



Electric Service Requirements

Primary Services Engineering Specification T010

October 2024




 SMUD[®]	ENGINEERING SPECIFICATION	No. T010 Page 1 of 20	
		REV 2	DATE: 10/24
CATEGORY ELECTRIC SERVICE REQUIREMENT			
SUBJECT PRIMARY SERVICES			

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1. General Requirements For Service

- 1.1. The following is intended for use by customers of the Sacramento Municipal Utility District (SMUD) desiring Primary service from SMUD. Primary service is defined as taking service at or above 12,000 Volts (12 kV). The requirements presented here are necessary if SMUD is to supply reliable, cost effective, and safe service. The customer and the customer's agents must carefully read and comply with all written material (this text, as well as all of the notes on the drawings).
- 1.2. It is important that satisfactory arrangements be made for the installation of electric service lines and the location and setting of meters. Contact SMUD's Customer Services Department, 6301 S Street, 1-888-742-7683, for new or additional service. This must be accomplished as soon as initial planning is considered. Delays in supplying this required information could cause an unnecessary inconvenience for the customer. Electric service will not be established until the "service entrance facilities" and interior wiring are satisfactorily completed by the customer.

NOTE: "Customer service entrance facilities" is the term used to designate all the electrical infrastructure and components required to be furnished and installed by the customer.

**USE CAUTION WHEN
DIGGING TO AVOID
BURIED ELECTRICAL CABLES.
BEFORE DIGGING CALL
U.S.A. (Underground Service Alert)
800-227-2600 or 811**

2. 69 kV Service

The basic steps for implementation of service at 69,000 Volts (69 kV) are listed below:

- 2.1. The total aggregate load per customer site will be limited to 50 MVA on the 69kV system.
- 2.2. The maximum transformer rating allowed to connect to the 69kV system is a 25 MVA transformer.
- 2.3. Customer's requirements are presented to SMUD. Information should include initial loads and future load projections (connected and demand), single-line diagrams, and service needs (including any redundancy requirements). Any proposed onsite generation will require an interconnection application per SMUD's requirement 11-01 in addition to the service application.

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- 2.4. Customer and SMUD agree on type of service and location. Service contract is prepared by SMUD and signed by the customer. Customer pays 100% of SMUD equipment and installation costs. See section 2.12.5 below.
- 2.5. Customer will grant SMUD any necessary right-of-ways for SMUD equipment.
- 2.6. Customer designs site and service to meet or exceed SMUD's design criteria as described in this document.
- 2.7. SMUD reviews and approves required documents as specified herein.
- 2.8. NOTE: SMUD approval is limited to design aspects that directly affect the reliability, protection and safe operation of SMUD furnished equipment and the safety of SMUD personnel in operating and maintaining such equipment. Approval by SMUD does not mean that SMUD concurs with all the design and construction details shown on the drawings. SMUD assumes no responsibility for the correct application and safety aspects of owner-installed equipment and facilities.
- 2.9. Customer constructs required work per approved plans and specifications with SMUD inspection.
- 2.10. SMUD installs metering and other associated equipment.
- 2.11. SMUD performs verification of customer protective equipment, and completes all approvals.
- 2.12. SMUD energizes station.
- 2.12.1. Where the operation of the customer's equipment will require unusually stable voltage regulation free from momentary outages and voltage transients or other stringent voltage control beyond that supplied by SMUD in the normal operation of its system, the customer, at their own expense, shall be responsible for installing, owning, operating, and maintaining any special or auxiliary equipment on the load side of the meter that will be required, as deemed necessary by the customer, for operation of the customer's equipment. SMUD may offer programs to advise and assist customers in obtaining the quality of power desired.
- 2.12.2. All materials used and all work performed on a customer's premises, with the exception of SMUD's metering facilities and service, must conform with local inspection authority requirements. No service can be connected unless passed by proper inspection authority. Only authorized SMUD employees are permitted to make connections between District wiring and customer wiring.

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- 2.12.3. SMUD reserves the right to revise the commitment for service after twelve (12) months. A new SMUD commitment will normally be required after one year unless a customer has requested and received written approval for a longer period of time from SMUD. Revised commitments may include design changes and will reflect the changing costs of service.
- 2.12.4. The customer shall secure, at their own expense, all permits and licenses necessary to the prosecution of the service work. Right-of-way encroachment permits for line construction to the customer's property will be obtained by SMUD.
- 2.12.5. SMUD will furnish and install electric facilities which include: instrument transformers, revenue meter, primary conductors to the instrument transformers, secondary conductors for metering, and minor associated materials. The customer shall pay 100% of SMUD's equipment and installation costs as determined by SMUD.
- 2.12.6. A SMUD Construction Management Inspector shall be assigned to the job. The customer shall notify the SMUD Construction Management Inspector, 30 days prior to the construction, to arrange for inspection. The installation of SMUD equipment shall not commence until a Final Inspection Report has been signed by the SMUD inspector.

3. 69 kV Site Design

- 3.1. Service at 69 kV will require the construction and installation of a substation which typically will include the SMUD revenue metering and the customer's first transformation. The design of the substation shall conform to the requirements of this document (in addition to any local, state, or federal codes). Any conflicts between this document and other jurisdictional codes shall be brought to the attention of SMUD.
- 3.2. Communication shall be tested by SMUD prior to selecting a meter location to verify a sufficient communication signal. If meter communication is not feasible, see section 4.2.8.
- 3.3. Site improvement plans shall be prepared by a Civil Engineer licensed by the State of California. The following criteria shall be used in the design of the substation:
 - 3.3.1. The site shall be well drained.
 - 3.3.2. Access to the site from public roads shall be via paved surface roads with no overhead obstructions. The road shall be a minimum of 20 feet wide and rated for HS-20-44 full traffic loading. The access roads into substation shall be all weather access, consisting of a minimum of 6" AB base at 90% relative compaction, with 4" AC topping.

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- 3.3.3. The site shall have an aggregate base with a maximum of four inches of $\frac{3}{4}$ " washed crushed rock. The crushed rock depth and resistivity value shall be determined as part of the site ground grid study. The crushed rock shall be fully installed before energization and maintained for the life of the substation. $\frac{3}{4}$ " Crushed Aggregate shall be from the George Reed Jackson Valley Quarry (209-334-0790). The rock shall have a 100 percent fractured face. The rock shall be washed clean and free of all dirt and deleterious material.
- 3.3.4. SMUD's revenue metering equipment shall be included in the customer's secured area. As a minimum the fence or enclosure shall be in accordance with the NESC. Additionally, SMUD requires an access gate of at least 18' in width. The gate shall have a latch mechanism that accepts both the customer and SMUD locks.
- 3.3.5. The fence and grounding system shall be designed and modeled to meet or exceed the requirements of IEEE Standard 80, latest edition. At a minimum, fencing shall conform to the latest revision of SMUD Standard Chain Link Fencing SS 6001

4. 69 kV Customer Scope of Work

- 4.1. The customer shall provide all land, civil facilities design, and construction for the substation. Civil facilities are all land, grading, drainage, slabs, foundations, structures, conduit, grounding, surfacing, and fencing necessary for the substation.
- 4.2. SMUD metering facility details may vary, based on the specific site configuration, design, and requirements. The customer is required to furnish the following for SMUD's metering installation, unless specifically waived or modified by SMUD:
 - 4.2.1. Dead-end/support structure for 69 kV conductor to/from SMUD's revenue metering instrument transformers.
 - 4.2.2. Support pedestals for SMUD's revenue metering instrument transformers. Necessary design details from instrument transformer vendor will be provided by SMUD.
 - 4.2.3. Foundations for above structures.
 - 4.2.4. Concrete pad for installation and access to meter enclosure. Pad is typically located adjacent to metering support structures.
 - 4.2.5. Customer will submit to SMUD the site plan and elevation drawings for the meter enclosure before the meter enclosure is procured.

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- 4.2.6. A level standing space on the property of the customer shall be provided in front of meter to permit ready access to the meter. This space must be at least 30 inches wide x 36 inches or the width of the meter equipment whichever is greater. Refer to ESR T004 page drawing A-26 for additional details.
- 4.2.7. Appropriate protective devices to detect and remove electrical faults on customer facilities from SMUD system.
- 4.2.8. AC power supply, 120 Volt 20 ampere, installed in conduit to SMUD's metering enclosure location. Installation details subject to SMUD approval.
- 4.2.9. If meter communication cannot occur due to meter location, the customer must supply means for communication to occur with the metering equipment (relay, additional conduit, telecom enclosure, antenna, etc.).
- 4.3. The customer shall complete required testing prior to energization. Tests include resistance test of ground grid and accuracy and ratio testing of metering CT's and PT's.

