



PRIMARY ELECTRIC SERVICE REQUIREMENTS

094676

Asset Type: Electric Distribution *D. Jantz* **Function:** Design, Estimating, and Field Metering
Issued by: Daniel Jantz (DWJ7) **Date:** 3/25/2022

Rev. #00: This new document replaces bulletin TD-2999B-030, Rev. #03. For a description of the changes, see Page 16.

Purpose and Scope

This document specifies the technical requirements for all customers requesting electric service at one of Pacific Gas and Electric Company's (PG&E) primary distribution voltages as defined in Rule 2. It is intended to give the customer a clear understanding of what their responsibilities are to receive Primary Service (PS) and those of PG&E. PG&E has developed these technical requirements in order to provide safe and reliable service to all the customers the Company serves.

This document applies to load and generation PS customers. If the PS customer already has or intends to install distributed generation or back up generation, then also refer to the information described in the PG&E [Distribution Interconnection Handbook](#) (DIH). The DIH contains the specific requirements for interconnecting generating facilities or distributed generation (DG) with PG&E electrical distribution system.

References	Location	Document
25 kV Underarm Side-Break Switch, Manual and Automated	OH:Switches	066195
Installing Automatic Circuit Reclosers on Distribution Lines	OH:Switches/EPM	066199
Installation of Pad-Mounted Interrupters for Underground Distribution Lines	UG:Switches	068188
Introduction of the Eaton/Cooper NOVA Pad-Mounted Line Recloser	UG:Switches	076266
Transmission Interconnection Handbook, Section G2, Protection and Control Requirements, Electric & Gas Service Requirements Manual (Greenbook)		

Section 1 General Requirements

Customers meeting the Rule 2 requirements for PS shall install, own, and operate their distribution system beyond their Point of Service (POS). While there are a number of technical requirements associated with a PS, two requirements are particularly important:

- PG&E must approve the POS.
- PG&E must approve the protection scheme that the customer installs, owns and operates at the POS.
- The maximum capacity of PG&E's primary distribution main line circuits is 600 amps. The maximum capacity of local loop distribution circuits is typically 200 amps. PS customers may be required to connect to a main line circuit if one or more customers are already connected to a local loop circuit as the capacity may be limited.

Additionally, the following information and requirements are also noteworthy.

- The PG&E system has an A-C-B counterclockwise rotation.
- Before making changes to PG&E-required protection equipment, the customer must submit the proposed changes to PG&E for review and approval.
- The customer is responsible for maintaining PG&E-required protection equipment in accordance with PG&E maintenance and test practices. A PG&E technical representative will reseal PG&E-required relays following setting changes and routine maintenance.

- After completing such tests, the customer must submit maintenance and test report documentation to PG&E for review and approval.
- Contact the local PG&E representative with any questions.

Satisfying these requirements assists PG&E in providing safe and reliable service to other customers connected to the Company's system. Customers considering a PS should contact PG&E early in the design process.

Section 2 Primary Service Arrangements

PG&E prefers that the POS, protective device, and revenue meter for a PS be at or near the property line nearest to PG&E's primary distribution. The PG&E-approved and customer installed primary protection must be at the POS to protect other PG&E customers from outages due to faults on customer facilities. The revenue-metering should also be at this point because the PS customer is responsible for the line losses on their primary conductor and transformer(s) as well as their load. However, unlike the requirement for the protective device, it is not an absolute requirement.

The sections below explain the primary protection requirements and revenue-metering location requirements for PG&E's preferred PS arrangements. Please note that non-preferred service arrangement proposals may take longer to approve and involve additional cost for the customer.

Section 3 Preferred PS Arrangements

PG&E's preferred PS arrangements are either: a) when the PS customer's primary distribution line is underground (UG) and the POS is less than 500 feet from the property line, or b) when the PS customer's primary distribution line is overhead (OH) and the protective device pole (if separate from the POS pole) is less than 50 feet from the property line.

1. UG Conductor and POS < 500 Feet

If the PS customer's primary line is underground and the POS is 500 feet or less from the property line, refer to Figure 1 on Page 12 and Figure 2 on Page 13. The following requirements apply:

- A. The PS customer must provide a PG&E approved pad-mounted switchgear enclosure for PG&E's revenue-metering equipment. See Section 12 on Page 13 for detailed revenue-metering requirements.
- B. The PS customer must install primary protection at the POS. This protection may consist of a circuit breaker with phase and ground relays or, depending on the customer's load, fuses may suffice. If PG&E determines that fuses will not coordinate with PG&E's source-side protection, then the customer must use a circuit breaker. See Section 8A on Page 6 and Section 8C on Page 7 for circuit breaker and fuse requirements.
- C. The PS customer must install conduit from the POS to PG&E's primary distribution equipment location.
- D. PG&E will pull one continuous run of cable and connect to the customer's POS termination facility, not to exceed 500 feet (subject to an acceptable number of bends in the conduit).

2. OH Conductor

If the PS customer's primary line is overhead, then the first pole at the customer's property line is the POS. Refer to Figure 3. The following requirements apply:

- A. PG&E will install pole-top revenue-metering on the first pole on the PS customer's property. See Engineering Standard [058779 Pole-Top Primary Metering Installation, \(12 or 21 kV Line\)](#) for pole-top revenue-metering requirements.
- B. The PS customer must install primary protection on the second pole on their property, not to exceed 50 feet from the revenue metering pole. This protection may consist of a recloser or, depending on the customer's load, fuses may suffice. If PG&E determines that fuses will not coordinate with PG&E's source-side protection, then the customer must use a recloser. See Section 8C on Page 7 for recloser requirements.
- C. The PS customer second pole and the equipment installed on it, must maintain a minimum clearance of 10 feet from the PG&E revenue metering pole and any equipment, crossarms, and wires installed on it.
- D. PG&E will interconnect its system with the customer's system at the revenue-metering pole.

