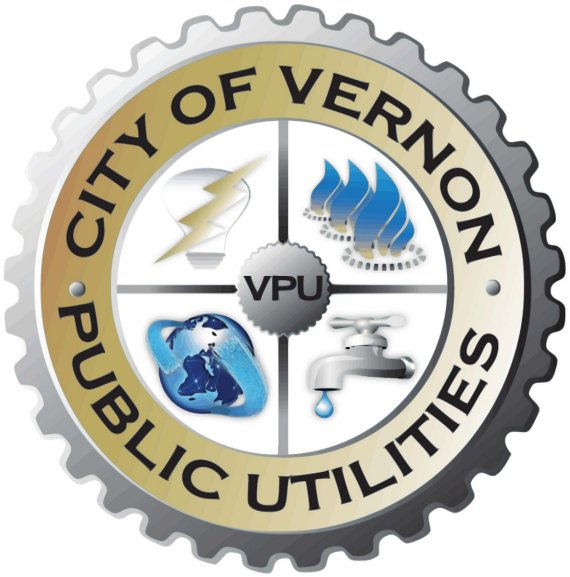


Electrical Service Guidelines

Rev: 5

Dated: 11/25/20

CONTENTS **PAGE**

A. PLANNING ELECTRIC SERVICES

1. INITIAL CONTACT

When considering the design of electrical facilities for a commercial, or industrial premises, customers should contact Vernon Gas & Electric (VPU) as soon as possible so that:

a. The VPU service planning staff can work with the customer to establish a serving voltage and an acceptable meter and service location.

b. Customers may avoid unnecessary expenses and delays in service caused by assuming the type of service VPU will provide.

2. PLAN SUBMITTALS

NOTE: Projects not completed in less than 1 year may need to be re-submitted and/or re-evaluated based on changing field conditions. At the time of initial contact with a VPU engineering office, please provide the following items:

a. A completed Service Planning Information sheet - see page 6 for master copy.

b. Electrical plans including load schedules, single-line diagrams, and equipment elevation drawings.

c. Plot, grading, elevation, and site improvement plans.

d. Switchgear shop drawings. VPU is a member of the Electric Utility Service Equipment Requirements Committee (EUSRC), and all submittal must comply and show required EUSERC specifications. See page 7 for acceptable EUSERC specifications.

e. Any additional information requested by the service planner needed to assist VPU in finalizing the customer's plans.

3. SERVICE CONFIRMATIONS AND FACILITIES REQUIREMENTS

a. **For projects to be served underground**, VPU will provide a construction drawing or other documentation specifying the facilities that the customer must install on the customer's premises to accommodate VPU's transformers, cables and any other equipment needed to supply the customer's load.

b. **For projects to be served overhead**, VPU will provide a written confirmation of the serving pole and its location. The customer is responsible for designing and building the service entrance and point of attachment facilities to meet the VPU's overhead service requirements.

4. APPLICATIONS FOR SERVICE

Customers must contact a Customer Service Office to make application for electric service. This should be done at the time of initial contact with an engineering office, or shortly after, to avoid delays in establishing service.

5. FEES AND CHARGES

Customers must make payment in full for all fees and charges assessed by VPU before construction will be started or service will be established. Such fees and charges include but are not limited to service application fees, charges for temporary services, charges for construction or relocation of VPU facilities, charges for line extensions or excess conductor allowances as specified in the Rules, charges for interconnection of customer-owned generation facilities and charges for nonstandard installations.

6. **PERMITS AND INSPECTIONS**

a. VPU will energize a customer's electric service only after the installation has been inspected and cleared by both VPU and Public works department.

b. Normally the following steps must be completed to establish electric service:

(1) An electrical permit must be obtained by the customer from Public works department.

(2) All site electrical wiring must be completed and inspected by Public works department and the final electrical release cleared to VPU (notice is generally made by teletype or letter).

Note: It may take several days after the final permitting agency inspection for VPU to be notified.

(3) All facilities specified by VPU must be inspected by VPU and all corrections must be completed and approved.

7. **SCHEDULING AND CONSTRUCTION**

a. When the required inspections have been completed and all fees and charges are paid in full, a "release" will be sent to the construction team for scheduling and construction.

b. Installation of facilities by VPU will normally be scheduled during regular working hours. However, customers may request VPU to install facilities during premium (overtime) hours for the convenience of the customer. Requests for premium time installations may be made by contacting the appropriate engineering office. Customers are required to reimburse VPU for all premium time charges.

c. VPU will make a reasonable effort to complete service installations as quickly as possible. However, the time required to complete an installation will vary according to the complexity of the service and the number of services already scheduled or under construction.

CITY OF VERNON
UTILITIES DEPARTMENT

ELECTRIC SERVICE PLANNING INFORMATION

1. Company Name: _____

   Company Address: _____

   Contact Name: _____ Telephone No. _____

   Type of Business: _____

   Operating Hours: _____ Total Facility Size: _____

2. Electric Service Request:

   ☐ New tenant in building using existing electric service (name change on electric bill)
   Existing Panel Rating _____ Amps Voltage _____
   Estimated Total Connected Load _____ kW Estimated Demand _____ kW

   ☐ Load Addition to Existing Electric Service
   Existing Panel Rating _____ Amps Voltage _____
   Estimated Total Connected Load _____ kW Estimated Demand _____ kW
   (including additions) (including additions)

   ☐ Installation of New Electric Panel
   New Panel Rating _____ Amps Voltage _____
   Estimated Total Connected Load _____ kW Estimated Demand _____ kW

   Date _____

   Submitted by _____ Print Name _____

   Title _____ Estimated Date For Electric Request _____

FOR OFFICE USE ONLY

Customer Service

Account No. _____

Meter No. _____

Phase _____

Rate: GS1 GS2 TOU-G TOU-V

Service is ON / OFF

NOTES _____

Engineering

Transformer _____

Transformer Size _____

Secondary Conductor Size _____

Additional Customers on bank _____

FDR# _____ LOAD BLOCK # _____

NOTES _____

Action Item _____

4305 Santa Fe Avenue, Vernon, CA 90058 Telephone: (323) 583-8811 Fax: (323) 826-1433 Rev: 7/01

Electric Utility Service Equipment Requirements Committee

EUSERC

Utility: Vernon, City of
Contact Name: Ali Nour/ Chris Delgado
Phone Number: 323-583-8811

Place an X in the appropriate box for each drawing: A = Acceptable, C = Consult, U = Unacceptable, N/A = Not Applicable

Drwg	A	C	U	N/A	Explain all "C's"
301	x				
301A			x		
302			x		
302A	x				
302B			x		
303				x	
304	x				
305	x				
305A	x				
306	x				
307		x			
308	x				
309			x		
311	x				
312	x				
313		x			
314		x			
315				x	
316				x	
317				x	
318				x	
319	x				
320	x				
321				x	
322		x			
323			x		
324		x			
325	x				
326	x				
327	x				
328A	x				
328B		x			
329A	x				
329B		x			
330	x				
331	x				
332	x				
333	x				
336				x	
338		x			
339	x				
342	x				
343	x				
343A			x		

Drwg	A	C	U	N/A	Explain all "C's"
344	x				
345	x				
347	x				
348	x				
349	x				
351				x	
353	x				
354	x				
401	x				
404	x				
407	x				
408		x			
409		x			
411		x			
414		x			
416	x				
418	x				
420	x				
500					
501					
502					
503					
515					
520					
G1	x				
G2	x				
G3	x				
G4	x				
G5	x				
G6	x				
G7	x				
G8	x				

B. ELECTRIC LOADS

1. GENERAL

a. Motor or lighting loads may be supplied from any service of appropriate class, phase, and voltage. However, such loads are subject to conditions or limitations specified in these service requirements and the VPU's Rules.

b. 120-volt single-phase loads must be reasonable balanced between phases with respect to the neutral, and 240-volt single-phase loads must be reasonably balanced between the phases.

2. CHANGES IN CONNECTED LOAD

a. VPU is required to serve only the load initially approved and connected, or specified, regardless of the rating of the service equipment or service disconnect.

b. When a customer proposes adding load to an existing service, the added load is considered to be a new installation. VPU's will consider the added loads on an individual basis and reserves the right to require the customer to make changes in the existing service facilities, including provisions for transformer facilities on the customer's premises.

3. INSUFFICIENT LOAD

VPU's will normally energize a customer's service when there is sufficient load to justify installation of the VPU's facilities. When a customer requests the VPU's to supply service to a facility where the load is insufficient to justify the VPU's ' investment, the customer will be required to reimburse VPU for the excess investment required to supply the load, or provide suitable, and mutually agreeable, guarantees that will warrant the VPU 's investment.

4. LOAD CHARACTERISTICS AFFECTING OTHER CUSTOMERS

Where, in the VPU's judgment, the characteristics of a customer's load may impair service to other customers, VPU may require that such loads to be supplied through a separate service, or that the customer supply suitable equipment, at the customer's expense, to reasonably limit voltage fluctuations caused by the equipment involved.

5. SINGLE-PHASE MOTORS

a. Motors operated at 120 volts are limited to a maximum locked-rotor current of 50 amperes, or a full-load current of 12 amperes.

b. Motors operated at more than 120 volts are limited to a maximum locked-rotor current not exceeding 170 A. Where more than one motor is installed in a device, the accumulated locked rotor currents shall be limited to 450-percent of the accumulated full-load running currents.

6. THREE-PHASE MOTORS

a. VPU will generally supply three-phase service for motor loads totaling more than 5 horsepower (hp). While such installations are not generally limited to capacity either of individual motors, or of the entire installation, VPU may require that large motor loads be supplied from dedicated transformer facilities located on the customer's premises.

b. Three-phase motors not exceeding 20 hp each and designed for "across-the-line" starting may be connected to VPU's electric system provided the starting demand does not exceed 6 kVA per rated horsepower.

c. Three-phase motors in excess of 20 hp each and designed for "across-the-line" starting require the VPU's approval before being connected to VPU's electric system. For each motor rated 40 hp and

above, the following information must be provided to VPU:

(1) Rated horsepower and the motor use.

(2) Starting current by test or guaranteed locked-rotor current.

(3) Duty cycle (constant or intermittent), and the maximum number of starts per day.

(4) Number of motors started from a single controller.

7. **X-RAY UNITS OVER 5 KVA**

Customers must obtain approval from the VPU before installing x-ray equipment.

8. **WELDERS**

Customers must obtain approval from the VPU before installing welders.

9. **SPECIAL EQUIPMENT**

Arc welding devices, x-ray machines, high-voltage testing and bombarding transformers, wireless telegraph or radio transmitting equipment, electric welders and furnaces, and other devices with similar load characteristics will be considered as special equipment and subject to VPU Rules regulating connected loads and maximum demand.

C. INSPECTIONS

1. **GENERAL**

- VPU will not energize any service or set any meter until the service and metering equipment, conduit, and other facilities required by VPU have been inspected and approved by VPU.

- VPU policy is to provide inspection of the customer's facilities in a timely manner and without causing unnecessary delays to the customer's construction schedule or service wanted date. However, it is the customer's responsibility to provide sufficient advance notice to VPU to avoid delays caused by conflicts with inspection schedules already committed.

2. **SCHEDULING INSPECTIONS**

- To schedule an inspection, contact the appropriate engineering office. VPU construction drawings may specify a telephone number to contact for inspection.

- Contractors should notify VPU at the beginning of construction at the job site. In addition, contractors should request inspection as soon as facilities specified by VPU are ready for inspection.

3. **SPECIAL INSPECTIONS**

- Inspections will normally be scheduled during VPU regular working hours. Special inspections may be requested during overtime (premium) hours by contacting VPU engineering office at least two (2) working days in advance.

- The customer shall reimburse VPU for all premium time charges including travel time.

D. SERVICE VOLTAGES

1. CHARACTER OF SERVICE

Service supplied throughout VPU's service territory is an alternating current at a regulated frequency of 60 cycles per second, and at the nominal voltages available from the VPU's electric system. All single phase load should be balanced and adjustment may be required per the Service Planner's review and approval.

2. SERVICE SUPPLY VOLTAGES

- **120/240 VOLTS, SINGLE-PHASE, 3-WIRE**

  a) This voltage is normally limited to a service ampacity of 400 amperes. Consult VPU when the proposed service exceeds 600 amperes.

  b) VPU may require that large single-phase services be supplied from dedicated transformers located on the customer's premises with a three-phase, four-wire wye voltage.

- **240/120 VOLTS, 3-PHASE, 4-WIRE**

  a) This voltage supplies single-phase and three-phase loads through the same metered service. Consult VPU.

  b) The service neutral is center-tapped and grounded at VPU's transformer and the "Power Leg" measures 208 volts-to-ground.

  c) Where service is supplied from dedicated transformers located on the customer's premises, VPU may require the service to be supplied with a four-wire wye voltage.

  d) The 208V power leg will be 'C' Phase (rightmost phase) and indicated with an orange finish at the weather head, pull sections, & utility metering compartment.

- **240 VOLTS, 3-PHASE, 3-WIRE**

  This voltage is not available for new services. Customers requesting a new service will be required to upgrade to grounded system. However, the customer is required to consult VPU when planning increases in load or service ampacity to an existing service supplied at this voltage. Such changes may require conversion to a 4-wire service.

- **208Y/120 VOLTS, 3-PHASE, 4-WIRE**

  a) This voltage is supplied from dedicated transformer installations located on the customer's premises and serves both single-phase and three-phase

  b) Where load is insufficient to justify the VPU's investment in on-site transformation, the customer will be required to reimburse the VPU for the excess investment required to serve the load. Consult the VPU's engineering offices for additional information.

c) Where load is insufficient to justify the VPU's investment in on-site transformation, the customer will be required to reimburse the VPU for the excess investment required to serve the load. Consult the VPU's engineering offices for additional information.

- **480Y/277 VOLTS, 3-PHASE, 4-WIRE**

a) This voltage is supplied from dedicated transformer installations located on the customer's premises and serves both single-phase and three-phase loads.

b) Where load is insufficient to justify VPU's investment in on-site transformation, the customer will be required to reimburse VPU for the excess investment required to serve the load. Consult the VPUs engineering offices for additional information.

- **480 VOLTS, 3-PHASE, 3-WIRE**

This voltage is not available for new services. A high resistance grounded system should be installed in lieu of an ungrounded system. The customer is required to consult with VPU when planning increases in load or service ampacity to an existing service supplied at this voltage. Such changes may require conversion to a 4-wire service. In addition, the following stipulations apply to these systems as well:

a) Due to the many safety issues systemic with ungrounded systems, services that have been off for 6 months will not be re-energized. Please contact the service planner for more information.

b) For existing services, grounding lights may be required by the utility if ground faults are a consistent issue on the customer's premises. Grounding lights will inform the customer when there is a ground fault, indicating the customer must trouble shoot to fix the issue.

- **MEDIUM-VOLTAGE SERVICES**

VPU generally supplies and meters services at, 4160, 7200 or 16500 volts. Services will be supplied and metered at the voltages specified by VPU, only when in the VPU's judgment the size or special character of the load, or location, warrants such service.

3. **ACCEPTABLE VOLTAGE RANGES**

Under Normal conditions, VPU will generally maintain service supply voltages at the point of service within the following voltage ranges:

Nominal Voltage	Voltage throughout Facility		Voltage at Meter	
	Minimum	Maximum	Minimum	Maximum
120	110	127	114	126
240	220	254	228	252
208	191	220	197	218
480	440	508	456	504

Note: VPU will not generally make adjustments for service supply voltage levels if the voltage at the meter is within range. Voltage related problems may be reported by calling the VPU's control center or service planner.

E. CLASSES OF SERVICE

1. Different classes of service are considered to have either different phase characteristics such as single-phase or three-phase, or different voltage characteristics such as 208Y/120 volts or 480Y/277 volts.

2. The VPU will normally provide only a single voltage class of service, supplying all single-phase and three-phase loads, on the premises. Requests by customers to supply some loads on a premises at different voltage classes of service will be considered on an individual basis.