5. 69 kV Customer Document Submittals

- 5.1. The customer shall submit to SMUD a complete set of plans, specifications, civil calculations, seismic calculations and reports, in PDF format showing the information requested in this section for SMUD review and approval. A minimum of ten (10) working days shall be required for submittal review. Submittals marked "NOT APPROVED" shall be corrected and resubmitted.

NOTE: SMUD approval is limited to design aspects that directly affect the reliability, protection and safe operation of SMUD furnished equipment and the safety of SMUD personnel in operating and maintaining such equipment. Approval by SMUD does not mean that SMUD concurs with all of the design and construction details shown on the drawings. SMUD assumes no responsibility for the correct application and safety aspects of owner-installed equipment and facilities.

- 5.2. After approval, the plans shall be resubmitted in AutoCAD format for SMUD records.
- 5.3. Site work shall not begin until all documents required below have been received and approved by SMUD.
- 5.4. The following information shall be required to be shown on the documents submitted for review.
 - 5.4.1. Master drawing index
 - 5.4.2. Front view elevation

- 5.4.3. Floor plan
- 5.4.4. Top view
- 5.4.5. Component list
- 5.4.6. Meter and Relay diagrams.
- 5.4.7. Nameplate schedule
- 5.4.8. Three-Line diagrams of required protective device.
- 5.4.9. Control diagrams including direct current (DC) tripping circuit.
- 5.4.10. Proposed relay manufacturer, model, specifications, and settings.
- 5.4.11. Assembly ratings:
 - 5.4.11.1. Short-circuit rating
 - 5.4.11.2. Voltage
 - 5.4.11.3. Continuous Current
 - 5.4.11.4. BIL
- 5.4.12. Projected electrical demand (i.e., kilowatt [kW]), including the following information:
 - 5.4.12.1. Power factor
 - 5.4.12.2. Load factor
 - 5.4.12.3. Large motor sizes (>50hp)
 - 5.4.12.4. Large motor starting currents (>50hp)
 - 5.4.12.5. Customer's transformer size(s)
 - 5.4.12.6. Estimated breakdown of the electric energy use (i.e., kilowatt hours [kwh]) by month
- 5.4.13. Site plan showing location of foundations and grading.
- 5.4.14. Layout plan showing conduits, grounding, and fencing. There shall be a minimum of two 2-inch conduits between the instrument transformers and the revenue meter.
- 5.4.15. Detail drawings of grounding, including fence, gate, and gate swing area grounding.
- 5.4.16. Equipment plans and elevations showing connections to and from metering instrument transformers.
- 5.4.17. Structural calculations and drawings for the metering structure(s), and its foundations.
- 5.4.18. Detail drawings for fencing.

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- 5.4.19. One-line diagram from 69 kV SMUD line to customer's main breaker or fuse, showing customer's isolating and protective devices.
- 5.4.20. Electrical schematics showing 69 kV metering connection, isolating switch, and protective devices.
- 5.4.21. Detailed grounding calculation, along with ground grid study report, supporting drawings, and data showing compliance of ground grid design with safety requirements of IEEE Standard 80, latest edition.
- 5.4.22. SMUD requires that Primary Service customers submit all relay specification and setting proposals for SMUD approval before finalizing the design and ordering equipment. Primary Service customers not submitting this information risk delaying their projects.
- 5.4.23. A registered Electrical Engineer must prepare and stamp the fault-study and coordination study results.
- 5.4.24. Before energizing the new Primary Service facility, the Primary Service Customer must provide a copy, to SMUD, Professional Engineer certified on-site test reports for the switches, devices, and relays at least thirty (30) working days before energizing the service. Qualified personnel must prepare these on-site test reports.

6. 69 kV Structural Design Requirements

- 6.1. Seismic Load Criteria
 - 6.1.1. The instrument transformer support shall be designed in accordance with the seismic criteria of IEEE Std 693, latest edition. The supports shall be qualified at the "moderate seismic qualification level" in accordance with Annex F for < 69 kV (Static Coefficient Analysis). All necessary instrument transformer vendor information to perform the analysis shall be obtained from SMUD.
- 6.2. Wind Load Criteria
 - 6.2.1. Conductor wind load shall be determined in accordance with General Order No. 95 and NESC.
- 6.3. Equipment and Structures
 - 6.3.1. The design wind pressures shall be in accordance with California Building Code, latest edition.
- 6.4. Conductor Tension
 - 6.4.1. SMUD will provide conductor design tension and tension angle for the customer's deadend structure.
- 6.5. Load Combinations:
 - 6.5.1. Per California Building Code, latest edition.

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6.6. Steel Design

6.6.1. All structural steel design shall be in accordance with California Building Code, latest edition and AISC Steel Construction Manual, latest edition.

6.7. Concrete Design

6.7.1. All concrete design shall be in accordance with the California Building Code, latest edition and ACI 318, latest edition.

7. 69 kV SMUD Scope of Work

7.1. SMUD shall furnish and install the following at the customer's expense:

7.1.1. All 69 kV line work to the dead-end structure and instrument transformers and to the customer's isolating switch structure. A tail will be left for the customer to connect at that structure.

7.1.2. Revenue metering instrument transformers (customer shall provide steel structure for the metering instrument transformers).

7.1.3. Revenue meter(s) and test switch(es).

7.1.4. Secondary wiring between instrument transformers and meter location, including necessary aboveground conduit. SMUD will use underground conduit provided by the customer.

7.2. SMUD shall test the Revenue Metering Instrument Transformers listed in 7.1.2 prior to installation.

8. 69kV Protection Requirements

SMUD must review and approve the fault-interrupting devices that the Primary Service customer selects: circuit breaker or fuses.

8.1. Circuit Breaker Requirements

8.1.1. SMUD must review and approve the Circuit Breaker that the Primary Service customer selects.

8.1.2. The interconnecting circuit breaker must have sufficient capacity to interrupt the maximum available fault current at its location. Phase and ground relays shall be approved by SMUD. These relays must coordinate with SMUD's source-side protection. It must also include the following features:

8.1.2.1. Shunt-trip via a trip signal supplied through a battery external to the circuit breaker.

8.1.2.2. Lock out if operated by protective relays required for service connection.

8.1.2.3. Capacitive tripping is unacceptable.

8.2. Relay Requirements

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- 8.2.1. DC Powered with battery backup.
- 8.2.2. Trip the Primary Service customer's incoming interrupting device on phase and ground overcurrent with available directional control (voltage potential inputs required to the relays).
- 8.2.3. Must coordinate with SMUD's source side protection device.
- 8.2.4. SMUD must approve the customer relay settings.
- 8.2.5. The customer will maintain their equipment in accordance with the manufacturer's requirements and industry accepted standards.
- 8.2.6. The incoming circuit breaker relaying shall have redundancy such that the failure of one relay will not compromise the protection of the system.
 - 8.2.6.1. This may be accomplished by primary/backup relaying.
 - 8.2.6.2. SMUD must approve the relay redundancy in the scheme.
- 8.3. Fuse Requirements
 - 8.3.1. It is recommended in this case that the customer consider installing single-phase protection for their equipment.
 - 8.3.2. For cases where transformer high side fuses are used, the relay requirements noted will be at the secondary circuit breaker relaying (21 kV, 12 kV, 4 kV, etc.) past the substation transformer.
 - 8.3.3. Lightning arrestors, if the Applicant chooses to install them, must be installed between the transformer and the high side of the fuse and be encompassed by the Applicants relay protection zone.
 - 8.3.4. SMUD may require customer's primary protection device to be replaced if it fails to interrupt abnormal service conditions.

9. 12/21 kV Service

- 9.1. Primary service is not available on the 4 kV system, or 12 kV Network.
- 9.2. 4 kV service is available as a secondary voltage, when fed from 69 kV / 21 kV / 12 kV systems.
- 9.3. Primary service is available on the 12 kV distribution system. SMUD may require a dedicated, gang operated 3-phase protection device (overhead or underground as applicable) with SMUD specified protective relaying paid for by the Primary service applicant as part of the Rule 16 job.
 - 9.3.1. For loads between approximately 3 - 5 MVA, a site-specific analysis by SMUD is required to evaluate if SMUD can serve the load from a primary 12 kV service under normal and emergency operating conditions. If the load cannot be served, a customer or dedicated substation is required.