Section 4 Non-Preferred PS Arrangement Proposals

PS customers may propose a non-preferred PS arrangement. This typically occurs when the PS customer's primary distribution line is UG and the proposed location for the primary switchgear is greater than 500 feet from the property line. PG&E will consider such proposals; however, non-preferred service arrangement proposals may take longer to

design, approve, and can involve additional customer expense. Customers should contact PG&E early in the design process if they are considering a non-preferred PS arrangement.

Also, a non-preferred PS arrangement may consist of:

1. A PG&E approved interrupter within 500 feet of the property line, or
2. Pad-mounted switchgear greater than 500 feet of the property line that includes a protective device such as a breaker or fuses. In these cases, the substructures and equipment are installed and owned by the customer. As with preferred arrangements, PG&E must approve the location, substructure/equipment arrangement and protective devices.

In addition, The PS customer must provide space for PG&E's revenue-metering in their switchgear. See Section 12.B.5).a. on Page 15 for detailed metering requirements.

3. PG&E will pull one continuous run of cable, not to exceed 500 feet, to the POS (interrupter) subject to an acceptable number of bends in the conduit.

Section 5 Location of Revenue – Metering

The preferred revenue meter location is at the POS. High-side metering is PG&E's preferred metering configuration. If PG&E approves low-side metering, a 2% adjustment factor will be applied at each stage of the transformation before the meter. See Section 12 on Page 13 for additional revenue-metering requirements.

Section 6 Service Wire Configuration

If the PG&E POS is at a protective device and not at the customer owned switchgear the wiring configuration, 3-wire or 4-wire, of the customer's service from the protective device to the switchgear must be the same as PG&E's.

Section 7 General Protection Requirements

It is important to minimize the potential hazard to life and property when interconnecting facilities to the PG&E distribution system. This requires the automatic detection of abnormal conditions and trouble related to a PS customer's equipment and the isolation of the condition and/or equipment within a reasonable time.

As a general rule, neither party should depend on the other for system protection. As such, PG&E's minimum protection requirements are designed and intended to protect the PG&E power system only. Moreover, the interconnection of a PS customer to the PG&E distribution system must not degrade existing PG&E protection and control schemes or interfere with the service of other customers (see Rule 2). The PS customer's facilities must isolate any fault or abnormality that could adversely affect the PG&E electric system, or the electric systems of other entities connected to the PG&E electric system.

PG&E assumes no liability for damage to the PS customer-owned facilities resulting from a lack of adequate coordination between the PS customer's protective device(s) and PG&E's protective devices, or negligence due to the PS customer's failure to maintain protective and/or isolation equipment.

PG&E recommends that the PS customer acquire the services of a qualified and licensed electrical engineer to review its plans. The PS customer must, at its expense, install, operate, and maintain system protection facilities in accordance with all applicable regulatory rules and requirements, and in accordance with this document.

1. Data the PS Customer Provides to PG&E
 - A. The PS customer must provide the information necessary for PG&E to determine the interconnection requirements before PG&E approves the specific PS installation. This information includes, but is not limited to, the following:
 - (1) Single-Line diagrams.
 - (2) Meter and Relay diagrams.
 - (3) Three-Line diagrams of required protective device.
 - (4) Control diagrams including direct current (dc) tripping circuit.
 - (5) Proposed relay specifications and settings.
 - (6) Relay manufacturer, model, style, type, ranges, settings, and a copy of the relay instruction manual.
 - (7) Projected electrical demand (i.e., kilowatt [kW]), including the following information:
 - (a) Power factor
 - (b) Load factor

- (c) Large motor sizes
- (d) Motor starting currents
- (e) Customer's transformer size
- (f) Estimated breakdown of the electric energy use (i.e., kilowatt hours [kwh]) by month
- (8) Full-size phase and ground coordination curves showing full coordination with PG&E's system.
- (9) A registered electrical engineer must prepare and stamp the fault-study results.
- (10) Maintenance program documentation for PG&E-required switches, interrupting devices, and protective equipment.
- (11) Completed [PS-1 Form](#) with main breaker(s) and relay data.
- (12) Main Protective Relay Current Transformer(s) (CT) data;
 - (a) Manufacturer
 - (b) Model Number
 - (c) CT Ratio
 - (d) CT Class (Minimum Class C100 Required)
 - (e) CT Burden (Value must be provided in Ohms)

B. PG&E strongly recommends that the PS customer, or their representative, provide the above information before ordering equipment and finalizing the design.

C. Also, before energizing the new PS facility, the PS customer must also provide a copy of the on-site test reports for the switches, devices, and relays at least 30 working days before energizing the service. This allows sufficient time for review, modification, and final PG&E approval. Qualified personnel must prepare these on-site test reports. Refer to Section 9, "Equipment Test Requirements," on Page 6 and Section 10, "Pre-Energizing Test" on Page 8 for further details.

2. Data that PG&E Provides to the Applicant

PG&E provides the following engineering data to the PS customer:

- A. System fault-duty at the property line.
- B. Settings for PG&E source-side protective devices and the required clearance time to comply with PG&E protection standards.
- C. Relay curves for PG&E source-side protective devices, if requested by the PS customer.

Section 8 Specific Protection Requirements

PG&E must review and approve the fault-interrupting devices that the PS customer selects. There are four basic types of fault-interrupting devices available for distribution systems:

- Circuit breakers
- Reclosers (without bypass)
- Interrupters
- Fuses

The following sections provide specific requirements for each of these devices.

1. Circuit Breaker Requirements

The interconnecting circuit breaker must have sufficient capacity to interrupt the maximum available fault current at its location. Phase and ground relays approved by PG&E (see Table 1, PG&E Approved Relays, on Page 7) must be used to trip the circuit breaker for phase and ground faults. These relays must coordinate with PG&E's source-side protection. It must also include the following features:

- A. Shunt-trip via a trip signal supplied through a battery external to the circuit breaker.
- B. Lock out if operated by protective relays required for interconnection.

