



Electric Service Requirements

Commercial Electric Vehicle Program

Engineering Specification T017

March 2018





SMUD[®]

**ENGINEERING
SPECIFICATION**

No.	T017
Page 1 of 16	
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CATEGORY

ELECTRIC SERVICE REQUIREMENTS

SUBJECT

COMMERCIAL ELECTRIC VEHICLE PROGRAM

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1. Overview

This document is intended to present the Sacramento Municipal Utility District's (SMUD's) "program" requirements for the installation of Electric Vehicle (EV) chargers that operate at either 120, 208, 240, or 480 Volts for SMUD's commercial customers.

Note: For customers not participating in SMUD's "program," the following requirements are not mandatory, but are design suggestions.

The Customer shall provide and install the necessary metering socket, cabinet(s), and visible disconnect device as required by SMUD, in locations approved by SMUD. SMUD will furnish and install the EV Meter at no cost, when participating in SMUD's Commercial Drive Electric Program.

The requirements presented here are necessary for SMUD to supply uniform, satisfactory, and safe electrical connections between the Customer's charger 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 Electric Vehicle charging equipment 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 (Electric Utility Service Equipment Requirements Committee) requirements and be UL approved. No charger 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 Electric Vehicle charging equipment and SMUD's electrical system, a SMUD representative will also have to inspect and approve the Electric Vehicle charging equipment.*

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.

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3. Definitions

- 3.1. **Combiner / Sub-Panel:** an electrical panel where one or more feeds to the EV charging equipment can be combined into one circuit to the Main Panel. If the Combiner / Sub-Panel has more than six (6) breakers, an additional Visible Disconnect Device (VDD) will have to be installed between the Combiner / Sub-panel and the EV Meter.
- 3.2. **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.
- 3.3. **Electric Vehicle Meter (EVM):** The meter located at the Electric Vehicle Charger, or otherwise located to record Electric Vehicle charging energy without other unrelated Customer loads. **All EVM panels shall be of ring type.**
- 3.4. **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.
- 3.5. **Medium Voltage:** voltages of 4 kV, 12 kV, or 21 kV phase-to-phase.
- 3.6. **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.
- 3.7. **Visible Disconnect Device:** An electrical switching device that can separate the Electric Vehicle charger 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 the Electric Vehicle charger equipment. 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 charging equipment from SMUD's distribution grid. *A Combiner / Sub-Panel may be substituted for a Visible Disconnect Device for systems 200 Amps or less.* 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 EV Meter.

4. Abbreviations

AC = Alternating Current	EV = Electric Vehicle
AHJ = Authority Having Jurisdiction	EVM = Electric Vehicle Meter
CEC = California Electric Code	NEC = National Electric Code
ESR = Electric Service Requirement	VDD = Visible Disconnect Device