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- 9.3.2. For loads greater than 5 MVA, a customer or dedicated substation is required.
- 9.3.3. A customer or dedicated substation is dependent upon the feasibility of extending 69 kV facilities and available 69 kV capacity.
- 9.3.4. Please contact SMUD for requirements if a dedicated substation is required.
 - 9.3.4.1. Customer substation requires 69 kV primary service – see section 2.
- 9.4. Primary service is available on the 21 kV distribution system. SMUD may require a dedicated, gang operated 3-phase protection device (overhead or underground as applicable) with SMUD specified protective relaying paid for by the Primary service applicant as part of the Rule 16 job.
 - 9.4.1. For loads greater than 4 MVA, a site-specific analysis is required to evaluate if SMUD can serve the load from a primary 21 kV service under normal and emergency operating conditions.
 - 9.4.2. Services more than local 21 kV capacity requirements have limited options due to restrictive space constraints for dedicated substations (urban area) and the difficulty and high cost of extending 115 kV transmission (underground).
- 9.5. If the Primary Service customer already has, or intends to install, distributed generation, then also refer to the information and requirements described in the Electric Service Requirement T015 Commercial Distributed Generation.
- 9.6. Customers meeting the monthly minimum demand of 299 kW specified in SMUD's Commercial Rate Schedules, and meeting the service equipment requirements for Primary Service shall install, own, and operate their distribution system beyond their Point of Service (POS). While there are a number of technical requirements associated with Primary Service, two requirements are particularly important:
 - 9.6.1. SMUD must approve the POS.
 - 9.6.2. SMUD must approve the protection scheme that the customer installs, owns, and operates at the POS.
- 9.7. Primary Service Arrangements
 - 9.7.1. SMUD prefers that the POS, protective device, and revenue meter for Primary Service be at or near the property line nearest to SMUD's primary distribution. The SMUD approved and customer installed primary protection must be at the POS to protect other SMUD customers from outages due to faults on customer facilities. The revenue-metering should also be at this point.

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- 9.7.2. SMUD's Primary Service arrangements are typically underground (UG) and the POS is to be less than 500 feet from the property line. In rural areas served by overhead distribution, where future conversion to underground is not anticipated, SMUD Overhead Primary Service will be considered. The Primary Service customer must provide a SMUD approved enclosure for SMUD's metering equipment (See Section 12).
- 9.7.3. The Primary Service customer must install primary protection at the POS. This protection shall consist of a circuit breaker with phase and ground relays.
- 9.7.4. The Primary Service customer must install conduit from the POS to SMUD's pull box.
- 9.7.5. SMUD 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). The Primary Service customer will terminate the cable on their panel.
- 9.8. Location of Revenue-Metering
 - 9.8.1. The Primary meter location is at the POS.
- 9.9. Service Wire Configuration
 - 9.9.1. The customer owned switchgear wiring configuration, 4-wire, must be the same as SMUD's.
 - 9.9.2. The Primary Service customer's facilities must coordinate with SMUD's protection and isolate any fault or abnormality that could adversely affect the SMUD distribution system.
 - 9.9.3. SMUD assumes no liability for damage to the Primary Service customer-owned facilities resulting from a lack of adequate coordination between the Primary Service customer's protective device(s) and SMUD's protective devices, or negligence due to the Primary Service customer's failure to maintain protective and/or isolation equipment.
 - 9.9.4. The Primary Service customer shall, at its expense, install, operate, and maintain system protection facilities in accordance with all applicable CEC, NEC, EUSERC, SMUD, local and state regulatory rules and requirements.
 - 9.9.5. A Primary Service customer may request an alternate primary service source installed at customer expense. Such requests are handled on a case-by-case basis.

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10. 12/21 kV Primary Service Commitments

- 10.1. The Primary Service customer must provide the information necessary for SMUD to determine the connection requirements before SMUD approves the specific Primary Service installation. This information includes, but is not limited to, the following:
- 10.1.1. Master drawing index
 - 10.1.2. Front view elevation
 - 10.1.3. Floor plan
 - 10.1.4. Top view
 - 10.1.5. Component list
 - 10.1.6. Single Line diagrams.
 - 10.1.7. Meter and Relay diagrams.
 - 10.1.8. Nameplate schedule
 - 10.1.9. Conduit entry/exit locations
 - 10.1.10. Three-Line diagrams of required protective device.
 - 10.1.11. Control diagrams including direct current (dc) tripping circuit.
 - 10.1.12. Proposed relay manufacturer, model, specifications, and settings.
 - 10.1.13. Assembly ratings:
 - 10.1.13.1. Short-circuit rating
 - 10.1.13.2. Voltage
 - 10.1.13.3. Continuous Current
 - 10.1.13.4. BIL
 - 10.1.14. Projected electrical demand (i.e., kilowatt [kW]), including the following information:
 - 10.1.14.1. Power factor
 - 10.1.14.2. Load factor
 - 10.1.14.3. Large motor sizes (>50hp)
 - 10.1.14.4. Large motor starting currents (>50hp)
 - 10.1.14.5. Customer's transformer size(s)
 - 10.1.14.6. Estimated breakdown of the electric energy use (i.e., kilowatt hours [kwh]) by month

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- 10.1.15. Full-size phase and ground coordination curves showing full coordination with SMUD's system. *.pdf (or other searchable document) is acceptable.
- 10.1.16. A registered Electrical Engineer must prepare and stamp the fault-study and coordination study results.
- 10.1.17. Before energizing the new Primary Service facility, the Primary Service Customer must provide a copy, to SMUD, Professional Engineer certified on-site test reports for the switches, devices, and relays at least thirty (30) working days before energizing the service. Qualified personnel must prepare these on-site test reports.

11. 12/21 kV Protection Requirements

SMUD must review and approve the fault-interrupting devices that the Primary Service Customer selects: medium voltage breakers, reclosers (without bypass), interrupters, and fuses.

11.1. Medium Voltage Breaker Requirements

- 11.1.1. The interconnecting circuit breaker must have sufficient capacity to interrupt the maximum available fault current at its location. Phase and ground relays shall be approved by SMUD. These relays must coordinate with SMUD's source-side protection. It must also include the following features:
 - 11.1.2. Shunt-trip via a trip signal supplied through a battery external to the circuit breaker.
 - 11.1.3. Lock out if operated by protective relays required for service connection.
 - 11.1.4. Capacitive tripping is unacceptable.
 - 11.1.5. Relay Requirements
 - 11.1.5.1. DC Powered with battery backup
 - 11.1.5.2. Trip the Primary Service customer's incoming interrupting device on phase and ground overcurrent with available directional control (voltage potential inputs required to the relays)
 - 11.1.5.3. Must coordinate with SMUD's source side protection device
 - 11.1.5.4. SMUD must approve the customer relay settings
- 11.1.6. SMUD requires that Primary Service Customers submit all relay specification and setting proposals for SMUD approval before finalizing the design and ordering equipment. Primary Service customers not submitting this information risk delaying their projects.

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- 11.1.7. The customer will maintain their equipment in accordance with the manufacturer's requirements and industry accepted standards.
- 11.1.8. The incoming circuit breaker relaying shall have redundancy such that the failure of one relay will not compromise the protection of the system.
 - 11.1.8.1. This may be accomplished by primary/backup relaying
 - 11.1.8.2. SMUD must approve the relay redundancy in the scheme
- 11.2. Reclosers and Interrupters Requirements
 - 11.2.1. No bypass equipment with recloser where it is the primary protection on the customer side
- 11.3. Fuse Requirements
 - 11.3.1. SMUD may approve fuse as the primary protection device on the customer side for load only facilities if the fuses coordinate with the SMUD source side devices for phase and ground faults.
 - 11.3.2. It is recommended that the customer consider installing single-phase protection for their equipment.
 - 11.3.3. If the facility has a generation source a dedicated transformer may be required to step-up the generator voltage to the interconnection level. The dedicated transformer must have a delta winding. A high-side fault-interrupting fuse for transformer protection may be acceptable for generation facilities of less than 1000 kW.
 - 11.3.4. Lightning arrestors, if the Applicant chooses to install them, must be installed between the transformer and the fault-interrupting devices and be encompassed by the Applicants relay protection zone.
 - 11.3.5. SMUD may require the customer's primary protection device to be replaced if it fails to interrupt abnormal service conditions.
 - 11.3.6. SMUD to best match the present distribution-system voltage.

12. 12/21 kV Primary Service Metering Enclosure

The following specification and requirements apply to metering compartments and protective device equipment of the indoor switchgear.

12.1. General

SMUD provides a review of all designs prior to manufacturing. SMUD will also provide the available system fault duty, and upstream protective device characteristics.