Primary Electric Service Requirements

C. Capacitive tripping is unacceptable.

D. Relay Requirements:

- (1) PG&E requires PS customers to install phase and ground over-current relays that trip the interrupting device at the POS. These relays must detect all phase and ground faults, and coordinate with PG&E's source side protection. All required relays must include relay targets and have "manual reset" capability.
- (2) The PS customer must either:
 - (a) select phase and ground relays approved by PG&E or,
 - (b) have an International Electric Testing Association certified testing company test the relay and provide the test results to PG&E for review. This option should be discussed with PG&E prior to testing the relays.
- (3) PG&E strongly recommends that PS customers submit all relay specification and setting proposals for PG&E approval before finalizing the design and ordering equipment. PS customers not submitting this information risk delaying their projects.

Table 1 PG&E Approved Relays

See Tables G2-4 and G2-5 located in the [Transmission Interconnection Handbook, Section G2, "Protection and Control Requirements."](#) These tables list all types of relays approved for load and generation interconnections on the PG&E distribution and transmission systems.

NOTE: PG&E's approval of the relays does not indicate the quality or reliability of a product or service. No endorsements or warranties are implied.

E. Relay Redundancy Requirement

The PS customer's protection system must contain redundancy such that the failure of any one component will still allow the customer's system to isolate the PS facility from the PG&E system under a fault condition. Three single-phase over-current relays and a ground over-current relay, or two three-phase over-current relays and a ground over-current relay satisfy the redundancy requirement. PS facilities, using microprocessor-based relays as a multifunctional protective device, must have backup relays.

F. Power Supply Requirements

- (1) Power supplies for PG&E required relays and the tripping circuitry for the fault-interrupting device must be supplied from a battery and charger system. The system must include dc under-voltage detection.
- (2) Fuses are not allowed in the dc trip circuitry (dc breakers are acceptable).
- (3) The preferred battery type is flooded lead-acid (calcium, antimony) or nickel-cadmium (NiCd). Sealed batteries (Valve Regulated Lead Acid [VRLA]) are not allowed. An uninterruptible power supply (UPS) is unacceptable. See Section 14, "Battery Requirements for Interconnecting to the PG&E System," on Page 10, for more details on PG&E's battery requirements.
- (4) The power supply system must include an alarm feature supplied from a DC low voltage source and connected to a customer monitoring system. The alarm must be audible and visual (strobe) and be operational at all times.

G. Fire Pump Circuit Breaker

Fire pumps connected to a separate circuit breaker that are not protected by the PS main circuit breaker are considered a second and independent main circuit breaker and therefore must meet all of the protection requirements in Section 8.1.

2. Reclosers and Interrupters

Contact PG&E for approved reclosers and interrupters.

When a recloser is used as the customer's primary protection, do not install a bypass switch or other type of equipment which bypasses the protective functions of the recloser. PG&E does not allow the customer's primary fault-interrupting device to be temporarily or permanently removed or bypassed at any time.

3. Fuse Requirements

- A. Fuses are single-phase, direct-acting, sacrificial links that melt to interrupt fault current and protect the equipment.
- B. PG&E may approve the use of fuses as the fault interrupting device at the POS for load-only facilities if the fuses coordinate with the PG&E source-side devices for both phase and ground faults. Large primary fuses that do not coordinate with PG&E's source-side protective phase and ground relays are not allowed. These fuses may cause other customers on the circuit to lose power due to a fault inside the PS customer's facility.
- C. If the facility has a generation source refer to the [Distribution Interconnection Handbook](#) for limitations on when fuses may be used as the fault interrupting device.
- D. The PS customer must replace the blown fuses manually after each fault before the facility can return to service. Only trained, qualified personnel should replace the primary fuses.
- E. If PG&E approves the fuses, the PS customer should consider installing a negative-sequence relay and/or other devices to protect its facility against single-phase conditions (however, this is not a requirement). The PS customer is responsible for protecting their equipment against single phase conditions, if they determine or feel that it is needed.
- F. Customers must keep a full set of replacement fuses (PG&E must approve the size and type) onsite.
- G. Solid Blade cutouts are not fuses and therefore not acceptable as a fault-interrupting device.

4. Replacement or Failure of Protective Equipment

When the customer's primary protection device malfunctions or fails to detect abnormal service conditions and trouble related to a PS customer's equipment and the isolation of the condition and/or equipment within a reasonable time then PG&E may require the equipment to be replaced. Also, when protective equipment is repaired or replaced the equipment must meet all of the qualification and testing requirements in this document including passing inspection by PG&E personnel. If new equipment is installed it must be currently listed as PG&E approved.

Section 9 Equipment Test Requirements

The tests in this section apply only to the PG&E-required equipment at the POS; specifically, the breaker, the relays, and the tripping circuitry.

The customer must complete the following requirements:

- The equipment must pass all the tests described below.
- The customer must submit two copies of the test reports to PG&E a minimum of 30 working days before energizing the PS facilities.
- Each test report must identify the equipment tested and that identification must match that in the single-line or three-line diagrams.

The customer must meet the above requirements and obtain PG&E approval of the test reports at least ten working days before PG&E energizes the PS. PG&E strongly recommends that the PS customer coordinate the test program with PG&E.

1. Circuit Breaker Tests

The PS customer must perform the following circuit breaker tests:

- A. Minimum-to-trip test at 70% or less of the nominal control voltage on all circuit breakers operated by PG&E-required relays.
- B. Micro-ohm test on the main circuit breaker(s) at the POS.
- C. Timing test showing the time from the trip initiation to the opening of the main poles. Proving insulation tests, as described below.
- D. Proving Insulation
 - (1) Megger circuit breaker(s) at the POS operated by PG&E require relays (see Table 2 below).

Table 2 Circuit Breaker Positions and Connections

Circuit Breaker Position	Connection
Circuit breaker open.	Each pole to ground, pole 1 to 2, pole 3 to 4, pole 5 to 6
Circuit breaker closed.	Pole 1–ground, pole 3–ground, pole 5–ground
If the poles are in a common tank or cell.	Pole 1 to 3, pole 3 to 5, pole 5 to 1

(2) Megger (phase-to-phase and phase-to-ground) all buses from the POS to the main breaker or fuses.

