “Backfill Sand”).

B. Compact the backfill at the sides of the PE pipe. Do not compact the backfill directly over the pipe until there is at least 12” of cover. Take care when dumping backfill material on top of PE pipe service connections or transition fittings.

C. DO NOT allow cement additives such as calcium oxide (quicklime) to come into contact with PE pipe, tubing, or fittings.

D. When using a flowable fill, such as controlled density fill or slurry, provide a minimum of 6” of sand shading above and between the pipe and fittings.

3.8. Direct burial

A. A warning tape must be installed in direct-burial installations per GDS L-16, “Gas Pipeline Underground Warning Tape.”

3.9. Insertion of PE main and services in casing

**Note:** When installing PE pipe, ensure that all plastic lines are slack before completing final tie-ins to allow for thermal expansion and contraction.

A. Insert plastic pipe into an existing casing by performing the following steps:

   (1) Clean the casing pipe.

   (2) Ream the steel casings to protect the plastic insert from the sharp edges of the casing. Where necessary, the entire length of the casing pipe must be reamed.

   (3) The leading edge of the plastic pipe or tubing must be sealed during insertion.

   (4) Push the plastic pipe through the casing.
3.9 (continued)

(5) Evaluate the first 5’ of the plastic pipe for damage as it leaves the casing pipe.

(6) IF there is damage that is caused by the casing pipe, THEN remove the plastic pipe and repair the pipe as described in Section 4.

B. Support exposed plastic at entry and exit points.

(1) Plug the space between the plastic and the casing pipe (see GDS A-90, “Polyethylene Gas Distribution System Design”) with casing plugs or cable protectors, duct seal, or other suitable means not detrimental to PE pipe.

(2) Any non-cased plastic pipe must be well supported with backfill.

C. Plastic pipe is approved for double insertion into existing mains and services. This application is approved provided the following conditions are met:

(1) It is not practical or economical to remove the previously inserted pipe.

(2) The installation is made per GDS A-75, “Gas Service and Mains in Plastic Casing,” or GDS A-90, as applicable, particularly with respect to protecting and supporting the entry and exit points.

(3) The installation is mapped with both the casing size and casing material identified. For example, a ½” plastic service inserted into a 1” copper pipe that is inserted into a 2” steel line is mapped as shown in Figure 1.

Figure 1. Mapping of a Double Insert
3.9 (continued)

D. Squeezing of the outer casing is only allowed in the event of an emergency. If the outer casing pipe is squeezed, the casing must be grounded. The PE gas-carrier pipe must be replaced after flow control is no longer needed.

(1) IF the outer casing is metallic (i.e., steel or copper),

THEN ground the casing using a ground cable that is grounded to wet earth.

(2) IF the outer casing is PE,

THEN ground the squeezer and casing as if the casing were the carrier pipe in accordance with Utility Procedure WP4170-01.

(3) IF the casing is polyvinylchloride (PVC) or cast iron,

THEN remove the casing before squeezing the carrier pipe or tubing, and ground the carrier pipe per Utility Procedure WP4170-01.

(4) Take special precautions when accessing the carrier pipe (window cutting) to avoid damaging it.

(5) IF the pipe is damaged,

THEN the carrier pipe must be repaired by replacing the damage section of the carrier pipe.

3.10. Boring or splitting of PE main and service

Note: If enough slack is not provided in all plastic lines before completion of first tie-in, stress due to thermal expansion and contraction may occur when boring or splitting pipe.

A. Ensure that the borehole meets the 24" depth requirement for the main or service.

B. PE pipe may be pushed or pulled through a borehole as described in the following:


(2) GDS M-70.7, “Pneumatic Piercing Tools”

(3) Utility Procedure TD-4412P-05, “Excavation Procedures for Damage Prevention”
3.10 (continued)

C. During pipe pulling, constantly monitor the pulling force on the pipe and use a pulling head containing a weak-link or mechanical breakaway per GDS M-16.2, “Weak-link and Mechanical Breakaway Connectors Used in Polyethylene Pipe Installation.”

D. During horizontal directional drilling (HDD) operations, the equipment gauge pressure must **not** be used to determine pulling forces on the pipe.

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CAUTION

A weak-link or a mechanical break-away is critical to ensuring that PE pipe is installed without exceeding its design load.

E. Examine the pipe as it leaves the hole to determine if the speed of the pipe is smooth and continuous. Any delay in the pipe pulling may indicate that the pipe has “hung up” and has possible damage.

F. When installing PE using HDD, minimize variations in the bore to avoid adding drag when pulling back the pipe. Proper back-reaming and mudflow will help reduce the drag on PE when pulling back the pipe.

