



Electric Service Requirements

Commercial Distributed Generation

Engineering Specification T015

April 2017

Powering forward. Together.





CATEGORY

ELECTRIC SERVICE REQUIREMENTS

SUBJECT

COMMERCIAL DISTRIBUTED GENERATION (DG)

TABLE OF CONTENTS

1. Overview 2

2. General Requirements for Service..... 3

3. Definitions 3

4. Abbreviations 5

5. References – Latest Editions, Errata, Corrections, and Amendments 5

6. Design Review and Approval 6

7. SMUD Requirements 8

8. Power Production Metering Requirements - General 12

9. AC Disconnects..... 14

10. Labeling..... 14

11. Minimum Telemetry & Metering Requirements – Nameplate rating
or facility aggregate 500 kW – 999 kW - Net Energy Metering (NEM) only 14

12. Minimum Telemetry & Metering Requirements – Nameplate rating
or facility aggregate of

- 1 MW or greater Net Energy Metering (NEM) and
- all non NEM equal to or greater than 500 kW. 16

13. Data from ESR T004 – Page A-25
(Reference page numbers refer to drawings in T004)..... 18

14. Data from ESR T004 – Page A-26
(Reference page numbers refer to drawings in T004)..... 19

Examples of panel types * 20

Figure 4 - Sample Site Plan (Partial View). Refer to Section 6.1.3..... 21

Figure 5 - Sample Single Line Drawing (refer to Section 6.1.2) of PV Connected
Between Meter and Main Breaker. 22

Figure 6 - Sample Cut Sheet - 800 Amp Breaker. Refer to Section 6.1.5..... 23

Figure 7 - Sample Elevation Drawing..... 24

Figure 8 - Sample Conduit Plan..... 25

Figure 9 - Sample Primary Panel Cut Sheet..... 26

 SMUD ENG. SPEC. T015	REV. 1	<p style="text-align: center;">ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)</p>	Page 2 of 26
---	-----------------------------	--	---

1. Overview

This document is intended to present the Sacramento Municipal Utility District's (SMUD's) requirements for the establishment of connecting Small and Large Commercial Distributed Generation (DG) to SMUD's electric grid. For the purpose of this document, Small Commercial customers will be those that have installed Distributed Generation less than 500 kW. Large Commercial customers will be those Commercial customers installing DG equal to or greater than 500 kW. This document exists on SMUD.org – search for “Electric Service Requirements”.

If you are a Commercial Customer served via our Downtown Secondary Network, in addition to the requirements set forth in this document, you will also have to abide by the requirements of SMUD's GP-001, *Distribution Generation (DG) Interconnection Requirements on the Downtown Secondary Network System*.

If you are creating a Purchase Power Agreement (PPA), these are so complex that a generic explanation in an ESR cannot cover all of the possibilities of such an installation. Refer to Section 12 for Telemetry and Metering Requirements. Please refer to SMUD's Policy and Procedure 11-01, *Interconnection Guideline*, for steps to submit the application.

All references to inverter-based DG system sizes will be based upon total nameplate AC rating of the inverter(s).

The requirements presented here are necessary for SMUD to supply uniform, satisfactory, and safe electrical connections between the Customer's DG and SMUD's electrical system. It is necessary that all written material (this text, as well as all of the notes on the drawings) be carefully read.

The National Electric Code (NEC) and the County / City Electrical Inspector for your area may have requirements for your generation system that are beyond what SMUD requires. Please check with your local Inspector to make sure your plans meet their requirements.

SAFETY FIRST!! All materials used, and all work performed, on a Customer's premise (with the exception of the meter), shall conform with requirements of the local inspection authority, the National Electric Code, and all applicable safety orders, rules, and regulations of the State of California. Customer service switchboard equipment shall meet SMUD and EUSERC (The Electric Utility Service Equipment Requirements Committee) requirements and be UL approved. No DG can be connected unless approved by the County / City Electrical Inspector for your area (also referred to as the Authority Having Jurisdiction or AHJ). In order to provide a safe interconnection between the Commercial DG and SMUD's electrical system, a SMUD representative will also have to inspect and approve the DG installation.

 SMUD ENG. SPEC. T015	REV. 1	<p style="text-align: center;">ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)</p>	Page 3 of 26
---	-----------------------------	--	---

2. General Requirements for Service

Portions of Sections 3 through 9 below are modified from the 2015 edition of EUSERC - The Electric Utility Service Equipment Requirements Committee.

3. Definitions

- 3.1. **Combiner / Sub-Panel:** an electrical panel where one or more feeds from Distributed Generation sources can be combined into one circuit to the Power Production Meter. If the Combiner / Sub-Panel has more than six (6) breakers, an additional Visible Disconnect Device will have to be installed between the Combiner / Sub-Panel and the Power Production Meter (2017 NEC 230.71(A) for Service Conductors and 240.92(D)2 for Feeder Conductors). Further, the Combiner / Sub-Panel shall be sized to only accommodate the DG breakers. If a larger sized Combiner / Sub-Panel is used, then the panel shall be rendered unable to accept any additional breakers for unrelated loads. The allowed related loads can include tracking motors, cooling fans, monitoring and metering, etc. Note: Generation connected between the meter and the main (Option 2) may only include monitoring and metering per 2017 NEC 230.82.
- 3.2. **Demarc/MPOE:** Demarcation point is sometimes abbreviated as demarc or DMARC, or **MPOE** (stands for Minimum Point Of Entry), and is used to describe the interface between customer premise and the telephone company wiring.
- 3.3. **DG (Distributed Generation):** Any type of Customer owned electric generator, static inverter, or generating facility that has the capability of being operated in parallel with SMUD's distribution system.
- 3.4. **Distribution System:** All electrical wires, equipment, and other facilities owned or provided by SMUD, including Interconnection Facilities, by which SMUD provides Distribution Service to a Customer.
- 3.5. **EUSERC:** The Electric Utility Service Equipment Requirements Committee. Designation that metering equipment meets the requirements of the member utilities developed to promote safe and uniform electric service equipment requirements.
- 3.6. **Generating Facility:** All Generators, electrical wires, equipment, and other facilities, owned or provided by the facility owner, for the purpose of producing electric power.
- 3.7. **Interactive Static Inverter:** A power electronic device that converts Direct Current (DC) power to Alternating Current (AC) by means of electronic

 SMUD ENG. SPEC. T015	REV. 1	ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)	Page 4 of 26
--	-------------------------	--	---

switching. The only static inverters acceptable for the interconnection of Customer owned equipment with SMUD are those inverters that are designed to automatically separate from SMUD’s distribution system upon loss of voltage from SMUD and to reclose with SMUD only after SMUD’s voltage has been restored.

- 3.8. **Medium Voltage:** voltages between 600 Volts and 34,500 Volts.
- 3.9. **Parallel Operation:** The simultaneous operation of a Generator with power delivered or received by SMUD while interconnected. Under SMUD’s Rate Policy and Procedures Manual, No. 11-01, “Interconnection Guidelines”, Parallel Operation includes only those generators that are so interconnected with the Distribution System for more than one second (60 cycles).
- 3.10. **Point of Common Coupling (PCC):** The transfer point for electricity between the electrical conductors of SMUD and the electrical conductors of the Generating Facility.
- 3.11. **Point of Interconnection (Delivery):** The electrical transfer point between a Generator or a Generating Facility and SMUD’s electrical system. This may or may not be coincident with the Point of Common Coupling.
- 3.12. **Power Production Meter (PM):** The Meter located at the Generator panel, or otherwise located to record generation output without other unrelated Customer loads. Loads ancillary to the generation (e.g., solar tracker motors, engine cooling fans, pumps, etc.) are to be connected, to the extent practicable, so that these are metered with the generation by the Power Production Meter, i.e., the ancillary loads should be connected between the DG and the Power Production Meter. **All PM panels shall be of ring type.**
- 3.13. **PPA (Power Purchase Agreement):** This refers to a contract entered into by an independent power producer and SMUD. The PPA specifies the terms and conditions under which electric power will be generated and purchased. PPA’s require the independent power producer to supply power at a specified price for the life of the agreement. While PPA’s vary, their common elements include: specification of the size and operating parameters of the generation facility; milestones in-service dates and contract terms; price mechanisms; service and performance obligations; dispatchability options; and conditions of termination or default.
- 3.14. **Station Service:** Station service loads include all energy consumption necessary for the generation of electricity that can be supplied by the facility itself while it is generating electricity, and any loads not separately metered from any station service load. These include, but are not limited to, pumps, condensers, pollution controls, monitoring and control equipment, and any

energy demand used in the operations of a facility that occur *only* in response to the operations or changes in operation of the facility itself. This does not include any energy used at the facility that is needed **when the facility itself is not generating**, e.g., maintenance, vehicle transportation, cleaning, or other similar energy uses, unless these energy uses are not separately metered from a station service load. Electricity used for station service, or parasitic load, is not eligible for California’s Renewables Portfolio Standard.

