

Section 3

Electric Service: Underground

3.1. Scope

This section provides information to help applicants, as well as their engineers and contractors, select acceptable locations and types of terminations for underground services when connecting to Pacific Gas and Electric Company's (PG&E's) overhead or underground electric distribution system.

3.2. General Information

PG&E has the right to enter and leave the applicant's premises at any time, for any purpose related to PG&E's obligation to furnish electric service. Only qualified PG&E personnel will connect service lateral conductors to (or disconnect them from) PG&E's energized distribution system. This includes installing or removing metering facilities or any other work related to PG&E's facilities or systems.

3.2.1. Safety Reminder



Before excavating, always call Underground Service Alert (USA) at 811 to request that member companies locate and mark their underground facilities.

Applicants must contact USA to avoid damaging any existing underground facilities. Call USA *at least 2 working days* (excluding weekends and holidays) in advance for marking service. *There is no additional charge for this service.* More information is available from the USA North website at <http://www.usanorth.org>.

3.2.2. Establishing Underground Electric Service-Responsibilities

Applicants are responsible for portions of construction, maintenance, and protection when installing underground electric service. The following subsections describe those responsibilities and explain PG&E's responsibilities in the construction process.

- A. Besides being responsible for all required *permits*, applicants must ensure that the following construction activities are performed and that the listed supplies are available on their properties and in public areas.
- Service trenching
 - Backfill
 - Excavation
 - Paving conduit
 - Substructures

- B. Applicants must provide satisfactory termination facilities on or within the structures being served. The locations for all transformers and meters, as well as the sizes, types, and quantities of conduit, are subject to PG&E's specifications and approval.
- C. Applicants are responsible for owning and maintaining conduit and substructures on private property; however, they must convey ownership of any portion in a public (i.e., franchise) area or right-of-way, if applicable, to PG&E.
- D. Applicants are responsible for providing, installing, and maintaining any structures that are required to protect service facilities from damage.

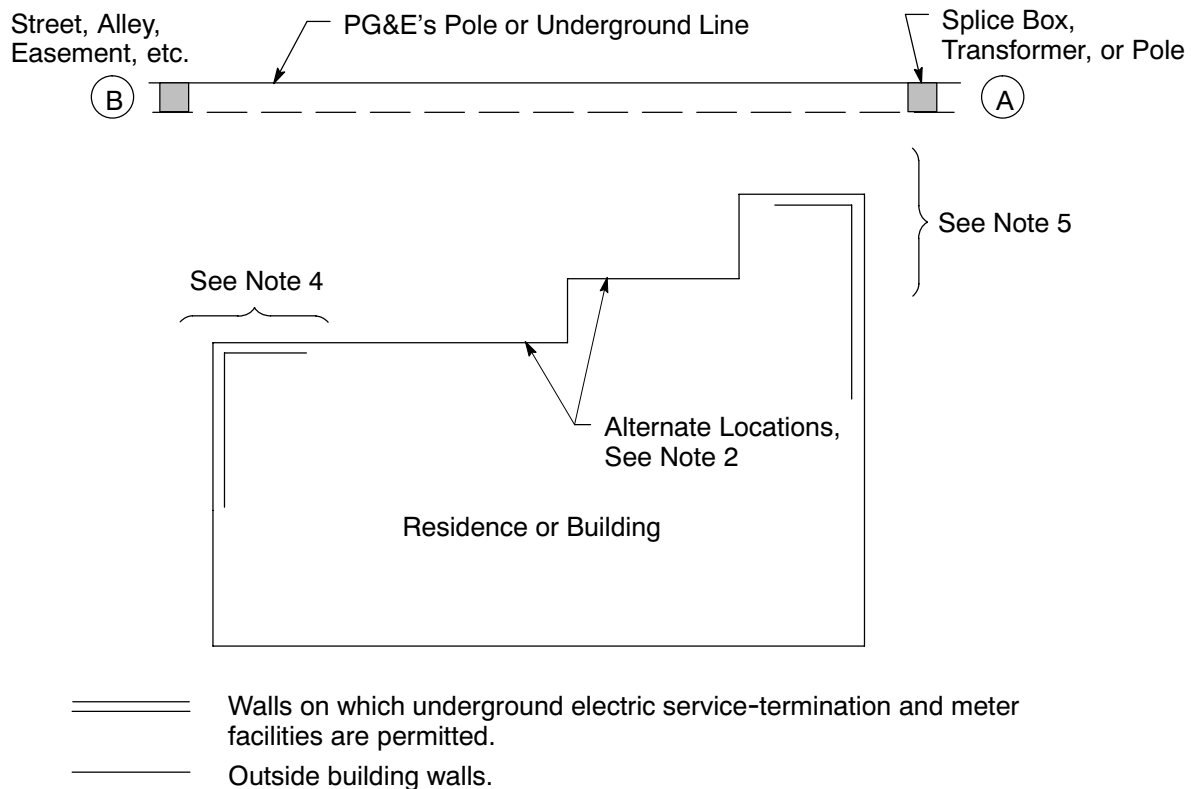


Figure 3-1
Location of Underground Electric Service-Termination and Meter Facilities