F. SHORT-CIRCUIT CURRENT AND OVER-CURRENT PROTECTION

1. VPU require the installation of metering and service equipment with over-current protection at least equal to the available short-circuit current provided by the VPU.

2. For all services, short-circuit contributions will be calculated on an individual basis and a short- circuit report will be sent to the permitting agency. Short-circuit information may be obtained by contacting the VPU engineering office.

3. **The customer is responsible for providing over-current protection equipment** such as circuit breakers, fusible switches, pull-out fuses, or other approved devices.

4. Fuses used for over-current protection:

   a. Where fuses are installed by customers for over-current protection, the VPU assumes no responsibility for their replacement.

   b. Fuses, circuit breakers, or disconnects provided by the VPU on its electric system shall not be used in place of a customer's fused service switch or breaker, and the VPU assumes no responsibility for maintaining such devices for the protection of customer-owned wiring or electrical equipment.

   c. **When entering a sealed enclosure to replace fuses**, call the VPU's Electric Trouble Board and obtain permission to break the seals

G. TEMPORARY SERVICES

1. APPLICATION FEES AND CHARGES

a. VPU will supply electric service to installations of transitory character such as construction sites, bazaars, fairs, and circuses providing the customer pays in full all application fees and engineering charges associated with the installation and removal of VPU facilities.

b. An application fee will be charged for 120/240 volt, single-phase or three-phase services when limited to a maximum ampacity of 100 amperes, a maximum connected load of 10 kW, and:

(1) Supplied from existing overhead facilities except for the installation of a single set of service drop conductors.

(2) Supplied from existing underground facilities except for the installation of a single set of service supply conductors to be used to serve the permanent load.

Note: Contact a customer service branch office or engineering office to determine the current application fees.

c. Additional engineering charges will be assessed for the installation and removal of transformers and other VPU facilities required to supply temporary service.

2. PERMITS AND APPROVALS

a. Customers must obtain approval from the VPU for location and other details of the temporary service prior to installing the facilities. On completion, the conduit and electrical facilities must be inspected and approved by VPU.

b. Customers must obtain the necessary permits from the inspection authority. Inspection must be completed by the inspection authority and the final electrical release received by the VPU before the customer's temporary service will be energized.

3. TIME LIMITATIONS

VPU will generally limit the use of the temporary power to the period of construction, remodeling, maintenance, repair, or demolition of buildings or structures or similar activities. Temporary power installations serving decorative lighting, carnivals and similar purposes are generally limited to 90 days.

4. REMOVAL OF SERVICE

i. VPU reserves the right to remove temporary power without notice when in the VPU 's judgment the service is no longer temporary in character, no longer used for the purpose for which the service was installed, not needed, or creates a hazardous condition.

ii. Requests for removal or "turn-off" will be accepted as an indication that service is no longer needed and any temporary facilities provided by VPU may be removed. Service can be transferred from the name of one customer to the name of a second customer provided the use location remains the same. Remove or turn-off orders may be made in person at one of the VPU 's customer service at:

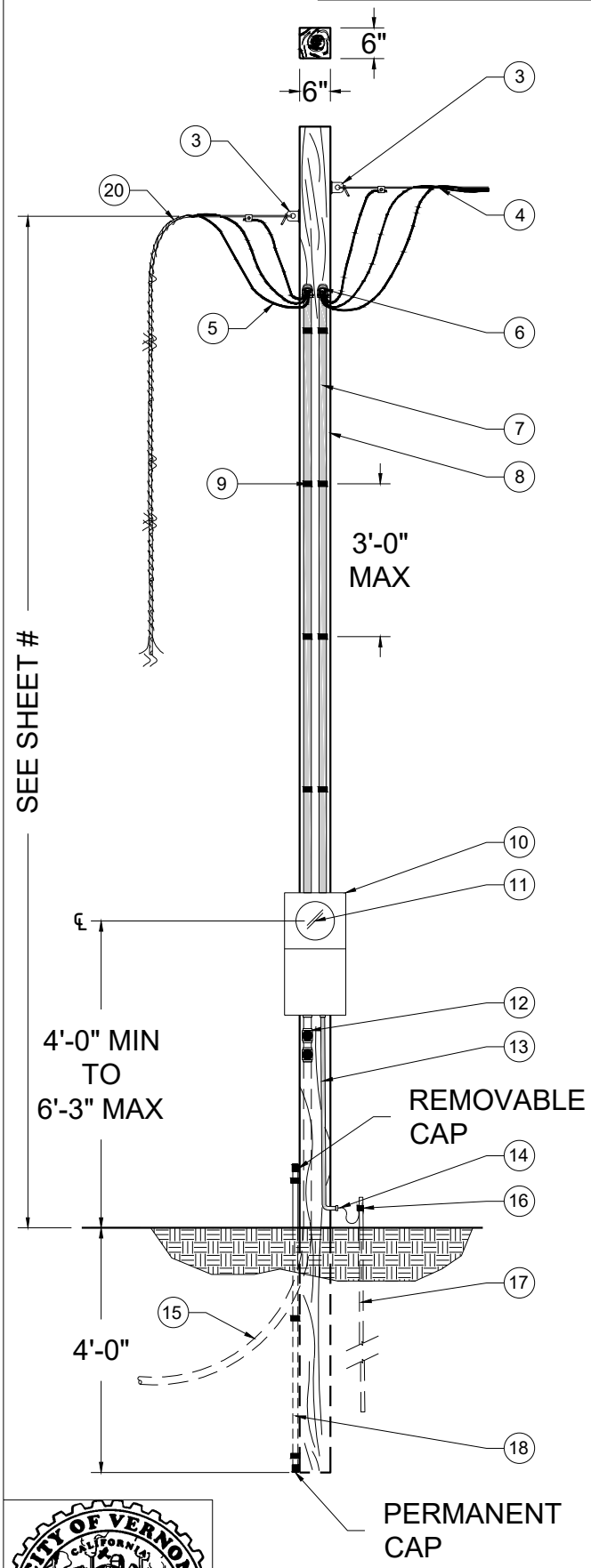
Vernon Public Utilities

4305 Santa Fe Ave, Vernon, CA. 90058

5. **INSTALLATION REQUIREMENTS**

i. For temporary services consult VG&E engineering office for requirements.

TEMPORARY SERVICE REQUIREMENTS (SERVICE FOR ONE YEAR OR LESS)



NOTE(S):

1. THE PREFERRED LOCATION FOR TEMPORARY METERED POWER POLES SHALL BE WHERE THERE IS VG & E VEHICLE ACCESS AND THE SERVICE DROP MAXIMUM SPAN LENGTH IS 100 FEET. IF COMPANY VEHICLE ACCESS CANNOT BE OBTAINED, CONTACT THE LOCAL SERVICE PLANNING OFFICE FOR METER SPOT LOCATION.
2. SERVICE DROP FURNISHED AND INSTALLED BY VG & E. VG & E'S SERVICE DROP MAXIMUM SPAN LENGTH IS 100 FEET.
3. WIRE HOLDER OR RACK FURNISHED AND INSTALLED BY HE CUSTOMER.
4. CUSTOMER'S LINE.
5. NOT LESS THAN 18 INCHES OF WIRE OUTSIDE SERVICE HEAD.
6. WEATHERPROOF SERVICE ENTRANCE CAPS.
7. MINIMUM 3/4"-INCH PVC CONDUIT SCH. 40.
8. SELF SUPPORTING TIMBER 6" X 6" X 20'-0" MINIMUM (BUTT-TREATED).
9. FASTEN CONDUIT SECURELY TO POLE.
10. FOR TYPE OF METER RECEPTACLE, AND THE NUMBER OF SOCKET TERMINALS, CONTACT VG & E SERVICE PLANING OFFICE
11. METER WILL BE FURNISHED AND INSTALLED BY VG & E. SELF-CONTAINED 300/400A (CLASS 320) TYPE METER PANELS ARE NOT ACCEPTABLE FOR TEMPORARY SERVICE. A SAFETY SOCKET BOX WITH FACTORY INSTALLED TEST/BYPASS BLOCKS, SHALL BE PROVIDED FOR ALL THREE-PHASE INSTALLATIONS.
12. WEATHERPROOF BOXES AND RECEPTACLES. 3/
13. ARMORED GROUND WIRE OR MINIMUM OF 1/2-INCH RIGID CONDUIT OR WOOD MOLDING OVER GROUND WIRE.
14. GROUND WIRE TO BE #8 AWG MINIMUM.
15. WHERE CUSTOMER'S FEEDER IS TO BE UNDERGROUND, INSTALL CONDUIT AS INDICATED BY DASHED LINES AND AS REQUIRED BY THE NEC.
16. APPROVED GROUND CLAMP AND FITING MUST BE ACCESSIBLE. CONDUIT MUST EXTEND TO GROUND ROD TO PROTECT GROUND WIRE FROM MECHANICAL INJURY.
17. GROUND WIRE FROM POLE TO ELECTRODE SHALL BE ENCLOSED IN GALVANIZED RIDGED CONDUIT, OR EQUIVALENT MECHANICAL PROTECTION. IF A GROUND ROD IS USED, THE FOLLOWING MINIMUM REQUIREMENTS APPLY:

- DIAMETER OF ROD: $\frac{3}{4}$ INCH, IF IRON ROD OR GALVANIZED PIPE
- $\frac{1}{2}$ INCH, IF SOLID ROD OF BRASS, COPPER, OR COPPER-COMERED STEEL.
- DRIVE TO MINIMUM DEPTH OF 8'-0" BELOW GROUND SURFACE.
- REFER TO THE LOCAL INSPECTION AGENCY FOR ALTERNATE OR ADDITIONAL REQUIREMENTS.

18. A 5' X $\frac{3}{4}$" SCH. 40 PVC CONDUIT WILL BE FURNISHED AND INSTALLED BY THE CUSTOMER. THIS CONDUIT MUST BE PERMANENTLY SECURED WITH THREE PIPE STRAPS TO THE BUTT AND FLUSH TO THE BOTTOM OF THE POLE. THE BOTTOM OF THE CONDUIT MUST BE PERMANENTLY CAPPED AND THE TOP CAP MUST BE REMOVABLE.
19. THE CUSTOMER MUST SET THE SERVICE POLE IN NATURAL SOIL. THE BACKFILL MUST BE TAMPED TO A MINIMUM COMPACTION OF 90 PERCENT WITHIN A 2-FOOT RADIUS OF THE POLE.
20. THE CUSTOMER SHALL FURNISH AND INSTALL A 10-FOOT SERVICE DROP STINGER. THE SERVICE DROP STINGER SHALL BE #4 ALUMINUM TRIPLEX FOR A 100 A SERVICE AND 1/0 ALUMINUM TRIPLEX FOR A 200 A SERVICE.
21. CUSTOMER'S SERVICE POLE SHALL BE 6 FEET OR MORE AWAY FROM ANY WELL.

3/ REFER TO THE LOCAL INSPECTION AGENCY AND THE CALIFORNIA ELECTRICAL SAFETY ORDER FOR GROUND FAULT CIRCUIT PROTECTION REQUIREMENTS.

TEMPORARY SERVICE REQUIREMENTS	APPVD	BY	DATE	REV	DWG.	ESR-V00G-1
	BA	CG	1/19/17	1		

H. CUSTOMER-OWNED GENERATORS

1. INTERCONNECTED GENERATORS

- Interconnected generators encompass any type of customer-owned generator or generating facility that can electrically parallel with, or potentially back feed into, VPU's electric system. Additionally, generators using a closed-transition ("make-before-break") type transfer switch or a multi- breaker transfer scheme, or an electrical inverter that can be configured to operate in a utility interactive mode constitute a potential back feed source into VPU's electric system and are classified as interactive generators. No interconnected generating system shall be switched or operated in parallel with VPUs electric system without the approval of VPU.

- All interconnected generating systems shall be connected on the load side of the customer's meter switch (main service disconnect device).

- VPU has specific Interconnection Requirements that must be complied with for all interconnected generators. These include a visible open disconnect switch to isolate the Customer's system from the VPU's system, as well as protective relaying, metering, special rate schedules, and other safety and information requirements. For additional information,

- Anyone considering installing an interconnected generator should contact VPU for information.

2. EMERGENCY OR STAND-BY GENERATORS

a. Customer-owned emergency or standby generators shall be connected on the load side of the customer's meter switch (main service disconnect device) and shall normally be switched using double-throw switches, or automatic relays and switches, which isolate the load from the VPU's electric system before the customer's generator is connected to the load - this switching arrangement is commonly referred to as open-transition or "break-before-make". When the VPU's electric lines are re-energized, the customer's generator(s) shall be isolated from the load before the load is reconnected to the VPU's electric system.

b. Customers with critical loads that require periodic testing of their emergency or standby generating systems without interruption to their loads may use an automatic transfer switch that is capable of operating in both open and closed transition modes. For these types of transfer switches, if the period of parallel operation is less than one second, the owner must sign a Certificate of Momentary Operation, If the period of parallel operation is greater than one second, the operation is considered an interconnected generating system and the customer shall be required to provide a visible open disconnect switch to isolate the customer's electric system from VPU's electric system. **Customers shall not under any circumstances connect a closed transition transfer switch to VPU's electric system without the express permission of** VPU **or energize an un-energized** VPU **electric line.**

Note: Closed-transition switches and programmable switches that can operate in either the open or closed transition modes shall be automatic rather than manually operated.

c. Switching arrangements that require the customer to manually open the service disconnect switch in addition to operating the transfer switch in order to isolate the customer's load from the VPU's electric system are not acceptable

d. **Portable generators are not designed or intended to be connected to a building's permanent wiring system**, and shall not be connected to any such wiring unless a permanent and approved open-transition transfer switch is used. Failure to use a transfer switch can result in a back feed through VPU -owned transformer and be stepped up to a very high voltage. This can pose a potentially fatal shock hazard to anyone working on or near power lines.

3. **STAND-ALONE GENERATING SYSTEMS**

Stand-alone generating systems shall not be installed or operated without the approval of the VPU

I. TRANSFORMER INSTALLATIONS ON THE CUSTOMER'S PREMISES

1. GENERAL

- VPU reserves the right to supply electric service by means of transformer installations located on the customer's premises when:

  a) The primary voltage of VPU transformer is supplied at 7,200 volts or greater.

  b) The service is supplied at 208Y/120 volts.

  c) The service is supplied at 120/240 volts:

2. Single-phase and the transformer required to serve the load is 167 kVA or greater.

3. Three-phase and the transformer(s) required to serve the load is 300 kVA or greater.

   Note: The Department may require large single-phase services, or services with three-phase load requirements to be supplied from a three-phase, four-wire wye voltage.

   d) The service is supplied at 480Y/277 volts.

   e) Required for VPU's operating convenience or necessity.

- The Department will determine whether the transformer facilities are supplied from the 7,200-volt electric system or the 16,500-volt electric system. Transformer installations will generally be supplied from the 16,500-volt system when the customer's estimated load exceeds 1000 kVA.

- All facilities specified by VPU and installed by the customer must comply with the requirements specified by VPU as well as applicable Federal and State laws, municipal regulations and codes of the City of Vernon, and regulations of other public bodies or agencies having jurisdiction.

- Transformer facilities required by VPU to be located on a customer's premises shall be dedicated to, and serve only, those loads on the premises on which the transformer facility is located. This restriction does not apply to VPU's distribution transformers installed on poles or in underground structures and located on Department easements or right-of-ways on the customer's premises.

2. TRANSFORMER INSTALLATIONS

- The type of transformer installation shall be determined by VPU with consideration being given to the customer's service size, demand load, suitability for the particular application, and VPU's operating needs.

- The following types of transformer installations are generally available from VPU:

  a) **POLE-MOUNTED TRANSFORMER INSTALLATIONS**

3. This installation is available only in areas served from overhead distribution lines and when approved by VPU. The pole or pole rack will be furnished and installed by VPU at the Customer's expens

- The pole or pole rack shall be installed in a location that is agreeable to both VPU and the customer. Poles shall not be located less than 10 feet from any property line, building, building overhang, or other location accessible to human contact unless suitable safe-guards are provided by the customer, and agreed to by VPU, to prevent contact with energized facilities.