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12.2. Drawing Approval

Design drawings shall be supplied to SMUD for review prior to procurement. Drawings shall include customer name, job address, and manufacturer information.

12.3. Working Space

Switchboards shall be installed with a minimum eight (8') feet in front and rear, and three (3') feet on sides, of clear and level working space, of any section that supports or provides access to metering or testing equipment.

12.4. Utility Compartment Labeling

Compartments of the metering enclosure shall be labeled.

12.5. See SMUD drawing A-05 for basic enclosure design.

12.5.1. Section 1 – SMUD metering panel

12.5.2. Section 2 – Main Breaker

12.5.3. Section 3 – Customer Distribution

12.6. Slots or louvers shall be provided. Ventilation shall be protected by baffles, barriers, or other obstructions to prevent protrusion of objects or wires.

13. Testing Requirement

The tests in this section apply to the subtransmission and to medium voltage breakers, and the tripping circuitry. Reclosers (without bypass), Interrupters, and Fuses would use applicable portions of these requirements.

13.1. The Primary Service customer must complete the following requirements:

13.1.1. Submit two copies of Professional Engineer certified test reports to SMUD a minimum of thirty (30) working days before energization of the Primary Service facilities.

13.1.2. Each test report must identify the equipment tested and that identification must match that on the drawings.

13.2. Customer must meet the above requirements and obtain SMUD approval of the test reports at least ten (10) working days before SMUD energizes the Primary Service facilities. SMUD strongly recommends that the Primary Service customer coordinate the test program with SMUD.

13.3. Circuit Breaker Tests

13.3.1. Primary Service customers must perform the following circuit breaker tests:

13.3.1.1. Minimum-to-trip test at 70% or less of the nominal control voltage on all circuit breakers operated by SMUD-required relays.

13.3.1.2. Micro-ohm test on the main circuit breaker(s) at the POS.

13.3.1.3. Timing test showing the time from the trip initiation to the opening of the main poles. Proving insulation tests, as described below.

13.3.1.4. Proving Insulation

13.3.1.4.1. Megger circuit breaker operated by SMUD required relays.

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

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

13.3.1.4.3. 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

13.4. Tests for Current Transformers and Current Circuits

Primary Service customers must perform the following tests for current transformers (CTs) and current circuits associated with SMUD-required relays:

13.4.1. Check the saturation characteristic for all CTs. If this is not possible, a manufacturer's curve is acceptable.

13.4.2. Prove the ratio of all CTs by using current (primary to secondary) or voltage (secondary to primary).

13.4.3. Check the CTs for the proper polarity.

13.4.4. Check the CT circuits for the proper connections.

13.4.5. Check the continuity of the CTs by:

13.4.5.1. Applying primary or secondary current at the CT block.

13.4.5.2. Verifying that the proper current exists in each phase relay and the ground relay.

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

- 13.4.7. Primary Service 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.
- 13.4.8. Check each phase of each current circuit feeding SMUD–required relays. Megger the total circuit with the ground wire lifted (to prove that only one ground exists)
- 13.5. Relay and Fuse Tests
- The testing requirements for relays/fuses include:
- 13.5.1. Primary Service customers must field test the settings of SMUD required relays to verify the following items:
- 13.5.1.1. The minimum operating point at which the relay picks up (minimum pickup).
- 13.5.1.2. Time delays at three different current–test points, in integral multiples of the minimum pickup that closely characterize the relay time–current curve.
- 13.5.1.3. Typical values in multiples of relay pickup: Phase 2x, 3x, and 5x; Ground 2x, 4x, and 8x. These values give a good operating range to determine relay performance.
- 13.5.1.4. Test results must be within the tolerances listed below:
- 13.5.1.4.1. Current/Voltage/Time $\pm 10\%$
- 13.5.1.4.2. Impedance/Phase Angle $\pm 0.05\%$
- 13.5.1.4.3. Frequency $\pm 0.05\text{ Hz}$
- 13.5.2. Check all fuses for continuity before energizing.
- 13.6. Tests Recommended (But Not Required by SMUD) for the Primary Service customers
- 13.6.1. Transformer
- It is recommended (but not required by SMUD) that the customer perform the following tests prove the insulation and turns ratio on their primary service transformers.
- 13.6.1.1. Proving Insulation
- A 1,000 or 2,500 (V) dc megger test or a 1,000 V, high–pot test is recommended for any of the insulation tests below.
- 13.6.1.1.1. Megger the main transformer(s) winding–to–winding and each winding–to–ground.
- 13.6.1.1.2. Megger the buses (phase–to–phase and phase–to–ground) from the POS to the main transformer.

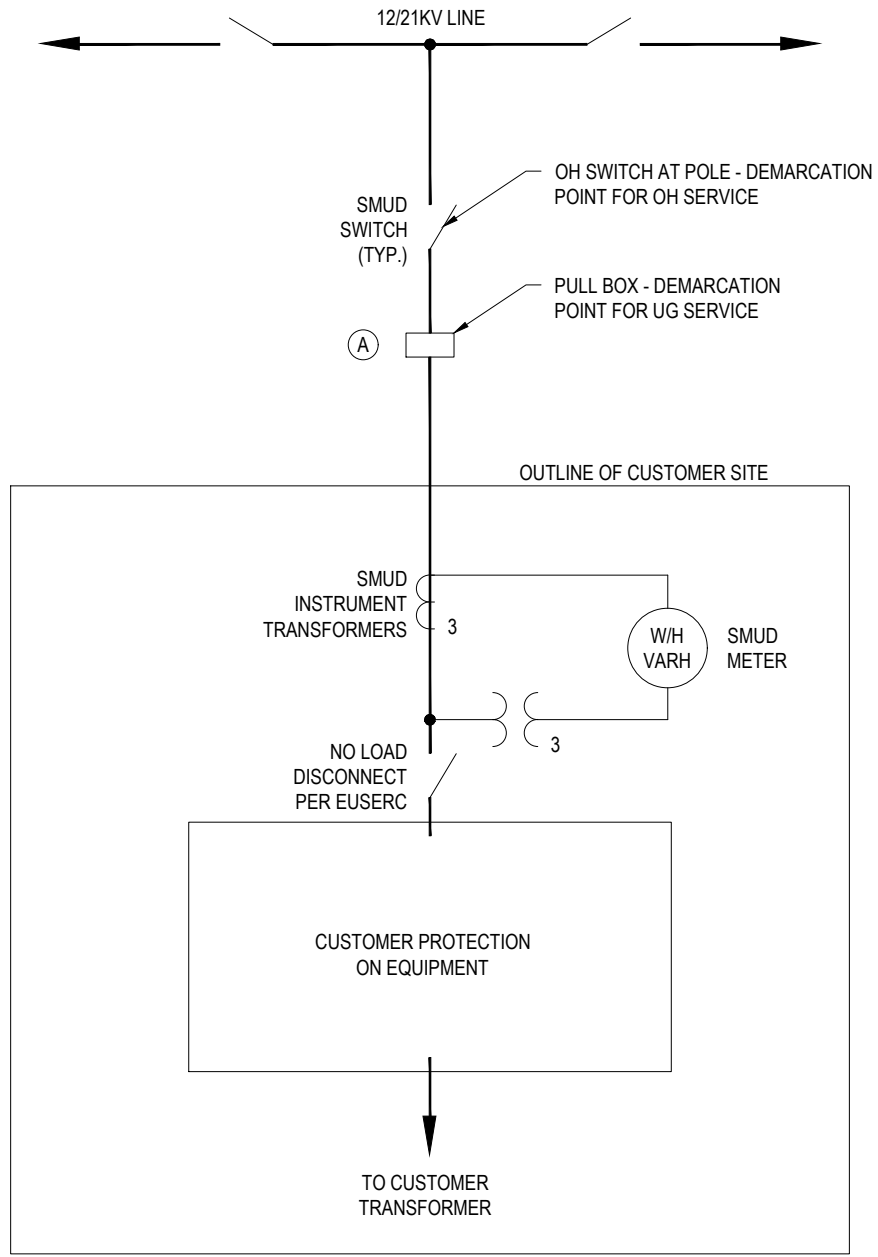
- 13.6.1.1.3. Perform a dielectric test on the main transformer(s) insulating medium (gas or oil).
- 13.6.1.1.4. Proving Ratios
- 13.6.1.1.5. Prove the main transformer(s) ratio(s) using one of the following methods:
- 13.6.1.1.6. Turns-ratio test.
- 13.6.1.1.7. Voltage-ratio test on the final operating tap. Consult with SMUD to best match the present distribution-system voltage.