Notes in reference to Figure 3-1.

1. If it is practical, attach the underground electric service-termination facility and the meter to the wall at a preferred location. To avoid future operation and maintenance problems, locate the facilities as close to PG&E's service facilities as possible.
2. **PG&E must approve all service locations before they are constructed.**
3. Applicants must locate the service so that the meter can be read *without* entering a fenced or enclosed location, when possible.
4. Preferred locations for electric service-termination and meter facilities from Point B.
5. Preferred locations for underground electric service-termination and meter facilities from Point A.

3.2.3. Installing Ground Rods

Applicants or their contractors are required to install ground rods when PG&E specifically requires them as part of a substructure installation; for example, when a transformer pad is required.

3.2.4. Installing Overhead and Underground Service for Two or More Buildings on One Lot

If more than two dwellings or buildings are located on the same lot, applicants must consult their local PG&E service planner to determine the acceptable service-termination locations and meter locations *before* wiring the buildings.

NOTE: See the “2008-2009 Service Planning Contact Information” at the front of this manual on Page iv for specific contact numbers listed by area.

Typically, PG&E only installs one service lateral to a single building on one premise, or to a single enterprise (with either one or multiple buildings) on one premise. However, PG&E may provide more than one service lateral if the following conditions are met.

- A. Multiple laterals are allowed or required by PG&E’s tariff schedules.
- B. Multiple laterals are provided for PG&E’s convenience.
- C. Multiple laterals are required by ordinance.
- D. Multiple laterals are installed as special facilities.

3.2.5. Inspecting and Approving Overhead and Underground Services

An applicant must contact the local PG&E service planner to arrange for a field representative to inspect and approve the applicant-furnished and installed service equipment, as well as any other mandatory components required for an underground service installation.

3.3. Underground Service Installation Requirements

3.3.1. Installing Services From Underground Distribution Systems

PG&E will serve applicants from an underground service if the site or lot is located in an area that is supplied from an *existing* underground distribution system. PG&E will own, maintain, and install the underground service lateral conductors. PG&E will provide underground-to-underground service along the shortest, most practical, and most available route to the applicant’s service-termination facility. Typically, the termination facility will be on or within the building or structure, as shown in Figure 3-2, “Underground-to-Underground Service Connection,” on Page 3-4. PG&E will install the conductors in conduit.

Besides being responsible for all required *permits*, applicants must ensure that the following construction activities are performed and that the following supplies are available on their properties and in public areas.

- Service trenching
- Backfill
- Excavation
- Paving conduit
- Substructures

Substructures include conduit, boxes, and transformer pads. Applicants must follow PG&E's guidelines and specifications, including those specified in [Electric Rule 16](http://www.pge.com/tariffs/tm2/pdf/ELEC_RULES_16.pdf), "Service Extensions," found online at http://www.pge.com/tariffs/tm2/pdf/ELEC_RULES_16.pdf.

PG&E will install the transformer, if required, and connect the service lateral conductors to the applicant's termination facilities.