- 3.15. **Utility Service Meter:** The Meter located in a Customer’s main electrical panel. This meter is capable of separately recording power flow into, and power flow out of, a Customer’s facility or premise.
- 3.16. **Visible Disconnect Device:** An electrical switching device that can separate the Generating Facility from SMUD’s Distribution System and is designed to allow visible verification that separation has been accomplished. This requirement can be met by opening the enclosure to observe the contact separation. It will be used by SMUD and the Customer to establish an open point when working on either the Power Production Meter or the DG system. With the door open, the air gap shall be visible at the trailing edge of the movable disconnect blades when the switch is in the open position. It will completely isolate the Customer’s generating facility from SMUD’s distribution grid. A Combiner / Sub-Panel may be substituted for a Visible Disconnect.

4. Abbreviations

AC = Alternating Current	LEC = Local Exchange Carrier
AHJ = Authority Having Jurisdiction	NEC = 2017 National Electric Code
CEC = California Electric Code	NEM = Net Energy Metering
DC = Direct Current	PCC = Point of Common Coupling
DG = Distributed Generation	PM = Power Production Meter
ESR = Electric Service Requirement	VDD = Visible Disconnect Device

5. References – Latest Editions, Errata, Corrections, and Amendments

All Customer equipment shall conform to nationally-recognized standards and recommended practices. These include, but are not limited to the following:

- 5.1. California Electrical Code (CEC)
- 5.2. IEEE 519 – Recommended Practice and Requirements for Harmonic Control in Electrical Power Systems
- 5.3. IEEE 929 – Recommended Practice for Utility Interface of Photovoltaic (PV) Systems

- 5.4. IEEE 1547 – Standard for Interconnecting Distributed Resources with Electric Power Systems
- 5.5. IEEE 1547.1 – Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
- 5.6. NEMA C84.1 - Electric Power Systems and Equipment-Voltage Ratings (60 Hertz) {formerly ANSI C84.1}
- 5.7. NFPA 70 – 2017 National Electrical Code (NEC), especially Article 690
- 5.8. OSHA 1910.145(F)(7)
- 5.9. UL 98 – UL Standard for Safety Enclosed and Dead-Front Switches
- 5.10. UL 1741 – UL Standard for Safety Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

6. Design Review and Approval

- 6.1. Prior to *APPROVAL* of Customer interconnection facilities, the Customer shall submit through *PowerClerk Interconnection* system:

Document Type	Project Type / Equipment
Single Line	All Commercial
Site Plan	All Commercial
Elevation Drawing	All Commercial
Panel Cut Sheets	> 200 Amps
Panel Inspection	>600 Volts

- 6.1.1. Distributed Generation (DG) interconnection on-line application for SMUD's review and written approval.
- 6.1.2. An electrical one-line or three-line diagram. For DG projects equal to or greater than 500 kW, SMUD will require a single line drawing and a conduit plan that shows the SMUD telemetry cabinet and the conduits to the Power Production Meter Panel. See Sections 11 and 12 for more information.
- 6.1.3. A site plan/layout showing the location of all electrical equipment from the inverter (including solar equipment or other generation equipment to be listed) back to the Main electric service panel.
- 6.1.4. Elevation drawing(s) showing the location of all electrical equipment to be mounted on the facility (with possible obstructions, e.g., gas meters, fences, etc.). For DG projects equal to or greater than 500 kW, SMUD will require an elevation drawing and a conduit plan that shows the SMUD

 ENG. SPEC. T015	REV. 1	ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)	Page 7 of 26
--	------------------	--	---------------------------

telemetry cabinet and the conduits to the Power Production Meter Panel. See Sections 11 and 12 for more information.

- 6.1.5. Detailed panel (cut sheets) are required on generation installations with meter panels rated greater than 200 amperes. **SMUD shall review and approve the cut sheets before the customer orders the equipment.**
- 6.1.6. For projects with a meter panel rated greater than 600 Volts, SMUD also requires inspection of the meter panel once it is delivered to the job site.
- 6.1.7. For projects with DG equal to or greater than 500 kW, SMUD needs to review the *preliminary* conduit drawings to determine if telemetry conduit can be incorporated into the project conduit runs. SMUD prefers to hard wire communications from the Power Production Meter back to the site Local Exchange Carrier (LEC) telecom room demarc.
- 6.1.8. **SMUD will not be responsible for the costs incurred by the Customer for the relocation or replacement of any equipment installed by the Customer prior to SMUD's approval.**
- 6.2. All metering equipment shall meet requirements set forth by EUSERC; SMUD's ESR T004; SMUD Policy and Procedure 11-01, *Interconnection Guideline*; and to this ESR T015.
- 6.3. Changes or modifications to the approved design shall not be made without prior approval. If changes or modifications are desired, the Customer shall submit the revised plans including the changes or modifications for SMUD approval.
- 6.4. If the Customer wants to connect a battery bank and an AC battery charger to their renewable generation system, the connections described in this document will NOT apply.
- 6.5. The accuracy of the Power Production Meter to monitor the true output of the DG system is very important to SMUD. Therefore, no other loads can be connected between the Power Production Meter and the DG equipment. The allowed related loads can include tracking motors, cooling fans, monitoring and metering, etc. Note: Generation connected between the meter and the main (Option 2) may *only* include monitoring and metering per 2017 NEC 230.82. Please reference on your design that the Combiner / Sub-Panel will be sized to only accommodate the DG breakers. If a larger sized Combiner / Sub-Panel is used, then the panel shall be rendered unable to accept any additional breakers or loads. The equipment needs to be called out on the drawing with the following text "DG load center sized for DG breakers only or rendered unable to accept additional loads".

7. SMUD Requirements

SMUD conditions customer's interconnection on the installation of a Power Production Meter (PM). A Combiner / Sub-Panel can substitute for the Visible Disconnect Device for systems less than 600 VAC and 200 Amps or less. Where Power Production Meter(s) are installed, a disconnecting means shall be located such that the inverter(s) can be serviced without de-energizing the production meter. A Combiner / Subpanel's breakers or a Visible Disconnect Device are acceptable as this disconnecting means. Medium voltage systems will be on a case-by-case basis.