(3) The main circuit breaker(s) must have a dielectric test performed on the insulating medium (gas or oil). This test is not required for factory-sealed, circuit-switcher interrupters.

2. Tests for Current Transformers and Current Circuits

PS customers must perform the following tests for current transformers (CTs) and current circuits associated with PG&E-required relays:

- A. Check the saturation on all CTs. If this is not possible, a manufacturer’s curve is acceptable.
- B. Prove the ratio of all CTs by using current (primary to secondary) or voltage (secondary to primary).
- C. Check the CTs for the proper polarity.
- D. Check the CT circuits for the proper connections.
- E. Check the continuity of the CTs by:
 - (1) Applying primary or secondary current at the CT block.
 - (2) Verifying that the proper current exists in each phase relay and the ground relay.

Customers must perform each test (primary or secondary) in all combinations prove that all phase relays and ground relays have proper connections.

PS customers must also ensure that no loose wiring or parallel current paths exist, by applying or injecting the current to achieve a secondary reading of 5 amperes (A) in each relay.

Check each phase of each current circuit feeding PG&E-required relays. Megger the total circuit with the ground wire lifted (to prove that only one ground exists).

3. Relay and Fuse Tests

The testing requirements for relays/fuses include:

A. PS customers must field test the settings of PG&E required relays to verify the following items:

- (1) The minimum operating point at which the relay picks up (minimum pickup).
- (2) Time delays at three different current-test points, in integral multiples of the minimum pickup that closely characterize the relay time-current curve.
- (3) Test results must be within the tolerances listed below:
 - (a) Current/Voltage/Time $\pm 10\%$
 - (b) Impedance/Phase Angle $\pm 0.05\%$
 - (c) Frequency $\pm 0.05\text{ Hz}$

B. Check all fuses for continuity before energizing.

4. Tests Recommended (But Not Required by PG&E) for the PS Customers

A. Transformer

It is recommended (but not required by PG&E) that the customer perform the following tests prove the insulation and turns ratio on their primary service transformers.

(1) Proving Insulation

A 1,000 or 2,500 volt (V) dc megger test or a 1,000 V, high-pot test is recommended for any of the insulation tests below.

- (a) Megger the main transformer(s) winding-to-winding and each winding-to-ground.
- (b) Megger the buses (phase-to-phase and phase-to-ground) from the POS to the main transformer.
- (c) Perform a dielectric test on the main transformer(s) insulating medium (gas or oil).

(2) Proving Ratios

Prove the main transformer(s) ratio(s) using one of the following methods:

- (a) Turns-ratio tester.
- (b) Voltage-ratio test on the final operating tap. Consult with PG&E to best match the present distribution-system voltage.

Section 10 Pre-Energizing Test

1. Customers must meet the following requirements before PG&E will energize the PS:
 - A. Ensure that any inspections required by local governmental and regulatory agencies are complete and any applicable permits are obtained before PG&E energizes the PS.
 - B. A PG&E technical representative must witness trip checks of all PG&E-required relays. This may require injecting a signal to trigger the relay. This proves that the relay will handle the trip current of the circuit breaker. It also proves relay targeting. Jumpering the studs on the back of the relay is not acceptable.
 - (1) The Primary Service Entity shall provide all test equipment and qualified 3rd party personnel to perform the required tests. PG&E recommends third party testers to be National Electrical Testing Association (NETA) certified. PG&E shall be there strictly as an observer. Form PS-1 shall be completed by the PG&E representative on site at the time of the pre-energizing test.
 - C. A PG&E technical representative must verify grounds are bonded per standard (switching platforms, fences, buildings, etc.) and verify signage is correct per the below requirement. All signs shall be constructed to be weatherproof.
 - (1) Disconnect – The disconnect sign shall have 1 inch wide by 2 inch high, with colors venetian red (#3) lettering on a buff (#1) background (or similar). If the facility has multiple feeds with multiple separate disconnect switches, then each disconnect requires a separate sign.
 - (2) Location – The location sign shall have 1 inch high venetian red (#3) lettering on a buff (#1) background. PG&E's standard location sign size is 14 inches wide by 7 inches high overall. It shall be posted at each entrance to the facility. If there are other gates or doors to go through, then each one of those shall have a sign as well. For example: One posted at the entrance to the primary service facility, and one posted on the entrance to the substation within the primary service facility.
 - D. After energizing the PS and adding load, a PG&E technical representative must witness the reading of the load current in each phase relay and the absence of load current in the ground relay. The PG&E technical representative will then seal the relays.
 - E. The PS customer is responsible for providing all test equipment, and qualified personnel to conduct the tests in the presence of a PG&E technical representative.

Section 11 Alternate Source

A PS customer may request an alternate primary service source installed at customer expense. Requests for an alternate source are handled on a case-by-case basis. This section describes some of the technical requirements associated with installing and operating a PS with an alternate source. Technical requirements may change depending on location and a variety of other factors. PG&E strongly recommends that customers contact the Company early in the design phase to ensure a successful project. The PS customer and PG&E must work together to ensure that an alternate source system fulfills the customer's needs while not degrading PG&E protection schemes, operating flexibility, or cause interference with another customer's service.

When a PS load is transferred from the primary source to the alternate source or vice versa, a momentary outage ("drop-and-pickup" operation) occurs.

When the PS is fed from the alternate source and the PS customer wants to transfer back to the primary source with a parallel operation (“make-before-break” method), the PS customer must meet the following requirements:

- F. The ratios and electrical connections of the transformers on both sources must be well matched to minimize circulating currents.
- G. The impedance of the transformers and the relative phase angles of the sources must be such that any “through load” (i.e., flowing of power through the PS customer’s electrical system to other customers) does not cause overloads.
- H. The parallel transfer operation must not degrade protection, inhibit PG&E’s operating flexibility, or overstress equipment (customer or PG&E equipment).
- I. The transfer switches, one on each side of the PS load, require an automatic interlock control scheme to minimize the time the two systems are paralleled. The transfer switches must be circuit breakers or other suitably rated, automatically controlled switches.