- An easement or right-of-way will be furnished by the customer at no cost to VPU.

- Service supply voltages exceeding 600 volts and supplied from poles will normally be served underground.

b) **PADMOUNT TRANSFORMER INSTALLATIONS**

Approved concrete pads or precast slab boxes shall be furnished, installed, and maintained by the customer at the customer's cost. Padmount locations shall comply with VPU requirements, and must be approved by VPU before installation.

- Customers shall furnish and maintain, at the customer's cost, an approved concrete pad of sufficient strength to support transformers and related equipment. The pad shall be lighted, and provided with a fenced enclosure constructed of galvanized chain link, concrete block, or other approved materials.

- Enclosure dimensions, together with provisions for access, drainage, ventilation and lighting if required, as well as other details shall be in accordance with specifications furnished by VPU.

- The Enclosure shall be for the exclusive use of VPU. No part of the enclosure shall be used for the customer's service equipment, storage, or for access to other equipment. Ducts, pipes, or conduits not specified for the installation shall not be installed in or under the fenced enclosure.

c) **STANDARD INSTALLATIONS**

- Standard installations consist of transformers and related facilities that are the most cost effective for VPU. Except where otherwise specified, standard installations are generally pole-mounted or padmounted transformer facilities.

- Pole-mounted transformer installations are not permitted in areas designated by VPU as underground distribution districts.

d) **CHARGES FOR NONSTANDARD INSTALLATIONS**

Where a nonstandard transformer installation is requested by the customer, or is required as a result of the customer's onsite construction or load requirements, the customer shall pay VPU, in advance, the estimated cost of the added facilities exceeding an equivalent standard installation. Consult VPU regarding the current charges for nonstandard installations.

e) **ACCESS AND CLEARANCES**

a. The customer shall provide adequate space, without cost to VPU, for the transformers and other necessary facilities required to provide electric service.

b. Space provisions, as specified by VPU, shall provide for the required clearances between VPU's facilities and adjacent structures and shall include adequate provisions for ingress to and egress from these facilities by Department personnel and access for Department trucks and cranes required for the installation and replacement of these facilities

3. **CUSTOMER STATIONS**

a) **GENERAL**

(1) In transformer installations supplied from VPU's 16,500-volt electric system, or 7,200-volt electric system are classified as Customer Stations.

(2) Customer Stations supplied from the 16,500-volt or 7,200 electric system are termed Industrial Stations (I. S.) Or Commercial Stations (C. S.).

(3) Consult with the VPU engineering Group regarding installation requirements.

(4) The Department will furnish and install:

b) All electrical equipment at, or in, the installation except for equipment which is provided by the customer as specified in VPU's customer requirement drawings.

c) Conductors supplying the primary side of VPU-owned transformers and secondary distribution conductors to supply points.

d) Service supply conductors from VPU-owned transformer, or supply point, to the point of service.

(5) The customer shall furnish and install all facilities specified by VPU on the Customer requirement drawings, including:

e) Cablebus structures from the terminating room or enclosure to the service terminating enclosure when required or approved for use by the customer station design engineer. VPU will furnish and supply the conductors.

f) Busway service (bus duct) from the transformer enclosure to the point of service when approved for use by the customer station design engineer. The bus duct will be owned and maintained by the customer at the customer's cost.

b) **REDESIGNS AND CANCELLATIONS**

(1) The Department will provide the design for customer station installations. Should it become necessary to redesign the customer station facilities for the customer's convenience, the customer will be required to reimburse VPU for the cost of the previous design before a new design will be provided.

(2) Should a customer cancel a project after completion of VPU's design, the customer will be required to reimburse VPU for the cost of the completed design.

c) **INSUFFICIENT LOAD**

The Department will normally energize a customer's service when there is sufficient load to justify installation of VPU's facilities. When a customer requests that the permanent Department facilities be energized without sufficient load, the customer will be charged for the cost of VPU's excess design

d) **SCHEDULED MAINTENANCE/STANDBY GENERATORS**

(1) Customer station installations enclosed (fenced) transformers require periodic outages so that VPU can service and maintain Department-owned equipment, and the customer can service and maintain customer-owned equipment.

(2) Customer outages will generally last six hours or more. However, VPU will make every effort to complete servicing and maintenance of Department facilities in a reasonable time.

(3) When a customer requires the premises to have a continuous electric service, the customer

shall be responsible for providing, at the customer's cost, standby generators or other equipment necessary to continue service while VPU -owned and customer-owned facilities are serviced and maintained. For additional information regarding customer-owned generators.

J. Overhead Service Connection.

Overhead service is not available in underground designated locations. Overhead service will not be supplied to any building or premises in an area designated as underground facilities only by VPU or local jurisdiction. In areas where both overhead and underground service facilities exist, VPU shall be consulted for determination of the type of service which will be supplied.

1. Service Drops General

Upon a sincere application for service, and where the VPU's distribution pole line is located on the customer's premises, or on a street, highway, lane, alley, road, or private easement immediately contiguous thereto, VPU will furnish and install a single span of service drop wires from its pole to the customer's first approved permanent support.

Customer service drop supports shall be of a type and so located that VPU service wires may be installed in accordance with good engineering practice, VPU requirements, and all applicable laws, ordinances, rules, and regulations, including those governing clearances and points of attachment. Proper service drop support locations must be approved and verified by VPU is not responsible for a service drop support location assumed by the contractor or the Customer.

2. Service Drop Termination on the Customer's Structure

The contractor shall provide a suitable landing at the point-of-service delivery adjacent to the service head which will permit the attachment of service drop conductors in a manner acceptable to VPU. This service drop support, together with its supporting building or structure, shall have adequate strength to safely withstand the strain of the service drops. Where an unusually heavy service is involved VPU Service Planning Office shall be consulted with respect to the service drop support. Where the building does not provide sufficient strength to comply with requirements, the contractor shall install an adequate service pole adjacent to the building.

VPU will furnish and install only its standard service knobs, insulators, brackets, or racks. Any special devices or structures when permitted or required shall be furnished and installed by the contractor, conform to all legal requirements, and be acceptable to VPU.

3. Height of Point-of-Service Drop Attachment on the Customer's Structure

The height of the point-of-support or attachment of service drop conductors on the customer's structure shall be adequate to provide vertical clearances between service drop conductors and the ground, structures, roofs, stairways, windows, and so forth, not less. Please see below.

4. Transformers on Pole-Type Structures

In cases where installations of VPU's transformers are on a pole-type structure(s), VPU can erect such structures. Service from this structure(s) will be supplied in accordance with VPU's rules governing overhead or underground service connections and the following requirements:

- For overhead service, locate the pole-type structure(s) no more than 12 feet from the Point-of-service attachment on the customer's building or structure. VPU will designate this location.

  The maximum service capacity from a pole-type structure(s) shall be limited to 500 kVA for each riser on the pole.

MINIMUM VERTICAL CLEARANCE OF SERVICE DROPS-INDUSTRIAL OR COMMERCIAL

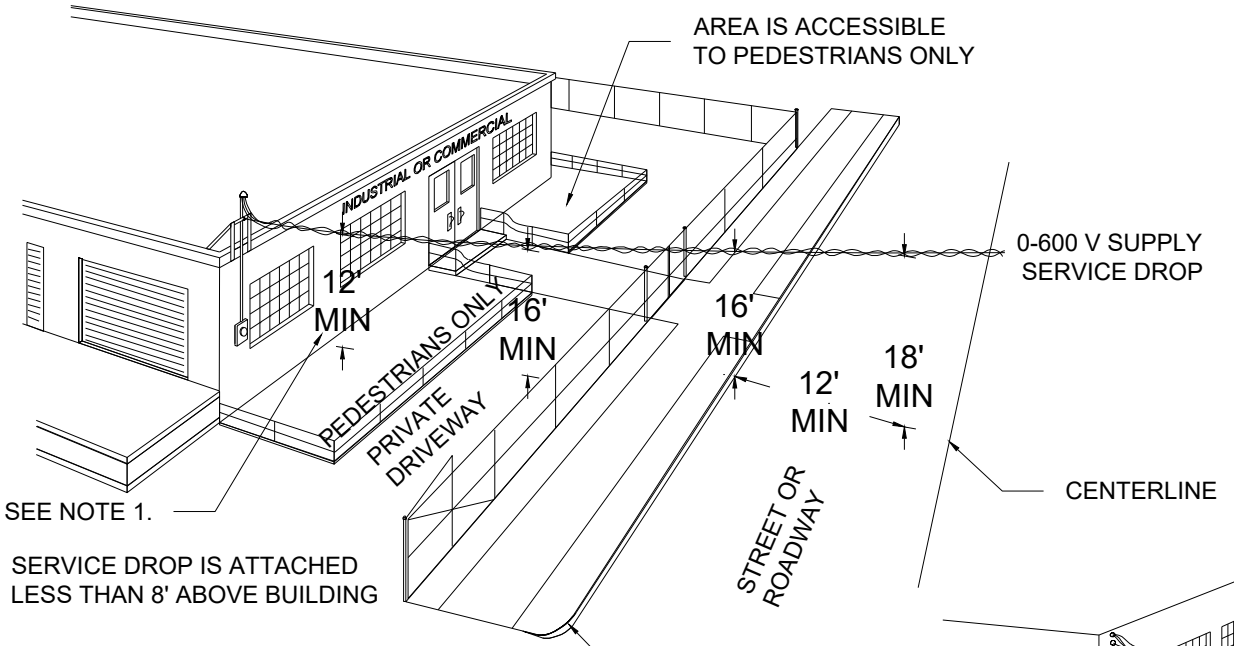


EXHIBIT A

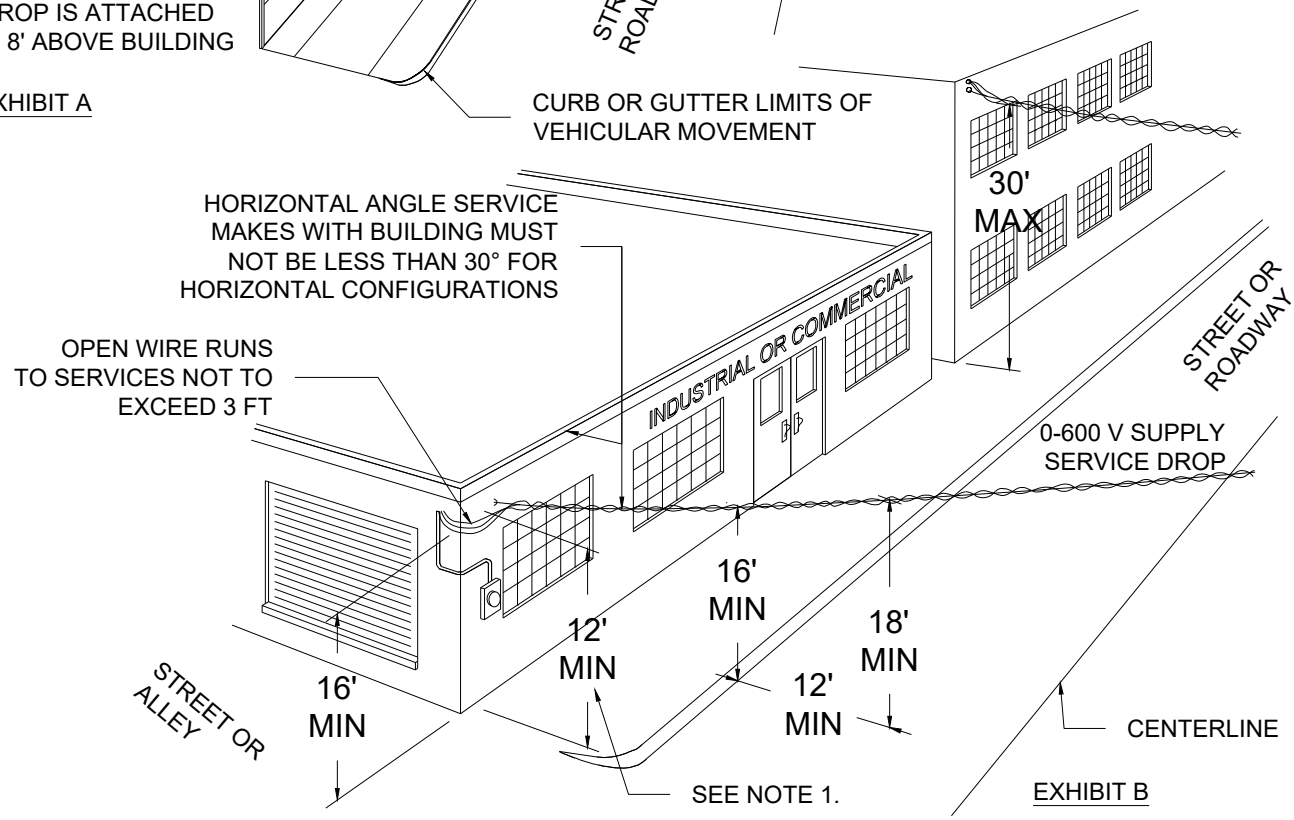


EXHIBIT B

NOTE(S):

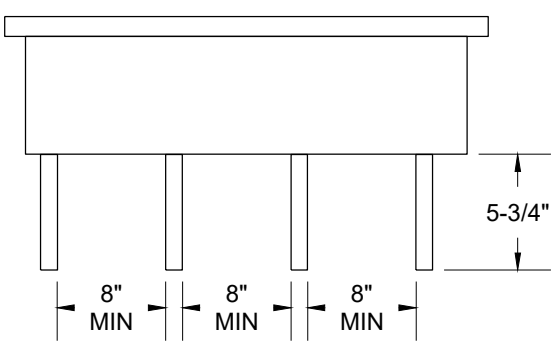
1. SERVICE WIRE CAN BE 10 FEET OVER WALKWAY, IF CONDUCTOR IS INSULATED TRIPLEX. REFER TO (?)
2. CLEARANCE ABOVE STRUCTURES UPON WHICH ANYONE CAN WALK SHALL BE 8-FEET MINIMUM.
3. CLEARANCE OF 0-600 V SERVICE DROPS FROM DOOR, WINDOWS, EXITS, FIRE ESCAPES, AND SO ON SHALL BE AS SHOWN IN FIGURE (?)
4. CLEARANCE OF 0-600 V SERVICE DROPS OVER RAILROAD TRACKS, AREAS CAPABLE OF BEING TRAVERSED BY AGRICULTURAL EQUIPMENT. SEE (TABLE ?)
5. WHERE SERVICE DROPS APPROACH A BUILDING WALL AT AN ANGLE OF LESS THAN 60 DEGREES, THE SPACING OF THE INSULATORS AT THE PONT OF ATTACHMENT IN HORIZONTAL CONFIGURATION SHOULD BE INCREASED SO AS TO PROVIDE AT LEAST SIX INCHES CONDUCTOR SEPARATION. VERTICAL CONFIGURATION IS NORMALLY PREFERABLY WHERE THE ANGLE BETWEEN THE SERVICE DROP AND THE WALL IS LESS THAN 60 DEGREES AND IS ACCEPTABLE FOR ANY ANGLE.
6. SEE FIGURE (?) FOR EXCEPTIONS FOR 0-600 V SERVICE DROPS.