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

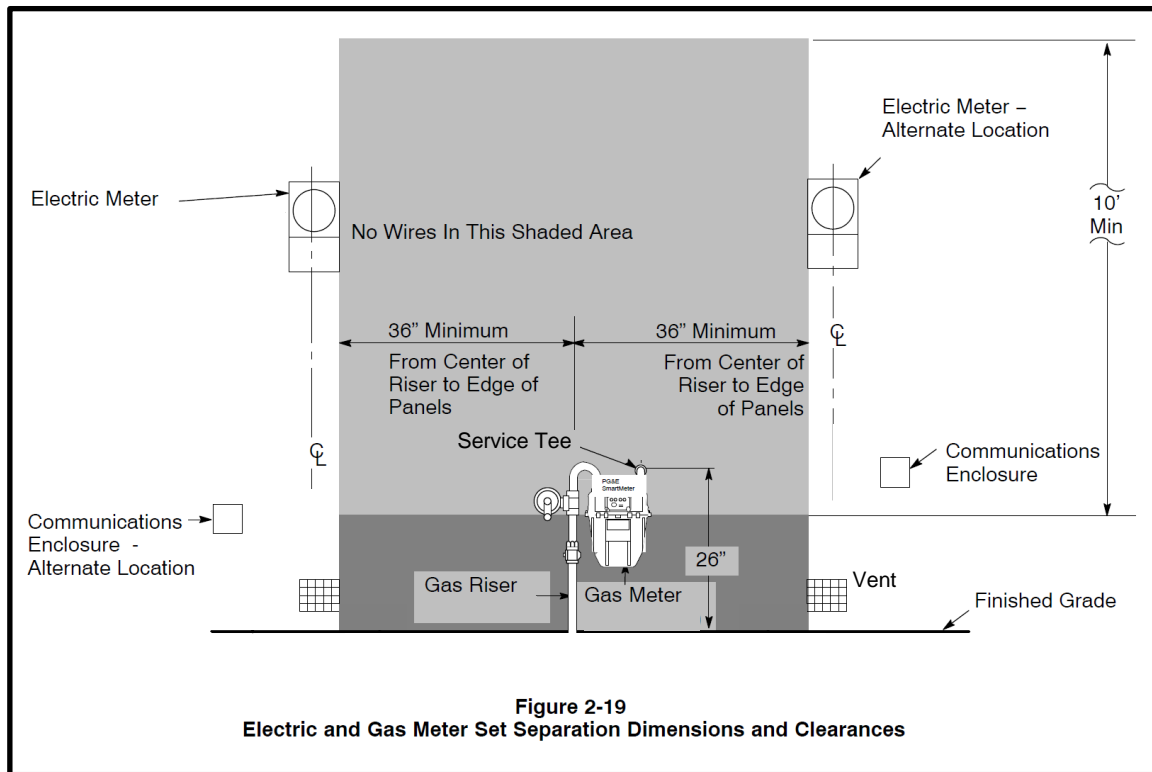
All Customer equipment shall conform to nationally recognized standards and recommended practices. These include, but are not limited to the following:

- 5.1. California Electrical Code (CEC)
- 5.2. Electric Utility Service Equipment Requirements Committee (EUSERC) Requirements Manual
- 5.3. NEMA C84.1 - Electric Power Systems and Equipment-Voltage Ratings (60 Hertz) {formerly ANSI C84.1}
- 5.4. NFPA 70 – National Electrical Code (NEC)
- 5.5. OSHA 1910.145(F)(7)
- 5.6. UL 98 – UL Standard for Safety Enclosed and Dead-Front Switches

6. Design Review and Approval

- 6.1. Prior to *APPROVAL* of Customer charging facilities, the Customer shall submit:
 - 6.1.1. An electrical one-line or three-line diagram showing load calculations to SMUD’s Commercial Drive Electric Program Team,
 - 6.1.2. Panel cut sheets for services over 200 Amps,
 - 6.1.3. Panel Inspections for panels over 600 Volts,
 - 6.1.4. A site plan/layout showing the location of all electrical equipment from the charger equipment back to the Main electric service panel, and
 - 6.1.5. 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.).
 - 6.1.6. ***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, and to this ESR T017.

- 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. The accuracy of the Electric Vehicle Meter to monitor the true power consumed by the charger is very important to SMUD. Therefore, no other unrelated loads can be connected between the Electric Vehicle Meter and the charging equipment.
- 6.5. Note that PG&E does not allow any meters or electrical equipment within 36 inches (36") of a gas riser. Please refer to PG&E's website for their latest edition of *PG&E's Electric & Gas Requirements* – portion of Figure 2-19 shown below. Other gas companies may have different requirements.