G. PE services may be replaced using Utility Procedure TD-4634P-01, “Polyethylene Service Splitting.”

H. IF pipelines are installed using technologies where a casing is required, including the following:
   
   (1) HDD
   
   (2) Steel pipe splitting (see GDS A-36.1, “Splitting Steel Pipe”)
   
   (3) Cast-iron pipe bursting

   THEN it is acceptable to insert plastic pipe and tubing into a new plastic casing if the installation of the new plastic casing meets the following requirements:

   (1) All the current design requirements per GDS A-75 are satisfied.

   (2) The newly installed products are mapped correctly. For example, the bursting of a 4” cast-iron main for the placement of a 4” plastic main into a 6” plastic casing is mapped as follows: 4 - PL (6PL).
3.11. Riser insert

A. Before installing a service head adapter kit, inspect the PE tubing for damage (see Figure 2).

B. Instructions for service head adapters are detailed in Utility Procedure TD-4170P-52, “Mechanical Fitting Connections for Polyethylene Pipe (Threaded Compression Transitions).”

C. The plastic pipe must be supported by well-compacted sand or fine soil.


![Figure 2. Typical Plastic Service Renewal](image-url)

3.12. Unsupported pipe spacing

A. Determine the maximum unsupported length of pipe in an excavation using Table 1.

<table>
<thead>
<tr>
<th>Nominal Size (inches)</th>
<th>Maximum (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4.9</td>
</tr>
<tr>
<td>4</td>
<td>6.5</td>
</tr>
<tr>
<td>6</td>
<td>7.9</td>
</tr>
<tr>
<td>8</td>
<td>9.1</td>
</tr>
</tbody>
</table>
4 PE Pipe Repairs

4.1. Make permanent repairs by replacing the damaged segment of plastic pipe.

4.2. Test segments of plastic pipe that are installed to replace damaged sections of mains and services per GDS A-34, “Piping Design and Test Requirements.”
   
   A. Soap test mechanical fittings and couplings during leak testing.
   
   B. Soap test the repair and squeeze areas after the repair is complete.
   
   C. Thoroughly rinse any areas exposed to detergents with clear water.

4.3. To make permanent repairs to any exposed Aldyl-A tapping tee (with black caps), whether leaking or not, install an Aldyl-A electrofusion repair kit per Utility Procedure TD-4170P-57, “Polyethylene Tapping Tee Repair Kits.”
   
   A. This requirement does not apply to main replacement jobs where the tees are not leaking AND will be excavated, deactivated, and removed under the same job.

4.4. Plexco tapping tees encountered during routine work, whether leaking or not, must be repaired by removing the existing cap and installing a Plexco replacement cap kit per Utility Procedure TD-4170P-57.
   
   A. This requirement does not apply to main replacement jobs where the tees are not leaking AND will be excavated, deactivated, and removed under the same job.

4.5. Make permanent repairs to Nipak and Continental tapping tees with damaged caps by replacing the cap with the approved replacement caps listed in GDS B-90.2, “Polyethylene (PE) System Accessories.”

4.6. A Performance Pipe 980 Quad Ring may be used to repair the Phillips Driscopipe old style orange resin tee (see Utility Procedure TD-4170P-57, Attachment 1, “Tapping Tee Identification and Component Replacement Kits”). The tee can be identified by the presence of a Quad Ring located at the top of the tapping tower.

4.7. Mechanical leak repair clamps must not be used as a repair method for plastic pipe.
4.8. Kerotest valves with compression ends (see Figure 3) are to be replaced if found leaking in the field.

![Kerotest Valve with Compression Ends](image)

Figure 3. Kerotest Valve with Compression Ends

4.9. Repair and test requirements for PE pipe damaged by dig-in or other causes.
   A. Visually inspect the plastic pipe upstream and downstream from the area of contact.
   B. Replace only enough pipe to make a permanent repair.
   C. Pressure leak test plastic pipe to be used for repair on site.
   D. Leak test the replaced section per GDS A-34.

4.10. IF the casing is damaged (broken, bent, or crushed),
      THEN replace the plastic carrier pipe 2' upstream and downstream of the dig-in location.

4.11. Repairing a service
   A. Refer to Utility Standard TD-4801S, “Service Replacement Criteria,” to determine if a service is to be repaired or replaced.
   B. Service lines must be pressure tested from the point of disconnection to the riser.
   C. In a dig-in situation, IF it appears that the pipe or casing was pulled or moved between the point of impact and the main,
   D. THEN leak test per GDS A-34.
4.12. Repair requirements for plastic-service inserted risers or prefabricated risers for meter sets exposed to or damaged by a fire or excessive heat.

A. IF a PE service-inserted riser or prefabricated riser has been subjected to unusually high temperatures (such as being exposed to a house fire or meter fire),

THEN replace either the plastic insert or the entire riser.

CAUTION

Pressure testing the service is not sufficient when a riser has been exposed to high temperatures. The plastic piping inside the riser could be damaged even though the pipe may hold during a leak test. When the service is used on a long-term basis, it could eventually rupture.

