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METHODS AND REQUIREMENTS FOR INSTALLING NON-RESIDENTIAL UNDERGROUND ELECTRIC SERVICES 0 – 600 VOLTS TO CUSTOMER-OWNED FACILITIES

063928

Asset Type:	Electric Distribution	**Function:**	Design and Construction
Issued by:	Lisseth Villareal (LDV2)	**Date:**	11-01-18

Rev. #24: This document replaces PG&E Document 063928, Rev. #23. For a description of the changes, see Page 5.

This document is also included in the following manuals:

- *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 conductors in commercial buildings and three-phase multi-residential buildings. For agricultural underground service refer to Document 054619

General Information

1. This document is also included in the *Electric and Gas Service Requirements (Greenbook)* and in *Electric Design Manual*. See Document 058817 for terminating service conductors.
2. Single-phase main service switches shall not exceed 225 amps for 120/208 V services or 600 amps for 120/240 V services. All single-phase, 120/208 V services require full-sized neutrals.

Customer Requirements

3. The applicant shall provide trench and backfill as specified by PG&E, service conduit in accordance with Table 1, Table 2, and Table 4 on Pages 4 and 4 and a service termination enclosure.
4. Conduit type for PG&E service conductors on or under the foundation up to 10' past the outside wall of the applicant's building shall be as indicated below:

   A. Galvanized rigid steel or PVC coated rigid steel.

   B. UL approved Schedule 40 or 80 PVC. Schedule 40 PVC shall not be used if the conduit is located so that it is subject to physical damage. To avoid cable insulation damage, the end of the conduit shall be provided with a suitable termination fitting such as a bushing, nipple, end bell, or cable protector, etc

   Note: Conduits shall not pass under or through one building to supply adjacent buildings.
5. 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.
6. State or local building codes require special conduit seals in certain locations, such as gasoline and hydrogen filling stations. If the underground service conduit runs within a 20' horizontal radius of a gas pump (from any edge of the dispenser enclosure), or within a 10' horizontal radius of an underground gas tank, the applicant shall be responsible for the requirements listed on A–C below. Similarly, if the underground service conduit runs within a 5' horizontal radius of a hydrogen cooling block, dispenser, or storage, or within 15' horizontal radius of a hydrogen compressor, the applicant shall be responsible for the requirements listed on A–C below:

   A. The type of conduit required from the meter termination point to the connection point with PG&E.

   B. The installation and maintenance of special fittings (explosion–proof) and sealing compounds at both ends.

   C. The type of cable required from the meter termination point to the connection point with PG&E.
7. Prior to cable installation, prove all conduits free and clear by means of a mandrel PG&E approved. A PG&E-approved polyester, flat pulling tape, white with sequential footage markings every foot, and 2,500-pound minimum tensile strength (**Code 560154**), shall be installed in all conduits and attached to an end cap.

8. The installation of a splice box may be required whenever cable pulling tensions may be exceeded, or a change in cable or conduit size is required. The applicant must contact the local PG&E office to determine these requirements.
9. Test bypass facilities are required for both single phase and three phase installations regardless of the panel ampacity.

PG&E Requirements

10. If PG&E service conductors are to be run in a multiple conduit system, all phases and the neutral shall be installed in each conduit that is used.
11. PG&E will furnish and install the underground service conductors and make connections in the applicant's service termination enclosure.
12. 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, shall be plugged or sealed."
    C. When the intrusion of water can reasonably be expected, the following actions are required:
        (1) PG&E is responsible for sealing the conduit at the meter termination facilities as shown in Document 062288. If the meter termination facilities are significantly lower than the source side facilities, then the conduit should be sealed at both ends. The Rayflate Duct Sealing System (RDSS) conduit sealing system can be ordered for this purpose. See Document 062288.
        (2) The applicant is responsible for providing a means to prevent the accumulation of excess water or water pressure in the service conduit system. This is accomplished by installing a splice box at the base of the riser to the meter panel, or at a maximum of 6 feet away to the meter panel along the service run. Use a secondary #3 splice box instead of a secondary #5 splice box for drainage purpose. Table 1 footnote 5 shown in Document 028028 does not apply when the #3 splice box is used for drainage purpose.
13. Minimum service requirements
    A. Install the number and size of conduits as shown in Table 2 and Table 3 on Pages 4 and 4, based on the main service panel rating. No more than seven 5-inch service conduits will be supplied from any one transformer.
    B. Install the number and size of conductors, as shown in Table 2 on Page 4, 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.
    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, will be used to serve future load increases.
14. Single main service panels fed by single transformer