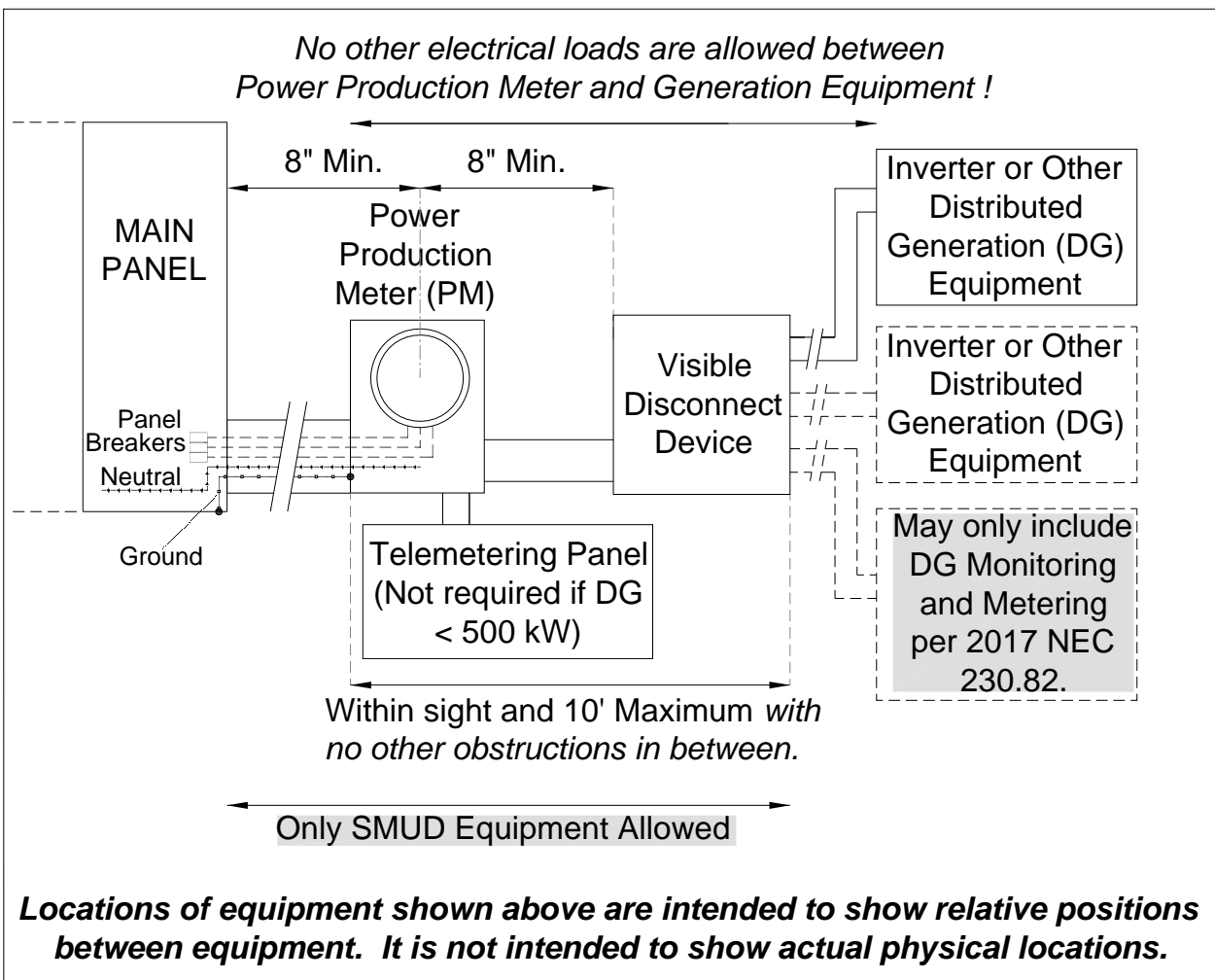


Figure 1: Commercial Generation - Option 1
 Generation connected to Breaker Position in Main Panel with VDD between Power Production Meter and Generation.

7.1. **Commercial – Option 1:** Generation connected to a breaker position in Main panel located at the opposite end of the bus from the Main breaker or otherwise located per applicable NEC code.

 ENG. SPEC. T015	REV. 1	<p style="text-align: center;">ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)</p>	Page 9 of 26
--	-----------------------------	--	---

7.1.1. There are 2017 National Electric Code requirements that limit the breaker size in the Main panel that connects to the generation. Section 705.12(B,2,3,b) states that the maximum size of this breaker is limited by the size of the bus bar within the Main panel and by the size of the Main breaker. The size of the Main breaker plus the size of the breaker for the generation circuit cannot exceed 120% of the bus bar's ampacity rating.

- Example 1: for a bus bar rating of 1000 Amps and a Main breaker rated 1000 Amps, the maximum breaker size available for the generation is:
 $(120\%) \times (1000 \text{ Amp bus bar}) = 1200 \text{ Amps} - 1000 \text{ Amp Main breaker} = 200 \text{ Amps}.$
- Example 2: for a bus bar rating of 1600 Amps and a Main breaker rated 1000 Amps, the maximum breaker size available for the generation is:
 $(120\%) \times (1600 \text{ Amp bus bar}) = 1920 \text{ Amps} - 1000 \text{ Amp Main breaker} = 920 \text{ Amps}.$

7.1.2. The Power Production Meter (PM) socket and a Visible Disconnect Device (VDD) need to be accessible 24 / 7 / 365 and located within sight and within ten feet (10') of each other ***with no other obstructions in between***. For meters 200 amps or smaller, there shall be a minimum of eight inches (8") between the center line of the Power Production Meter socket and any obstruction. For meters greater than 200 amps, there shall be a minimum of eight inches (8") between the edge of the enclosure and any obstruction. A Combiner / Sub-Panel may be substituted for a VDD for systems under 200 Amps.

7.1.3. It is highly desired that the breaker / disconnect in the inverter have the ability to be locked in the open position.

7.1.4. 2017 NEC Section 705.12(B,2,3,c) provides an additional method to determine the maximum allowed size of the breaker serving the generation circuit. The sum of all ratings of the breakers in the panel (not including the Main breaker) cannot exceed the ampacity of the bus bar's rating. This section also requires that permanent warning labels shall be applied to distribution equipment that displays the following or equivalent wording:

WARNING:
THIS EQUIPMENT FED BY MULTIPLE SOURCES.
TOTAL RATING OF ALL OVERCURRENT DEVICES,
EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE,
SHALL NOT EXCEED AMPACITY OF BUSBAR.

 SMUD ENG. SPEC. T015	REV. 1	ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)	Page 10 of 26
---	-------------------------	--	--------------------------------

7.1.5. The 2017 NEC also has a requirement for the labeling of the breaker that connects to the generation. Section 705.12(B,2,3,b) states “A permanent warning label shall be applied to the distribution equipment adjacent to the back-fed breaker from the inverter that displays the following or equivalent wording:

**WARNING:
POWER SOURCE OUTPUT CONNECTION -
DO NOT RELOCATE THIS OVERCURRENT DEVICE.”**

7.1.6. ***As mentioned earlier, the NEC and the County / City Electrical Inspector for your area may have requirements for your generation system that are beyond what is listed here. Please check with your local Inspector to make sure your plans meet their requirements.***

7.1.7. Small Commercial: If the Customer’s DG is less than 500 kW (gross AC nameplate), the telemetering panel shown in Figure 1 will not be required.

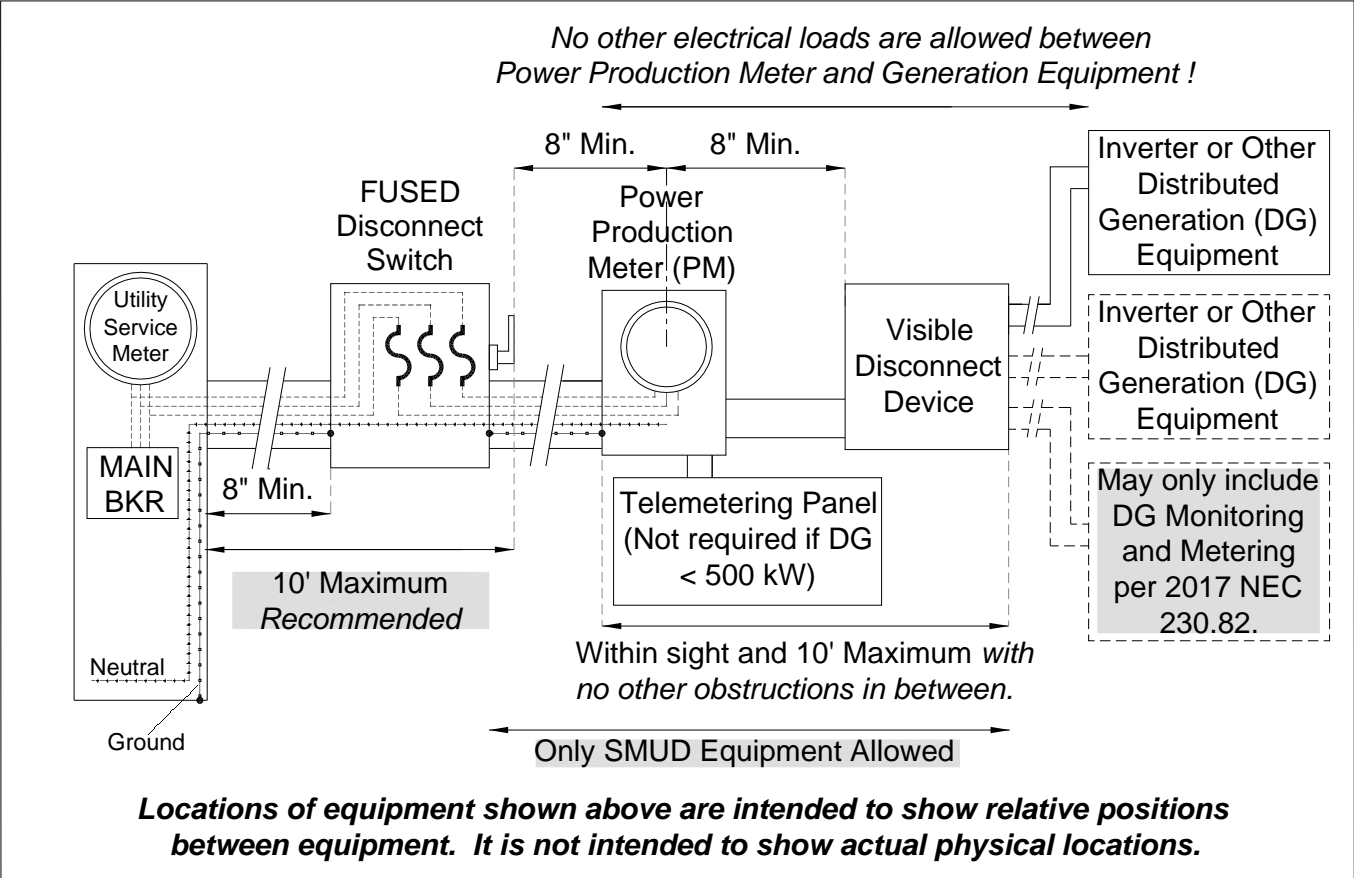


Figure 2: Commercial Generation - Option 2
 Generation connected between Utility Service Meter and Main Breaker Position in Main Panel with VDD between Power Production Meter and Generation.