7. SMUD Requirements

All participating charging equipment will have a SMUD EV Meter (EVM) and a Visible Disconnect Device (VDD) installed. A Combiner / Sub-Panel can substitute for the Visible Disconnect Device for systems less than 600 VAC and 200 Amps or less. Where EV Meters are installed, a disconnecting means shall be located such that the EV charging equipment can be serviced without de-energizing the EV 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

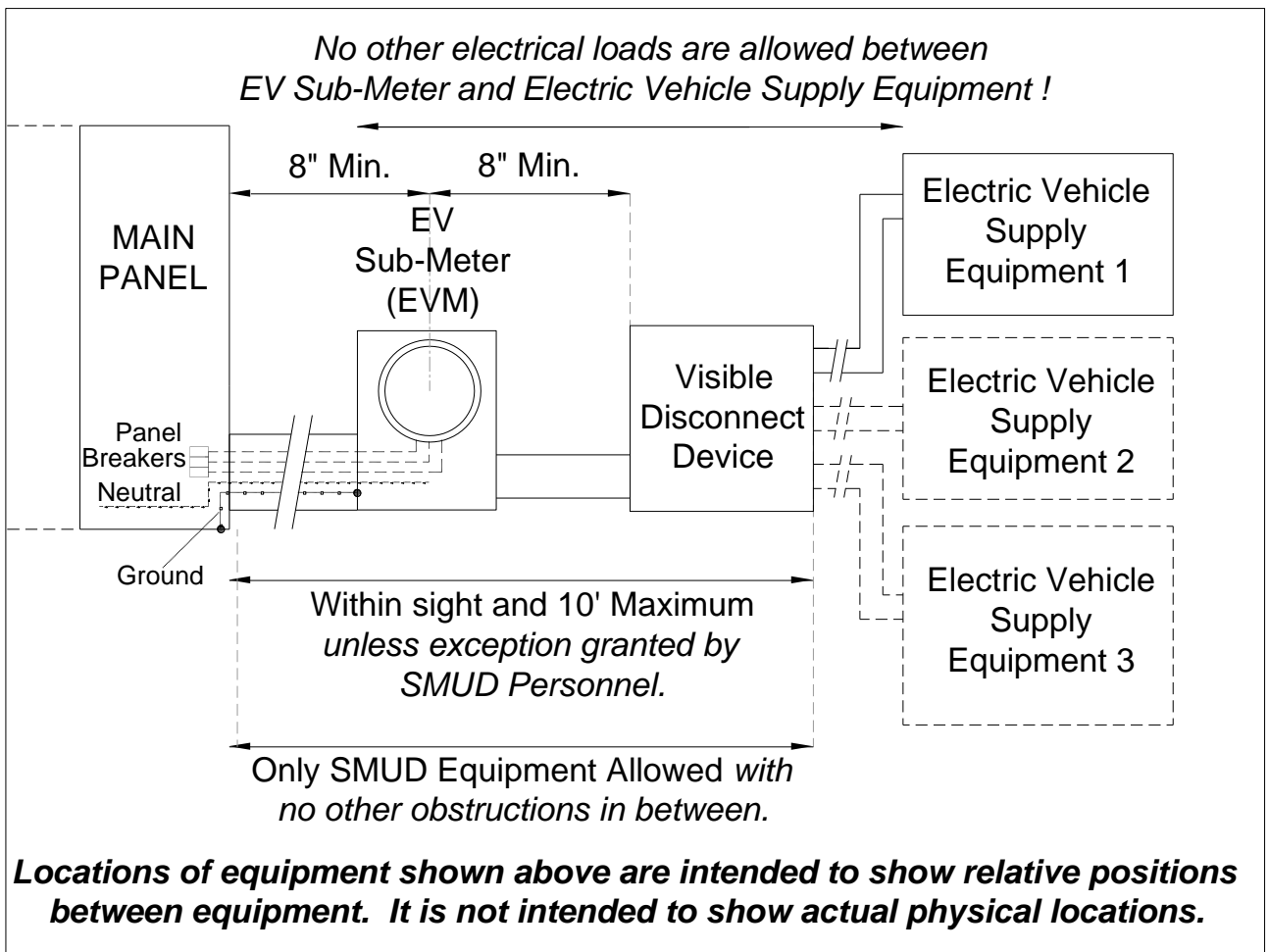


Figure 1: EV Sub-Meter

EV Load connected to Breaker Position in Main Panel with VDD between EV Sub-Meter and EV charger load.