B. IF a leak is identified on any fusion connection (i.e., butt, socket, saddle, or electrofusion connection) during routine repair of any grade leak or any pressure test failure where the fusion is cut out,

THEN perform the following steps:

(1) Safely stop the flow of gas.

(2) Submit a material problem report (MPR), per Utility Procedure SCM-2106P-01, “Material Problem Report Procedure.”

(3) Complete the following steps:

a) Take a photo of the overall fusion and of the defect of the fusion prior to removal.

b) Remove the leaking fusion by cutting a minimum of 12" from both sides of the joint.

c) Tag and carefully package the fitting or connection along with the MPR number and leak notification number.

d) Ship the package to the following address:

ATTN: MPR Shed (Fusion Retrieval)
3400 Crow Canyon Road
San Ramon, CA 94583
5  Leak Testing

5.1. Only those individuals trained and qualified per the Company’s Operator Qualification (OQ) program may perform leak tests.

CAUTION

The squeeze-off technique must not be used to separate gas and air during an air test to prevent air gas mixture.

5.2. Pipe must be leak tested per GDS A-34.

5.3. IF a qualified individual completed a production PE connection that leaked or failed during a pressure test with no obvious material defects, THEN the following actions must be performed immediately:

A. Qualified individual discontinues performing connections covered by the relevant qualification until requalified.

B. Submit a CAP item to gas qualifications personnel with the information below. For contractors and applicant installers, the overseeing PG&E employee must complete the following.

(1) Name of individual who produced the failed connection

(2) Type of connection

(3) Date of failure

(4) Any associated MPR number

(5) Any applicable investigative information

5.4. Call OQ personnel (1-855-85-GO-CAP, Option 4) to schedule requalification.

5.5. If it is determined that the pressure test failure was not due to a material defect, the responsible employee must requalify.

6  Records

6.1. Retain records per the Record Retention Schedule.
Target Audience

Gas distribution engineers, gas planners, estimators, new business inspectors, maintenance and construction (M&C) crews, materials inspectors, and personnel involved in PE pipe connection training and qualification.

Definitions

Imported Backfill  Soils or man-made materials not native to the specific trench location for use in backfill. These materials will ensure that required compaction is achieved. See EMS-4123 for specific bedding and backfill requirements.

Stub Service  Service piping extended from distribution facilities to provide for a future service completion.

Compliance Requirement / Regulatory Commitment


References


GDS A–04, “Cover and Clearance Requirements for Transmission Lines, Distribution Mains, and Service Lines,”

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


Gas Design Standard A-90, “Polyethylene Gas Distribution System Design”

References (continued)

Gas Design Standard A-91, “Prefabricated Risers”

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


Gas Design Standard B-54, “Compression Couplings”

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-91, “Transition Fittings for Polyethylene Pipe”

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

Gas Design Standard D-34, “Qualifications for Joining Polyethylene Pipe”

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

Gas Design Standard L-16, “Gas Pipeline Underground Warning Tape”

Gas Design Standard M-16.2, “Weak-link and Mechanical Breakaway Connectors Used in Polyethylene Pipe Installation”

Gas Design Standard M-17.2, “Large Diameter PE Coil Pipe Trailers and Accessories”

Gas Design Standard M-70.7, “Pneumatic Piercing Tools”


Utility Procedure TD-4170P-31, “Heat Iron Socket Fusion for Polyethylene Pipe”

Utility Procedure TD-4170P-33, “Heat Iron Saddle Fusion for Polyethylene Pipe (Mechanical Assist Tool)”

Utility Procedure TD-4170P-34, “Heat Iron Butt Fusion for Polyethylene Pipe (Mechanical)”
References (continued)

Utility Procedure TD-4170P-35, “Heat Iron Butt Fusion for Polyethylene Pipe (Hydraulic)”

Utility Procedure TD-4170P-40, “Electrofusion for Polyethylene Pipe (Coupling)”

Utility Procedure TD-4170P-41, “Electrofusion for Polyethylene Pipe (Saddle)”

Utility Procedure TD-4170P-50, “Mechanical Fitting Connections for Polyethylene Pipe (Stab Outlet)”

Utility Procedure TD-4170P-52, “Mechanical Fitting Connections for Polyethylene Pipe (Threaded Compression Transitions).”

Utility Procedure TD-4170P-53, “Mechanical Fitting Connections for Polyethylene Pipe (Bolt-On Saddle)”

Utility Procedure TD-4170P-57, “Polyethylene Tapping Tee Repair Kits.”