    Example 1

    480 V, 4-wire, 1,600-amp rated main switch, initial demand load is 300 kVA. Install five 5-inch ducts, service size is 1,000 kcmil for phase and 350 kcmil for neutral. Only two sets of service conductors are required to meet initial loading. The remaining three ducts should be capped for future use.
15. Multiple main service panels fed by single transformer

    Example 2

    1,000-amp, 600-amp, and 400-amp mains to be served. The number of sets of conduits required are three, two, and one, respectively. A total of six conduits are needed to serve the three main switches. The three services can be served from one transformer.
16. Multiple main service panels fed by multiple transformers

    Example 3

    2,000-amp and 1,000-amp mains to be served. The number of sets of conduits required are seven and three respectively. A total of ten conduits are needed to serve the two main switches. The two services cannot be served from one transformer; they must be served from individual transformers.

Upgraded Panel

17. 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 for the new panel if both of the following are met:
    A. The maximum fill ratio is not exceeded.
    B. The calculated cable pulling tensions along the conduit route is within limits of the new cable.
18. 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.
19. Note 17 and Note 18 above do not apply to the following conditions.
    A. Direct buried or Cable-In-Conduit (CIC) service cables. Direct buried and CIC service cables need to be replaced
    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.

Temporary Service

20. 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 shall 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”.

References	Location	Document
Methods and Requirements for Installing Commercial Underground Electric Services 0 – 600 Volts to Customer-Owned Facilities	UG-1: Enclosures/Greenbook	028028
Agricultural Underground Service 500 HP or Less	UG-1 Services/Greenbook/EMWP	054619
Terminating Underground Electric Services 0-600 Volts in Customer-Owned Facilities	UG-1: Services/Greenbook	058817
Underground Conduits	UG-1: Conduits/Greenbook	062288
Requirements for Bus Duct Entrance Termination Unit for Use with Pad-Mounted Transformers	UG-1: Services/Greenbook	063929

Table 1 Service Conduit Types Approved for Underground Applications With Prior PG&E Approval

Type	Specification [1] (must be marked on conduit)
PVC, DB 120 [2]	ASTM F512, DB 120, Cell Class 12164B or 12264B
Co-extruded Cellular Core PVC, DB 120	ASTM F512, DB 120, Cell Class 12254B
Hot-Dip, Galvanized, Rigid Steel	ANSI C80.1
PVC, Co-extruded Cellular Core PVC Schedule 40 or 80	UL 651

[1] The entire “conduit system” shall 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.

[2] This type of conduit is not approved for 2” conduit.

Table 2 Cable and Conduit Requirements for Single-Phase Commercial Services

Main Service Panel Rating (amps) [1]	Conduit Size and Number	Cables Required to Serve Maximum Load			
		Aluminum		Copper	
		Per Phase	Neutral	Per Phase	Neutral
100	1–3”	1–1/0	1–#2	NA	NA
200	1–3”	1–4/0	1–1/0	NA	NA
400 [2]	1–4”	1–750	1–4/0	NA	NA
600 [2]	2–4”	2–750	2–4/0	NA	NA

1 Service rating shall be the termination section, pullcan, service section, or main service switch continuous current rating, whichever is greater. See Note 2 on Page 1 for 100-600 amp 1∅ services.

2 Require transformer rated meter.

Table 3 Cable and Conduit Requirements for Three-Phase Commercial Services [1]

Main Service Panel Rating (amps) [2]	Conduit Size and Number	Cables Required to Serve Maximum Load			
		Aluminum		Copper	
		Per Phase	Neutral	Per Phase	Neutral
100	1–3”	1–1/0	#2	NA	NA
200	1–3”	1–4/0	1–1/0	NA	NA
400	1–5”	1–750	1–4/0	NA	NA
600	2–5”	2–750	2–4/0	NA	NA
800	2–5”	2–750	2–4/0	NA	NA
1,000	3–5”	3–1,000	3–350	NA	NA
1,200 [3]	4–5”	4–1,000	4–350	NA	NA
1,600 [3]	5–5”	5–1,000	5–350	NA	NA
2,000 [3]	7–5”	7–1,000	7–350	NA	NA
2,500 [3, 4]	7–5”	NA	NA	7–1,000	7–250
3,000	Bus Duct	NA	NA	NA	NA
3,500 [5]	Bus Duct	NA	NA	NA	NA
4,000 [5]	Bus Duct	NA	NA	NA	NA

1 3,000–, 3,500–, and 4,000–amp service rated panels require using a bus duct.