- 7.1. EV charging equipment connected to a breaker position in Main Panel located per applicable NEC code.

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- 7.1.1. The EV Meter 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 centerline of the EV 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. If the Combiner / Sub-Panel has more than six (6) breakers, an additional Visible Disconnect Device (VDD) will have to be installed between the Combiner / Sub-panel and the EV Meter.
- 7.1.2. It is the Customer's responsibility to purchase and install the EV Meter socket and Visible Disconnect Device (VDD). In keeping with T004, they shall be located within sight and within ten feet (10') of each other ***with no other obstruction(s) in between***. Refer to Figure 1 for location requirements of devices
- 7.1.3. ***As mentioned earlier, the NEC and the County / City Electrical Inspector for your area may have requirements for your EV charging equipment that are beyond what is listed here. Please check with your local Inspector to make sure your plans meet their requirements.***

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8. Electric Vehicle 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 – *within ten feet (10') of the Main Panel unless SMUD personnel approve of a different location*. SMUD will furnish and install the EV Meter at no cost.
- 8.2. The EV Meter socket shall be wired so the output to the Customer's EV equipment will be properly measured by the meter. All phase conductors, one grounded conductor (neutral), and one grounding conductor (case ground) shall enter the EV Meter socket and they shall be labeled to differentiate between SMUD and EV equipment.
- 8.3. The EV Meter and the Visible Disconnect Device(s) 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 EV Meter remains energized from the Main Panel during EV charger equipment replacements or during maintenance on the EV charger 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 EV Meter shall be located within sight and 10 feet of the Main service meter with no other obstruction(s) between them. Additionally the EV meter and the Visible Disconnect Device shall be located within sight and 10 feet of each other ***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. SMUD will be responsible for maintenance, repair, and/or replacement of the EV Meter. The Customer will be responsible for the maintenance, repair,

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and/or replacement of the EV Meter socket, Visible Disconnect Device(s), switch(es), and/or Combiner / Sub-Panel.

8.10. After installation, SMUD employees will not energize the EV charging equipment. This will be the responsibility of the Customer / Contractor.

8.11. For EV Metering over 600 volts (these requirements are in addition to the general EV Metering requirements):

- 8.11.1. There shall be an eight-foot (8') clearance from the utility CT section to any other obstruction.
- 8.11.2. Two Visible Disconnect Devices need to be installed – one on each side of the EV Meter.
- 8.11.3. All equipment shall meet EUSERC requirements.
- 8.11.4. Where possible, metering can be done with a pole-mounted rack.

9. AC Disconnects (where applicable)

The Customer shall provide and install all necessary Visible Disconnect Device(s) as required by SMUD, in locations approved by SMUD. The Device(s) will isolate all ungrounded (hot) conductors of their EV charging equipment from SMUD's distribution system. The switch shall be a gang-operated, load-break device with a visible air-gap in the open position. It shall be rated for the current and voltage requirements of the Customer's EV charging equipment.

10. Labeling

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

11. Data from ESR T004 – Page A-25 and A-26

(Reference page numbers refer to drawings in T004).

<u>MINIMUM REQUIREMENT FOR CUSTOMER'S UNDERGROUND SERVICE</u>						
<u>COMMERCIAL DELTA METER REQUIREMENTS</u>						
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.

COMMERCIAL WYE METER REQUIREMENTS

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:

1. ANY SERVICE OVER 200A, SINGLE PHASE, 120/208, IS NOT AVAILABLE.
2. CHECK WITH SMUD'S ENGINEERING DESIGNER FOR AVAILABILITY OF 3 PHASE DELTA SERVICE.
3. TEST SWITCH PROVIDED BY SMUD.
4. 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.