CITY OF VERNON CALIFORNIA FOUNDED 1905 EXCLUSIVELY INDUSTRIAL

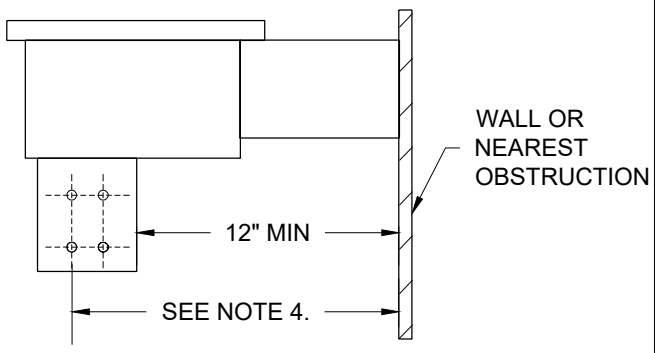
SERVICE DROP VERTICAL CLEARANCES

APPVD	BY	DATE	REV	DWG.	
BA	CG	1/19/17	1		ESR-V0J1-1

BUSWAY SERVICE HEAD REQUIREMENTS FOR 3Ø, 4 WIRE-WYE OR DELTA-600 V MAXIMUM



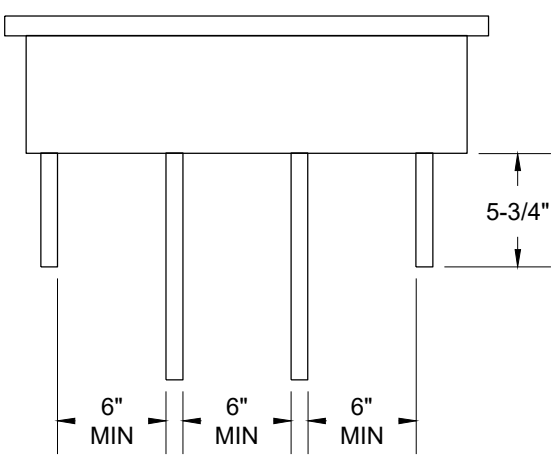
FRONT VIEW



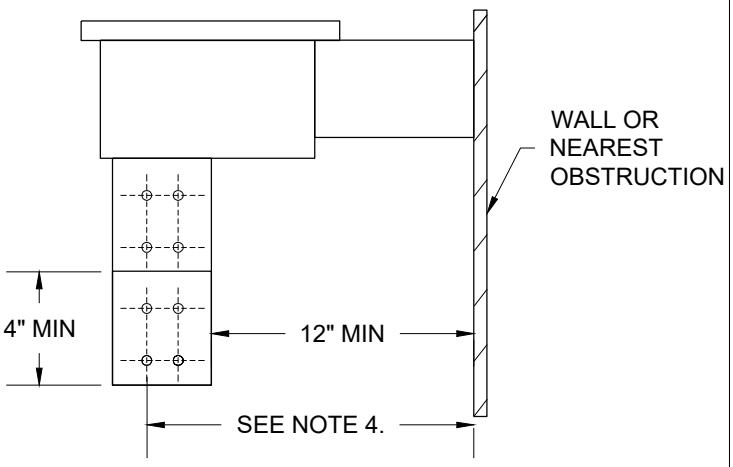
SIDE VIEW

TERMINATING FACILITIES THE SAME LENGTH (4-WIRE SHOWN)

EXHIBIT A



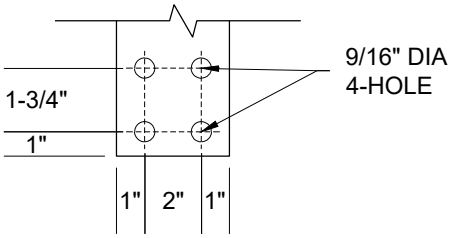
FRONT VIEW



SIDE VIEW

TERMINATING FACILITIES NOT THE SAME LENGTH (4-WIRE SHOWN)

EXHIBIT B



NOTE(S):

1. ONE TERMINAL-LANDING POSITION IS REQUIRED FOR EACH 400 A OF SERVICE AMPACITY (OR PORTION THEREOF). EACH LANDING POSITION SHALL CONSIST OF TWO 9/16-INCH HOLES SPACED ON 1-3/4-INCH VERTICAL CENTERS. WHEN MULTIPLE LANDING POSITIONS ARE REQUIRED, THE HORIZONTAL SPACING BETWEEN LANDING POSITIONS SHALL BE PERMANENTLY MARKED BY THE MANUFACTURER.
2. NEUTRAL TERMINAL SHALL BE PERMANENTLY MARKED BY THE MANUFACTURER.
3. FOR 120/24 V, THREE-PHASE, 4-WIRE SERVICES, THE POWER LEG (C PHASE) TERMINAL SHALL BE PERMANENTLY MARKED IN AN ORANGE COLOR BY THE MANUFACTURER.
4. THE MAXIMUM DIMENSION FROM THE BUILDING OR NEAREST OBSTRUCTION TO THE OUTERMOST LANDING POSITION SHALL NOT EXCEED 25 INCHES UNLESS APPROVED BY VPU.
5. SERVICE HEADS WITH ENCLOSED TERMINATING POSITIONS ARE NOT PERMITTED.
6. THE CLEARANCES INDICATED BETWEEN PHASES IS FOR SINGLE-CABLE LUG-MOUNTING ONLY, NOT MULTIPLE-CABLE STACKING LUGS.

CITY OF VERNON CALIFORNIA FOUNDED 1905 EXCLUSIVELY INDUSTRIAL

BUSWAY SERVICE HEAD REQUIREMENTS

APPVD	BY	DATE	REV	DWG.	ESR-V0J2-1
BA	CG	1/19/17	1		

K. Underground Service Connections

Overhead service will not be supplied to any building or premises in an area designated as an underground location. VPU shall be consulted for determination of the type of service that will be supplied.

1. **Service Capacity (0–600 V)**
   Normally, for a given voltage or phase, only one set of service conductors with one meter switch which carries a customer's entire load will be permitted to a single occupancy. In all cases, VPU shall be consulted relative to available voltage and method of service delivery prior to making the service installation. The maximum main switch capacity allowed for 120/208 V, 240 V, or 277/480 V three-phase is 4,000 A of connected load.
   When capacities exceeding 4,000 A are required, two or more services may be installed with totalized metering.

2. **Service Capacity (600 V and above)**
   Consult VPU Engineering Office with respect to special requirements prior to planning any high-voltage service installations.
   A set of service cables may consist of a single run or more than one operating in parallel, with each run in a separate conduit. The maximum demand load which will be supplied by a single run is 400 A.

3. **Service Specifications**
   VPU approval is required for specifications of installations involving any underground structures, service conduits and pull boxes. Such specification must comply with all applicable codes, laws, ordinances, and similar regulations.
   VPU approval is required in advance of construction for the locations and types of structures installed for VPU use.
   In certain cases, VPU inspection will be required during construction. Consult the VPU Engineering & Service Planning Offices to ascertain if inspection is required. Notice must be given 48 hours prior to construction to obtain this inspection. These inspections may not negate requirements of the public works department for inspection of the facilities being installed.
   All installations on the customer's premises are made by the customer. Installations of service conduit and its appurtenant structures for service from an overhead line source, both on and off the customer's premises, are made by the customer,
   All grounding materials shall be furnished and installed by the customer. Contact VPU for requirements on specific installations.

4. **Easements**
   Where VPU installs transformers and related service equipment on the Applicant's premises, the Applicant shall furnish, as required, without cost to VPU, an easement providing adequate space for VPU's lines and transformer and equipment installation, together with their necessary appurtenances. Easements and space provisions shall be such that required clearances will be maintained between VPU's facilities and adjacent structures. This shall include adequate provisions for ingress and egress from these facilities by VPU employees. The Applicant shall provide truck access, or other approved means for the installation and replacement of such facilities. Any room or enclosure provided by the Applicant shall conform with all applicable laws, ordinances, or requirements of Public works department, and shall meet with the approval of VPU.

VPU's standard installations for VPU's transformers and related equipment located on the Applicant's premises or private property, are:

- Outdoor Pad or Slab Box
- An approved outdoor-walled or fenced-enclosure
- Pole-type structure
- Single VPU-Owned Customer Substation.

5. **Permits**

Where the public works department requires the issuance of a permit for an underground service installation on the premises of the customer or on other private property, the customer shall obtain such permit(s). In cases where the service is supplied from an overhead source and any part of the installation is located on a public way, the customer will normally obtain any required permit(s).

6. **Underground Service from an Overhead Source**

Any customer desiring the service conductors underground for low- or high-voltage (0–16,500 V), including conductors supplying transformers, shall furnish, install, and maintain at their expense, conduit systems & structures. VPU will determine the size of structures, the number of conduits and number of runs to be installed in each case.

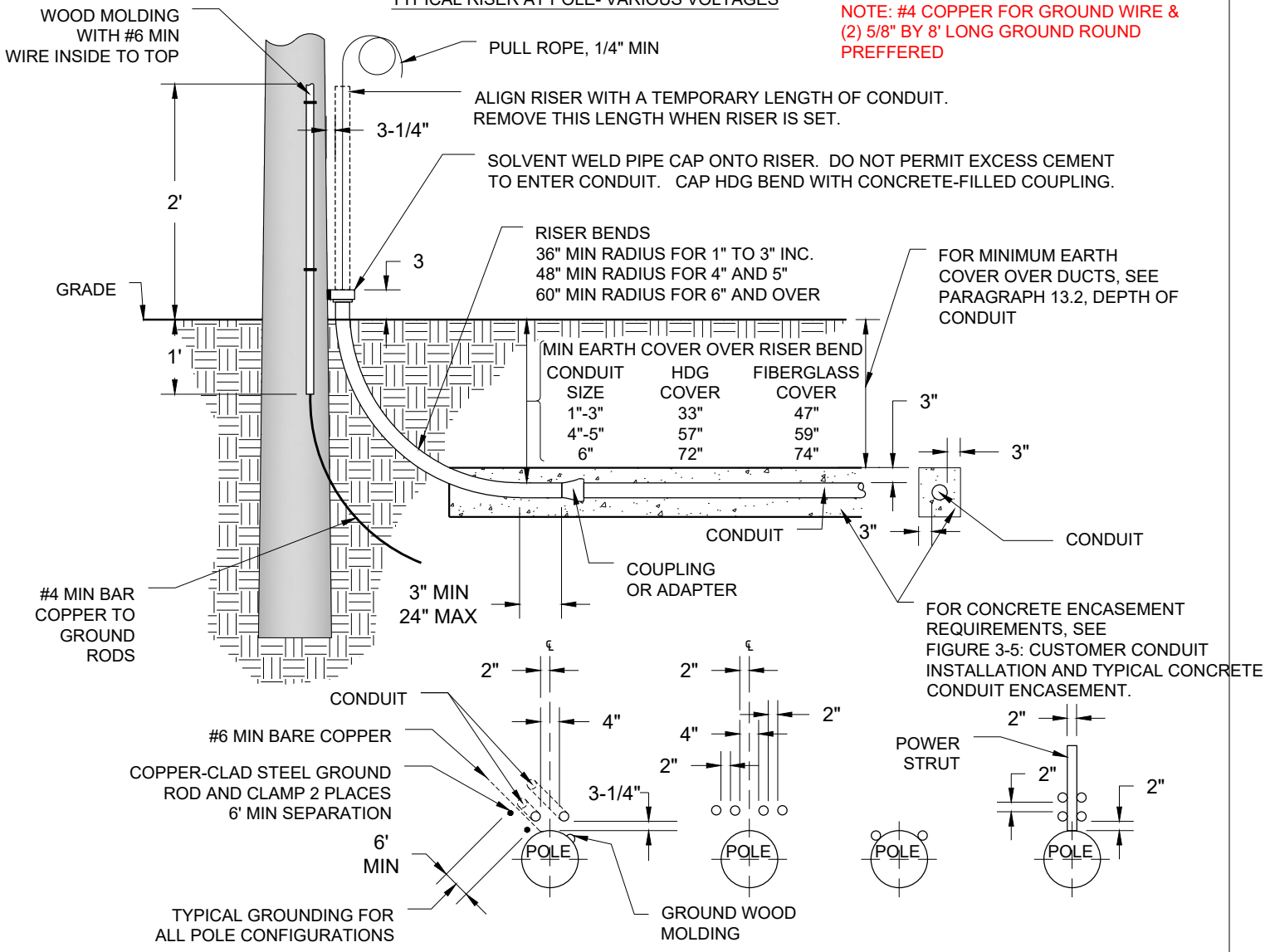
a) Pole Riser Conduits

Pole-riser conduit(s) and necessary miscellaneous material and fittings shall be furnished and installed on the pole as follows:

- VPU will furnish all materials and charge the customer the labor cost. VPU will erect, own, and maintain this material on the pole at its expense.
  See Figure below of these requirements for minimum conduit size, application, and installation practices.

TYPICAL RISER AT POLE- VARIOUS VOLTAGES

NOTE: #4 COPPER FOR GROUND WIRE & (2) 5/8" BY 8' LONG GROUND ROUND PREFFERED



RISER CONDUIT SPACING DIAGRAM (AT BASE OF POLE)

NOTE(S):

1. APPROVED RISER BEND MATERIALS AND SIZES ARE SHOWN IN TABLE 3-2.

TABLE 3-2: APPROVED RISER BEND MATERIALS AND SIZES

MATERIAL*	**SIZE(in)**							
	1	**1-1/2**	**2**	**2-1/2**	**3**	**4**	**5**	**6**
FIBERGLASS	NA	NA	NA	NA	3	3	4	4
HDG	3	3	3	3	3	3	4	4

NA = NOT APPROVED
3 = APPROVED

*SCHEDULE 80 PVC BENDS MAY BE SUBSTITUTED FOR FIBERGLASS BENDS FOR STRAIGHT RUNS OF 150 FEET OR LESS IN CONDUIT SIZES FOUR INCHES AND UNDER.

2. VPU SHALL DESIGNATE POLE AND QUADRANT LOCATIONS OF RISER CONDUITS.
3. SCHEDULE 80 PVC SHALL BE 2-1/2 INCHES MINIMUM DIAMETER EXTENDING TO 8 FEET ABOVE GROUND LEVEL. ABOVE EIGHT FOOT, SCHEDULE 40 PVC WITH TWO INCHES MINIMUM DIAMETER MAY BE USED. PVC SHALL NOT BE PLACED IN THE CLIMBING SPACE. WHEN HDG IS USED, IT SHALL BE GROUNDED UNLESS TEN FEET OR MORE IS BURIED IN THE GROUND. ALL GROUNDING MATERIALS SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. CONSULT THE LOCAL SERVICE PLANNING OFFICE FOR DETAILS.
4. PRIOR TO BACKFILLING, CONTACT THE LOCAL SERVICE PLANNING OFFICE 48 HOURS PRIOR TO BACKFILLING FOR AN INSPECTION.

TYPICAL RISER AT POLE	APPVD	BY	DATE	REV	DWG.	ESR-V00K-1
	BA	CG	1/19/17	1		

Note(s):

1. Approved riser bend materials and sizes are shown in the Table below.

Approved Riser Bend Materials and Sizes

Material[a/]	Size							
	1	**1-1/2**	**2**	**2-1/2**	**3**	**4**	**5**	**6**
Fiberglass	NA	NA	NA	NA	3	3	3	3
HDG	3	3	3	3	3	3	3	3
NA = Not Approved								

Schedule 80 PVC bends may be substituted for fiberglass bends for straight runs of 150 feet or less in conduit sizes four inches and under.

2. VPU shall designate pole and quadrant locations of riser conduits.
3. Schedule 80 PVC shall be 2-1/2 inches minimum diameter extending to 8 feet above ground level. Above eight foot, Schedule 40 PVC with two inches minimum diameter may be used. PVC shall not be placed in the climbing space. When HDG is used, it shall be grounded unless ten feet or more is buried in the ground. All grounding materials shall be furnished and installed by the contractor. Consult the local Service Planning Office for details.
4. Prior to backfilling, contact the local Service Planning Office 48 hours prior to backfilling for an inspection.

b) Service Termination Facilities

The customer shall furnish, install, and maintain at their expense, facilities for the termination of the service conduit at the load end, All material and equipment required to be furnished and installed by the customer, under the terms of this paragraph, shall comply with the detailed requirements hereinafter specified and shall permanently be maintained in good order by the customer.

c) Service Conductors

In all cases, VPU will determine the size, type, and number of runs of service conductors from VPU lines to the terminating enclosure.

VPU will furnish and install the service conductors together with terminations on the pole and any necessary miscellaneous materials required.