Appendix A: Design and Construction Drawings

The customer and/or their representatives or contractors shall adhere to the design and construction drawings listed in the table below, unless otherwise specified in writing by a SMUD inspector or designer. The customer shall review all drawings. Any questions or comments shall be brought to Sacramento Municipal Utility District's (SMUD) attention for clarification or resolution.

Design and Construction Drawings

Drawing Title	Drawing Identification Code	Page Number
12/21 kV Typical Single Line Diagram		A-01
69 KV TYPICAL SINGLE LINE DIAGRAM		A-02
PARTIAL EVALUATION - TYPICAL SITE		A-03
TYPICAL 69 KV METERING INSTALLATION		A-04
SMUD 69 kV Meter Panel		A-05
Metal Clad Switchgear		A-06
Metering Enclosure (Section 1) 12 kV		A-07
Metering Enclosure (Section 1) 21 kV		A-08



NOTES:

- (A) PULL BOX SHALL BE DEDICATED, SERVING A SINGLE CUSTOMER. NO ADDITIONAL DISCONNECTS SHALL BE INSTALLED BETWEEN THE PULL BOX AND CUSTOMER METER.



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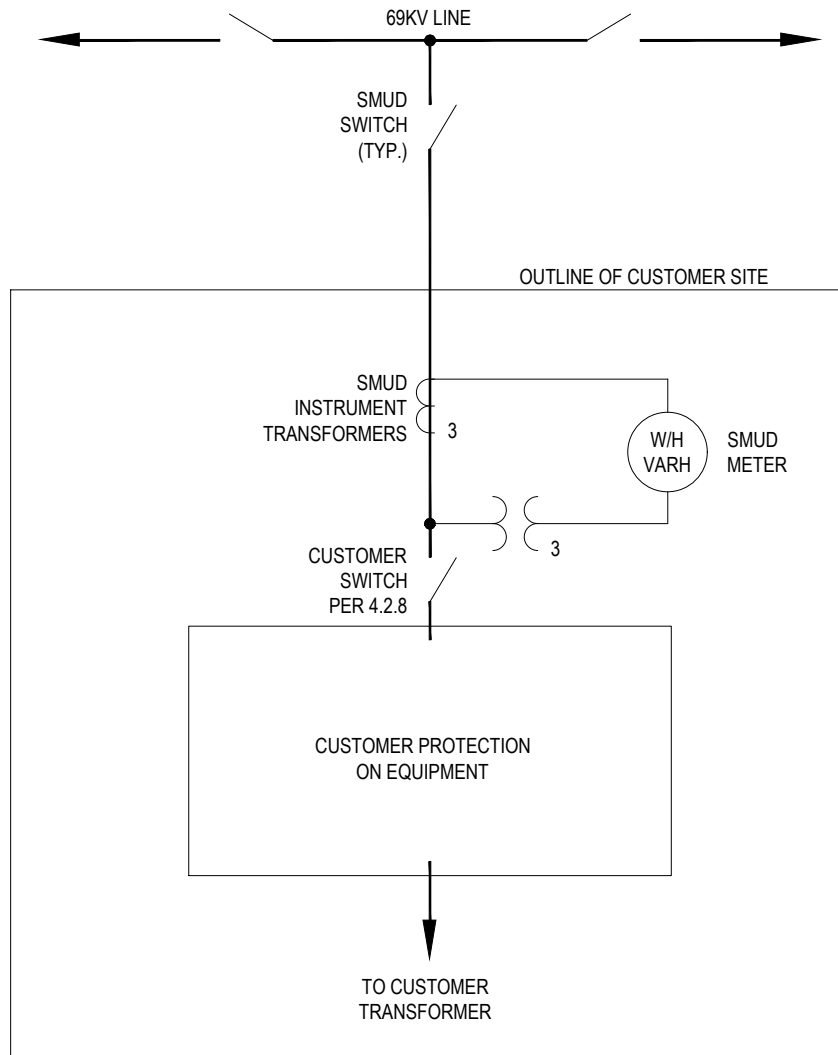
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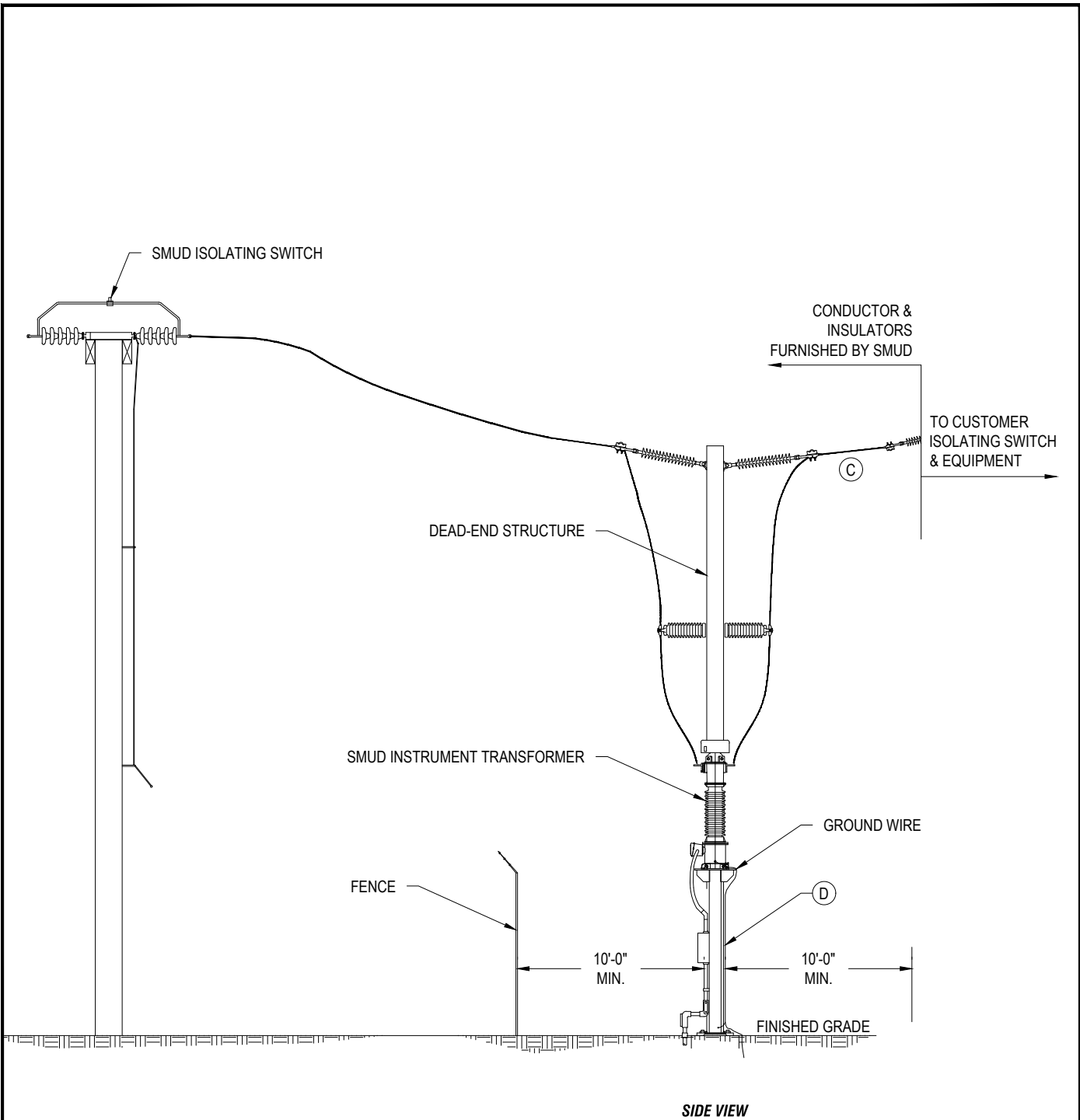
12/21KV TYPICAL SINGLE LINE DIAGRAM