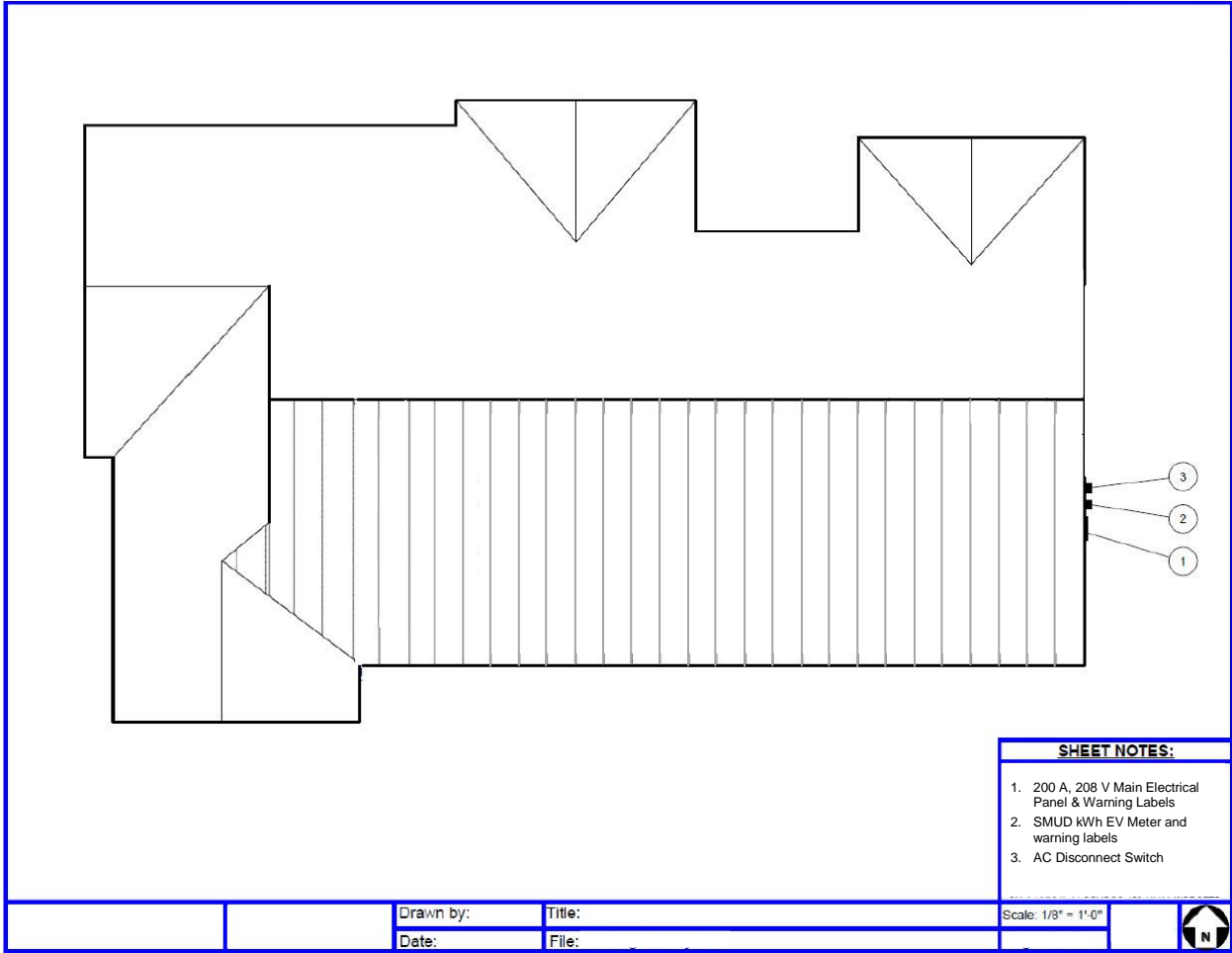


Figure 2 - Sample Site Plan (Partial View)