All service conductors, terminations, and miscellaneous material installed by VPU will be owned and maintained by VPU after their installation.

7. **Location of Point of Service**

The location of each point-of-service delivery must be approved by VPU in advance of construction. The following requirements will apply:

- Low-Voltage Service (0–600 V)

Where the VPU installs underground service cable from its overhead or underground system to a point-of-service delivery on or in a building or structure, the point-of-service delivery shall be at or immediately adjacent to the building wall nearest and facing

(1) The point at which the service conduit enters the premises or

(2) The pole from which the service originates; and shall be as near as practicable to the corner of such wall which is accessible with a minimum length of service conduit.

The Switchboard & the terminating location shall be approved by VPU.

- Service (above 600 V)

VPU will install the service cable for all high-voltage services in accordance with the applicable provisions of its rules.

All points-of-service delivery shall be in a location approved by VPU either inside or outside of a building.

The service terminating enclosures shall be located in accordance with the detailed requirements for such locations.

Services above 600 V will be treated individually as special cases. Consult the Engineering & Service Planning Offices for details.

8. **Terminating Enclosures / Service Entrance Panels**

Every service-terminating enclosure shall be in a permanently accessible location which is acceptable to the VPU.

Whenever a terminating enclosure is within a single-occupancy building and such building is divided into a multiple occupancy, all sets of service-entrance conductors shall be brought to a single-terminating enclosure located as required for multiple-occupancy buildings.

a) Type Required for Service (0–600 V)

A terminating enclosure shall be provided for all underground services. Terminating

enclosures shall be subway-type as shown in Table below,

Table 3–5: Minimum Pull Box Dimensions

Service Ampacity (Amps)	W (See Note 5.)		Y Depth (in)	X Height (in)
	3-Wire (in)	4-Wire (in)		
201–400	10-1/2	14	6	22
401–800	16-1/2	22	11	26
801–1,200	22-1/2	30	11	26

Note(s):

1. The above dimensions are for the case where the conduit enters the bottom of the pull box and all load conductors exit above the terminals. Where the service conduit enters from the side or back of the pull box, the "X" dimensions shall be taken from the closest portion of the conduit to the nearest termination bolt.
2. Pull box covers shall be removable, sealable, provided with two lifting handles, and limited to a maximum size of nine-square feet in area.
3. Clear working space shall be maintained. Return flanges shall not intrude into the shaded space.
4. The "W" dimension is the minimum width of the pull box access opening.
5. Consult the local Service Planning Office for conduit requirements.
6. Terminating facilities shall be secured to prevent bus turning or misalignment when the cables are installed.

Where required, terminating lugs for Company service cables will be furnished and installed by VPU.

b) Type Required for Service (above 600 V)

All services above 600 V require special terminating enclosures. Contact the Engineering Office for additional information.

c) Multi-Meter Gear

Each meter installed in multi-meter gear shall be labeled with a permanent placard. The placard shall have the address assigned to each meter by customer service and public works.

e) Switchboard Pull Sections

Switchboard pull sections shall be located on or recessed in an exterior wall of the building served, facing outward. The enclosure shall be permanently accessible without entering the building, shall not project into any driveway, walk, or public way and shall have access and working space in compliance with VPU REQUIREMENTS. The bottom of the wall-mounted enclosures shall not be less than 6 inches nor more than 5 feet above the standing and working surface.

Switchboard pull sections may be installed inside a commercial or industrial occupancy at grade floor level. All such installations shall comply with access and working space requirements and shall meet with the approval of VPU.

The service conduit runs directly to the terminating enclosure, either in a straight line or in a bend of not less than a three-foot radius, and enters the enclosure at right angles to the top, back, or bottom.

There is permanent, unobstructed, 24-hour access for all equipment and material that may be required by the VPU for future maintenance, repair, or upgrading of the service.

Switchboard pull sections may be incorporated in outdoor switchgear in a location approved by VPU. The pull section shall not project into any public way and shall be located to provide clear access and working space.

Existing underground terminating pull box or switchboard pull section ampacity rating shall be equal to or greater than the ampacity rating of the total main switch capacity for which it is serving. Adding services exceeding the ampacity rating of a terminating pull box or switchboard pull section is not acceptable.

f) Access to and Working Space in Front of Termination Enclosures

All terminating enclosures shall be provided 24-hour accessibility for installation and maintenance of VPU's facilities. Access must be through walking space affording not less than seven feet in height and three feet in width and be acceptable to VPU.

A permanent, level standing-and-working surface shall be provided. It shall be clear and unobstructed, at least equal to the width and height of the terminating enclosure space and extending not less than three feet in front of all terminating enclosures and their housings. In no case shall the height of the clear space be less than 6'-6". The width shall not be less than three feet. Consult Engineering or Planning Office for details. Greater clearances are required for high-voltage installations.

9. Electric Meter Rooms

An electric meter room is an illuminated room, located inside a building provided by the customer and approved by VPU as to the location of the electric service and metering equipment. The electric meter room may be used by the customer at their option, rather than placing metering equipment on the exterior of the building. A chain-link fence is not acceptable as a separating room wall. Electrical rooms shall not be used for storage. The following provisions shall apply:

a) Access

Access shall be through a door on the building exterior opening directly into the electric meter room that provides 24-hour access. This door should swing out of the room whenever possible. If the door swings into the room, it is to be located so it does not open into any service equipment or working space(s). When metering equipment is installed in a locked room, a lock-box (provided by VPU) shall be permanently secured to the outer surface of the access door or immediately adjacent to the room in a permanently accessible location. The customer shall provide a key for the meter room prior to delivery of service. This key is to be housed inside the lock-box for utility access. The exterior door shall not be alarmed.

When meter access problems result due to metering equipment being improperly located and VPU had not approved the location, the customer, at their expense, will be responsible for all modifications.

If, at any time, VPU determines a meter access problem exists, or may exist (for example, fences, building additions, shrubbery, dogs, hazardous materials, and so forth) the customer, at their expense, shall relocate the metering facilities to a new location acceptable to VPU. For single-family dwellings only, an acceptable remote meter reading device may be installed. Installation of this device(s) will be made by VPU. This option is available for 100 A and 200 A residential services only.

Due to different characteristics of a building design, VPU could restrict meter location options. An order of preference shall be used to evaluate and approve meter/metering equipment access. This order of preference is to provide direction for Planners and Design Service Representatives in determining meter/metering equipment location.

(1) Metering facilities and related service equipment are preferred to be located on the exterior of buildings and or structures to provide immediate access.

If exterior locations become unavailable, then customers may install metering facilities inside a meter closet recessed within the exterior structure wall and accessible from the exterior.

(2) The customer may install metering facilities inside a building or structure within an

approved meter room. This meter room and location must be approved by VPU in advance of construction. The customer shall provide an access door on the building exterior which allows access directly into the meter room. VPU-provided lockbox will be provided to allow Company access directly into the meter room.

(3) If an access door directly into the meter room is not provided, then immediate and non-hazardous access to the meter room shall be required through entrances and areas used during normal business hours. In addition, an exterior door in close proximity to the meter room location shall also be required for installation, replacement, and maintenance of utility service entrance cables and equipment. A local telephone number shall also be readily posted for emergency access during non-business hours to electrical service equipment located within a meter room without direct exterior door access.

In certain cases, the customer may be required by the NEC to provide two entrances into a meter room. This is a code issue between the customer and the local authority having jurisdiction.

b) Doors

The entrance to an electric meter room shall be through a vertical doorway (roll-up doors are not acceptable), not less than three feet wide and 6'-6" high. The door should open out and have a door-stop mechanism to keep the door from closing, and should use Lever-operated hardware, if the room contains service equipment rated at 1200 amps or larger. Lever-operated hardware is a type that permits the door to be opened from inside the room without the use of hands. Exterior doors shall not be alarmed.

c) Foreign Equipment

The following equipment is not allowed in an electric meter room. Such equipment includes but is not limited to:

i. Gas equipment, including piping
ii. Water heaters/boilers, including any piping under pressure
iii. Storage of any materials, liquids, and so forth
iv. Fire and security alarms, including alarm systems connected to the access door that will operate when entry is made to the electric meter room
v. Dry or wet-filled batteries and battery charging equipment
vi. Irrigation and sprinkler controllers
vii. Standby emergency and generators

Exceptions

Sprinkler supply piping and heads[3], when required in an electric meter room by the local fire department or building official, are acceptable. Requirements for placement and shielding of sprinkler heads will be determined by the Public Works Department.

Pipes not under pressure may be allowed in the meter room, but may not extend from the floor to the structural ceiling that is above the electrical equipment.

L. Pad-Mounted Transformer Locations

1. General Information

VPU requires transformers and related service equipment installations on the Applicant's premises when, VPU determines such installations are necessary. The Applicant shall provide the required space on their premises at the location approved by VPU for transformers, switches, capacitors, and electric protective equipment when required. The Applicant shall consult with the local Service Planning Office to determine the proposed transformer installation method.

In cases where VPU plans to install transformers and related equipment on the customer's premises, VPU may require the Applicant to furnish, without cost to VPU, an easement providing adequate space for VPU's lines and equipment installation.

Easement and space provisions shall maintain the required clearances between VPU's facilities and adjacent structures. This shall include adequate provision for ingress to and egress from these facilities by company employees, and shall provide truck access or other approved means for the installation, maintenance, and replacement of such facilities. Any room or enclosure provided by the customer shall comply with all applicable laws of the State of California, and approved by VPU shall approve the installation with consideration being given to the customer's demand load, suitability for the particular application, and VPU's operating and maintenance requirements. The capacity of the transformer installation shall be determined by VPU.

2. Pad-Mounted Transformers and Related Service Equipment

Where using pad-mounted equipment, installations shall be made in accordance with applicable VPU rules, procedures and requirements, including state ordinances.

The Applicant shall furnish and install VPU approved pads or slab boxes at the Applicant's expense. Consult the VPU Service office for structure specifications and installation requirements.

VPU shall specify locations for the pads and slab boxes. General locations for these structures.

Pad-Mounted Transformers Installations Shall Conform to the Following:

A. Pad-mounted transformers shall not be located directly in front of doors, stairways, beneath windows that can be opened, or where they will obstruct the vision of vehicular traffic.

B. Pad-mounted transformers shall be located at least the minimum distance, as identified in the figure below, away from buildings or other structures to ensure adequate space for operating, to minimize vibration hums, and to meet fire safety requirements. Whenever possible, place pad-mounted structures and equipment away from areas with frequent irrigation to help prevent future corrosion.

C. A clear passageway of 12-feet minimum shall be available at all times, immediately adjacent to one side of the transformer to provide an accessible roadway for transformer maintenance. This passageway shall be designed to meet H-20 (20-ton) Construction.

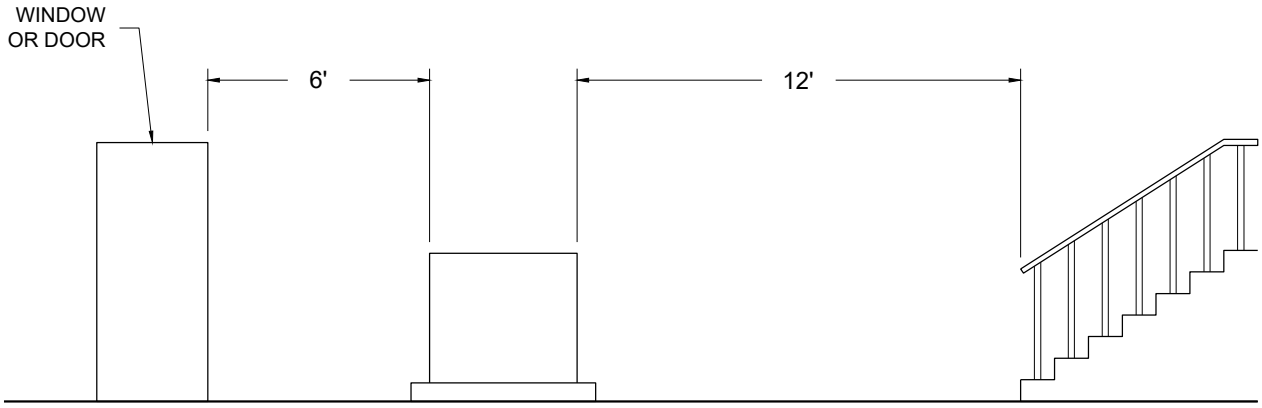
D. If VPU has installed or agrees to install, transformers at locations where VPU cannot use its standard transformer lifting equipment and special lifting facilities are required to install or remove the transformers on the customer's premises, the customer shall, at their

expense, (a) furnish, install, own, and maintain permanent lifting facilities and be responsible for lifting the transformer to and from its permanent position, or (b) provide (or pay for) portable lifting facilities acceptable to VPU for installing or removing the transformers. Rights-of-way and space provisions shall be provided by Applicant such that access and required clearances from adjacent structures can be maintained.

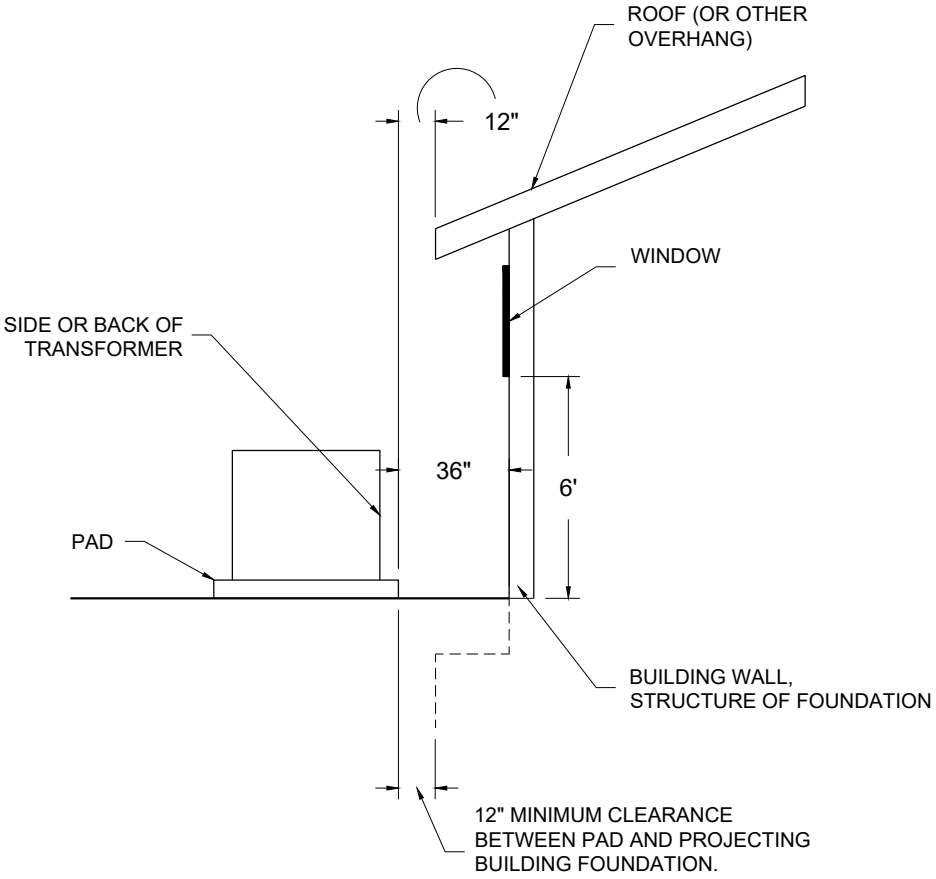
Pad-Mounted Transformers — General Locations

General Requirements for Placement of Pads and Slab Boxes
1. A clearance of at least eight feet must be maintained on the door side of any pad-mounted transformer or switch for operating purposes. This clearance shall be measured from the edge of pad or back of access opening.
2. A clearance of at least three feet must be maintained on the non-door side of any pad-mounted transformer or switch. This clearance shall be measured from the edge of the pad.
3. A horizontal clearance of 12 inches must be maintained from the edge of the pad or slab box to projections of the building foundation or other building projections.
4. Transformers cannot be placed directly in front of or beneath windows that can be opened, doors, or stairways.
5. Transformers will not be exposed to damage from vehicular traffic. Where exposed to such damage, protective barriers will be required. See barrier details.
6. For multiple pad-mounted equipment installations, a clearance of at least three feet must be maintained between units to allow air ventilation/circulation.
7. Whenever possible, place pad-mounted structures and equipment away from areas with frequent irrigation to help prevent future corrosion.