Utility Procedure TD-4412P-05, “Excavation Procedures for Damage Prevention”

Utility Procedure TD-4634P-01, “Polyethylene Service Splitting”

Utility Procedure TD-9500P-14, “Gas Service Record”

Utility Procedure TD-4170P-40, “Electrofusion for Polyethylene Pipe (Coupling)”

Utility Procedure TD-4170P-41, “Electrofusion for Polyethylene Pipe (Saddle)”

Utility Procedure TD-4170P-50, “Mechanical Fitting Connections for Polyethylene Pipe (Stab Outlet)”

Utility Procedure TD-4170P-52, “Mechanical Fitting Connections for Polyethylene Pipe (Threaded Compression Transitions)”

Utility Procedure TD-4170P-53, “Mechanical Fitting Connections for Polyethylene Pipe (Bolt-On Saddle)”

Utility Procedure WP4170-01, “Grounding Polyethylene (PE) Pipe to Control Static Electricity”

Utility Procedure WP4170-02, “Squeezing Polyethylene (PE) Pipe”

Appendices

Appendix A, “Polyethylene Joining Method and Approved Material References”

Attachments

Job Aid A-93.1-JA01, “DGP-4 Pit Gauge for Polyethylene (PE) Pipe Wall Loss”

Revision Notes

Revision 10 has the following changes:

1. Simplified content, removed unnecessary and redundant references throughout document, and moved references for gas design standards and joining procedures into Appendix A.

2. Added new Appendix A, “Polyethylene Joining Method and Approved Material References.”

3. Section 4, “PE Pipe Repairs” changes include:
   
   • Removed requirement to clamp exposed Aldyl-A pipe squeeze points with full encirclement clamps per a recent study that revealed the clamps do not extend the life or enhance integrity of Aldyl-A pipe.

   • Deleted Table 2, “Support Clamps for Aldyl-A.”

   • Added clarification that black Aldyl-A tee caps which are supposed to be replaced every time they are exposed (leaking or not), do not need to immediately be replaced if they are not leaking AND are part of a main replacement job where the tees will be excavated, deactivated, and removed under the same job.

   • Added note that Plexco tee caps must be replaced when exposed, whether leaking or not, it is part of a main replacement job where the tees will be excavated, deactivated, and removed under the same job AND it is not leaking when exposed.


Asset Type: Distribution Mains, Distribution Services

Function: Construction, Maintenance

Document Contact: Gas Design Standard Responsibility List
Joining Polyethylene (PE)

1. Only personnel qualified under GDS D-34, “Qualifications for Joining Polyethylene Pipe,” can make connections to plastic gas distribution facilities.

2. Connections within the PE system must be made with the following:
   - Heat socket fusion and butt fusion (GDS B-90, “Plastic System Socket and Butt Fusion Fittings”)
   - Heat saddle fusion (GDS B-90.1, “Plastic System Saddle Fittings”)
   - Electrofusion (GDS B-90.3, “Electrofusion Fittings and Tapping Tees”)
   - Mechanical connection (GDS B-91, “Transition Fittings for Polyethylene Pipe,” and GDS B-91.1, “Polyethylene (PE) System Mechanical Fittings”)

3. Qualified personnel must join PE pipe and fittings using approved heat-iron or electrofusion joining procedures:
   - Utility Procedure TD-4170P-31, “Heat Iron Socket Fusion for Polyethylene Pipe”
   - Utility Procedure TD-4170P-33, “Heat Iron Saddle Fusion for Polyethylene Pipe (Mechanical Assist Tool)”
   - Utility Procedure TD-4170P-34, “Heat Iron Butt Fusion for Polyethylene Pipe (Mechanical)”
   - Utility Procedure TD-4170P-40, “Electrofusion for Polyethylene Pipe (Coupling)”
   - Utility Procedure TD-4170P-41, “Electrofusion for Polyethylene Pipe (Saddle)”

OR using approved mechanical fitting installation procedures:
   - Utility Procedure TD-4170P-50, “Mechanical Fitting Connections for Polyethylene Pipe (Stab Outlet)”
   - Utility Procedure TD-4170P-52, “Mechanical Fitting Connections for Polyethylene Pipe (Threaded Compression Transitions)”
   - Utility Procedure TD-4170P-53, “Mechanical Fitting Connections for Polyethylene Pipe (Bolt-On Saddle)”
Construction Materials

1. Heat Fusion Fittings are listed in GDS B-90 and GDS B-90.1.

2. Electrofusion Fittings are listed in GDS B-90.3.

3. PE-to-PE mechanical connections are listed in the following standards:
   - GDS B-90.1
   - GDS B-91
   - GDS B-91.1

4. Transition fittings are listed in the following standards:
   - GDS B-54, “Compression Couplings”
   - GDS B-91
   - GDS B-91.1

5. Excess flow valves are listed in GDS A-93.3.

6. Plastic valves are listed in GDS F-90, “Polyethylene (PE) Valves.”

7. Prefabricated risers are listed in GDS A-91.