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TYPICAL SINGLE LINE DIAGRAM

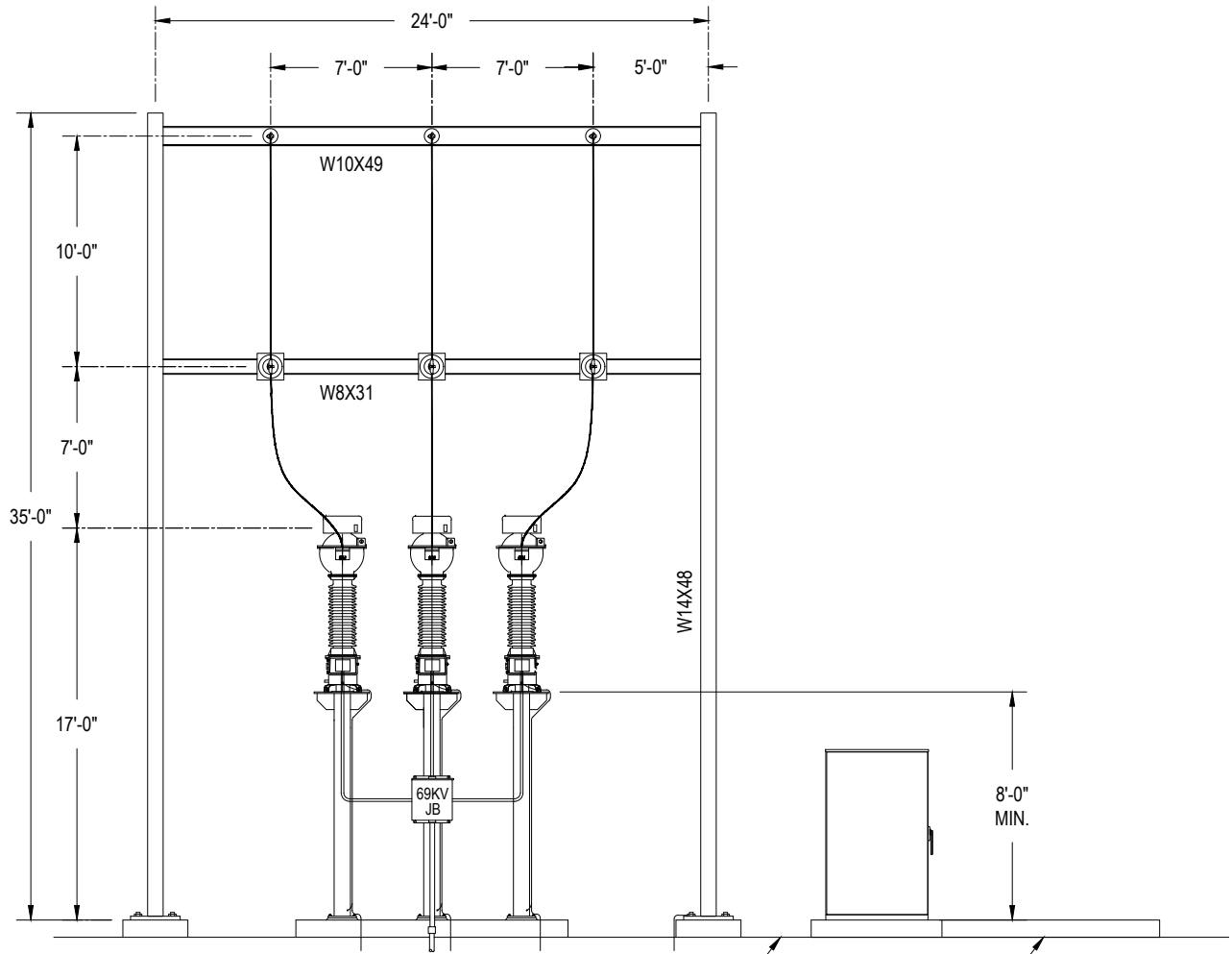


PARTIAL ELEVATION - TYPICAL SITE

NOTES:

- (A) THIS DRAWING IS FOR INFORMATIONAL PURPOSES ONLY. IT IS INTENDED TO AID THE CUSTOMER'S ENGINEER IN UNDERSTANDING THE SMUD REQUIREMENTS FOR SERVICE OF 69KV.
- B. 10' MINIMUM CLEARANCE AROUND METERING STRUCTURES IS REQUIRED FOR ACCESS BY TRUCK.
- C. DEADEND ON CUSTOMER A-FRAME LEAVE 25' TAIL.
- (D) STRUCTURAL SETTLE INSTALLED BY CUSTOMER.

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	PARTIAL ELEVATION - TYPICAL SITE 69KV		STANDARD NO.: --- PAGE 1 OF 1



FRONT VIEW

FINISHED GRADE

LEVEL CONCRETE WORK
SURFACE 30WX36"D

69KV METERING H-FRAME



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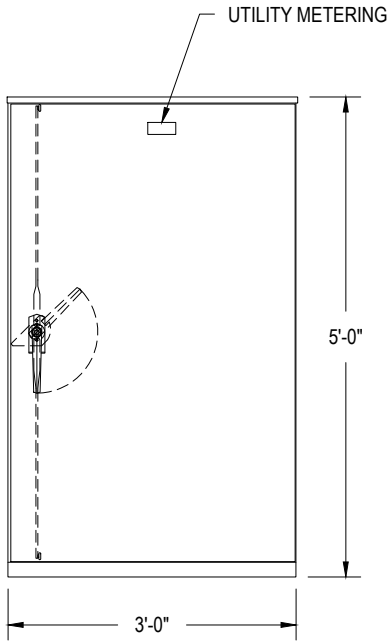
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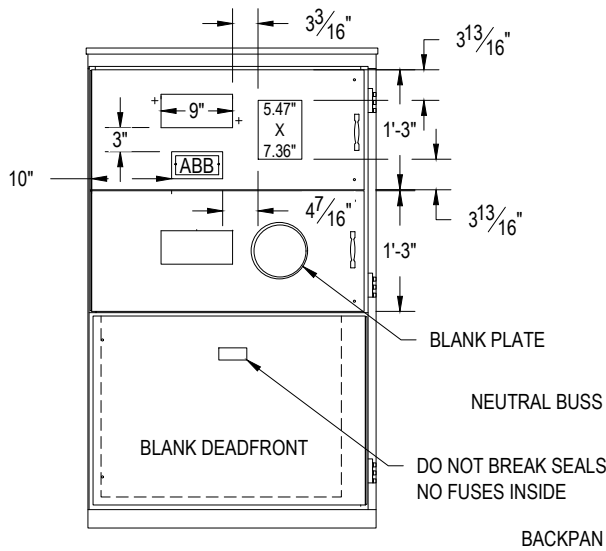
TYPICAL 69KV METERING INSTALLATION

STANDARD NO.:

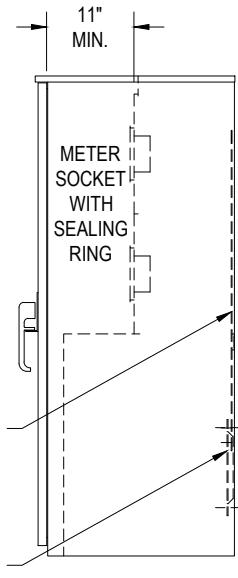
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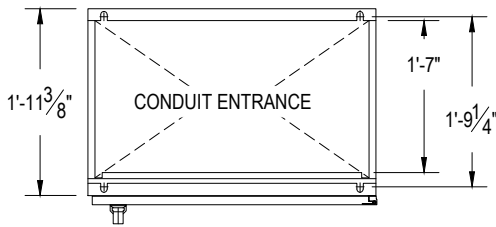
PANEL ELEVATION



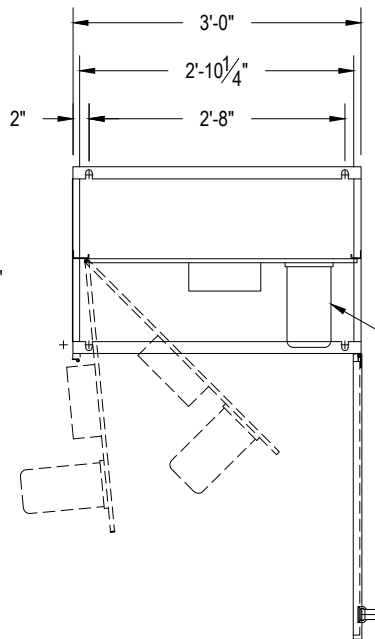
METER SECTION
INNER DEADFRONT DOOR
(SHOWN WITH OUTER DOORS REMOVED)



SIDE VIEW



PANEL BASE PLAN



METER, TEST SWITCH & WIRING
BY THE UTILITY COMPANY



TEST SWITCH

DEMAND METER



METERING
DIAGRAM
13CT

ENCLOSURE CONSTRUCTION NOTES:

- A. EXTERIOR 12 GA. H.D. GALV. STEEL AND INTERIOR 14 GA. COLD ROLLED STEEL ELECTRICALLY WELDED AND REINFORCED WHERE REQUIRED.
- B. CONSTRUCTION WILL BE NEMA 3R, RAIN TIGHT.
- C. ALL NUTS, BOLTS AND SCREWS WILL BE STAINLESS STEEL.
- D. NUTS, BOLTS & SCREWS WILL NOT BE VISIBLE FROM OUTSIDE OF ENCLOSURE.
- E. NAMEPLATES WILL BE PROVIDED AS REQUIRED.
- F. CONTROL WIRING WILL BE MARKED AT BOTH ENDS BY PERMANENT WIRE MARKERS.
- G. A PLASTIC COVERED WIRING DIAGRAM WILL BE ATTACHED TO THE INSIDE OF THE FRONT DOOR.
- H. ENCLOSURE WILL BE FACTORY WIRED AND CONFORM TO REQUIRED NEMA AND UL 508A STANDARDS.
- I. COLOR TO BE: 49 GRAY.