PAD-MOUNTED TRANSFORMER LOCATIONS



NOTE:
AN 8' MINIMUM CLEARANCE IS REQUIRED ON THE DOOR SIDE OF TRANSFORMER FOR OPERATION. THE 8' CLEARANCE SHALL BE MEASURED FROM THE EDGE OF PAD OR BACK OF ACCESS.



NOTE:
FOR 3000 A SERVICE OR MORE VPU REQUIRE 6' FROM THE TRANSFORMER PAD TO WALL

	APPVD	BY	DATE	REV	DWG.	
PAD–MOUNTED TRANSFORMER LOCATIONS	*BA*	CG	1/19/17	1		ESR-V00L-1

3-New and Existing Pad-Mounted Transformer Structures

Structure (W x L x D)	MAX Size (kVA)	MAX Cable Runs	Phase		MAX Cable Size	Splice	MAX Junction Bar	
			Single	Three		"T"	3W	4W
4'-6" x 7' Pad with 3' x 5' Pull Box	25 (for 33 kV CPT Only)	2	Yes	No	4/0 CLP (primary), #8 AWG (service / secondary)	No	No	No
48" x 54" Pad (Concrete or RPM)	100	3—Primary, 4—Secondary	Yes	No	1/0 CLP (primary), 350 kcmil (service / secondary)	No	No	No
94" x 72" Pad (Concrete)	500	2—Primary, 4—Secondary	No	Yes	1/0 CLP (primary), 700 kcmil (service / secondary)	No	No	No
6' x 8'-6" Slab Box	500	3—Primary	No	Yes	1/0 CLP (primary), 700 kcmil (service / secondary)	Yes	Yes	No
8' x 10' x 6' Slab Box	1,000	3—Primary	No	Yes	1/0 CLP (primary) 700 kcmil (service / secondary)	Yes	Yes	No
10' x 12 ' Pad with 5' x 8'-6" x 5' Box (Slab Box)	3,750	3—Primary	No	Yes	350 kcmil (primary), 700 kcmil service	Yes	Yes	No
Poured-in-Place Pad	3,750	3—Primary	Yes	Yes	350 kcmil (primary), 700 kcmil service	No	No	No
60" x 72" x 22" Bart Pad w/Box	500	2—Primary	Yes	Yes	1/0 CLP (primary), 350 kcmil (service / secondary)	No	No	No
72" x 114" x 22" Bart Pad w/Box	1,500	2—Primary	Yes	Yes	1/0 CLP (primary), 700 kcmil (service / secondary)	No	No	No
72" x 114" x 30" Bart Pad w/Box	2,500	2—Primary	Yes	Yes	1/0 CLP (primary), 700 kcmil (service / secondary)	No	No	No

Notes:

1. A pad should be used with four or less secondary/service conduits. Six conduits may be installed to a pad if the Cable is 350 kcmil or smaller, or if it is unlikely that all six conduits will ever be used, and up to two additional #8 Streetlight runs may be added.

2. A slab box is normally required for more than four secondary/service conduits except as noted in Note 1.

3. When using a slab box with 3Ø transformers up to 1,000 kVA where 6–4" conduits will leave the structure through a single corner, specify a 12" grade ring to ensure 30" of cover over the conduits. For conduit placement.

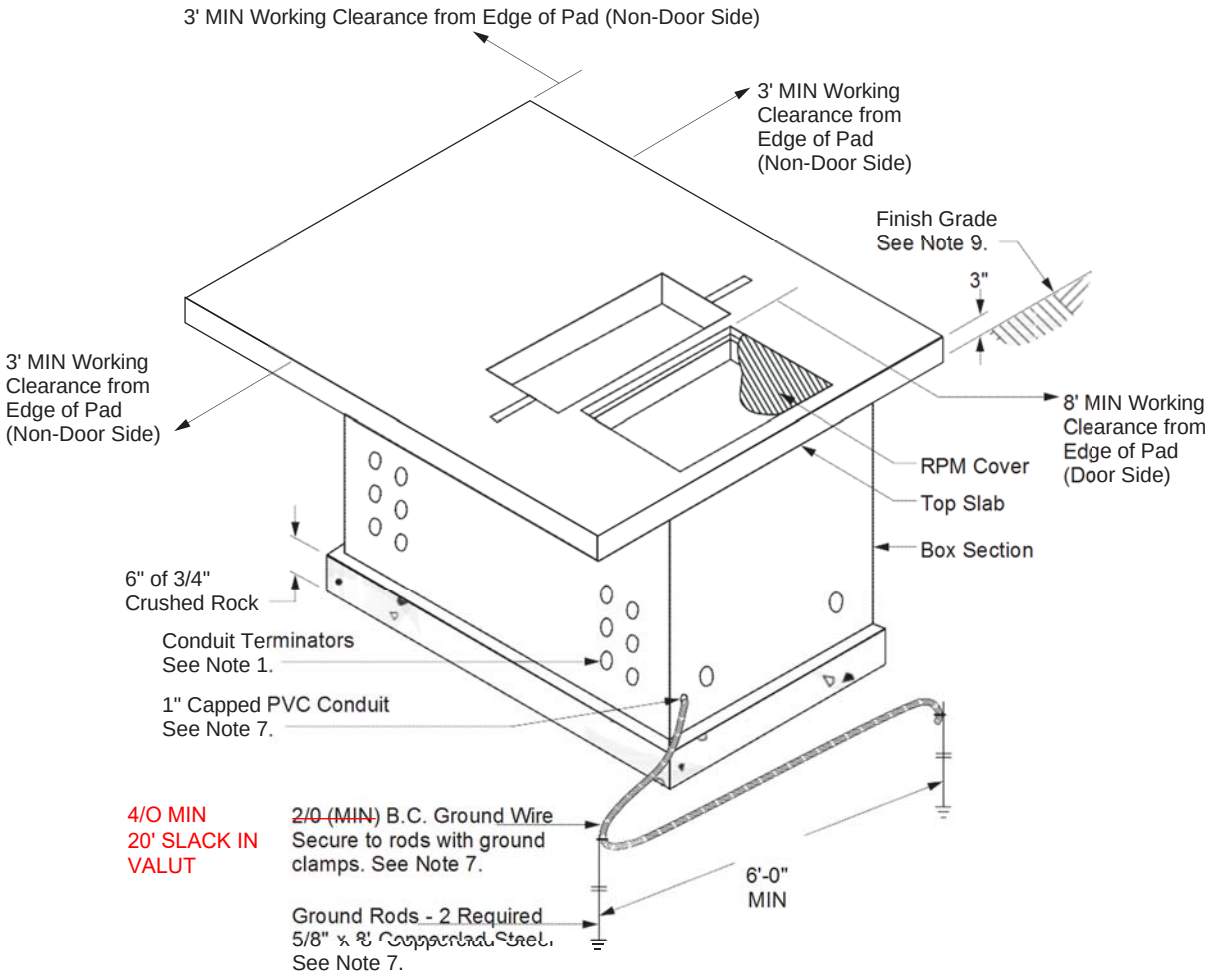
4. When replacing a standard pad-mounted with a minipad-mounted transformer, a 17" x 30" x 15" inverted handhole shall be installed under the cable opening in the pad.

5. Applications requiring a cable trench will require a special order 10' x 12' slab box w/24" x 30" window. Specify which corner is to receive the window at the time of ordering.

6. The single phase, 25 kVA (33 kV) control power transformer shall not be used for residential, commercial, or Street lighting loads, and is dedicated or limited only to provide control power for underground automated Equipment.

7. A single 600 A T-Body Splice is designed to perform the task of two in-line stacked 600 A Separable Connectors (T-Bodies).

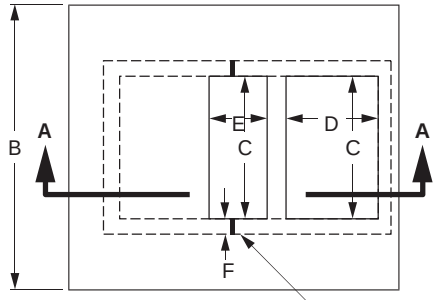
10' x 12' Precast Slab Box for 3Ø Pad-Mounted Transformers up to 3,750 kVA



Note(s):

1. Standard conduit entrance will be a flat wall design. Slight variations by manufacturers may be allowed with Company approval.
2. When cable trench openings are required in a slab box, they can be special ordered from the concrete precaster.
3. Consult manufacturers' installation guides for excavation dimensions.
4. An 8' minimum clearance is required on door side of transformer for operation.
5. Ground rods, clamps, and wire will be furnished by contractor. See approved grounding materials. Ground wire to be a minimum of 2/0 bare copper. Ground wire to be placed through capped one-inch PVC conduit at either end of slab box. A minimum three-foot length of ground wire will be placed in slab box.
6. Mastic sealant is required at joints.
7. Top surface of slab box will be set three inches above finished grade.

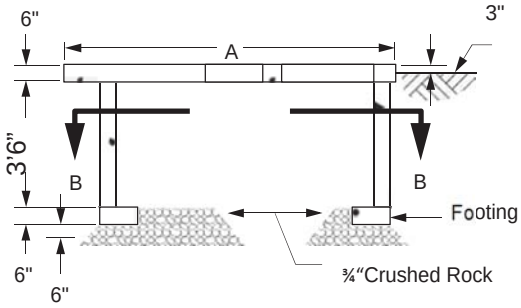
6' x 8'-6" and 8' x 10' Slab Box for Pad-Mounted Transformer



Plan

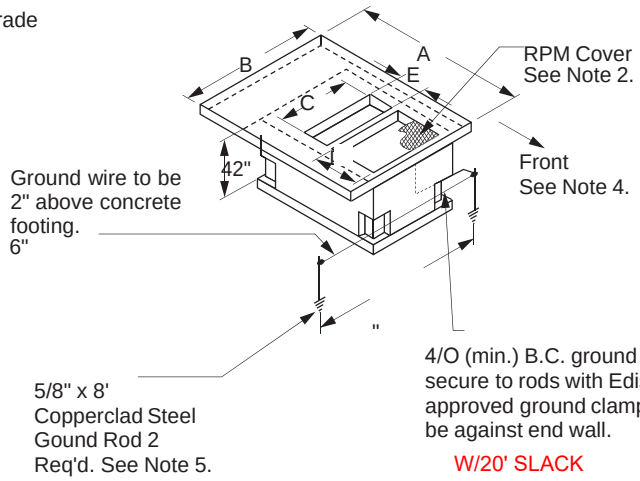
Unistrut (P3200 Series) or Equal (2 Places)

Slab-Box Descriptions	Slab-Box Dimensions (Inch)					
	A	B	C	D	E	F
6' x 8'-6"	102	72	48	30	18	11
8' x 10'	120	96	48	30	18	18

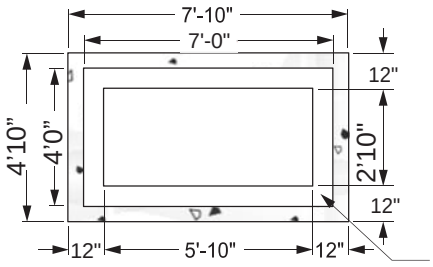


Section A-A

Finish Grade



Detail
(Ground Rod Installation)



Section B-B

Footing required on
6' x 8'-6" and 8' x 10'
Slab boxes

Note(s):

1. Pad overhang to rest on undisturbed earth or well-compacted backfill to prevent future subsidence.
2. The slab 30" x 48" clear opening will be covered with a 2-1/2" x 4' RPM cover. Six1/2" stainless steel bolts with stainless steel captive washers will be supplied for cover bolt down.
3. Slab RPM cover recess will be concrete (nonmetal framed), and provided with six 1/2" threaded inserts, each with clean out holes.
4. An 8' minimum clearance is required on door side of cabinet for operation.
5. Ground rods, clamps, and wire will be furnished and installed by the contractor. See approved grounding materials. Ground wire to be a minimum of 2/0 bare copper.
6. Mastic sealant is required at joints.

4. Service Equipment

Service equipment installations shall be made in accordance with the applicable sections of these Electrical Service Requirements.

Service equipment locations must have VPU approval prior to the installation of any equipment. Where equipment is improperly installed without VPU approval, any necessary modifications shall be made at the Applicant's expense.

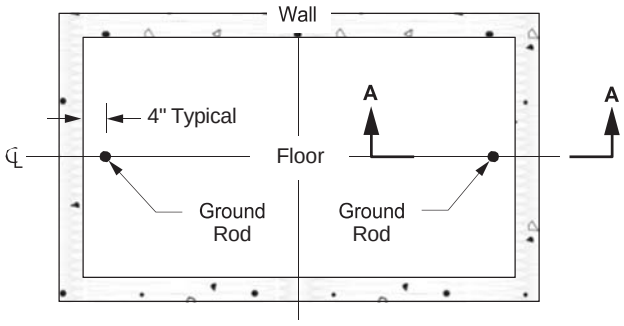
5. Grounding

The Applicant shall furnish and install all grounding materials. Consult Engineering or Service Planning Office for information on specific details and installations.

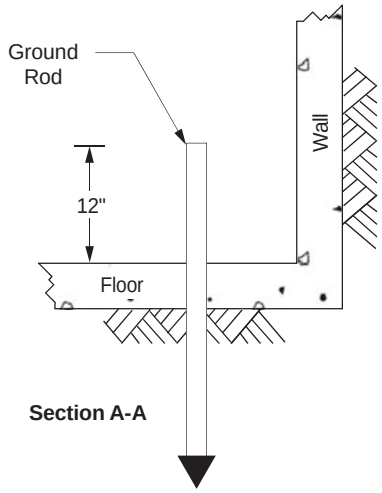
Precast tunnel-style vaults (7' x 8' and 8' x 9'-4") are furnished with two one-half-inch bronze grounding inserts on each end section. Other styles (stacked and so on) of precast vaults and manholes are normally furnished with grounding bars (two per vault/one per manhole). Grounding bars are five-eighths-inch (minimum diameter) copper clad steel bars. Both the grounding inserts and bars are welded to the reinforcing mats of the structures. No ground rods are required where grounding inserts or bars are present.

Where grounding inserts or bars are not present (and in field-poured structures), install 5/8" x 8' copperclad steel ground rods as shown in below.