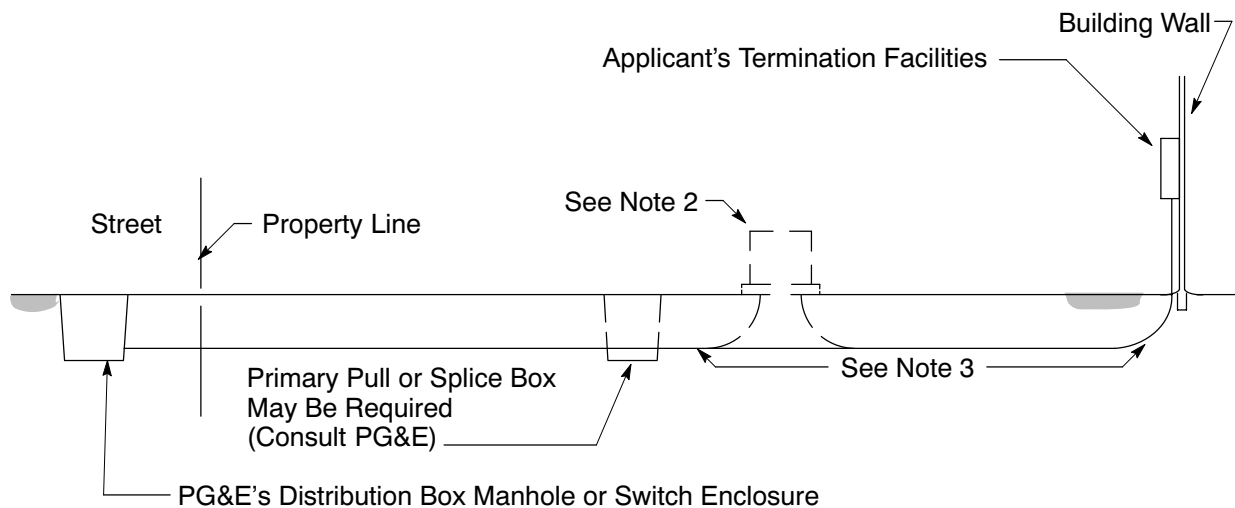


Figure 3-2
Underground-to-Underground Service Connection

Notes in reference to Figure 3-2.

1. When the service delivery voltage is the same as the available, primary distribution voltage (i.e., over 2,000 volts), typically the applicant will provide a primary splice box according to PG&E's requirements.
2. PG&E will supply a transformer, if required. (The applicant must provide the trench, backfill, and required conduit, pad, and substructures.)
3. PG&E-owned primary and/or secondary conductors. (The applicant must furnish the substructures.)

3.3.2. Installing Services From Overhead Distribution Systems

PG&E will provide service from an underground riser that is installed on an *existing* pole, as shown in Figure 3-3, “Overhead-to-Underground Service Connection,” located below, if *any* of the following requirements are met.

- A. The applicant is located in an area served from an overhead system and the applicant prefers to have the service installed underground.
- B. The applicant’s load requires a transformer that is 75 kilovolt amperes (kVA) or larger.
- C. A local city or county ordinance requires underground service.

In these cases, in addition to the requirements described in Subsection 3.3.1., “Installing Services From Underground Distribution Systems,” on Page 3-3, the applicant must pay the material costs of both the pole riser facility and any conduit that is required in the public right-of-way.

