	METHODS AND REQUIREMENTS FOR INSTALLING RESIDENTIAL UNDERGROUND ELECTRIC SERVICES 0 – 600 V TO CUSTOMER-OWNED FACILITIES		063927
	Asset Type: Electric Distribution	Function: Design	
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Rev. #24: This document replaces PG&E Document 063927, Rev. #23. For a description of the changes, see Page 7.			

This document is also included in the following manual:

- [Electric and Gas Service Requirements \(Greenbook\)](#)
- [Electric Design Manual](#)

Purpose and Scope

This document shows the methods and requirements for installing PG&E-owned, underground service cables in customer-owned, residential, terminating facilities. See [Document 058817](#) for terminating underground services.

General Information

1. Underground electric service laterals are normally installed in a PG&E service trench or in a joint trench with natural gas and communication service facilities.
2. To determine the most satisfactory meter location, PG&E should be contacted for requirements while the building is in the planning stage.
3. When it is necessary to install a service 75 feet or longer, the applicant must contact PG&E before ordering the service riser, conduit, or termination enclosure. If the service riser and/or conduit specified in Table 3 on Page 5 of this document will not accept the cable required to meet flicker and/or voltage drop requirements, a larger conduit must be installed. This could require the installation of a larger termination enclosure.
4. Install a splice box whenever cable pulling tensions may be exceeded or whenever there is a change in cable or conduit size.
5. Ensure that any new installed secondary distribution cable is not smaller, either in size or in number of runs, than the largest new service that is on the load side of that new secondary system. For example, if the largest service required will be 1–350 Al, then the secondary must be a minimum of 1–350 Al. The existing secondary distribution system can remain as is if it can adequately supports any new services without causing loading, voltage drop, and voltage flicker issues.

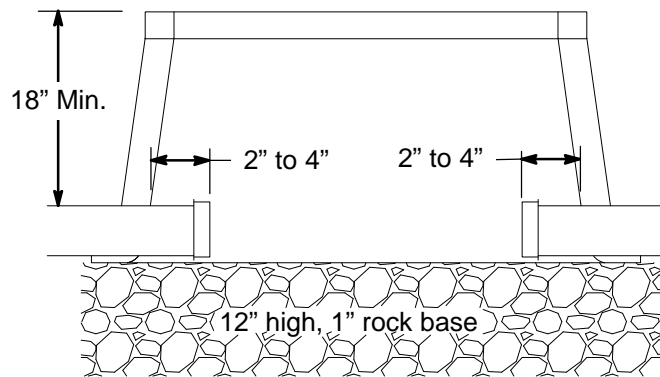
Residential Services Information

6. A “residential service” is a service supplying a single or multi-metered residential building. This document addresses services through 600 amp, single-phase for 120/240 V. For three-phase residential services or services larger than 600 amp, see [Document 063928](#). Single-phase main service switches must not exceed 225 amps for 120/208 V services.
 - A. Standard voltage for single metered residential building is 120/240 V.
 - B. All single-phase, 120/208 V services require full-sized neutral.
 - C. 800 amp single phase services are not allowed. 800 amp rated services and larger must be three-phase, and terminate in pad-mounted switchgear.
7. Minimum service requirements.
 - A. Install the number and size of conduits as shown in Table 3 on Page 5, based on the main service panel rating. No more than seven service conduits, of any size, will be supplied from any one transformer.
 - B. Install the number and size of conductors, as shown in Table 3 on Page 5, to meet the individual initial demand load. Take load characteristics and growth into consideration.
 - C. It is permissible to install a smaller transformer and fewer conductors to serve a long term initial load with the intent of installing a larger transformer and additional conductors should future load increase occur.