- 7.2. **Commercial – Option 2:** Generation connected between Utility Service Meter and Main Breaker position as per applicable NEC code. A FUSED Disconnect Switch needs to be installed between the Main Panel and the Power Production Meter (2017 NEC 230). All other items from 7.1.2 through 7.1.7 apply.
- 7.3. The FUSED Disconnect Switch should be as close as possible to the Main Panel, and it is recommended that it be within ten feet (10') of the Main Panel. Please consult with the AHJ as to the maximum distance allowed from the Main Panel.
- 7.4. 2017 NEC section 705.12(A) states that “The sum of the ratings of all overcurrent devices connected to the power production sources shall not exceed the rating of the service.”

 ENG. SPEC. T015	REV. 1	ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)	Page 12 of 26
--	------------------	--	----------------------------

8. Power Production Metering Requirements - General

- 8.1. Pursuant to 7.1.2, the Customer shall provide and install the necessary metering socket and cabinet(s) as required by SMUD, in locations approved by SMUD. A stipend will be provided by SMUD to help offset these costs. SMUD will furnish and install the Power Production Meter at no cost.
- 8.2. The Power Production Meter socket shall be wired so the output from the Customer's DG Source will be properly measured by the meter. Therefore, the DG shall be wired to the top clips of the PM. All phase conductors, one grounded conductor (neutral), and one grounding conductor (case ground) shall enter the Power Production Meter socket and they shall be labeled to differentiate between SMUD and DG Source.
- 8.3. The Power Production Meter, Visible Disconnect Device, and Telemetry Panel (if required) will be installed in a location readily accessible by SMUD 24 / 7 / 365 and in keeping with SMUD's metering requirements in T004.
- 8.4. A Visible Disconnect Device should be located such that the Power Production Meter remains energized from the Main Panel during Inverter replacements or during maintenance on the DG equipment.
- 8.5. Under no circumstances shall any metering enclosure be used as a conduit or raceway for any conductors other than those phase conductors being metered and the associated grounded conductor (neutral) and grounding conductor (equipment ground).
- 8.6. Arrangement and Location - The Power Production Meter shall be located within sight and 10 feet of a Visible Disconnect Device **with no other obstruction(s) between them**. Where physical limitations prohibit this, alternate arrangements shall be made and approved by SMUD (e.g., installation of additional Visible Disconnect Device(s), labeling as per NEC and Authority Having Jurisdiction, etc.).
- 8.7. Equipment Protection and Grounding - All related metering enclosures and equipment shall be grounded in compliance with the NEC and the local Authority Having Jurisdiction.
- 8.8. All equipment shall be approved by a National Recognized Testing Laboratory (NRTL).
- 8.9. **After installation, SMUD employees will not energize the DG system. This will be the responsibility of the Customer / Contractor. It will also be the responsibility of the Customer to monitor the production of the DG system.**

 SMUD ENG. SPEC. T015	REV. 1	ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)	Page 13 of 26
--	-------------------------	--	--------------------------------

8.10. For Power Production Metering over 600 volts (these requirements are in addition to the general Power Production Metering requirements):

8.10.1. There shall be an eight foot (8') clearance from the utility CT section to any other obstruction.

8.10.2. Two Visible Disconnect Devices need to be installed – one on each side of the Power Production Meter.

8.10.3. All equipment shall meet EUSERC requirements.

8.10.4. Where possible, metering can be done with a pole mounted rack.

8.10.5. For telecommunication equipment, clearance to high voltage equipment shall be maintained at all times from the high voltage bus support.

8.10.6. To provide the communications circuit, SMUD Telecom will require additional testing to determine if high voltage protection is needed.

8.11. For Projects Equal to or Greater than 500 kW:

8.11.1. The Facility Owner will need to provide a 13-point socket in the switchgear.

8.11.2. The SMUD Power Production Meter will require auxiliary power, ranging from 120 VAC to 277 VAC single phase (120 VAC preferred), to be installed into the Utility Meter section. This circuit should not be fed from the generation circuit.

8.11.3. If the Facility Owner would like to install metering equipment for their own need, the Facility Owner is responsible for purchase and installation of its own separate metering equipment and will install it in their section of the switchgear. The Facility Owner cannot attach their metering equipment to the SMUD metering equipment.

8.11.4. For Net Energy Metering installations, the SMUD Power Production Meter shall be the closest meter to the DG source.

8.12. Curtailable Power Purchase Agreement (PPA) or Feed In Tariff (FIT)

8.12.1. Some DG installations may be required to have the option of being curtailed by SMUD. This will be determined by the PPA agreement.

8.12.2. The Facility Owner will run conduit from the meter and curtailment device to their telecommunications enclosure and provide support as required by SMUD to install a data and voice grade circuit line to the Power Production Meter to stream production data to SMUD's Energy Management System. SMUD will work with the Local Exchange

 SMUD ENG. SPEC. T015	REV. 1	ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)	Page 14 of 26
---	-----------------------------	--	--

Carrier (LEC) to acquire a data line and the monthly cost for the line will be absorbed by SMUD.

8.12.3. SMUD requires the first section of the metal enclosed switchgear (closest to the substation bank) to be the SMUD Power Production Metering Section. SMUD doesn't want any load losses between the Power Production Meter and the PCC.

8.12.4. The Power Production Meter requires DNP3 communication protocol between the plant controller and the RTU.

9. AC Disconnects

The Disconnect Device(s) will isolate all ungrounded (hot) conductors of the generating facility from SMUD's distribution system. The switch/breaker shall be a gang-operated, and load-break rated. A Combiner / Sub-Panel can substitute for the Visible Disconnect Device.

10. Labeling

Labels shall conform to the current California Electric Code, NEC, and Authority Having Jurisdiction.

11. Minimum Telemetry & Metering Requirements – Nameplate rating or facility aggregate 500 kW – 999 kW - Net Energy Metering (NEM) only

(If your nameplate rating or facility aggregate is one (1) MW or greater NEM or greater than 500 kW non-NEM, please refer to Section 12, this document.)

This is in compliance with revisions to SMUD Interconnection Guideline 11-01 approved by the Rates Department and management.

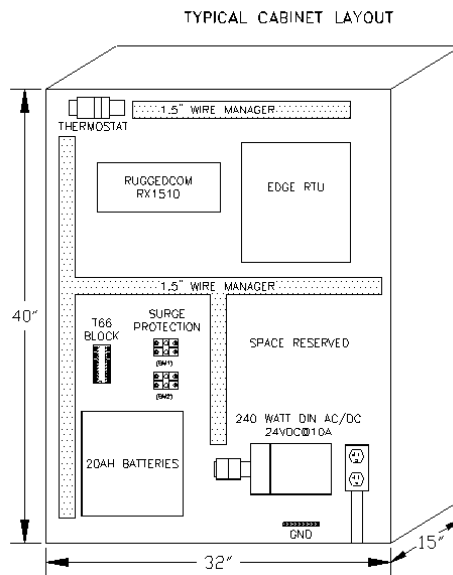
11.1. **Facility Owner** is responsible for the following: (SMUD shall provide a stipend to offset some of these costs):

11.1.1. Install Power Production Meter panel or provide Power Production Meter section in existing switchgear per SMUD and EUSERC metering standards, which may include relocation of disconnects. This is required for installation of the Power Production Meter.

Please refer to your *Power Clerk Interconnect* application for appropriate stipend amount.