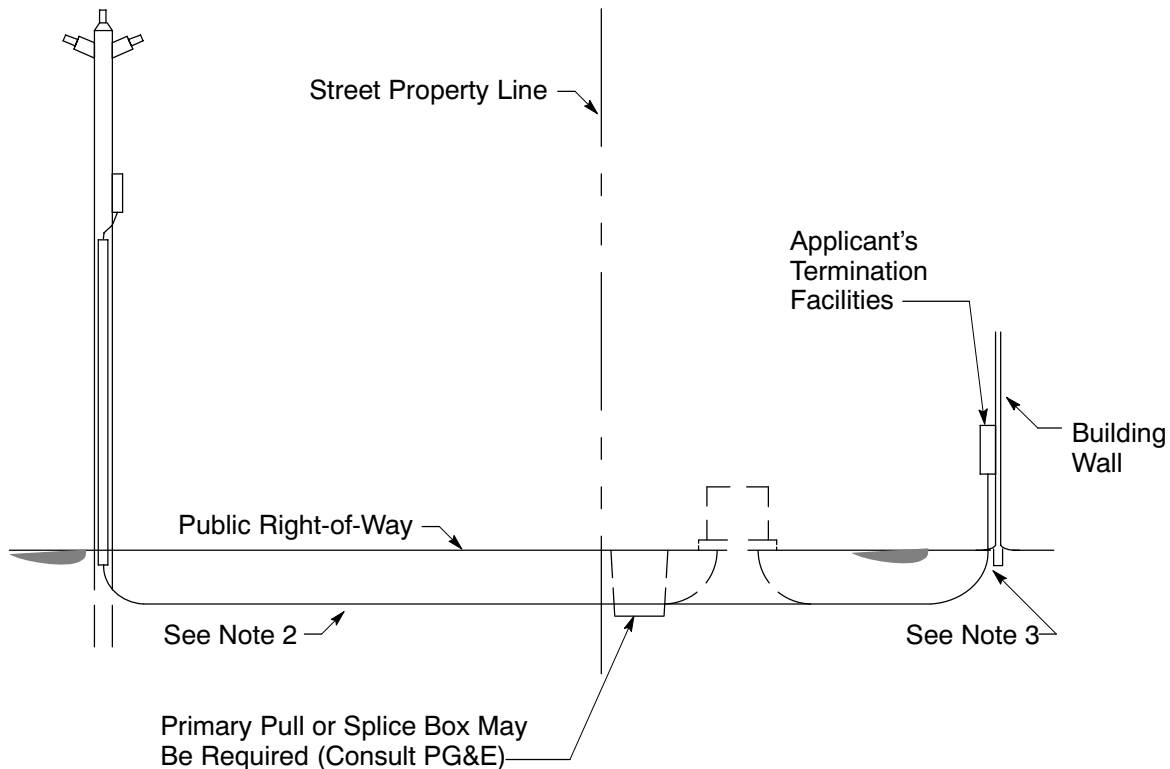


Figure 3-3
Overhead-to-Underground Service Connection

Notes in reference to Figure 3-3.

1. When the service delivery voltage is the same as the available, primary distribution voltage (i.e., over 2,000 volts), typically the applicant will provide a primary splice box according to PG&E’s requirements.
2. PG&E’s pole and secondary riser. (The applicant must pay the installed cost of the pole riser and conduit within the right-of-way.)
3. PG&E-owned service lateral conductors. (The applicant must furnish the conduit, as required.)

3.3.3. Installing Conduit for Underground Service

NOTE: PG&E will *not* install its supply cables in conduits that run beneath any building or structure when those conduits *do not terminate* on or within that building or structure, but are intended to supply *another* building or structure on the same or another premise.

PG&E requires applicants to install a conduit system for underground service laterals. It is the applicant's responsibility to provide service conduit as described in the following two PG&E documents. Both of these documents are located in [Appendix B](#), "Electric Underground Service Documents," and also in PG&E's *Electric Underground Construction Manual*, Volume 1.

- A. [Document 063927](#), "Methods and Requirements for Installing Residential Underground Electric Services 0–600 Volts to Customer-Owned Facilities."
- B. [Document 063928](#), "Methods and Requirements for Installing Commercial Underground Electric Services 0–600 Volts to Customer-Owned Facilities."

Also, applicants must ensure that conduit runs have a polyester pull-tape (Code 560154) to initiate the cable pulling. The pull-tape must be attached securely either to conduit plugs or caps.

Applicants must prove that the service conduit system is free of dirt, rocks, or other obstructions that could prevent, hinder, or harm the installation of the service lateral conductors. PG&E must approve of the method an applicant chooses to prove the service conduit system's readiness.

Applicants must furnish and install either conduit caps or plugs on the ends of all conduits. In addition, at locations where the cable insulation may be damaged (e.g., transformer pads or switchboard pull sections), applicants are required to install cable protection at all of the conduit ends. Applicants should contact their local PG&E service planner for specific requirements.

3.3.4. Trenching Work

Applicants must ensure that trenches containing only electric service facilities are *covered* when those trenches are located on:

- Private property
- Designated sidewalks
- Parkways
- Driveways

The electric service conduit must be covered as described in the following text.

- A. Provide an 18-inch minimum cover for secondary (i.e., 0–750 volts) electric service conduit.
- B. Provide a 24-inch minimum cover for primary (i.e., over 750 volts) service conduit.

The term “cover” refers to the standard distance between the outer surface of an underground facility and the final grade level. ***The actual trench depth must be greater than the cover depth.***

All electric service conduit must enter PG&E splice boxes or enclosures from the bottom or through the boxes’ conduit knockouts. Applicants may need to increase the installed depth of the conduit at those locations.

PG&E may require service conduit to be installed between 18 inches to 24 inches, ***or*** may require the applicant to provide other means of protection in the following circumstances.

- Increased traffic loading
- Soil erosion
- Open ditches

This increased depth also may be required in areas where similar situations either are anticipated or exist already.

NOTE: The required minimum depth for service trenches is 24 inches below grade. Applicants must receive pre-approval from PG&E when requesting an exception to the 24-inch, minimum-depth requirement.

Applicants must ensure that the trench depth is sufficient to meet the minimum depth requirements when taking into consideration the following conditions.

- A. The required depth of cover (as described previously).
- B. The size of the conduit that is being installed (e.g., 3 inch, 4 inch).
- C. The necessary bedding materials.
- D. The size of the electric conduit bends (e.g., 24-inch or 36-inch bends).