**Methods and Requirements for Installing Residential
Underground Electric Services 0 – 600 V
to Customer-Owned Facilities**

- D. Always size the transformer pad to accommodate the largest transformer size necessary to serve the combined ampacity of all services. Never exceed more than seven sets of conductors per transformer.
 - E. Vacant ducts, if any, are to be used to serve future load increases.
8. Residential design includes mobile home and mobile home parks parks that are individually metered and not master-metered. For mobile home park design requirements see [Document 052521](#), “Electrical Service Requirements for Mobile Home Developments”.
9. Conduit is required for residential services, including multi-metered residential buildings.
10. The applicant must provide the trench, conduit, and backfill in accordance with [Electric Rule 16](#) and PG&E requirements. PG&E will furnish and install the service cables and make the connection at the point of service delivery in the applicant’s service termination enclosure.
- Qualification of material for use as backfill is the responsibility of the job foreman or, in the case of contract work, the inspector or their designer. A visual inspection of the material is sufficient for evaluation of the material. The source of the backfill, native or import, is immaterial to the suitability of the backfill for use in the trench. In new construction areas, the developer may be required to have a soils report available, which will assist in determining if import backfill is necessary.
11. Soil compaction must meet PG&E’s and any applicable federal, state, county, and local requirements. PG&E specific soil compaction requirements are as follows:
- A. Trenches that run across or along public roads and streets in the franchise areas must have soil compacted to a minimum of 95% density.
 - B. Trenches that run across private properties and in all other areas must have soil compacted to a minimum of 90% density.
 - C. A compaction test report may be required by PG&E. This report must include the testing company information: Name, Address, Contact information.
12. Service conduits installed through or under the applicant’s building foundation/slab must not exceed 20’ past the outside wall of the building and must terminate into the electrical room. See Figure 4 in Page 6. The installation requirements and conduit types for PG&E’s service conductors used in this application must be as indicated below;
- A. Conduits must not pass under or through one building to supply adjacent buildings.
 - B. UL651 approved PVC Schedule 40 or 80.
 - C. Galvanized Rigid Steel (GRS). GRS conduit is required when the conduit will be exposed, installed along walls and low clearance ceilings, and may be subject to damage from vehicles, machinery, or tools.
13. To avoid cable insulation damage, the ends of conduits must be provided with a suitable fitting, such as a bushing, hub, or end bell.
14. When an applicant’s main service panel is installed in an electric meter and service termination room, the room must be built with one wall and a door that leads to the outside of the applicant’s building. See [Greenbook Section 5.3.4](#). Electric Meter Rooms.
15. When service terminations/connections are made at the customer termination can or pull section, whether the service is left energized or de-energized,
- A. Cover and seal all meter sockets with an approved blank-off cover (Pie Plate) or set the electric meter(s). Material codes for electric meter socket covers are **M249424** and **M249559**.
 - B. Seal all seal-able covers on the customer owned panel using PG&E approved seals.
16. Potential water intrusion into service conduits and meter termination facilities.
- A. Water intrusion into service conduits and meter termination facilities may occur if the source side of the service facilities (e.g., secondary splice box) is at an elevation greater than the meter termination facilities.
 - B. [CPUC General Order 128, Rule 31.6](#) requires “Lateral ducts for services to buildings, through which water may enter buildings, must be plugged or sealed at the customer meter panel and at the source end of the service conduit.”
 - C. When the intrusion of water into the service and metering equipment can be reasonably expected through lateral ducts, the conduits must be sealed at both ends using one of the PG&E approved sealing method shown in [Document 062288](#).

- D. If the meter termination facilities are significantly lower than the source side facilities, use the Rayflute Duct Sealing System (RDSS) conduit sealing system listed in [Document 062288](#).
- E. The applicant is responsible for providing a means to prevent the accumulation of excess water pressure in the service conduit system. This is accomplished by the following methods:
 - (1) For wall-mounted service and metering equipment install an enclosure, outside, at the base of the riser to the meter panel, or at a maximum of 6 feet away from the meter panel along the service run.
 - (a) Install a 26" deep #2 enclosure, and enter through the short walls making sure to maintain the 18" minimum depth from finish grade to the top of the conduit. See Figure 1 on Page 3.
 - (b) Install the enclosure on a twelve-inch base of one-inch rock to aid in the drainage of the unwanted water, align the conduits at either end to achieve a nearly straight through pull and install end bell fittings on all conduits.
 - (c) Seal both ends of the service conduit from the drain enclosure to the customer meter panel.