11.1.2. Install and properly ground a separate lockable telemetry cabinet (32" wide by 40" tall by 15" deep, rated NEMA 3R). The Facility Owner will

also provide facilities to bring two power feeds (120 VAC to 277 VAC single phase as required (120 VAC preferred), 15 Amps capacity – one feed for telecommunications and one for the meter) to the telemetry cabinet and Power Production Meter. *The cabinet and location shall be approved by SMUD prior to the Facility Owner ordering the cabinet and installation. Facility Owner is responsible for termination of power, neutral, and grounding cables.* SMUD will contribute an additional \$6,000 paid to the Facility Owner or in the form of a credit toward other work that may be billable to the Facility Owner. SMUD, in its discretion, may adjust this contribution amount in the future. This amount is based on SMUD’s estimated average cost for telemetry equipment, labor, and materials.



**Figure 3 - Equipment Layout in SMUD's Telemetry Cabinet
(SMUD will install the equipment)**

- 11.1.3. Provide support as required by SMUD to install data and voice grade circuit to the Power Production Meter to stream production data to SMUD’s Energy Management System. SMUD will work with the LEC to acquire a data line and the monthly cost will be absorbed by SMUD.
- 11.2. **SMUD** is responsible for the following telemetry labor and material costs:
 - 11.2.1. Furnish and install all materials and labor associated with the installation of Power Production Meter(s) to read energy generated by the generation facility, including metering transformers if necessary.

 <p>SMUD ENG. SPEC. T015</p>	<p>REV. 1</p>	<p align="center">ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)</p>	<p align="right">Page 16 of 26</p>
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11.2.2. Pay for all materials and labor costs associated with Energy Management System programming and testing.

11.2.3. Pay for all interconnection project management time.

11.2.4. If primary metering associated with telemetry is to be pole mounted, construction costs associated with the Power Production Metering will be provided by SMUD.

12. Minimum Telemetry & Metering Requirements – Nameplate rating or facility aggregate of

- **1 MW or greater Net Energy Metering (NEM) and**
- **all non NEM equal to or greater than 500 kW.**

This is in compliance with revisions to SMUD Interconnection Guideline 11-01 approved by the Rates Department and management.

12.1. **Facility Owner** is responsible for all telemetry labor and material costs incurred by SMUD:

12.1.1. Install and pay for SMUD Power Production Meter section in switchgear cabinet per SMUD Power Production Metering standards, which may include relocation of disconnects. This is required for installation of the Power Production Meter. When 69 kV connections are required, the Facility Owner incurs the cost associated with purchasing the metering transformers (PT's / CT's) per SMUD approval.

12.1.1.1. Pay for, install, and properly ground, a separate lockable telemetry cabinet (32" wide by 40" tall by 15" deep, rated NEMA 3R). The Facility Owner will also provide facilities to bring two power feeds (120 VAC to 277 VAC single phase as required (120 VAC preferred), 15 Amps capacity – one feed for telecommunications and one for the meter) to the telemetry cabinet and Power Production Meter. *The cabinet and location shall be approved by SMUD prior to the Facility Owner ordering the cabinet and installation. Facility Owner is responsible for termination of power, neutral, and grounding cables.*

12.1.1.2. Please refer to Figure 3 on page 15 above for cabinet layout.

12.1.2. Provide support for SMUD to install data and voice grade circuit to the Power Production Meter to stream production data to SMUD's Energy Management System. Facility Owner will reimburse SMUD for all

 SMUD ENG. SPEC. T015	REV. 1	<p style="text-align: center;">ELECTRIC SERVICE REQUIREMENTS COMMERCIAL DISTRIBUTED GENERATION (DG)</p>	Page 17 of 26
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materials and labor costs. SMUD will work with the LEC to acquire a data line and the monthly costs will be passed to the Facility Owner.

- 12.1.2.1. Facility owner pulls two CAT5e shielded cables from the telemetry cabinet to the telephone distribution frame to the Customer's LEC demarc.
- 12.1.2.2. Facility owner will provide conduit from the new telemetry cabinet to the switchgear utility Power Production Meter section. (Note: Customer shall provide conduit plan drawing before installation of conduit.)
- 12.1.3. Pay for all materials and labor associated with installation of Power Production Meter(s) to read energy generated by the generation facility.
- 12.1.4. Pay for all materials and labor costs associated with Energy Management System installation, programming, and testing.
- 12.1.5. Pay for all interconnection project management time.
- 12.1.6. The Facility Owner is responsible for all labor and material costs including line work associated with all metering requirements (refer to SMUD Interconnection Guideline 11-01 for details).

**13. Data from ESR T004 – Page A-25
 (Reference page numbers refer to drawings in T004).**

<i>MINIMUM REQUIREMENT FOR CUSTOMER'S UNDERGROUND SERVICE</i>						
<i>COMMERCIAL DELTA METER REQUIREMENTS</i>						
TYPE OF SERVICE	REF. PAGE NO.	MAIN SIZE AMPS.	METER	METER SOCKET	METERING AND TRANSFORMERS	TEST BYPASS
2W-1 PHASE 120V	A-19	30	CL.100 120V 2W 1 PHASE S	100A 4 POINT CONTINUOUS DUTY RATED		SEE PAGE A-19
3W-1 PHASE 120/240V	A-19	0-100	CL.200 240V 3W 1 PHASE S	100A 4 POINT CONTINUOUS DUTY RATED		SEE PAGE A-19
3W-1 PHASE 120/240V	A-20	101-200	CL.200 240V 3W 1 PHASE S	200A 4 POINT CONTINUOUS DUTY RATED		SEE PAGE A-20
3W-1 PHASE 120/240V (1)	A-6 A-7	201-400	5A 240V 3W 1 PHASE S.P.	COMB. CAN BOX 6 POINT SEE A-7	2-2W SEE NOTE 4	7 POLE TEST SWITCH SEE NOTE 3
3W-1 PHASE 120/240V (1)	A-7 A-11	800	5A 240V 3W 1 PHASE S.P.	6 POINT	2-2W SEE NOTE 4	7 POLE TEST SWITCH SEE NOTE 3
4W-3 PHASE 120/240V (2)	A-19	0-100	CL.200 240V 4W DELTA 3 PHASE S	100A 7 POINT CONTINUOUS DUTY RATED		SEE PAGE A-19
4W-3 PHASE 120/240V (2)	A-20	101-200	CL.200 240V 4W DELTA 3 PHASE	200A 7 POINT CONTINUOUS DUTY RATED		SEE PAGE A-20
4W-3 PHASE 120/240V (2)	A-6 A-7	201-400	5A 240V 4W 3 PHASE S.P.	COMB. CAN 13 POINT SEE A-6, A-7	3-2W SEE NOTE 4	10 POLE TEST SWITCH SEE NOTE 3
4W-3 PHASE 120/240V (2)	A-7 A-12 A-13 A-14 A-16	401-800	5A 240V 4W DELTA 3 PHASE S.P.	13 POINT	3-2W SEE NOTE 4	10 POLE TEST SWITCH SEE NOTE 3

NOTES:

- ANY SERVICE OVER 200A, SINGLE PHASE, REQUIRES APPROVAL OF SMUD'S ENGINEERING DESIGNER.
- CHECK WITH SMUD'S ENGINEERING DESIGNER FOR AVAILABILITY OF 3 PHASE DELTA SERVICE.
- TEST SWITCH PROVIDED BY SMUD.
- METERING CURRENT TRANSFORMERS PROVIDED BY SMUD.

**14. Data from ESR T004 – Page A-26
 (Reference page numbers refer to drawings in T004).**

<i>COMMERCIAL WYE METER REQUIREMENTS</i>						
TYPE OF SERVICE	REF. PAGE NO.	MAIN SIZE AMPS.	METER	METER SOCKET	METERING AND TRANSFORMERS	TEST BYPASS
2W-1 PHASE 120V	A-19	30	CL.100 120V 2W 1 PHASE S	100A 4 POINT CONTINUOUS DUTY RATED		SEE PAGE A-19
3W-1 PHASE 120/208V	A-20	0-200	CL.200 120V 3W 1 PHASE S	100A-200A 5 POINT CONTINUOUS DUTY RATED		SEE PAGE A-20
4W-3 PHASE 120/208V	A-19	0-100 UNDER 30KW	CL.200 120V 4W 3 PHASE S	100A 7 POINT CONTINUOUS DUTY RATED		SEE PAGE A-19
4W-3 PHASE 120/208V	A-20	101-200 UNDER 30KW	CL.200 120V 4W 3 PHASE S	200A 7 POINT CONTINUOUS DUTY RATED		SEE PAGE A-20
4W-3 PHASE 120/208V	A-19	0-100 OVER 30KW	CL.200 120V 4W 3 PHASE	100A 7 POINT CONTINUOUS DUTY RATED		SEE PAGE A-19
4W-3 PHASE 120/208V	A-6 A-7	201-400	5A 120V 4W 3 PHASE S.P.	COMB. CAN 13 POINT SEE A-7	3-2W SEE NOTE 4	10 POLE TEST SWITCH SEE NOTE 3
4W-3 PHASE 120/208V		401-800	5A 120V 4W 3 PHASE S.P.	S.S. BOX 13 POINT	3-2W SEE NOTE 4	10 POLE TEST SWITCH SEE NOTE 3
4W-3 PHASE 277/480V	A-19	0-100 UNDER 30KW	CL.200 277V 4W 3 PHASE S	100A 7 POINT CONTINUOUS DUTY RATED		SEE PAGE A-19
4W-3 PHASE 277/480V	A-20	101-200	CL.200 277V 4W 3 PHASE	200A 7 POINT CONTINUOUS DUTY RATED		SEE PAGE A-20
4W-3 PHASE 277/480V	A-6 A-7	201-400	5A 277V 4W 3 PHASE S.P.	COMB. CAN 13 POINT SEE PAGE A-6, A-7	3-2W SEE NOTE 4	10 POLE TEST SWITCH SEE NOTE 3
4W-3 PHASE 277/480V	A-7 A-12 A-13 A-14 A-16	401-800	5A 277V 4W 3 PHASE S.P.	COMB. CAN 13 POINT	3-2W SEE NOTE 4	10 POLE TEST SWITCH SEE NOTE 3