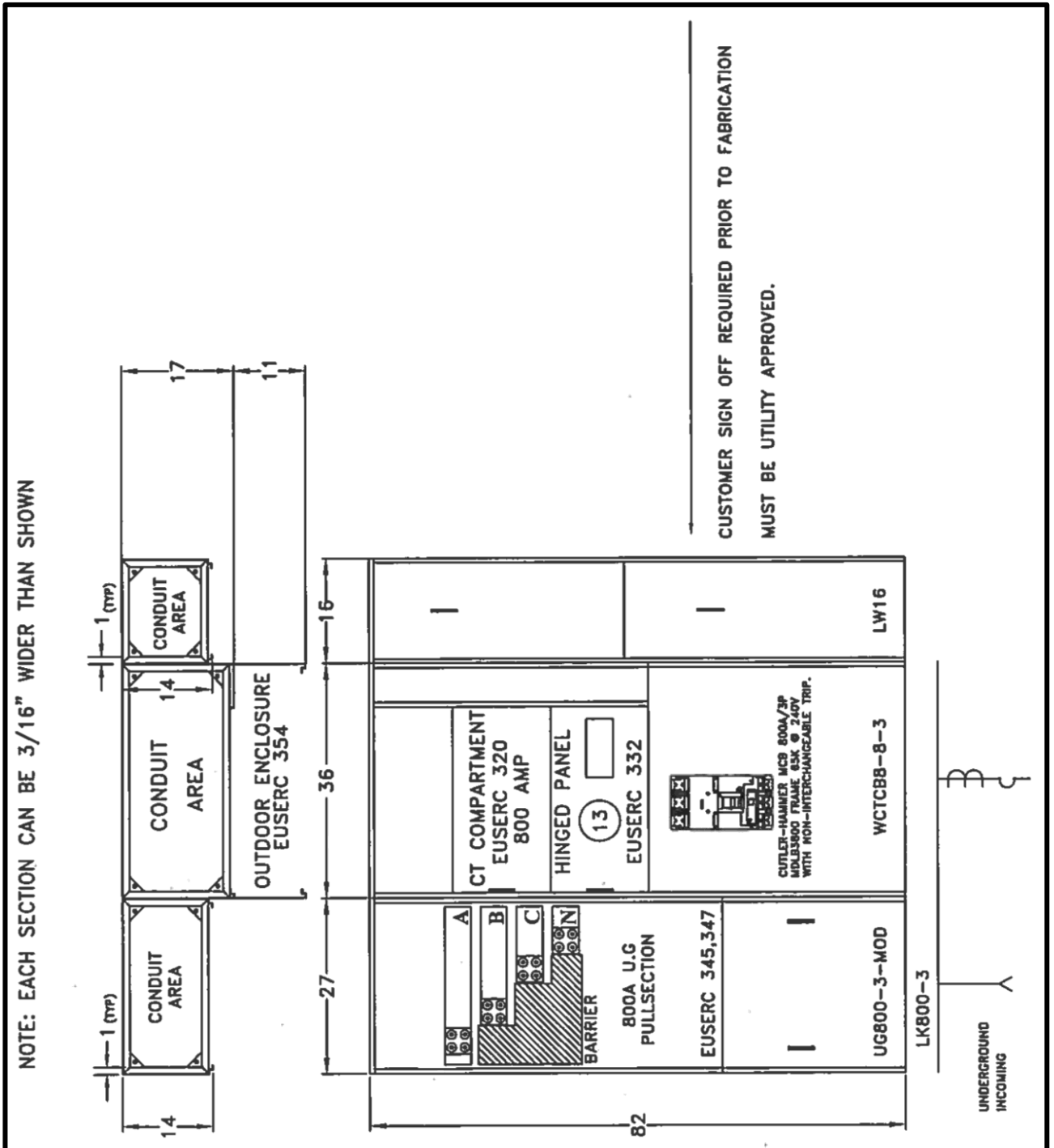


Figure 3 - Sample Cut Sheet - 800 Amp Breaker.