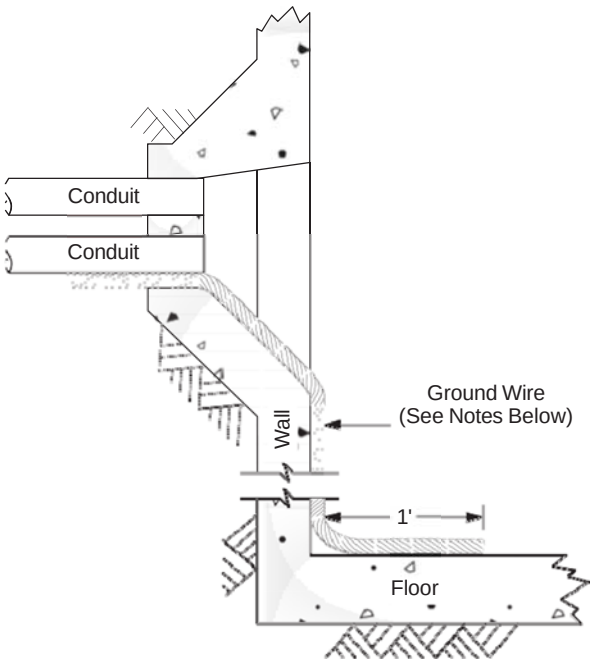
Ground Rod Location for Vaults and Manholes



Two ground rods are required in any vault that does not have a ground wire in the conduit bank. One ground wire is required in any manhole that does not have a ground wire in the conduit bank

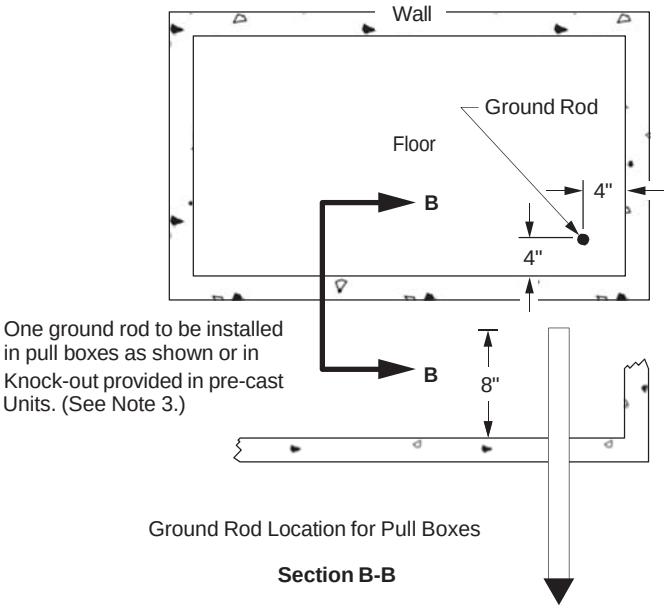


Section A-A



Ground Wire Entrance See Note 1.

Ground Rods — Pull Boxes



One ground rod to be installed in pull boxes as shown or in Knock-out provided in pre-cast Units. (See Note 3.)

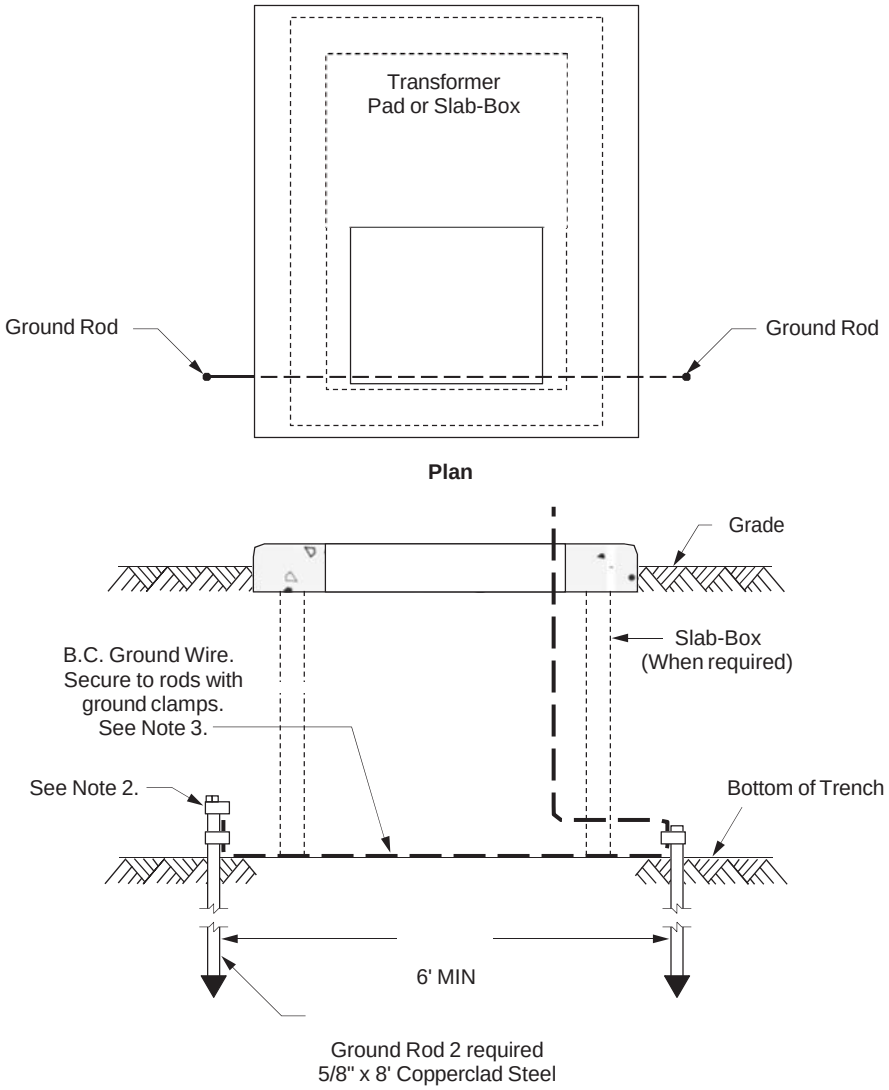
Ground Rod Location for Pull Boxes

Section B-B

Note(s):

1. Install ground wire only where specified on the working drawing.
2. When specified on working drawing, bring Telephone Company bond wire into structure the same as shown for ground wire. Extend bond wire to ground rod or bar and attach. (Telephone Company to furnish bond wire and clamp.)
3. One ground rod is required only in pull boxes where primary cables are installed.
4. Ground rods and ground wire, when required, are furnished by the contractor. Contractor will install all grounding materials required.

Ground Rod Installation for Pad-Mounted Transformers and Capacitors



NOTE: LEAVE 20' SLACK IN VAULT

Minimum Ground Conductor Size

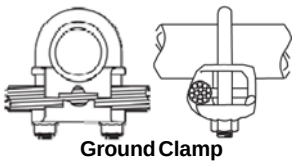
Structure Type	Structure Size	Ground Wire Size
Transformers		
Pads	4' x 4'-6"	4.O
	6' x 5'-6"	4/O
	7'-10" x 6'	4/O
Slab Box	6' x 8"	4/O
	8' x 10'	4/O
	10' x 12'	4/O
Capacitors/Ground Fault Detector		
Pad	7'-10" x 6'	4/O

Note(s):

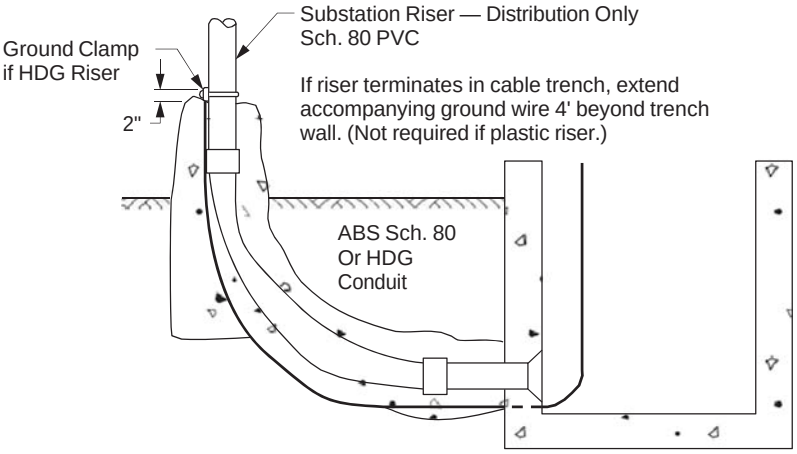
1. When driving ground rods, care should be taken not to drive rod through buried cable or duct.
2. When specified on working drawing, Telephone Company #6 tinned copper bond wire is to be attached to ground rod with clamp. Wire and clamp furnished and installed by Company.

NOTE: #4 COPPER FOR GROUND WIRE & 5/8" BY 8' LONG GROUND ROUND PREFFERED

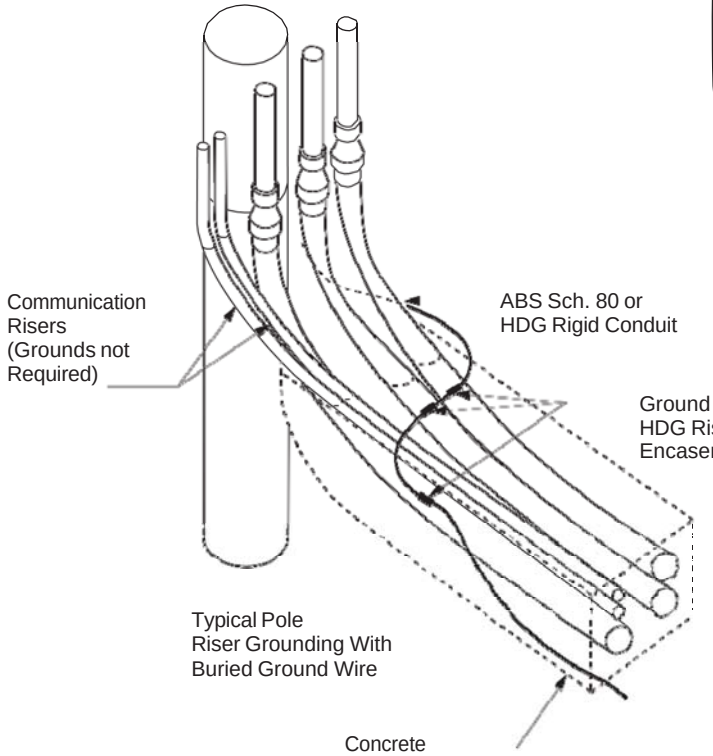
Riser Bend Grounding



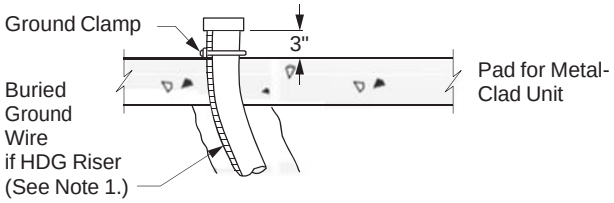
Ground Clamp



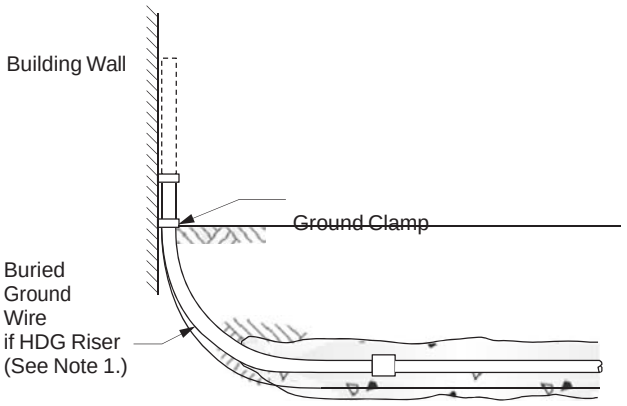
Typical Substation Risers



4 kV conduit bank buried ground wire (4 kV neutral) to have tap to 4 kV transformer bank in addition to riser grounding. 12 kV, 16 kV, 34.6 kV conduit bank buried ground wire to be connected to substation ground grid in addition to riser grounding.



Riser for Metal-Clad Unit



Typical Riser at Building

All HDG noncommunication riser bends will be grounded. (ABS bends need not be grounded.)

Table AC 702–1: Ground Clamps

Rod or Pipe Size	Wire Size	
	From	To
3/4" I.P.S.	#4 SOL.	2/0 STR.
1" I.P.S.	#4 SOL.	2/0 STR.
1-1/4" I.P.S.	#4 SOL.	2/0 STR.
1-1/2" I.P.S.	#4 SOL.	2/0 STR.
2" I.P.S.	#4 SOL.	2/0 STR.
2-1/2" I.P.S.	#4 SOL.	2/0 STR.
3" I.P.S.	#4 SOL.	2/0 STR.
3-1/2" I.P.S.	#4 SOL.	2/0 STR.
4" I.P.S.	2/0 SOL.	250 kcmil
5" I.P.S.	2/0 SOL.	250 kcmil
6" I.P.S.	2/0 SOL.	250 kcmil

Grounding Materials — Ground Rod and Clamps

Figure 703–1: Copper-Clad Steel Ground Rod

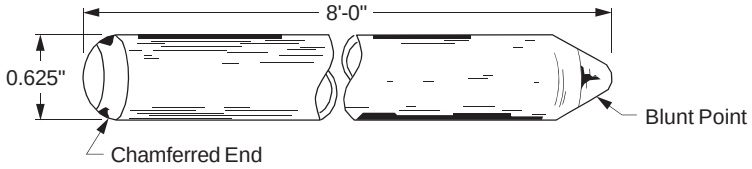


Table 703–1: Ground Rod

Manufacturer	Catalog No.
Blackburn	6258
Joslyn	J-8338

Figure 703–2: Heavy-Duty Bronze Ground Clamp

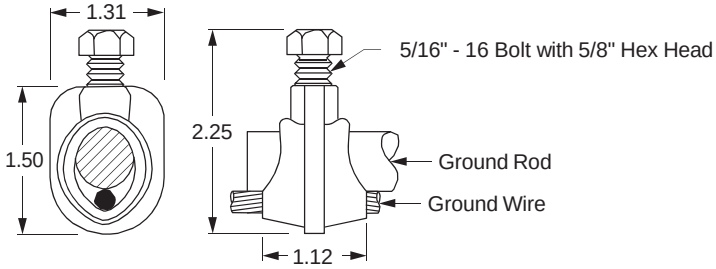


Table 703–2: Heavy-Duty Bronze Ground Clamp

Manufacturer	Catalog No.
Blackburn	J-AB5/8H
Burndy	GRC58
Connector Mfg. Co.	WB58
Dossert	GN62
Joslyn	J8492AB
Penn-Union	CAB-2

U-Bolt Bronze Ground Clamp

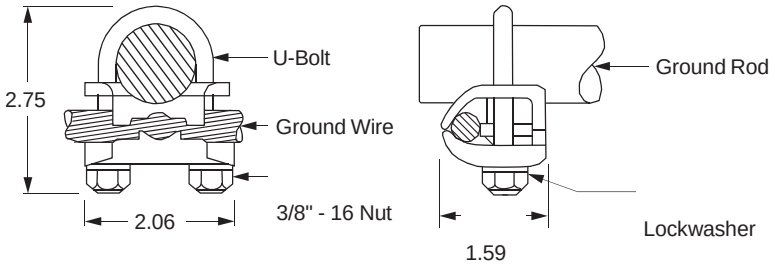


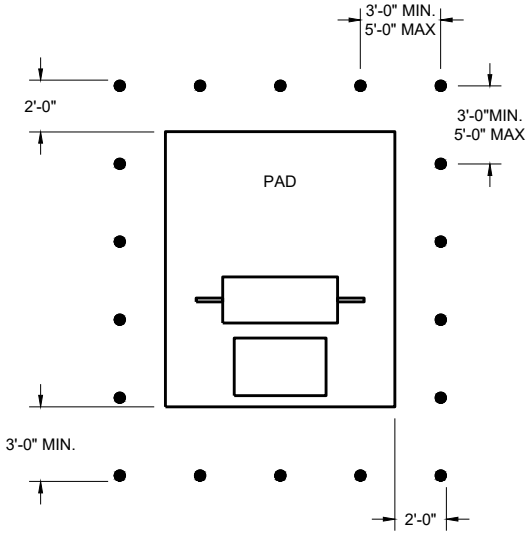
Table 703–3: U-Bolt Bronze Ground Clamp

Manufacturer	Catalog No.
Burndy	GAR6426SE
Dossert	GPC38-13
Penn-Union	GPL-5

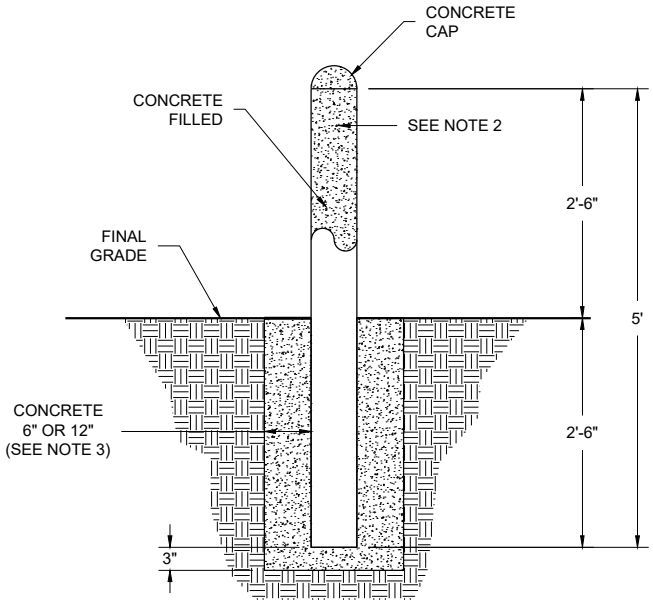
Note(s):

1. Copper-clad steel ground rods will be 5/8" diameter by 8' long. Rods are to be driven in undisturbed earth and will be a minimum of 8' in the ground. For approved manufacturers and catalog numbers.
2. Bronze grounding clamp has a ground wire range from #6 to #2 AWG. Clamp dimensions shown in are approximate. For approved manufacturers and catalog numbers.
3. Bronze U-bolt grounding clamp has a ground wire range from #4 to 2/0 AWG.