NOTES:

- ANY SERVICE OVER 200A, SINGLE PHASE, REQUIRES APPROVAL OF SMUD'S ENGINEERING DESIGNER.
- CHECK WITH SMUD'S ENGINEERING DESIGNER FOR AVAILABILITY OF 3 PHASE DELTA SERVICE.
- TEST SWITCH PROVIDED BY SMUD.
- METERING CURRENT TRANSFORMERS PROVIDED BY SMUD.

Examples of panel types *

Eaton/B-Line (catalog #)	
Commercial < 200 amps	100 A = "117TB" 200 A ="127TB"
Commercial >200-800 amps	122013
Commercial > 800 amps	Ground Mounted Switchgear

* or similar from another manufacturer. Please note that Catalog # changes with the number of clips in socket.

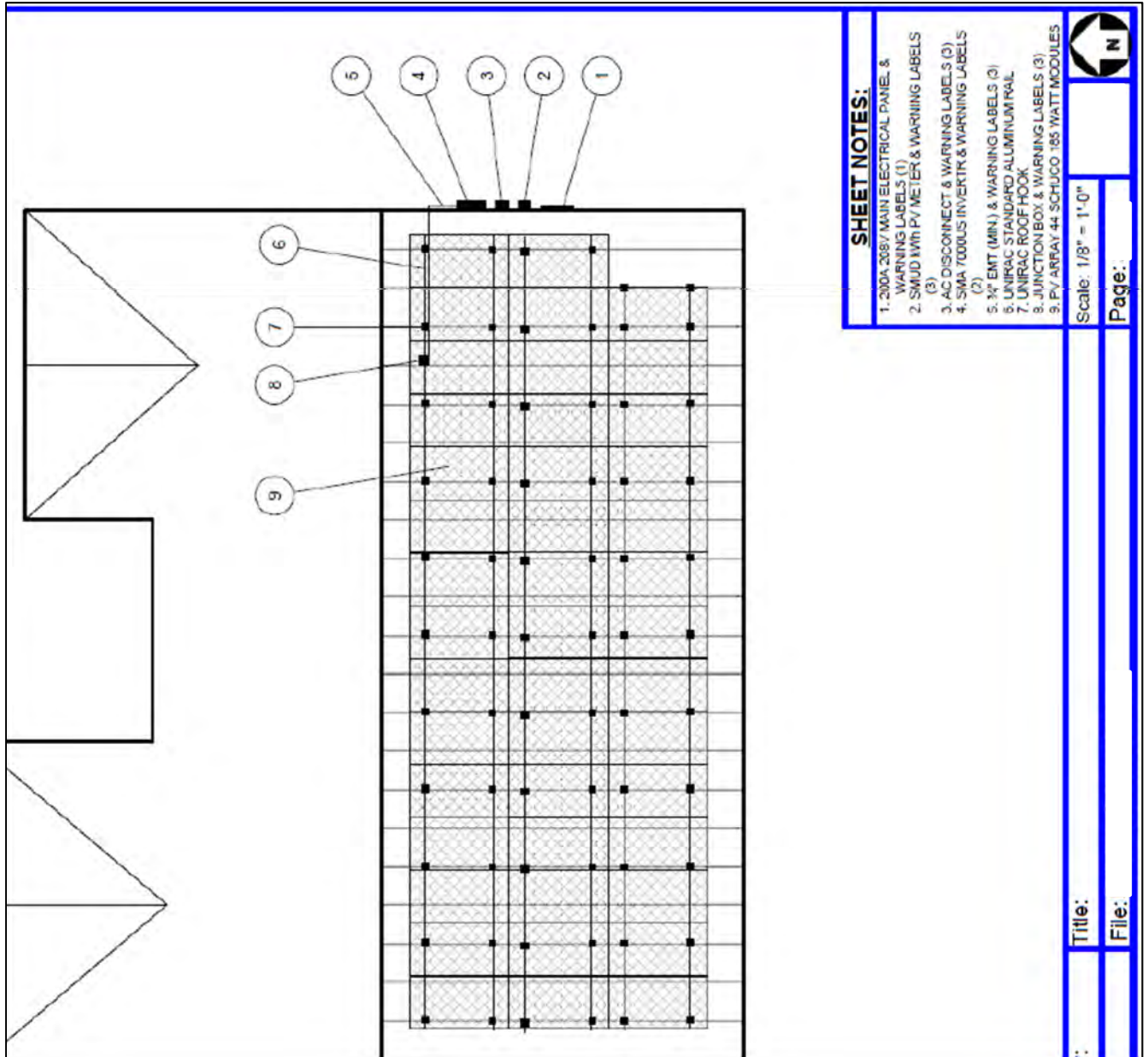


Figure 4 - Sample Site Plan (Partial View). Refer to Section 6.1.3

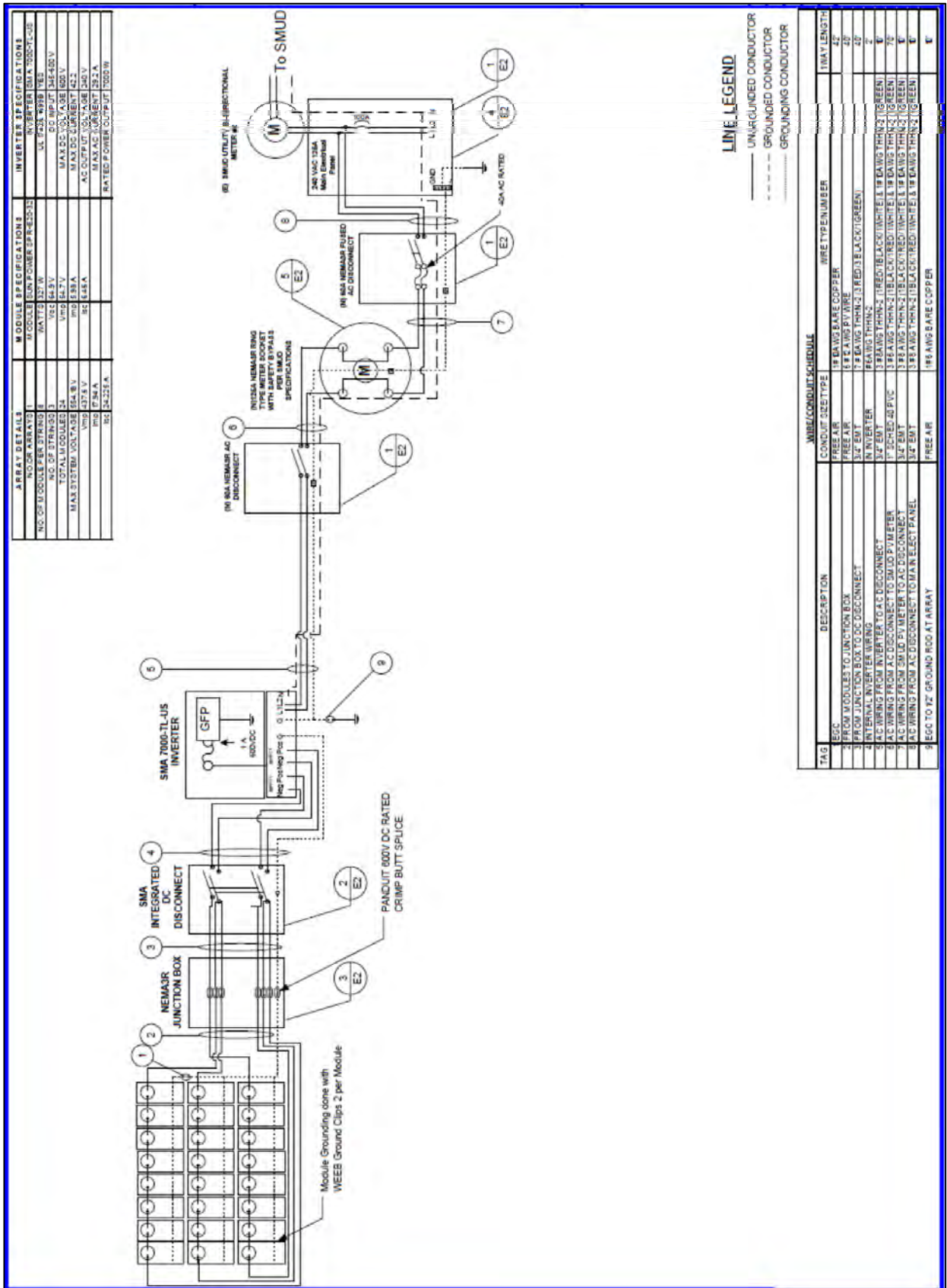


Figure 5 - Sample Single Line Drawing (refer to Section 6.1.2) of PV Connected Between Meter and Main Breaker.

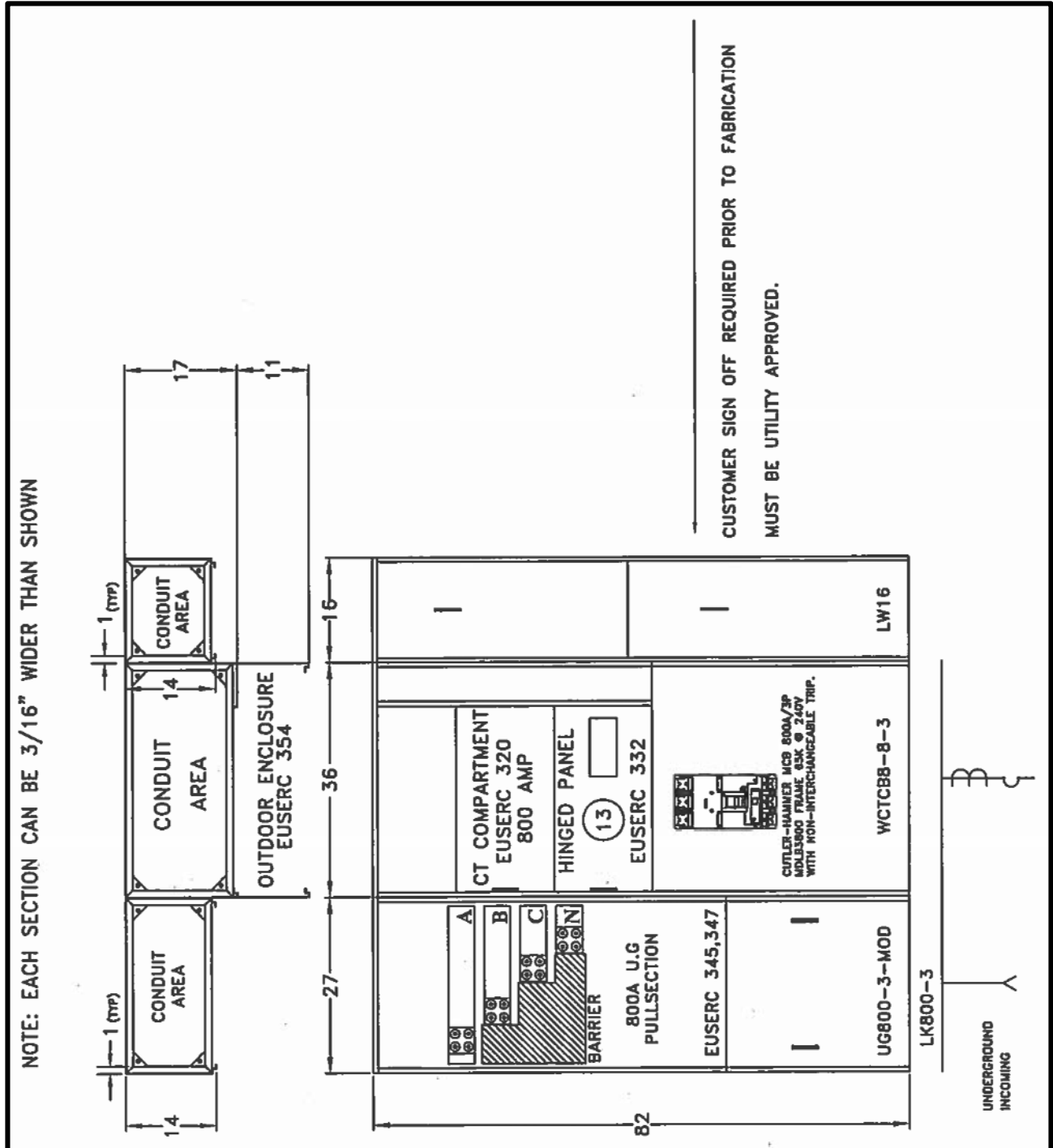
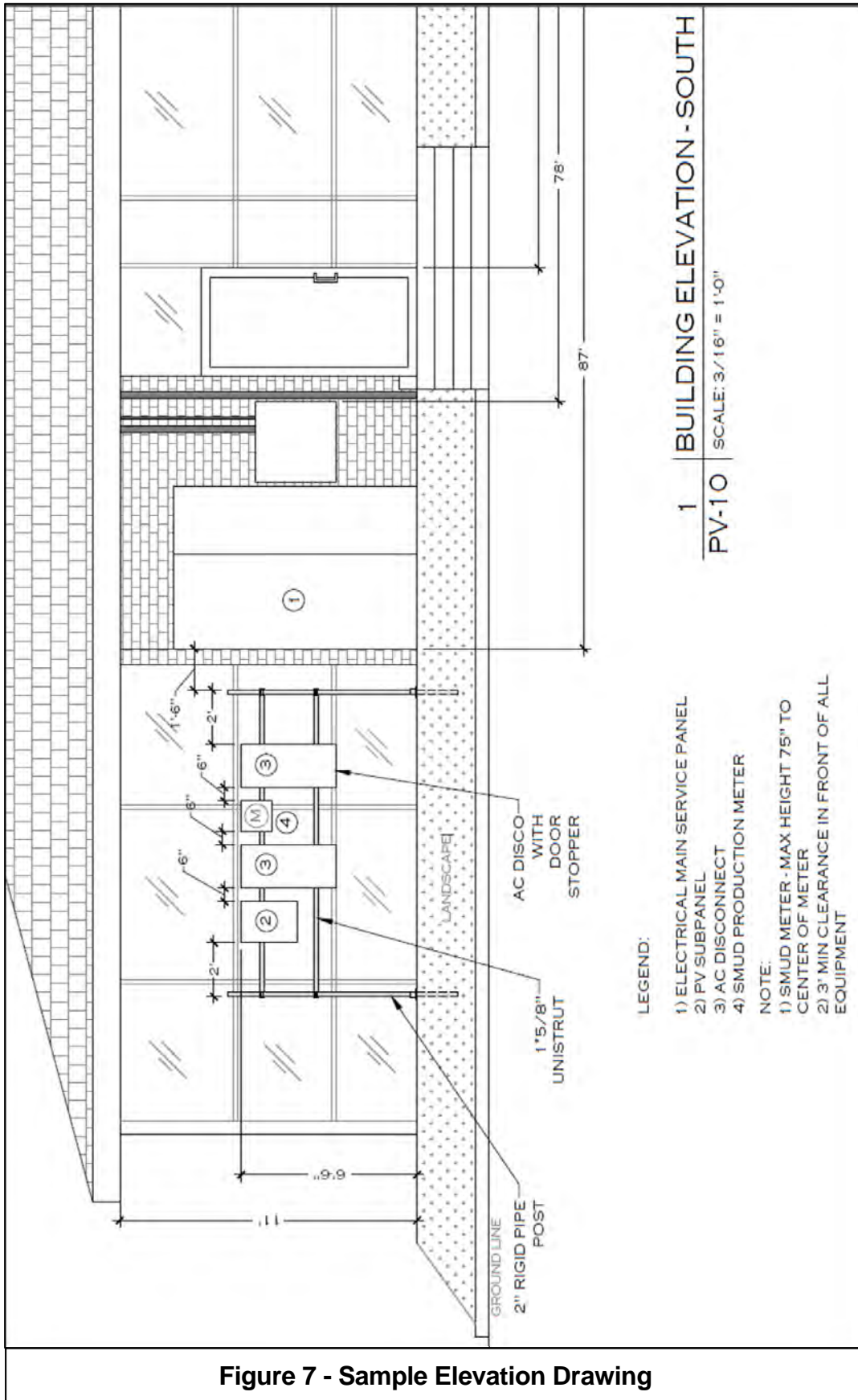


Figure 6 - Sample Cut Sheet - 800 Amp Breaker. Refer to Section 6.1.5.