Applicants should contact their local PG&E service planner with questions about trench depth.

Also, when applicants plan to install electric service facilities with other services, such as telephone or cable television, they must refer to:

- Subsection 3.3.8., “Installing Joint Utility Service Trenches,” on Page 3-9
- Figure 3-4, “Typical Service Trench,” on Page 3-11
- Table 3-1, “Minimum Separation and Clearance Requirements for Service Trenches,” on Page 3-11

Applicants should contact their local PG&E service planner in the development stages of their projects for additional details and requirements about using joint trenches.

3.3.5. Installing Offsets

In situations where more than two 90° bends are required, applicants should consult their local PG&E service planner to determine whether an additional raceway pull-box is needed to avoid excessive pulling tension on the service cables.

A. PG&E does **not** approve short-radius conduit fittings, commonly known as LBs or service elbows, for use in underground service conduits that are intended to hold PG&E service conductors. Applicants must ensure that offsets are **not** installed in the following situations.

1. Avoid making an offset in the service lateral conduit entering the electric service panel or enclosure.
2. Avoid making an offset in the conduit system because it may prohibit the use of a mandrel to prove the acceptability of the conduit system.
3. Avoid making an offset in the service conductors because it will increase the pull tension required to install the service conductors.

B. In some situations, applicants may be required to perform both of the following numbered actions.

1. Install larger conduits and/or additional splice boxes or pull boxes to accommodate the installation of the conductors.
2. Transition to cables appropriately sized for the service capacity.

The following scenarios represent situations in which B.1. and B.2. above could be required.

1. Construction sites where PG&E determines that larger-than-standard cables or conductors are required to maintain voltage and flicker drop.
2. Construction sites where normal pulling tensions may be exceeded.

EXCEPTION: Applicants must ensure that neither pin adaptors nor cable ringing are used to terminate the cables. PG&E **does not** accept these termination techniques.

3.3.6. Selecting Backfill

Applicants must use backfill (i.e., sand or native soil) to provide a smooth bedding area when installing utility facilities. The backfill must fill all of the voids around the facilities and provide at least 6 inches of cover for the conduit or pipe. PG&E considers soil that contains occasional, rounded rocks that are 1/2 inch in diameter or less to be acceptable backfill.

Crushed rock or sharp-edged materials of any kind, or backfill containing any rocks larger than 6 inches in diameter, is not acceptable.

Additionally, PG&E **prohibits** applicants to use backfill with rocks greater than 6 inches in **any** dimension within 6 inches of the top of the pipe or conduit or less than 12 inches below the pavement subgrade.

When backfilling a service trench, instead of using acceptable backfill material, the applicant may install either rigid, galvanized-steel conduit or, with PG&E's pre-approval, rigid, polyvinyl chloride (PVC), Schedule 80, 90°C, Underwriters Laboratories- (UL-) approved or *better* conduit.

3.3.7. Providing Drainage From the Conduit System

In some conditions, water can enter into the wire and conduit system and migrate into the meter panel and/or building. The applicant or applicant's contractor must provide a means to discharge any excess water or water pressure from the conduit system. The two most common methods of discharging water from the conduit are listed below.

- A. Install a box at the base of the riser to the meter panel, or
- B. Install a fitting or series of fittings from the conduit riser to the meter panel to channel the water out of the service conduit system and away from the service wires.

Any other methods of discharging water will require PG&E's approval *before* construction begins.

3.3.8. Installing Joint Utility Service Trenches

When installing electric services underground, the gas service pipe and the electric service lateral typically are installed in a common, joint trench. A joint trench also may include telephone and cable television facilities.

The following wet facilities are *not* permitted in a joint trench.

- Propane lines
- Sewer pipes
- Sanitary drains
- Storm drains
- Other wet-utility piping or facilities

There are additional requirements for separating a wet utility from a joint trench.

Applicants must submit a written request to PG&E when they want to include other facilities in a joint trench. The request must include a justification and be submitted to PG&E for review and approval *before* excavation or work begins.

PG&E must coordinate joint trench installations with telephone, cable television, or other facilities. This coordination requires lead time, so applicants should submit their requests and justifications as early in the planning process as possible. Applicants must ensure that PG&E has reviewed and approved their trenching plans before digging begins.