2 Service rating shall be the termination section, pullcan, service section, or main service switch continuous current rating, whichever is greater.

3 Requires termination provisions (i.e., longer bolts) that allow connectors to be stacked when needed.

4 Limited to 50 feet between the transformer secondary spades and the customer’s gear connection point. For greater distances, a bus duct is preferred, but a termination enclosure is allowed if installed per the requirements listed in Document 063929.

5 Panels rated over 3000 amps cannot be served at 120/208 V.

Table 4 Minimum Bend Radius for New Construction

Conduit Diameter	Vertical Radius	Horizontal Radius
2”	24”	36”
3”	24”	36”
4”	36”	36”
5”	36”	60”

Service Installation

Note

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.
2. The conduit end must extend at least 12 inches beyond 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 the final grade.

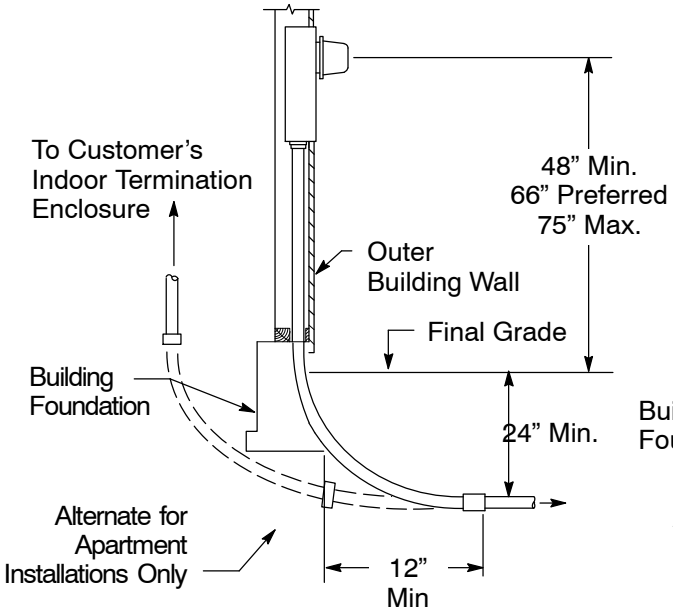

Figure 1
Recessed-Mounted Service Termination Enclosure

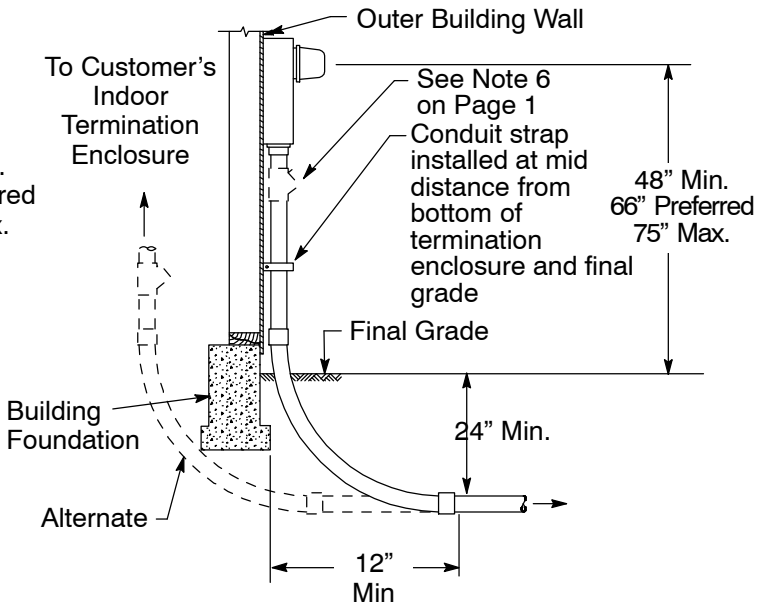

Figure 2
Surface-Mounted Combination Meter Socket Panel

Revision Notes

Revision 24 has the following changes:

1. Revised Document Title on Page 1.
2. Corrected Note 19 on Page 3.
3. Revised Note 12.C (2) on Page 2.
4. Added Notes on Page 5.
5. Revised Figure 1 and added text to Figure 2.