**Figure 1
Conduit Installation in a Drain Box**

- (2) For indoor electric meter rooms below grade level, a reliable method of water mitigation and drainage must be incorporated into the design of the meter room(s) to prevent the accumulation of water.
- 17. Prior to cable installation, all conduits must be proven free and clear by means of a mandrel or other methods acceptable to PG&E. A polyester flat pulling tape, white with sequential footage markings every foot, 2,500 minimum tensile strength, and approved by PG&E (**Code M560154**), must be installed in all conduits and attached to an end cap (see [Document 063928](#)).

Upgraded Panel

- 18. For upgraded panels where the new specified size of service conductor will fit in the existing conduit, it is not necessary to upgrade the conduit to the currently specified size and number for the new panel if all of the following are met:
 - A. The maximum conduit fill ratio is not exceeded.
 - B. The calculated cable pulling tensions along the conduit route is within limits of the new cable.
 - C. Copper or larger size of Aluminum cable is able to handle full load in existing number of conduits. See Table 1 below.

Table 1 Service Cable Size Allowed in Existing Conduit When Upgrading Panels

Existing Service Equipment Rating (amps)	New Upgrade Service Equipment Rating (amps)	Minimum Allowed Existing Conduit Size and Number	Aluminum or Copper Cable Required to Serve Maximum Load AWG or kcmil ¹	
			(Per Phase)	Neutral
100–125	200–225	1–2"	1–4/0 Al	1–1/0 Al
200–225	320	1–3"	1–350 Al	1–4/0 Al
320	400	1–3"	1–750 Al	1–4/0 Al
400	600	1–4"	1–1000 Al ²	1–350 Al

¹ Mixing Aluminum and Copper cable runs for the same service is not allowed.

² Center conduit underneath middle hot leg to allow flexibility to terminate the conductor.

19. If the new panel is able to accommodate it, the existing service conductor may be reused provided it meets the load, voltage drop, and flicker requirements of the new load. If the service conductor size must be upgraded, the existing conduit must be proofed with a mandrel.
20. For existing panels that are less than 36" horizontally away from the gas service riser, it is allowed to use the existing service conduit and extend new conduit of the same size and material to a new panel location that is 36" or more away from the gas riser as long as all the parameters listed in Notes 18, 19, 20, and 21 are met.
 - A. For service runs that approach the front of the existing panel, directly or at an angle, the new conduit will need to start back along the existing conduit and far enough away from the new panel location to minimize additional bends in the conduit system.
 - B. The new total number of bends must be within the maximum 315° allowed for service conduit run. For further information refer to [Document 038193](#).
 - C. The new panel must be relocated no more than 20' away from the existing panel.
21. For upgraded panels, splice boxes are not allowed on private property to accommodate customers' existing services. Service cable needs to be brought up to our current standard conduit service system from the customer meter to PG&E point of secondary distribution.
22. Notes 18, 19, 20, and 21 do not apply to the following conditions:
 - A. Direct buried or Cable-In-Conduit (CIC) service cables. Direct buried and CIC service cables must be replaced with approved service cable and installed in approved service conduit.
 - (1) Splice boxes between the customer panel, with existing DB or CIC cable, and PG&E secondary distribution system are not allowed. See Note 22 above.
 - B. Upgraded electric meter panels that are within 36 inches of the gas service riser. The clearance requirements in [Greenbook Section 5.4.3](#), "Meter Set Clearance Requirements" must be met for upgraded and relocated meter panels.
 - C. New upgraded panels with a Service Equipment Rating (amps) that is more than one upgraded size than the existing panel, as specified in Table 3 on Page 5. For example, if an existing panel less than or equal to 100 amps is upgraded to a 400 amp panel instead of a 200 amp panel.
 - D. If the existing cable size is more than one size smaller than the cable required to serve maximum load for the new panel, as specified in Table 3 on Page 5. For example, if the existing cable is #2 AWG aluminum and new upgraded panel requires 4/0 aluminum.