Figure 3-4, on Page 3-11, illustrates a “Typical Service Trench.” Separation and clearance details for the trenches are found in Table 3-1 on Page 3-11. Also, see Utility Standard S5453, “Joint Trench,” [Exhibit B](#), “Joint Trench Configurations & Occupancy Guide,” located in [Appendix B](#) of this manual. This guide contains additional information and joint trench requirements. For PG&E-approved import material, see [Appendix B](#) for the [California Gas Transmission \(CGT\) Engineering Guideline EG-4123](#), “Backfill Sand Specification.”

When applicants plan to use joint service trenches, they must ensure that the gas and electric meters are installed either adjacent to, or in close proximity to, each other. [Section 5](#), “Electric Metering: General;” [Section 6](#), “Electric Metering: Residential;” and [Section 7](#), “Electric Metering: Commercial and Industrial;” provide information about determining acceptable locations for utility electric meters. [Section 2](#), “Gas Service,” Subsection 2.4.2., “Gas Meter Set Locations,” on Page 2-17, provides information about determining acceptable locations for utility gas meters.

Applicants must discuss the service arrangements and coordinate the meter locations and joint trench requirements with a PG&E service planner *before* installing utility conduits or gas service piping.

Applicants must ensure that when multiple service facilities (i.e., gas, electric, and telecommunications) are installed in close proximity (e.g., in a joint trench), a 12-inch minimum, horizontal separation is maintained where those facilities transition from below ground to above ground. PG&E allows an exception to that rule when the separation is between PG&E secondary, electric-service conduit and gas-service piping. In this instance, the minimum separation distance may be reduced to 6 inches. Clearances between other facilities can be reduced *only* when the facility owners reach a mutual agreement.

Applicants must ensure that adequate amounts of space exist to maintain and operate the facilities even when they have obtained exceptions to the minimum separation distances. In addition, applicants must *not* install enclosures for terminating or connecting telecommunication cables, wires, or other equipment within an area 12 inches above and extending the entire width of the gas meter and service facilities. This includes the gas service riser. Finally, applicants must ensure that the area immediately *behind* the gas meter, service facilities, and risers...and *between* those facilities and the premises or structures being served...is kept free and clear of all other facilities or equipment such as pipes, wires, cables, or conduits.

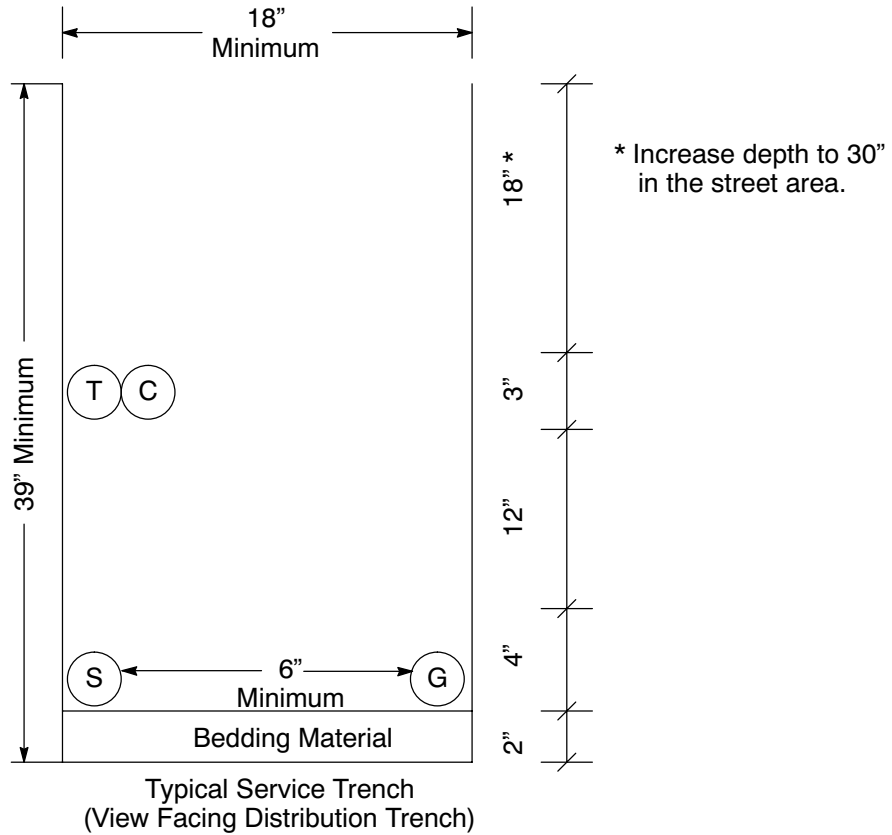


Figure 3-4
Typical Service Trench

Note: For more information on Figure 3-4, see PG&E's [Joint Trench Configurations & Occupancy Guide](#), located in [Appendix B](#).