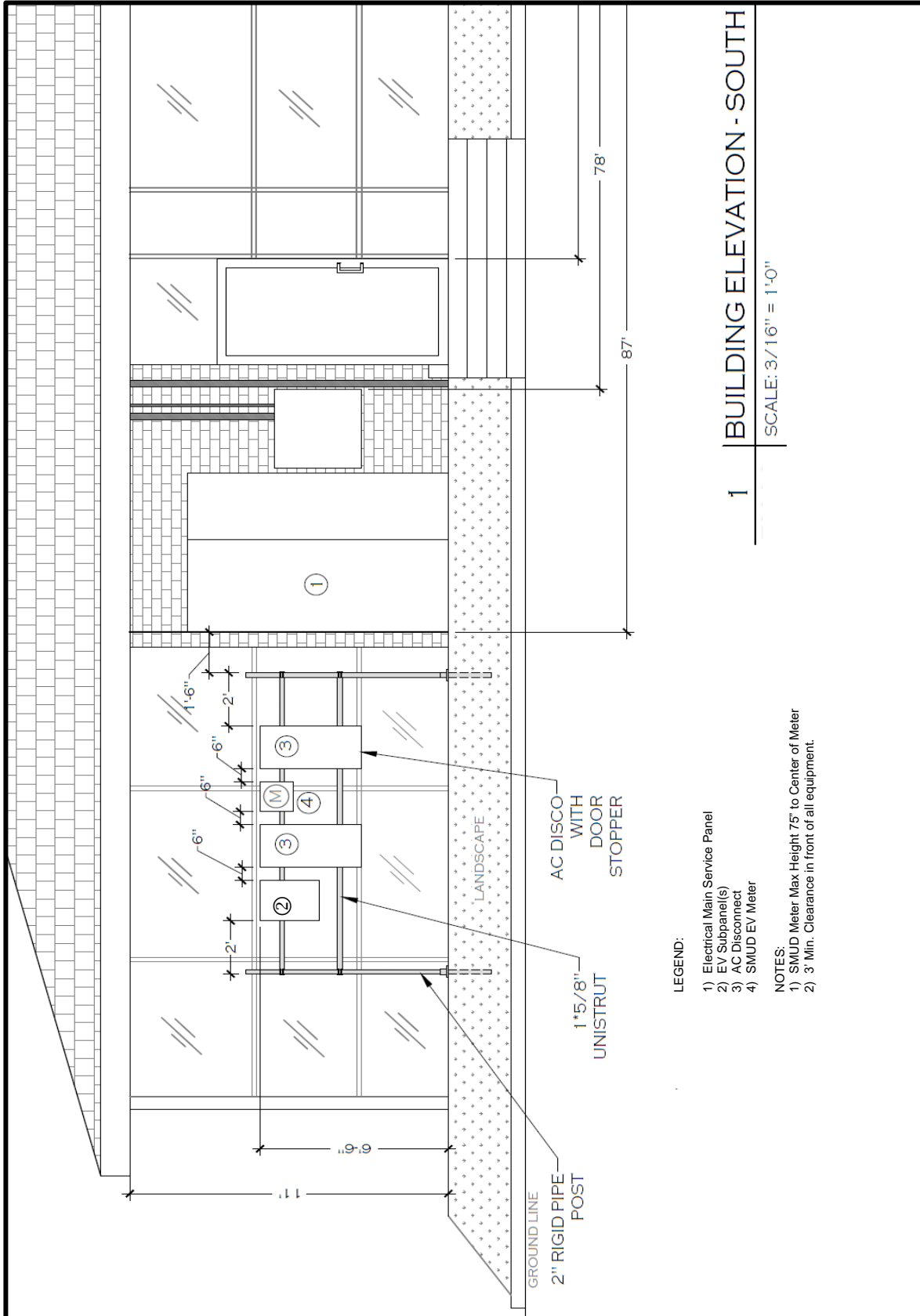


Figure 4 - Sample Elevation Drawing