NOTE

The parallel period must be less than one second because the presence of two parallel circuits will increase the fault duty and may overstress the PS customer’s equipment.

- J. In some cases, PG&E may require additional protective devices and/or special operating procedures to ensure safe and reliable service for the PS customer and other PG&E customers.
- K. Each parallel transfer operation can only proceed after PG&E’s specific approval. The PS customer must obtain PG&E’s approval before performing the parallel transfer operation. PG&E may withhold approval if, in its sole judgment, the above requirements have not been met, or if a previously unforeseen factor or change in conditions is deemed to jeopardize the operator, public safety, or reliability to customers.
- L. The PS customer must assume all liability for any problems or damage resulting from any parallel transfer operation.

Section 12 Revenue-metering Requirements

This section addresses direct access (DA) and bundled-service PS customers connected at distribution voltages (34.5 kV and below), as described in Rule 2. Customers must satisfy PG&E’s revenue-metering requirements and those of other applicable governing authorities (i.e., California Public Utilities Commission [CPUC], California Independent System Operator [CAISO], etc.).

For customers exporting power, loads connected at distribution voltages must satisfy the metering protocols established by PG&E and CAISO. Exceptions are handled on a case-by-case basis with approval from PG&E’s Meter Engineering department in close coordination with Field Metering Services.

Other arrangements that affect the required metering installation may also require a “Generation Special Facilities Agreement.”

There are two types of distribution services:

- Wholesale
- Retail (i.e., end-users)

1. Wholesale Service

- A. For wholesale-service interconnections, please refer to the [Wholesale Distribution Tariff \(WDT\)](#) and document [092816 Wholesale Distribution Tariff \(WDT\) Interconnection Design Options for Primary Voltage Service](#)
- B. For the revenue metering of the wholesale-service interconnections, the PS customers must provide, install, own, and maintain all revenue-metering-related equipment, including all the items provided and maintained by PG&E or a Meter Service Provider (MSP) listed under “Retail Service” below.
- C. PS customers requesting wholesale service must meet the following criteria:
 - (1) CAISO metering standards
 - (2) PG&E’s requirements

- (3) Enter into a Meter Service Agreement (MSA) with the CAISO and, in certain cases, with PG&E. The MSA specifies requirements regarding the retrieval of load data and accessibility by CAISO.
 - D. The wholesale PS customer is responsible for ensuring that the meters comply with CAISO's meter standards and accuracy requirements.
 - E. All PS customers must contact PG&E's local account services representative for PG&E's revenue-metering requirements.
2. Retail Service (End Users)
- [Electric Rule 22](#) governs the interconnection and operating requirements for DA customers. Please use the following link to access the document, https://www.pge.com/tariffs/assets/pdf/tariffbook/ELEC_RULES_22.pdf_for_the_following_elections.
- A. Customer service elections
 - B. Customer metering options
 - C. Customer Responsibilities

The customer (end-user) maintains the following:

- (1) The (pad-mounted) primary switchgear
 - (a) Please refer to [PG&E's Electric and Gas Services Requirements](#) (<http://www.pge.com/greenbook>) [Section 11](#) for primary switchgear requirements and to [Section 5](#) for our general requirements of all metering equipment.
 - (b) The ampacity rating of primary switchgear should not exceed 600 amps. This supply rating must be listed on the switchgear nameplate. As this is the maximum rating of PG&E's primary distribution main line circuits. Also note that some circuits may be de-rated to less than 600 amps due to the PG&E installed distribution wire size and distribution equipment ratings.
 - (c) To maintain the required metering accuracy and to meet PG&E requirements, the revenue-metering instrument transformers must be located in the same switchgear with the revenue meters.
 - (d) The enclosure must be grounded and if applicable, located within the substation ground grid.
 - (e) Access must be readily available for PG&E employees to read and maintain the metering equipment
- (2) Overhead PS

Refer to Engineering Document [058779, "Pole-Top Primary Metering Installation, \(12 or 21 kV Line\)."](#) for metering requirements of overhead primary services.

Section 13 Communication Circuits

PG&E may require communications circuits between PG&E and the customer's PS facilities for the following purposes:

- Protection
- Revenue Metering
- Energy Management System (EMS)
- Supervisory Control and Data Acquisition (SCADA)
- Generation
- Voice communications

When external communication circuits are installed, the responsible party must ensure that the high-voltage protection (HVP) equipment on these circuits meets all applicable standards.

Section 14 Battery Requirements for Interconnecting to the PG&E System

This section describes PG&E's process for ensuring safety and reliability of for customers who connect to Company systems. The recommendations made here will ensure that the system operates as designed.