# XXXXXXXXXXXX				
# XXXXXXXXXXXX				
INDUSTRIAL CONTROL PANEL				
VOLTAGE	PHASE	WIRES	MAINS AMPERES	Hz
120/240	3	4	N/A	60
SUITABLE FOR USE ON A CIRCUIT CAPABLE OF DELIVERING NOT MORE THAN:				
AMPERES		VOLTAGE		
N/A	RMS SYM.	240	V	
METER SOCKET RATING: 20CT A. CONT. ENCLOSURE: TYPE 3R				



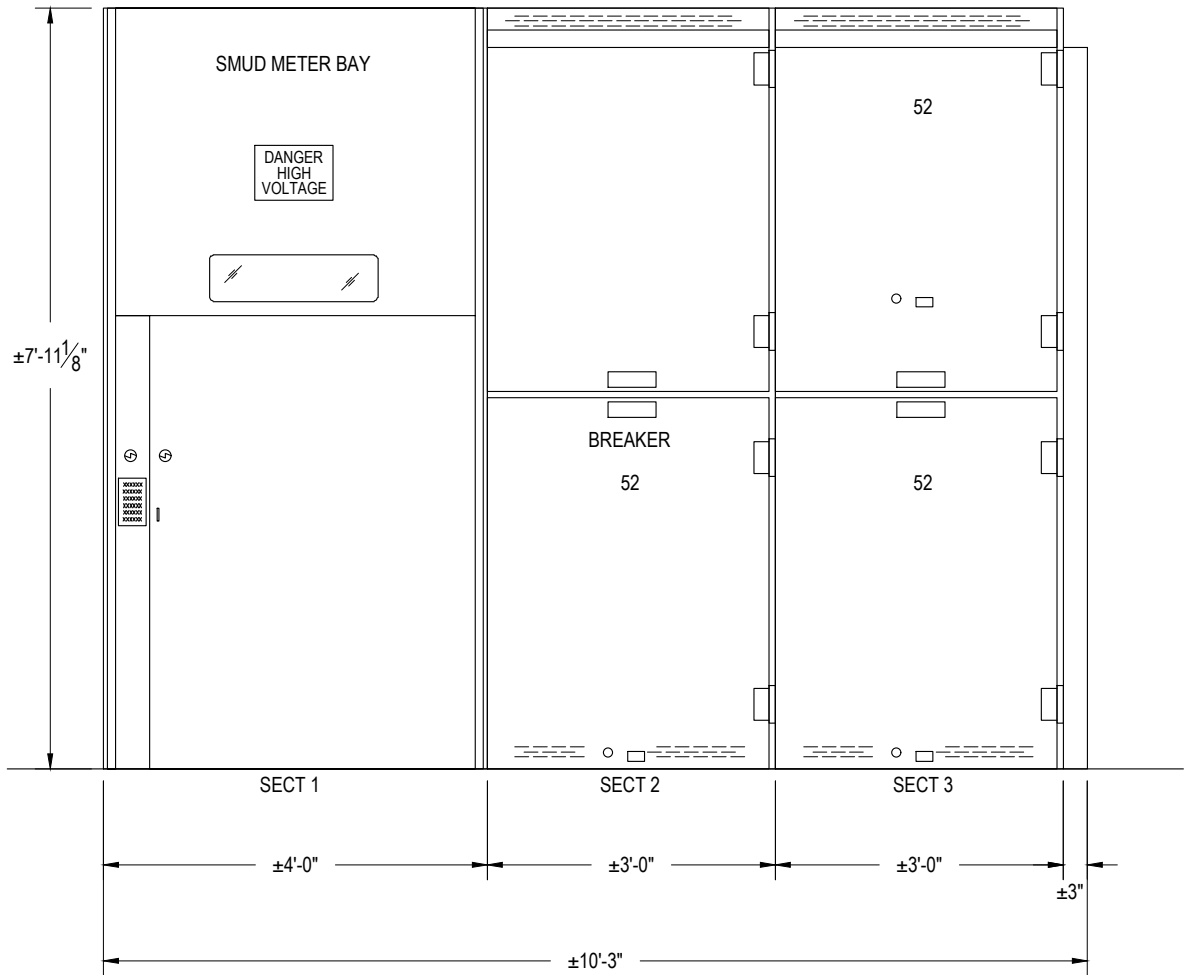
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SMUD 69KV METER PANEL

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NOTES:

A. 8'-0" CLEARANCE FRONT & BACK OF EQUIPMENT. 3'-0" CLEARANCE ON THE SIDE OF EQUIPMENT.



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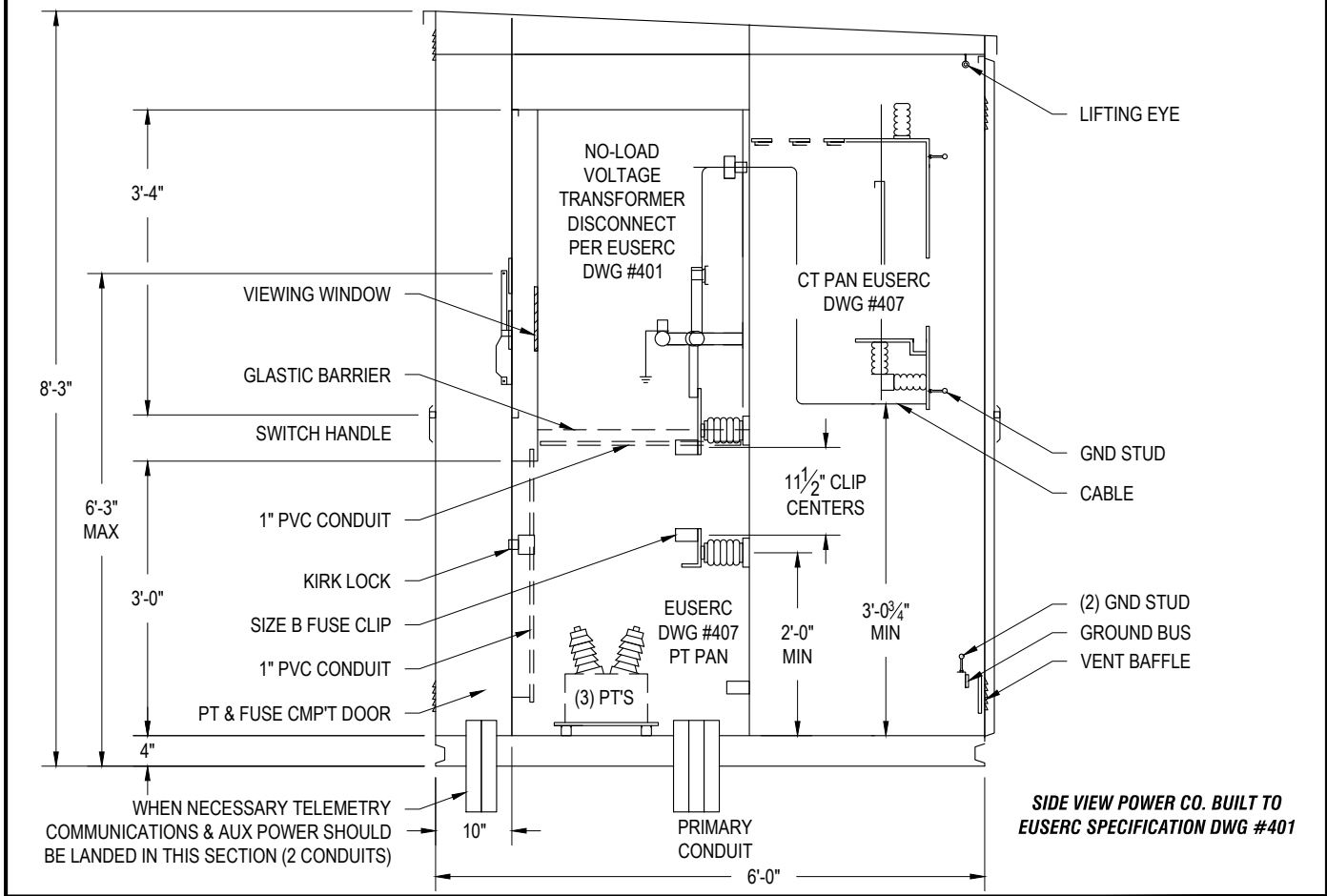
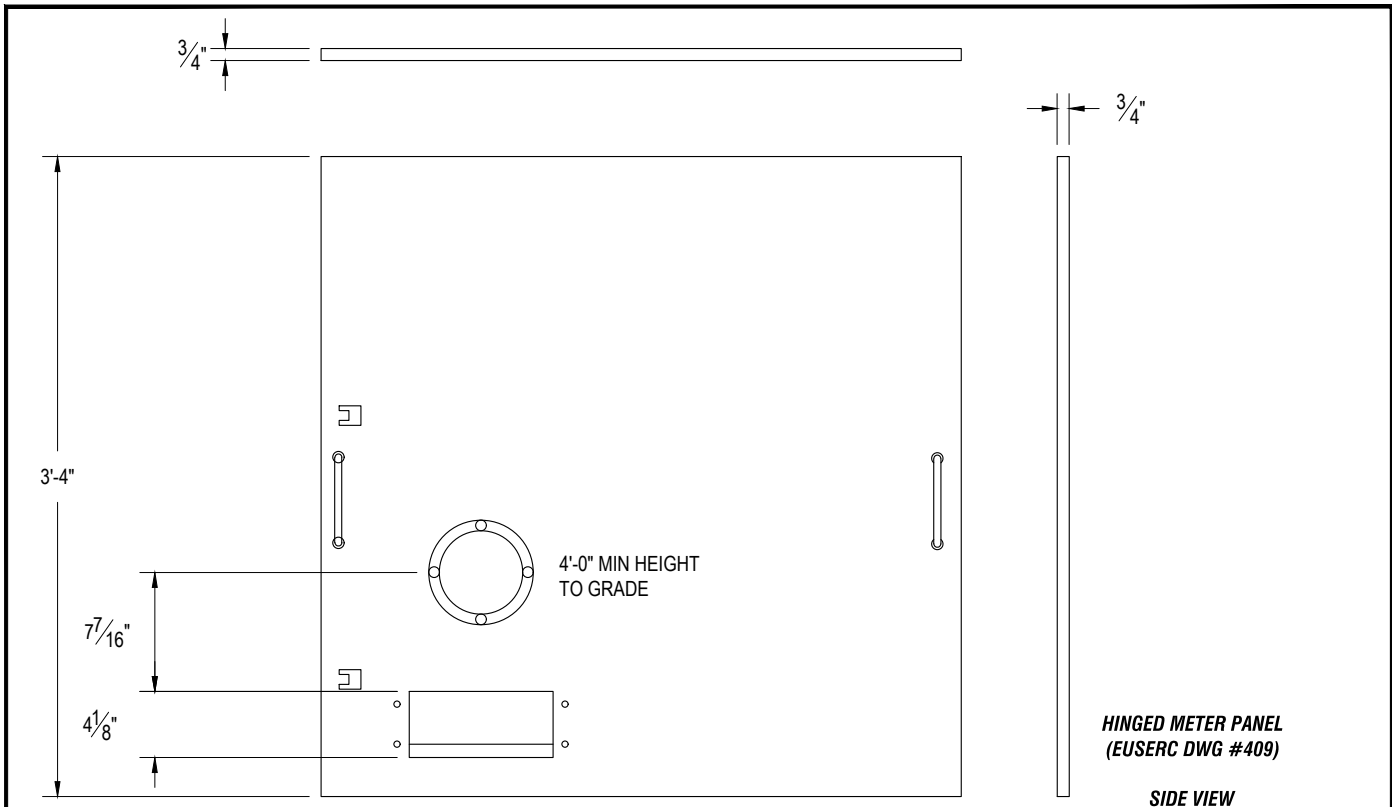
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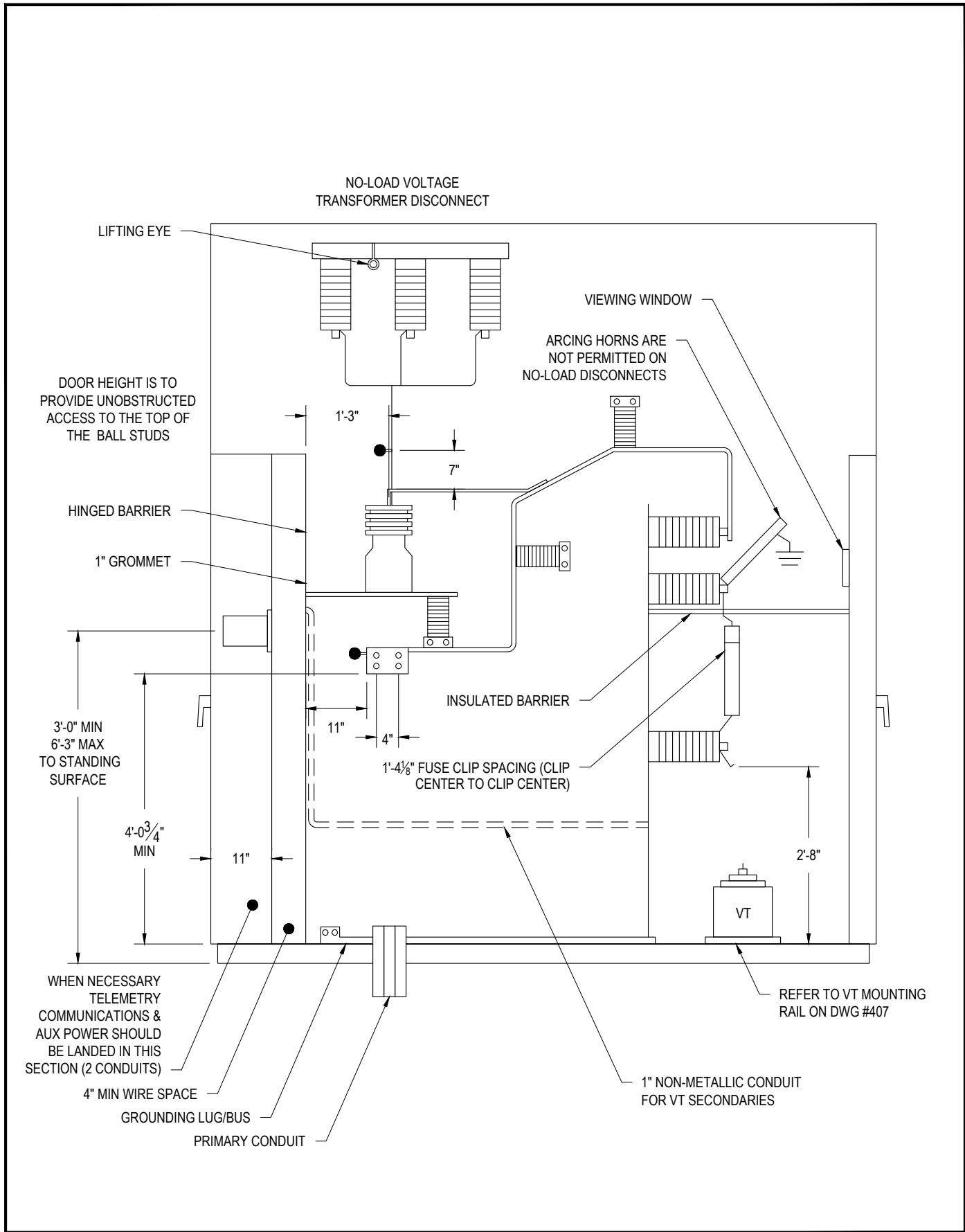
METAL CLAD SWITCHGEAR

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 <p>Sacramento Municipal Utility District</p>	ESR: T010	ESR PG. NO.: A-07	REV. DATE: OCTOBER 2024	REV. NO.: 0
	METERING ENCLOSURE (SECTION 1) 12KV		STANDARD NO.: ---	
				ESR



ESR: T010

ESR PG. NO.: A-08

METERING ENCLOSURE (SECTION 1) 21KV

REV. DATE: OCTOBER 2024

REV. NO.: 0

STANDARD NO.: ---

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