Cover

23. A minimum of 24 inches of cover for secondary (0 - 750 V) electric service, or 36 inches minimum cover for primary (over 750 V) is required. Cover is the distance from the outer surface of an underground facility to the top of the final grade. The actual trench depth will be greater (approximately 30 inches or 42 inches minimum respectively) to accommodate the underground facility, bedding, enclosures, riser sweeps, and joint trench installations with other utilities.

Temporary Service

24. The policy of using permanent service panels to supply temporary power is expanding. Schedule 40 or 80 PVC riser conduit may be damaged by staples and nails, and this has resulted in damage to service cables. Therefore, for those locations where cable will be installed or that will be energized prior to completion of the wall, the conduit must be Schedule 40, rigid steel conduit, to protect the service cables from damage caused by siding nails, etc. Refer to [Greenbook Section 5.9.1](#), "Temporary Service Using Permanent Service Panels".

Table 2 Service Conduit Types Approved for Underground Application

Type	Specification ³ (must be marked on conduit)
Hot-Dip, Galvanized, Rigid Steel	ANSI Spec. C80.1
PVC, Co-extruded Cellular Core PVC, Schedule 40 or 80	UL 651, or ETL conforms to UL 651

³ The entire "conduit system" must meet the specifications listed above. The conduit system includes conduits, conduit bends, conduit fittings or couplings and all related components (e.g., end bells and cable protectors) that are needed to install PG&E cables and conductors.

Table 3 Service Conduit Types Approved for Underground Application Cable and Conduit Requirements for Residential Services

Service Equipment Rating (amps) ¹	Conduit Size and Number ²	Minimum Vertical Radius	Minimum Horizontal Radius	Aluminum Cable Required to Serve Maximum Load AWG or kcmil ⁶	
				(Per Phase)	Neutral
100–125	1–2"	24"	36"	1–1/0	1–#2
200–225	1–3"	24"	36" ⁷	1–4/0	1–1/0
320 ³	1–3"	24"	36" ⁷	1–350	1–4/0
400 ^{4, 5}	1–4"	36"	36"	1–750	1–4/0
600 ^{4, 5}	2–3"	24"	36" ⁷	2–350	2–4/0

- ¹ Service rating must be the termination section, pullcan, service section, or main service switch continuous current rating, whichever is greater.
- ² See Note 3 on Page 1 for size and distance limitations, Note 12 on Page 2 for conduit type allowed on or within buildings, and Table 2 above for conduit type allowed underground.
- ³ Require manual bypass facilities.
- ⁴ Require transformer rated meter.
- ⁵ Requires two bolt terminations and cable to spade connectors. Lay-in lugs are not allowed.
- ⁶ Cable size shown in Table 3 is the minimum size cable that must be used.
- ⁷ Available only on 90 degree bends.

Service Installation

Notes

1. A Vertical 90° manufactured sweep is required to be installed to meet trench grade. The riser conduit must not protrude away from the wall or mounted panel.
 - A. Couplings on the riser conduit installed inside the building foundation must be no higher than flush with the top of the concrete. Couplings installed outside building foundation must be installed a minimum of 6" below final grade.
2. The conduit end must extend at least 12 inches away from the foundation. Install the sweep in the direction of the service trench. If a deeper trench is required, the sweep must extend to the same depth as the conduit in the trench.
3. A minimum of 24 inches of cover must be maintained from the top of conduit to final grade.
4. See [Greenbook Section 5.4.3](#) for electric service and metering room requirements.
5. See [Greenbook Section 3.2.2](#) for establishing PG&E and applicants underground electric service responsibilities.

Service Installation (Continued)