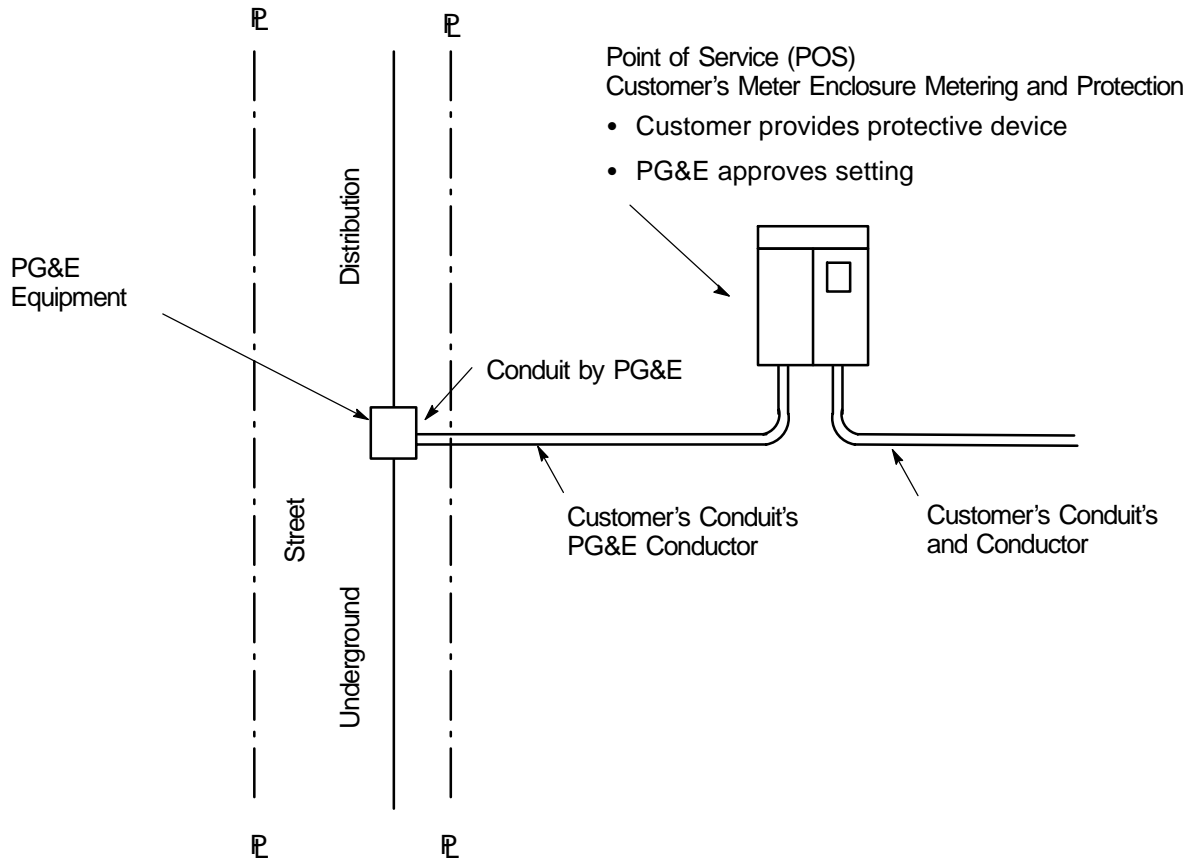
1. Because of reliability and safety reasons only flooded lead acid (calcium, antimony) and Nickel-Cadmium (NiCd) batteries are acceptable in switchgear installations.

2. It is required for the third party customer to provide the following documentation to PG&E for review and acceptance by the Substation Engineering Department:
 - A. Complete **FORM AT-1**, “[Third Party Interconnection Battery Information Sheet and Acceptance Document](https://www.pge.com/includes/docs/pdfs/shared/rates/tariffbook/ferc/tih/app_t.pdf)” (https://www.pge.com/includes/docs/pdfs/shared/rates/tariffbook/ferc/tih/app_t.pdf), located on pages 4 thru 5 in Appendix T on the [Transmission Interconnection Handbook](#) webpage.
 - B. Type of Battery (Vented Lead Acid–VLA or NiCd). Monoblock (multiples cells in a jar) batteries from C & D, EnerSys or other vendors will be acceptable. Battery racks must be designed to withstand loading based on IEEE 693 (High Seismic).
 - C. Detail information of load including continuous and momentary. No minimum requirement– Smallest flooded acid may be the limitation.
 - D. Battery sizing calculation based on IEEE Standard 485–2010 (IEEE recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations) or IEEE Standard 1115–2014 (IEEE recommended Practice for Sizing Nickel–Cadmium Batteries for Stationary application) and minimum 8 hours discharge rate using manufacturer software (to ensure proper discharge curve is used) using aging factor of 1.25 and design margin of 1.1 to be clearly shown on the calculation. Charger sizing calculation based on battery size with recharge time of 12 hours assuming charger will support the continuous load as well as recharges the battery at the same time.
 - E. When battery is installed proof of three (3) hour discharge testing to ensure battery has the capacity to support the load and trip; per IEEE Standard 450–2010 (Voltage measurements should be taken every 15 minutes throughout the testing).
 - F. Documentation showing what kind of maintenance will be done (Monthly, Quarterly, and Yearly etc.).
 - G. Monitoring of minimum battery low voltage by separate voltage relay or through charger and provide critical audible and visual alarm for the monitoring system.

Section 15 Preferred Service Arrangement Figures

The following pages provide figures showing the preferred service arrangements for overhead and underground primary services.