Table 3-1 Minimum Separation and Clearance Requirements for Service Trenches

		G	Duct T	DB T	C	S	P
(In Inches)							
G	Gas (See Notes, 4, 7, and 13. ¹)	-	12	12	12	6	12
T	Telephone (Duct)	12	-	1	1	12	12
T	Telephone (Direct Bury)	12	1	-	1	12	12
C	CATV	12	1	1	-	12	12
S	Electric Secondary	6	12	12	12	-	3
P	Electric Primary	12	12	12	12	3	-
SL	Streetlight (See Note 2 below.)	6	12	12	12	1	3

¹ For more information about this table see PG&E's [Joint Trench Configurations & Occupancy Guide](#) in [Appendix B](#) of this manual. Specifically see Notes 4, 7, and 13.

² Streetlight circuits **not owned** by PG&E must be installed to meet the requirements in PG&E's [Joint Trench Configurations & Occupancy Guide](#). Specifically, applicants must review the requirements for working with a second utility company.

3.3.9. Providing a Service-Termination Facility

In addition to the requirements in Table 3-1 on the previous page, applicants must provide and maintain a satisfactory termination facility on or within the building or structure to be served.

PG&E will *not* install services supplied from different electrical sources in the same termination facility unless the services are separated using suitable barriers. When two or more services are in one termination facility, the minimum dimensions of each compartment created by the barriers must be the same as if each compartment were a separate termination facility.

3.4. Electric Underground Documents

The following electric underground documents are provided in [Appendix B](#) of this manual. See PG&E's Intranet site at www.pge.com/greenbook to access the most recent versions of these documents *or* contact your local PG&E service planner. Most of these documents also are available in PG&E's *Electric Underground Construction Manual*, Volume 1.

Table 3-2 Electric Underground Documents

Section ¹	Document Number	Title
Connectors	013109	Corrosion-Resistant Ground Rods and Ground Rod Clamps
Enclosures	028028	Secondary Enclosures for Electric Underground
Transformers	045292	Concrete Pad for Three-Phase, Loop-Style, Pad-Mounted Transformers
General	051122	Locations, Clearances, and Mechanical Protection Details for Pad-Mounted and Subsurface Equipment
Services	058817	Terminating Underground Electric Services 0-600 Volts in Customer-Owned Facilities
Transformers ²	063422	Landscape Screen for Pad-Mounted Transformers
Services	063927	Methods and Requirements for Installing Residential Underground Electric Services 0-600 V to Customer-Owned Facilities
Services	063928	Methods and Requirements for Installing Commercial Underground Electric Services 0-600 Volts to Customer-Owned Facilities
Services	063929	Requirements for Bus Duct Entrance Termination Unit for Use With Pad-Mounted Transformers
Transformers	064309	Box-Pad for Pad-Mounted Transformers
General ²	066211	PG&E Approved Manufacturers

¹ For PG&E reference only: "Section" refers to the sections in PG&E's *Electric Underground Construction Manual*, Volume 1, which contains these documents.

² This document is not in the *Electric Underground Construction Manual*

3.4.1. Mandrels

The following section includes both an overview of, and a procedure for, using mandrels to prove conduit systems.

A. Using Mandrels to Prove Conduit Systems

Applicants must ensure that the conduit systems required for PG&E cables and/or conductors are installed in a trench that meets all of PG&E's requirements and specifications for the particular job or project. The conduit systems must meet PG&E's requirements for each specific installation, as well.

NOTE: The term "conduit system" includes conduits, conduit bends, conduit fittings, and all related components (e.g., bell ends and cable protectors) that are needed to install PG&E cables and conductors.

Applicants must ensure that conduit systems are *not* covered or hidden from view before the facilities are inspected visually by a PG&E field inspector. The inspector must determine if the conduit system and its installation comply with all of PG&E's specifications (e.g., type, size, schedule, radius of bends) and installation requirements before the customer backfills the trench.

After the conduit system passes PG&E's visual inspection, including visual verification of the conduit system's materials and the radius of the bends, the applicant must backfill the trench and compact the soil. Then, the applicant must provide PG&E with proof that the conduit system is in compliance by successfully inserting and pulling a flexible steel mandrel through the *entire* conduit system.

The PG&E inspector will remain onsite to ensure that the appropriately sized, flexible-steel mandrel is inserted and pulled through the length of the conduit system without encountering blockages or obstructions.