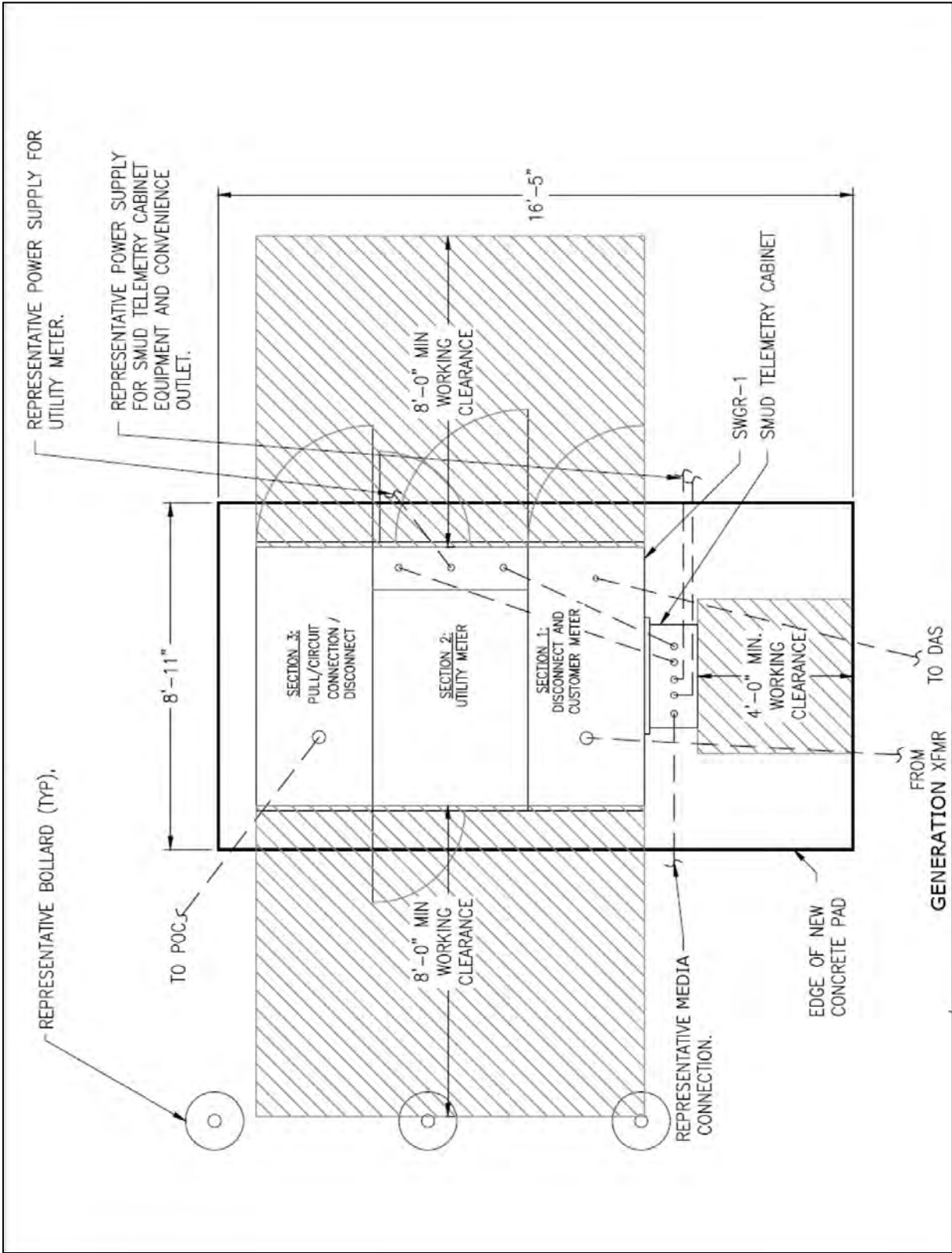


Figure 8 - Sample Conduit Plan

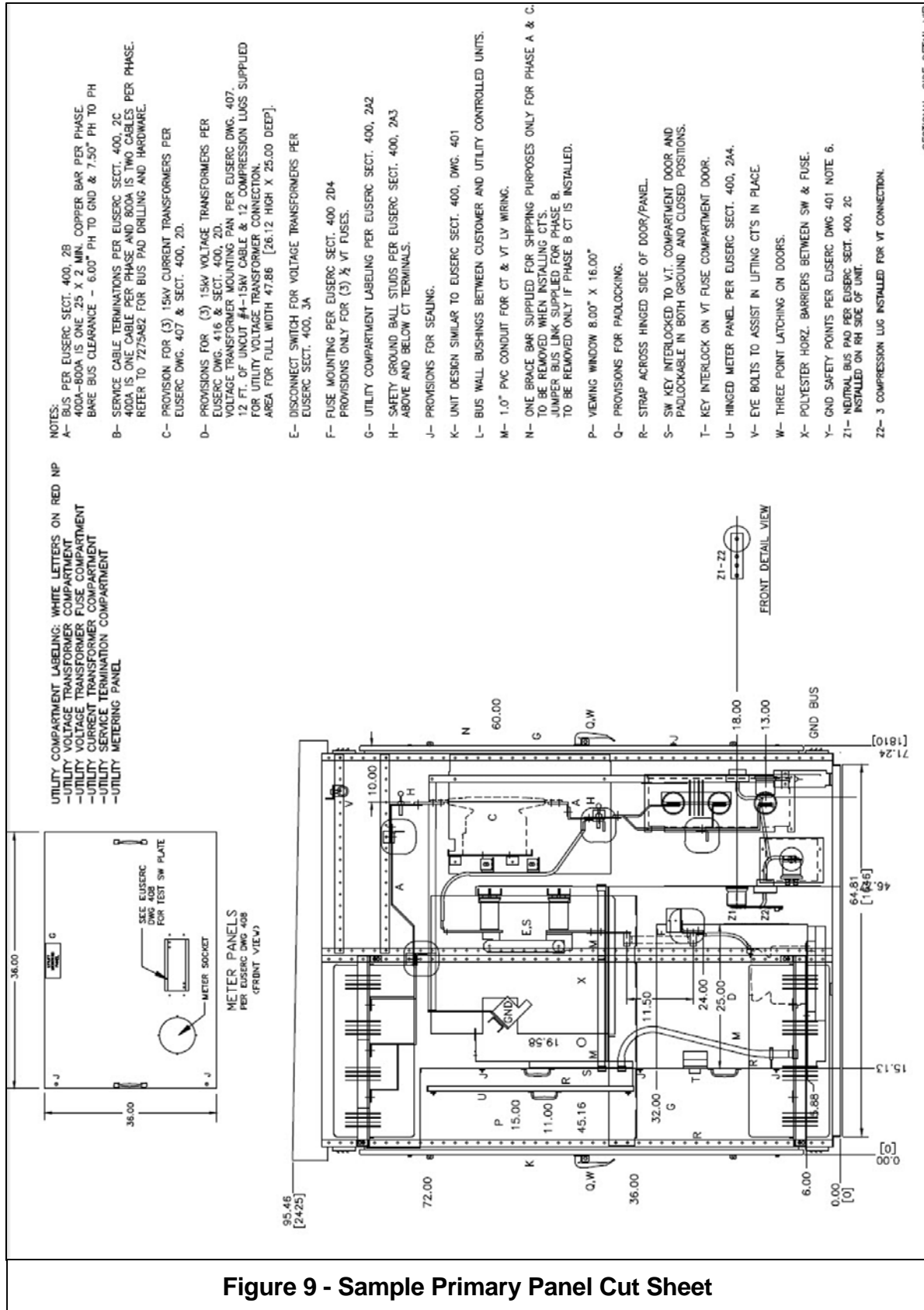


Figure 9 - Sample Primary Panel Cut Sheet