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

Asset Type: Electric Distribution  Function: Design
Issued by: Lisseth Villareal (LDV2)  Date: 12-17-20

Prepared by: ABB1

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 2 on Page 4 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 installed secondary—distribution cable is not smaller, either in size or in number of runs, than the largest service that is on the load side of that 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.

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 three-phase residential services or services larger than 600 amp, see Document 063928.

   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 no longer allowed. 800 amp services 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 2 on Page 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, are to be used to serve future load increases.
8. Residential design includes mobile home and mobile home 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. The conduit type for PG&E's service conductors installed through or under the foundation and up to 10' behind the outside wall into the applicant's building or electrical room, must be UL PVC Schedule 40 or 80. Galvanized Rigid Steel (GRS) conduit is required when the conduit will be exposed, installed along walls and low clearance ceilings, and may be subject to damage such as vehicles, machinery or tools. If conduits may be subjected to physical damage install rigid steel conduit instead of Schedule 40 or 80. To avoid cable insulation damage, the ends of conduits must be provided with a suitable fitting, such as a bushing, nipple, hub, cable protector, or end bell.

   **Note:** Conduits must not pass under or through one building to supply adjacent buildings.

12. 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.

13. 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."

   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. However, if the meter termination facilities are significantly lower than the source side facilities, use the Rayflate Duct Sealing System (RDSS) conduit sealing system listed in Document 062288. Also, 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 a splice box, 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. Use a secondary #3 slice box instead of a secondary #5 slice box for drainage purpose. Table 1 footnote 5 shown in Document 028028 does not apply when the #3 slice box is used for drainage purpose.

   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.

14. 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 560154), must be installed in all conduits and attached to an end cap (see Document 063928).

**Upgraded Panel**

15. 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.

16. 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.
17. Notes 15 and 16 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.
   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 2 on Page 4. 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 2 on Page 4. For example, if the existing cable is #2 AWG aluminum and new upgraded panel requires 4/0 aluminum.

Cover
18. 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
19. 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”.

- Notes 15 and 16 do not apply to the following conditions:
  - Direct buried or Cable-In-Conduit (CIC) service cables must be replaced with approved service cable.
  - Upgraded electric meter panels within 36 inches of the gas service riser require clearance.
  - New upgraded panels with a Service Equipment Rating more than one upgraded size than the existing panel.
  - Existing cable size smaller than the cable required for the new panel.

- Cover requirements:
  - Minimum 24 inches for secondary (0 - 750 V) service, 36 inches for primary (over 750 V).

- Temporary Service:
  - Using permanent service panels for temporary power.
    - Schedule 40 or 80 PVC conduit may be damaged.
    - Requires Schedule 40, rigid steel conduit for protection.
Table 1  Service Conduit Types Approved for Underground Application

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification ¹ (must be marked on conduit)</th>
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</thead>
<tbody>
<tr>
<td>Hot-Dip, Galvanized, Rigid Steel</td>
<td>ANSI Spec. C80.1</td>
</tr>
<tr>
<td>PVC, Co-extruded Cellular Core PVC, Schedule 40 or 80</td>
<td>UL 651, or ETL conforms to UL 651</td>
</tr>
</tbody>
</table>

¹  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 2  Cable and Conduit Requirements for Residential Services

<table>
<thead>
<tr>
<th>Service Equipment Rating (amps) ¹</th>
<th>Conduit Size and Number ²</th>
<th>Minimum Vertical Radius</th>
<th>Minimum Horizontal Radius</th>
<th>Aluminum Cable Required to Serve Maximum Load (Per Phase)</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>100–125</td>
<td>1–2”</td>
<td>24”</td>
<td>36”</td>
<td>1–1/0</td>
<td>1–#2</td>
</tr>
<tr>
<td>126–225</td>
<td>1–3”</td>
<td>24”</td>
<td>36”</td>
<td>1–4/0</td>
<td>1–1/0</td>
</tr>
<tr>
<td>320 ³</td>
<td>1–3”</td>
<td>24”</td>
<td>36”</td>
<td>1–350</td>
<td>1–4/0</td>
</tr>
<tr>
<td>400 ⁴, ⁵</td>
<td>1–4”</td>
<td>36”</td>
<td>36”</td>
<td>1–750</td>
<td>1–4/0</td>
</tr>
<tr>
<td>600 ⁴, ⁵</td>
<td>2–3”</td>
<td>24”</td>
<td>36”</td>
<td>2–350</td>
<td>2–4/0</td>
</tr>
</tbody>
</table>

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 11 on Page 2 for conduit type allowed on or within buildings, and Table 1 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 2 is the minimum size cable that must be used.
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 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.

Revision Notes

Revision 23 has the following changes:

1. Modified Note 1 on Page 1.
2. Added Note 5 and 7 on Page 1.
3. Added Note 5 and Note 6C on Page 1.
5. Revised Note 11, 13C, and 15C, 15D on Pages 2 and 3.
6. Revised Table 1 and 2 on Page 4.
7. Added new Note 5 under Service Installation Section on Page 5.