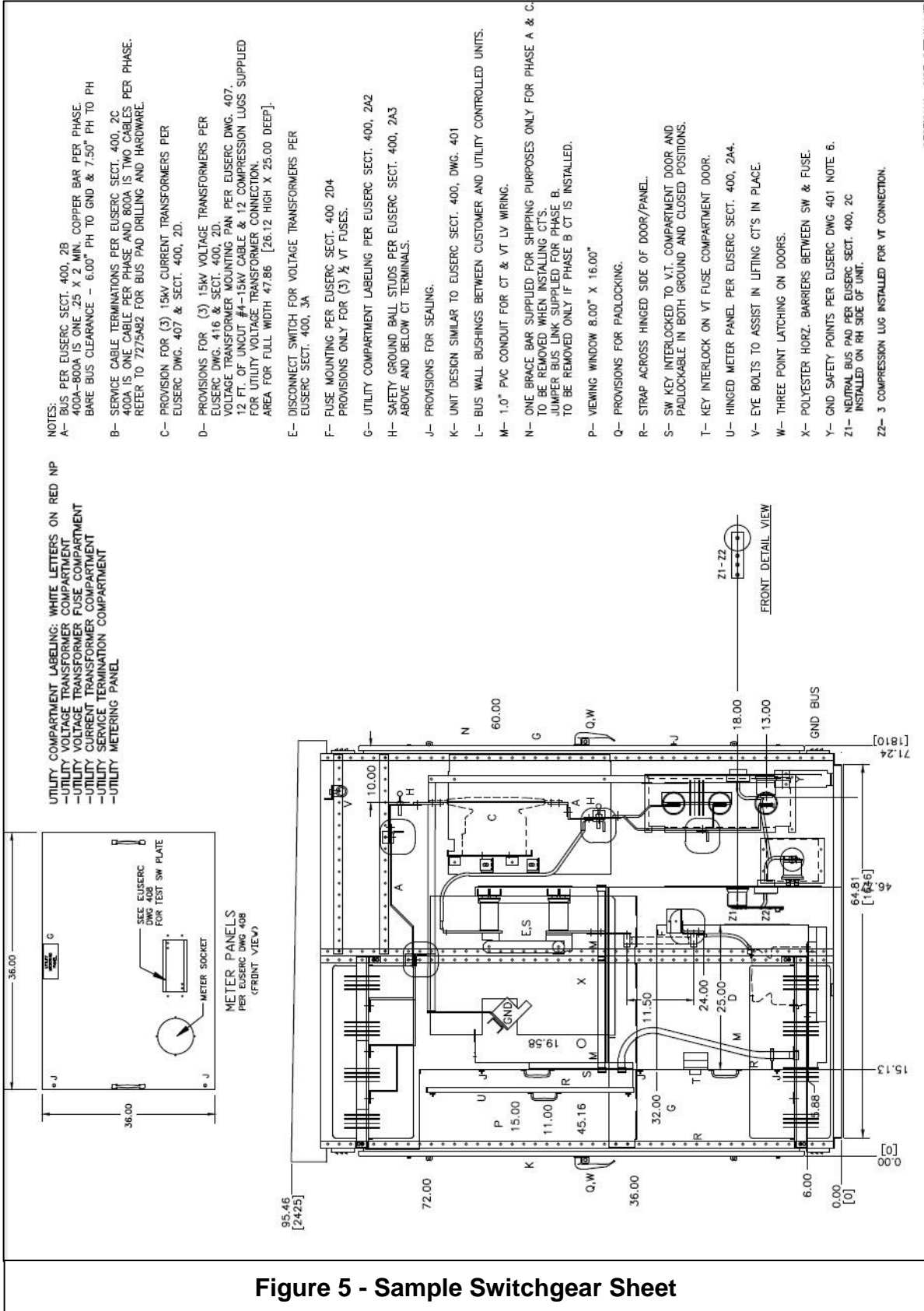


Figure 5 - Sample Switchgear Sheet