B. Procedure for Using Mandrels

Applicants must follow the procedural steps below when using a mandrel to prove a conduit system.

Step 1. Select the mandrel that is sized properly for the type of conduit that will be proven. See Figure 3-5, "Flexible Steel Mandrel," on Page 3-14, and Table 3-3, "Mandrel Dimensions, Part Numbers, and Order Codes," on Page 3-15, for mandrel specifications.

NOTE: For high-density polyethylene (HDPE) continuous conduit only (i.e., 3 inch, 4 inch, 5 inch, and 6 inch sizes), use the next smaller-size mandrel shown in Table 3-3.

Step 2. To pull the mandrel through the conduit, securely tie one end of the 2,500-pound pulling tape to the pulling eye of the mandrel. (The pulling tape was installed in the conduit previously.)

Step 3. Securely tie a second section of 2,500-pound pulling tape to the pulling eye located on the other end of the mandrel. This section of tape must be long enough to replace the pre-installed pulling tape completely.

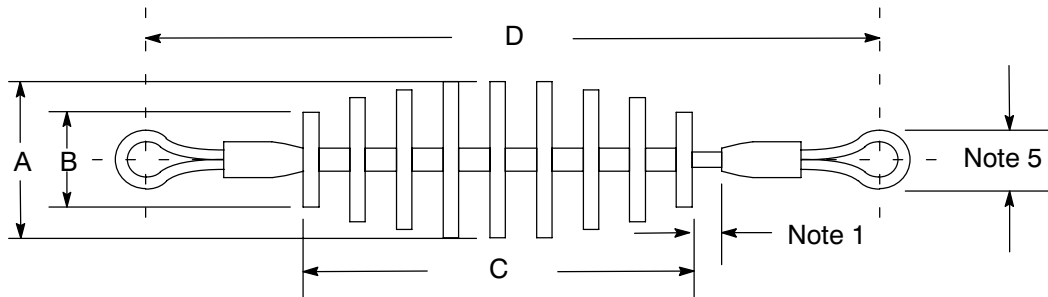
Step 3. ensures that a run of pulling tape remains in the conduit after the mandrelling process is completed. Also, if the mandrel becomes blocked or stuck in the conduit, the second run of pulling tape allows the mandrel to be pulled back out of conduit **and** provides a means of measuring the distance to the point of blockage.

Step 4. After both pulling tapes are attached securely to the mandrel, insert the mandrel into one end of the conduit. Slowly start to pull the pulling tape at the opposite end of the conduit. This removes any slack in the pulling tape.

Step 5. Slowly pull the mandrel through the conduit. The rate of the pull should *not* exceed 100 feet per minute. Both the person pulling the tape and the PG&E inspector must check the pulling tape for signs of stress (i.e., molten plastic) as the tape comes out of the conduit.

NOTE: The PG&E inspector may *not* approve a section of the conduit if any portion of the pulling tape shows damage in the form of molten plastic. If the inspector decides to reject the conduit section, he or she will secure the melted section of pulling tape as evidence.

If the mandrel passes through the conduit without encountering any blockage or obstructions, the PG&E inspector will approve the conduit section for use.



**Figure 3-5
Flexible Steel Mandrel**

Notes in reference to Figure 3-5.

1. The length must be adequate for the mandrel to pass through a 24-inch radius bend (all sizes).
2. The disks must be fabricated from 1/2-inch, flat, steel plate (average weight: 490 pounds per cubic foot) with a 7/16-inch hole for the 3/8-inch cable.
3. The spacers must be fabricated from 1/2-inch iron pipe size (IPS) pipe with a minimum inside diameter of 0.6 inches.
4. Cable size: 3/8-inch, 6 x 19 mild, plow-steel hoisting rope.
5. The outside diameter of the eye must not exceed Dimension A.
6. The size must be stamped permanently into one end of the plates.

Table 3-3 Mandrel Dimensions, Part Numbers, and Order Codes¹

Size (In Inches)	PG&E Code	Dimensions (In Inches)				
		A	B	C	D ²	Spacer Length
2	202567	1.69	1.69	6.5	15	0.25
3	202570	2.65	1.65	10.5	23	0.75
4	202571	3.57	2.57			
5	200911	4.56	3.56			
6	202572	5.51	4.51			

¹ For HDPE continuous conduit only (sizes 3 inches, 4 inches, 5 inches, and 6 inches), use the next smaller-size mandrel.

² "D" dimensions are approximate.

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