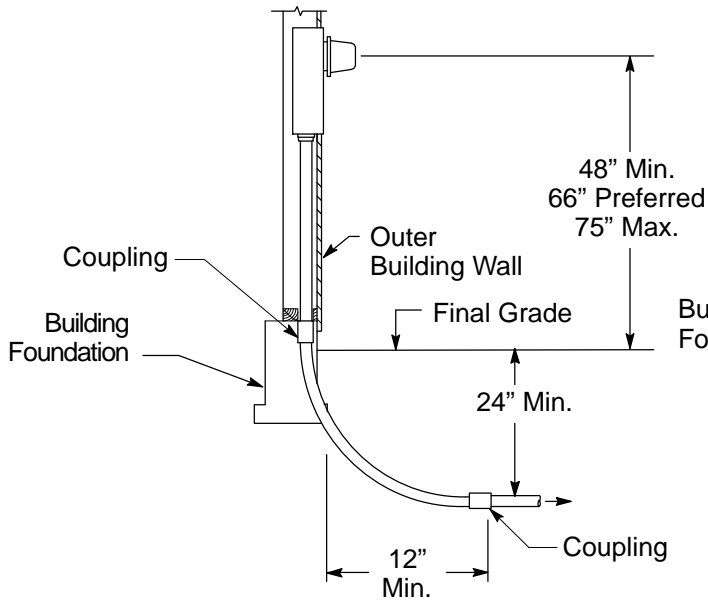


Figure 2
Recessed-Mounted Service Termination Enclosure

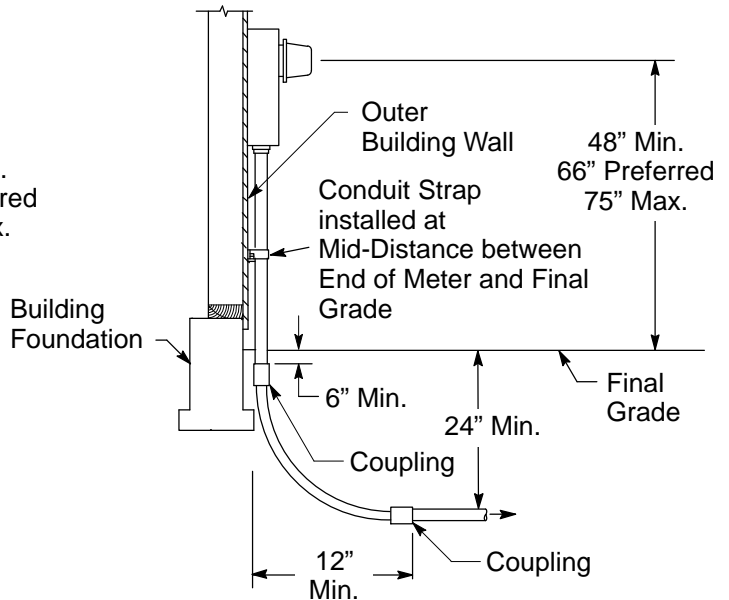


Figure 3
Surface-Mounted Service Termination

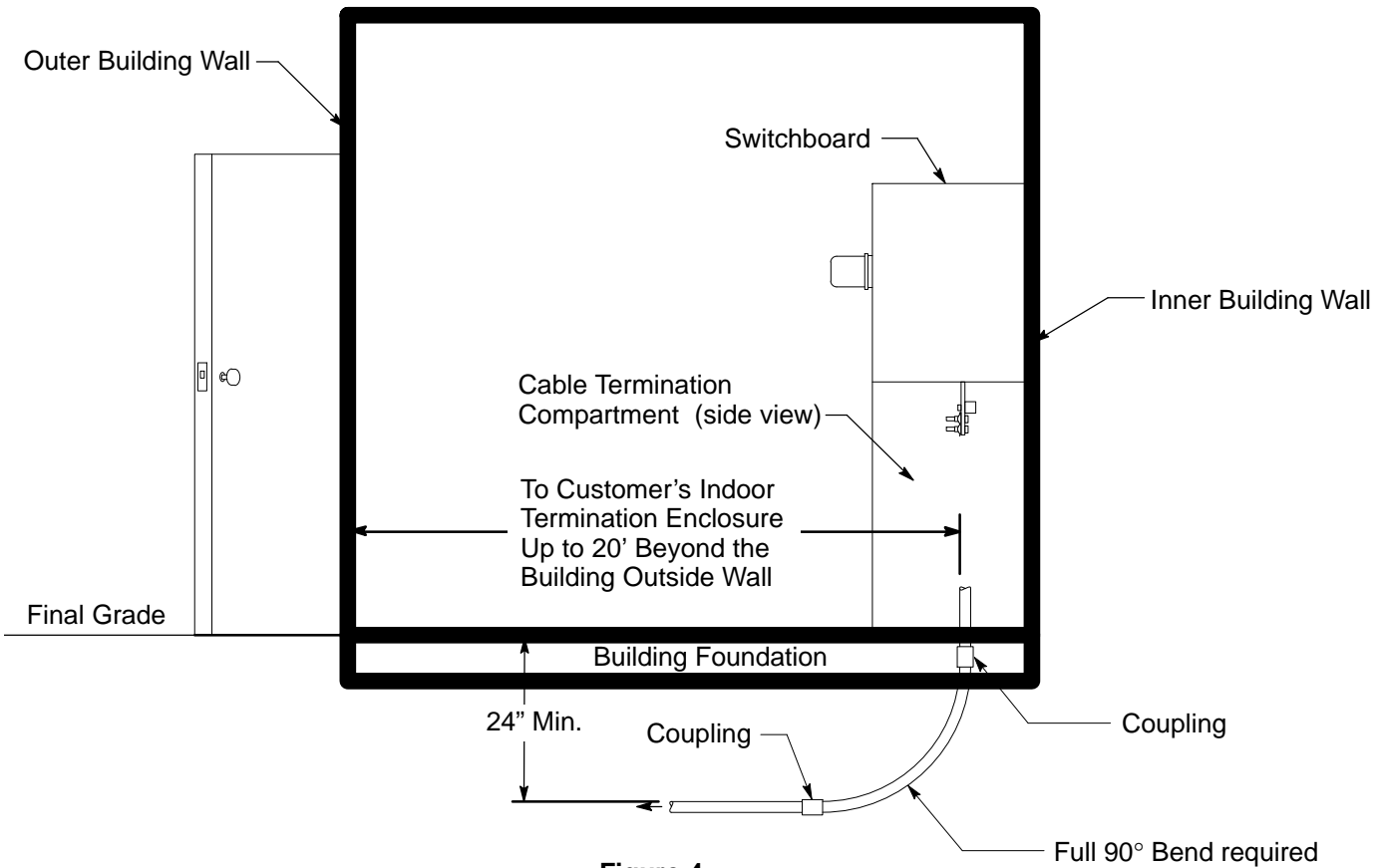


Figure 4
Indoor Service Termination and
Metering Enclosure in Electric Room

**Methods and Requirements for Installing Residential
Underground Electric Services 0 – 600 V
to Customer-Owned Facilities**

References	Location	Document
Secondary Electric Underground Enclosures	UG-1: Enclosures/Greenbook	028028
Minimum Requirements for the Design and Installation of Electric Conduit, Insulated Cable, and Facilities	UG-1: General/Greenbook	038193
Electrical Service Requirements for Mobile Home Developments	Greenbook/EMWP	052521
Terminating Underground Electric Services 0–600 Volts in Customer-Owned Facilities	UG-1: Services/Greenbook	058817
Underground Conduits	UG-1: Conduits/Greenbook	062288
Methods and Requirements for Installing Non-Residential Underground Electric Services 0–600 Volts to Customer-Owned Facilities	UG-1: Services/Greenbook	063928

Revision Notes

Revision 24 has the following changes:

1. Updated Note 5 on Page 1.
2. Revised Note 6 on Page 1 to add limit to single-phase service for 120/200V.
3. Modified Note 7A on Page 1.
4. Added compaction requirements to Note 10 on Page 2.
5. Modified Note 11 on Page 2.
6. Moved section of what used to be part of Note 12 to new Note 13 on Page 2.
7. Added new Note 15 on Page 2.
8. Re-structured Note 16 on Page 2.
9. Added Note 18C on Page 3.
10. Added new Figure 1 on Page 3.
11. Added new Table 1 on Page 3.
12. Added new Notes 20 and 21 on Page 4.
13. Added Note 22A1 on Page 4.
14. Added Note 1A under Service Installation on Page 5.
15. Modified Figures 2, 3, and added Figure 4 on Page 6.
16. Moved Reference sections to the end of the document before Revision notes on Page 7.
17. Added document 038193 to Reference Section on Page 7.