Primary Electric Service Requirements

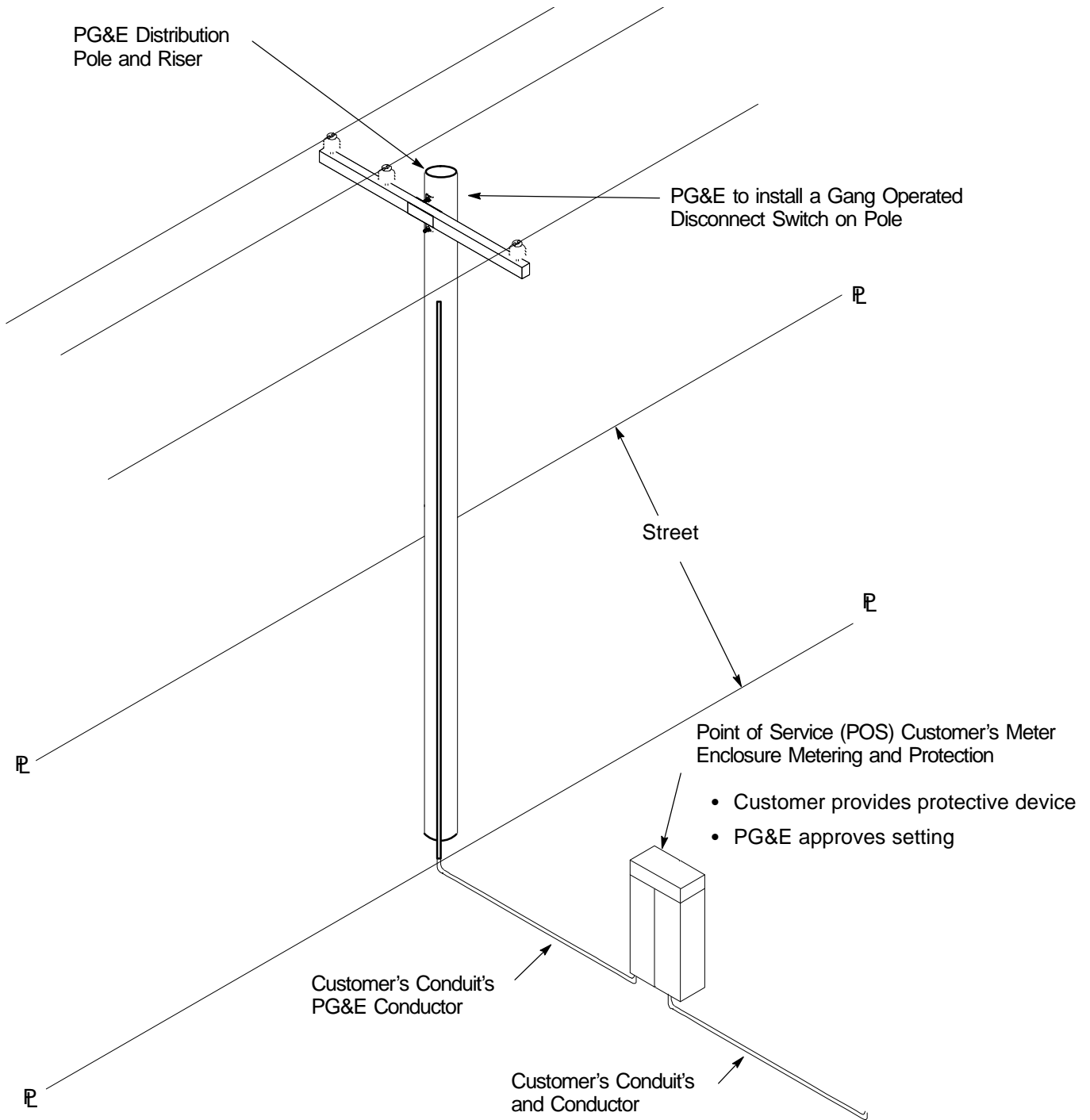


Notes:

1. PG&E will install a protective device under a special facilities agreement if there are extenuating circumstances that prevent the customer from installing one. This is an exception and will be handled on case-by-case basis.
2. PG&E will own and maintain substructures in the franchise area and the customer will own and maintain substructures on private property
3. PG&E will provide one continuous pull of cable to POS, not to exceed 500 feet.

Figure 1
Underground Primary Service from Underground Distribution Preferred Service
Arrangement Switchgear > 500 feet from PG&E Equipment

Primary Electric Service Requirements

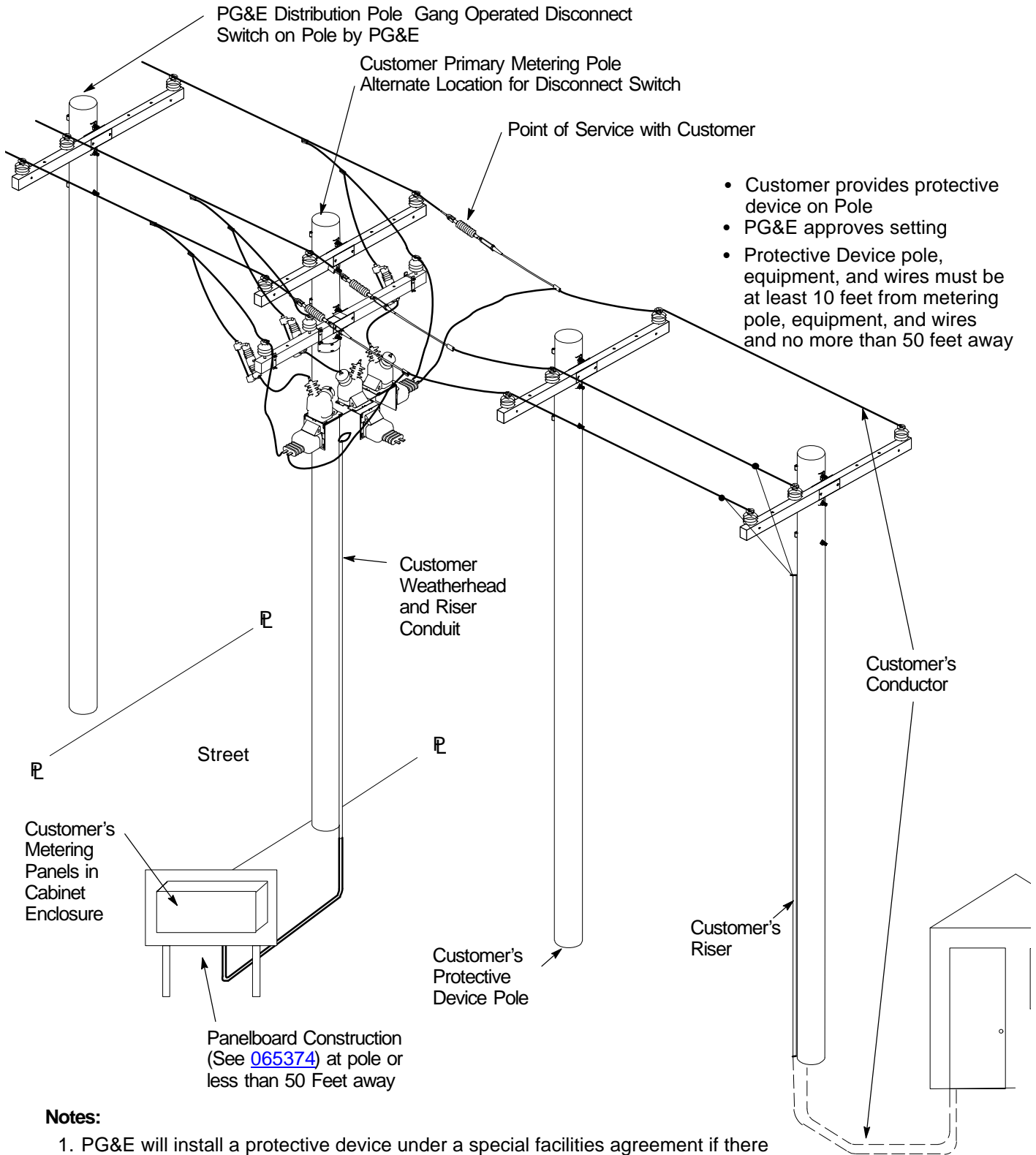


Notes:

1. PG&E will install a protective device under a special facilities agreement if there are extenuating circumstances that prevent the customer from installing one. This is an exception and will be handled on case-by-case basis.
2. PG&E will own and maintain substructures in the franchise area and the customer will own and maintain conduit on private property.
3. PG&E will still provide one continuous pull of cable to POS, not to exceed 500 feet.

Figure 2
Underground Primary Service from Overhead Distribution Preferred Service Arrangement
POS \leq 500 feet from PG&E Pole

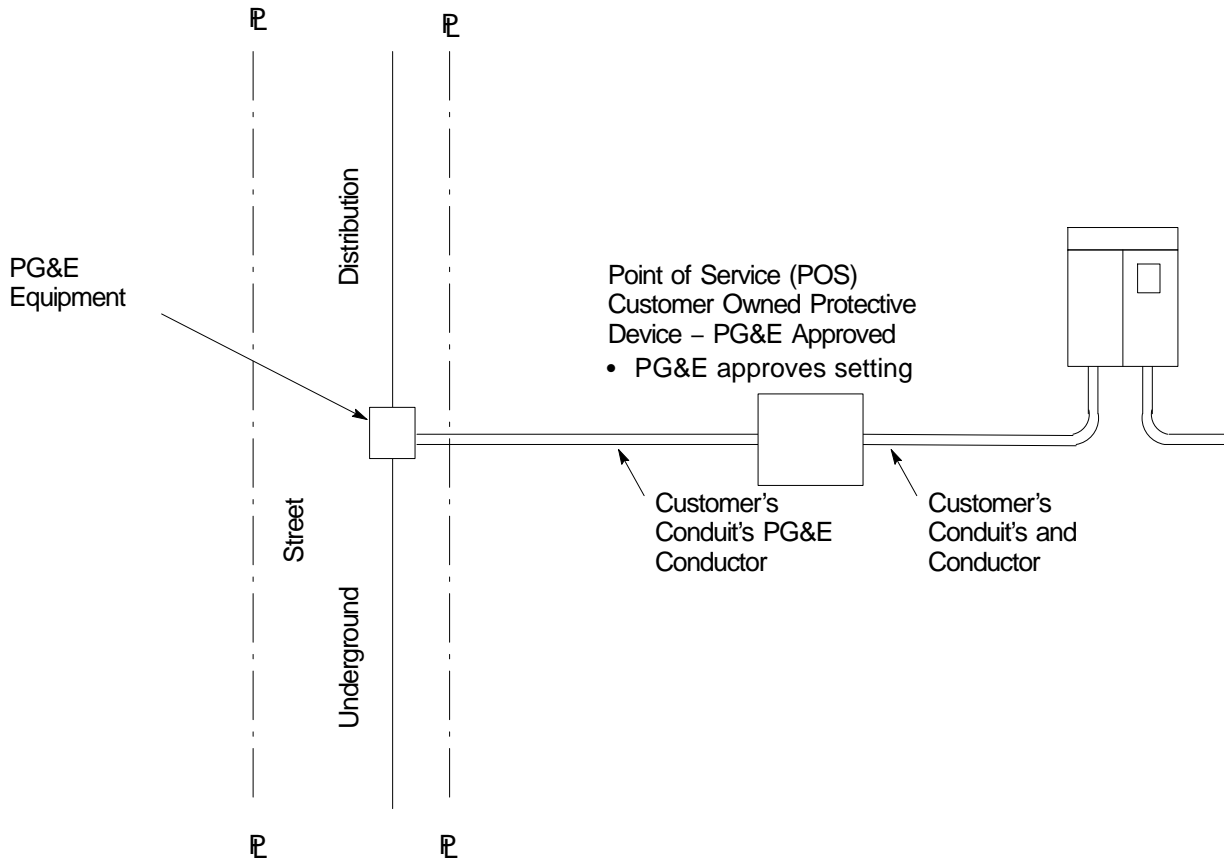
Primary Electric Service Requirements



Notes:

1. PG&E will install a protective device under a special facilities agreement if there are extenuating circumstances that prevent the customer from installing one. This is an exception and will be handled on case-by-case basis.

Figure 3
Overhead Primary Service From Overhead Distribution Preferred Service Arrangement



Notes:

1. PG&E will install a protective device under a special facilities agreement if there are extenuating circumstances that prevent the customer from installing one. This is an exception and will be handled on case-by-case basis
2. PG&E will own and maintain substructures in the franchise area and the customer will own and maintain substructures on private property.
3. PG&E will provide one continuous pull of cable to POS, not to exceed 500 feet.

Figure 4
Underground Primary Service from Underground Distribution Non-Preferred
Service Arrangement Switchgear > 500 feet from PG&E Equipment

Revision Notes

Revision 00 has the following changes:

1. Converted Bulletin TD-2999B-030 to this new numbered engineering document.
2. Consolidated general requirements through document to Section 1 General Requirements on Page 1.
3. Added links and updated information throughout the document.
4. Updated Figure 1 on Page 12.
5. Updated Figure 2 on Page 13.
6. Updated Figure 3 on Page 14.
7. Added Figure 4 on Page 15.
8. Added Note 1.A.(11) on Page 4.