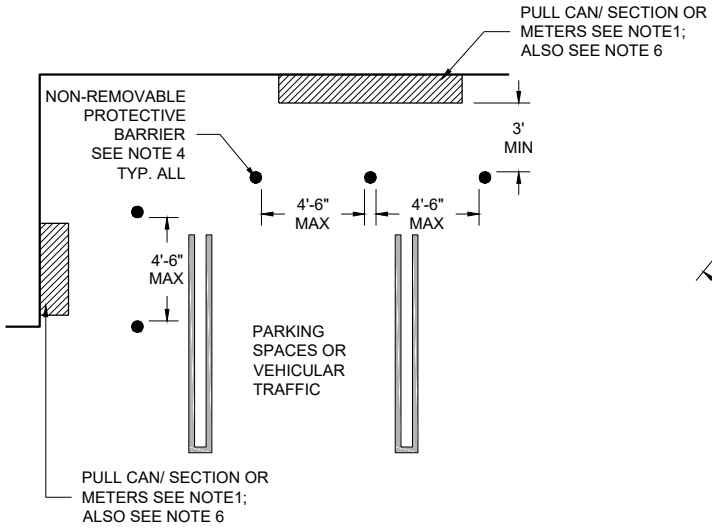
PROTECTIVE BARRIER FOR SERVICE EQUIPMENT INSTALLATION REQUIREMENTS

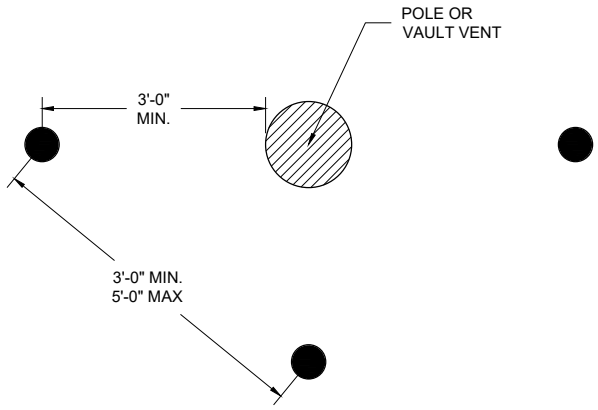


EQUIPMENT PAD POST LAYOUT



NON-REMOVABLE BARRIER POST DETAIL





POLE OR VENT POST LAYOUT

NOTE(S):

1. METERS LOCATED ON A WALL ADJACENT TO ANY PARKING AREA, OR AREA ACCESSIBLE OT VEHICULAR TRAFFIC, SHALL BE PROTECTED BY NON-REMOVABLE BARRIERS. WHEEL STOPS AND REMOVABLE BARRIERS ARE NOT ACCEPTABLE SUBSTITUTES. MAINTAIN A MINIMUM OF THREE FEET OF SERVICE EQUIPMENT DOORS/ PANELS TO BE OPENED 90 DEGREES.
2. USE FOUR INCH GALVANIZED STEEL PIPE (1/4 -INCH MINIMUM WALL) FILLED WITH CONCRETE.
3. THE CONCRETE ENCASEMENT SHALL BE MINIMUM OF SIX INCHES THICK IN STABLE SOIL AND 12 INCHES THICK IN SANDY OR UNSTABLE SOIL.
4. BARRIERS MUST BE INSTALLED IN LINE WITH EACH END OF THE SERVICE EQUIPMENT TO PREVENT VEHICLE CONTACT. THE DISTANCE BETWEEN BARRIERS SHALL NOT EXCEED 4'-6".
5. BEFORE EXCAVATING FOR THE BARRIERS, CALL DIG ALERT AT 1-811-227-2600 FOR MARK-OUT SERVICE. CALL AT LEAST 48 HOURS PRIOR TO EXCAVATING.
6. SEE FIGURE 3-2.
7. POST TO BE PAINTED BRIGHT YELLOW.

		APPVD	BY	DATE	REV	DWG.	
CITY OF VERNON CALIFORNIA FOUNDED 1905 EXCLUSIVELY INDUSTRIAL	PROTECTIVE BARRIER DETAIL	BA	CG	1/19/17	1		ESR-V00O-1

Non-Removable
Barrier Post Detail

Note(s):

2. Meters located on a wall adjacent to any parking area, or area accessible to vehicular traffic, shall be protected by
   Non-removable barriers. Wheel stops and removable barriers are not acceptable substitutes. Maintain a minimum of three feet of clear and level working space in front of all the service equipment enclosures. Barriers must be so positioned as to allow all service equipment doors/panels to be opened 90 degrees.
3. Use four-inch galvanized steel pipe (1/4-inch minimum wall) filled with concrete.
4. The concrete encasement shall be a minimum of six inches thick instable soil and 12 inches thick in sandy or unstable soil.
5. Barriers must be installed in line with each end of the service equipment to prevent vehicle contact. The distance between barriers shall not exceed 4'-6".
6. Before excavating for the barriers, call DIG ALERT at 1-811-227-2600 for mark-out service. Call at least 48 hours prior to excavating.
7. See Figure above.

M. **Conduit Installation Standards**

The following standards cover the methods to be used in performing the work essential to the installation of conduits for VPU. Reference to Contractor will be interpreted as the organization or party performing the specified construction.

1. **General**

a) All conduits will be carefully aligned and laid to a uniform grade as specified on the plan or profile of working drawings. A slight degree of snaking will be permitted with flexible and semi rigid plastic conduit.

b) A minimum conduit coverage of 30 inches will be maintained unless otherwise specified.

c) When conduit is located in streets drained by gutters, cover is to be determined from flow line of gutter.

d) No conduit will be installed that is cracked, damaged, or contains any roughness that would injure the cable jacket.

e) All questionable conduit to be installed will be tested for passage of mandrel prior to installation. Any conduit not permitting passage of mandrel will be rejected.

f) All conduit banks requiring concrete encasement will be adequately held in place to prevent floating during installation. VPU Service planner will approve conduit construction prior to placing concrete.

g) All joints on rigid PVC conduits will be made with solvent cement in accordance with manufacturer's recommendations and a watertight seal is required at all joints.

h) When directional boring, a locking watertight joint may be used and does not require solvent cement. Joint will be made per manufacturing installation instructions.

i) Conduit supplier is to provide up-to-date joining instructions with conduit delivery.

j) VPU service planner is to verify type and date of solvent cement prior to application of rigid PVC conduit.

2. **Entrances, Terminations, and Connections**

a) Conduit will be terminated in substructures as follows:

1. Flush with face of recesses including reduced conduit sizes with cast in terminators.
2. With end bells if terminated other than in a recess (Exception: Floorless structures.);
3. End bells may be omitted on conduit connecting substructures less than 10 feet apart.

b) Care must be taken to maintain roundness of conduit at terminations.

c) Grout conduit at outside wall. Encase.

d) VPU service planner is to be present during installation of all conduit entrances and terminations.

e) All terminations will be in end walls of structures. Side wall terminations and core drilling are not permitted except where no alternative exists and with VPU approval.

3. **Conduit Types.**

a) Unless otherwise specified on the working drawing, all of the below listed conduit types are approved for use.

Table 110–1: Approved Conduit Types

Conduit	Type	Application	
		Concrete Encasing	Direct Buried
Rigid Plastic (PVC)	Schedule 40-80	X	X

b) All conduit will be installed per VPU standards and will be watertight. In known water or subsidence areas, semi-rigid plastic conduit will be used.

c) The correct cements as recommended by the manufacturer will be used on each plastic conduit type so as to obtain a watertight connection.

d) Horizontal Bends and Sweeps

The difference between bends and sweeps is determined by their radii. Minimum radius for all Bends is 36" and the maximum radius for all bends is 60". The radius of each bend is Determined by conduit size, as follows:

- 36" for conduit 3" in diameter and smaller
- 48" for conduit 4" and 5" in diameter
- 60" for conduit 6" in diameter

e) Short lengths of conduit, properly coupled, may be used in conduit installations to form sweeps of a radius not normally supplied by manufacturers. The maximum deflection per length of conduit will be:

- 1/2" for lengths 2-1/2' and shorter
- 1" for lengths over 2-1/2'

Number of Conduits for Commercial/Industrial Services

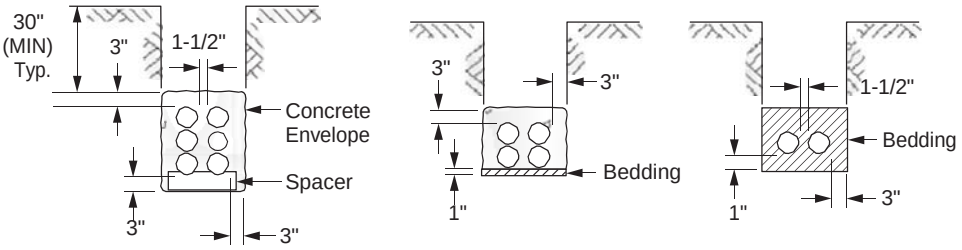
Main Switch Ultimate	Number of
400 A /600 A /800 A	Two 5-inch
1,000 A	Four 5-inch (See Note 7)
1,200 A	Four 5-inch
1,600 A	Six 5-inch
2,000 A /2,500 A	Two banks of Four 5-inch (See Note 6)
3,000 A	Two banks of Six 5-inch (See Note 6)
4,000 A	Cable Trench (See Note 9)

Notes:

1. The recommended number of conduits is based on ultimate ampacities of cable (700 kcmil) at 75 percent load factor.
2. For alternate designs, contact Field Engineering.
3. For ampacities of cable in trench or conduit, Field Engineering.
4. Ultimate ampacity is based on use of 700 kcmil Al cable in each conduit.
5. When 700 kcmil Al cable will be pulled beyond 100' equivalent straight length, use five-inch conduit.
6. Cable trench is preferred. When two conduit banks are used, they shall be spaced a minimum of six feet apart, until conduit is configured to pull section.
7. Three five -inch conduits may be used, but four, four-inch conduits create a block for semi-encasement.
8. For commercial and industrial installations (including specification buildings), size all conduits and structures t o the main switch or pull section capacity. However, if the main switch or pull section capacity used for strip or retail commercial building(s) exceeds the normally expected ultimate peak demand by 200 percent, the number of ducts from the transformer and the structure size may be reduced. The main switch or pull section capacity will be considered excessive when it is equal to or greater than 200 percent of the calculated demand
9. Cable trench is preferred. When it is not practical to install cable trench, two banks of seven four-inch conduits may be used, and they shall be placed a minimum of six feet apart

5. Conduit Bank Sections

Typical Conduit Bank Sections (Mainline and Commercial/Industrial)

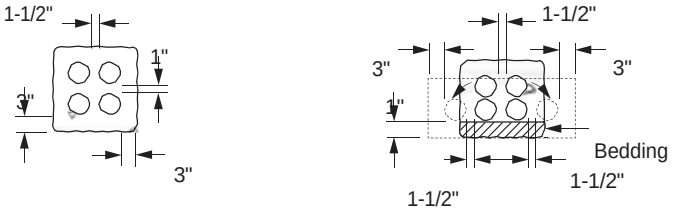


Full Encasement
More than 4 conduits
(base spacer required)

Semi-Encasement
3 or 4 conduits

Direct Burial

Special Conduit Formations



Conduit Bank Terminations
Minimum separations required between all types of conduit at conduit entrances to substructures.

Conduit Rolling
Used only when specified or sanctioned for ducts to occupy minimum vertical space and maintain required

Note(s):

1. Spacing and concrete coverage as shown is minimum.
2. Spacers, when required, will be as recommended by the conduit manufacturer and approved by VPU and will be placed at the intervals shown in Table 120–1. Vertical spacers and base spacers will be manufactured from rigid noncompressable-type materials. Use temporary means to maintain horizontal conduit spacing at these intervals until backfill bedding or encasement is placed.

Table 120–1: Horizontal Conduit Spacing Intervals

Conduit Size	2"	3"	3-	4"	5"	6"
Spacing with Encasement	10'	10'		10'		
Spacing with	10'	8'		6'		

3. Base spacers are required on all banks of more than four conduits.
4. “Sch. 40” Rigid PVC for inside bore casings
5. For general conduit bank, concrete, and trenching requirements, see Conduit Installation Standards.
6. Concrete encasement will be kept uniform. Excessive amounts of concrete will be avoided.
7. Bedding will be in accordance with Conduit Installation Standards

6. **Fittings.**

a) All couplings, adapters, segments, end bells, and so forth will be standard types recommended by the manufacturer or a Company-approved equal.

b) The couplings, sweeps, and other fittings are to be made of the same material as the conduit.

c) Offset couplings are not approved.

d) The spigot end of all fittings (segments, sweeps, bends, and so forth) will be chamfered at 45° ± 15° on the inside surface in order to make a smooth transition when installed into EB and DB conduit.

e) Name or trademark of fitting manufacturer will be placed on the outside surface of all fittings with 1/4" minimum size letters.

7. **Excavation.**

a) Excavation will be fully protected against hazard to the public and will be braced to prevent caving. Proper protective measures will be used where excessive caving is encountered or where protection is required for adjacent structures or roads. The requirements of the California State Construction Safety Orders and OSHA will be complied with.

b) VPU reserves the right to specify when protective measures for excavation must be employed.

c) Contractor will provide walkways and/or roadways around and over excavations to safely accommodate traffic, both along streets and into adjacent buildings. Such structures will conform to existing local regulations.

d) Trench subgrades will be brought to a uniform grade. Subgrade of spongy, unstable, or other unsuitable material will be removed and replaced with suitable bedding material.

e) Where rocks are encountered during excavation, they will be removed to 0.6 inches below the trench bottom and the conduit structure laid on a bed of compacted sand.

f) Special care will be taken to prevent damage to existing buried structures and facilities. Contractors will assume responsibility for proper notification and restitution to interested parties in the event of damage to existing structures.

8. **Buried Neutral Wire, Bond Wire, and Ground Wire.**

a) Neutral wire is required in conduit banks.

b) Any ground wire required will be supplied by the contractor.

c) On joint construction with telephone, a bond wire may be required between telephone and VPU substructures. (Consult working drawings.) Install bond wire in conduit bank, bring through recess, and attach to grounding bar at substructure floor.

d) Telephone Company to furnish No. 6 solid-tinned copper-bond wire and clamp when required.

9. **Mechanical Protection.**

a) Concrete encasement as specified, is required on all rigid conduit .Encasement will be per Conduit Bank Requirements.

b) Conduits

A. Full concrete encasement, when specified, will have a minimum concrete coverage of three inches on top, bottom, and sides of the conduit.

B. Concrete semi-encasement, when specified, will have a minimum of concrete coverage of three inches on top and sides of the conduit.

c) No concrete cap or encasement of any type will be poured without prior notice to the City Inspector.

d) Concrete for conduit bank protection may have the following minimum proportions:

A. Water content sufficient to give a minimum slump of two inches and maximum of four inches;

B. Aggregate content of a maximum of 40 percent sand by weight and a coarse aggregate of 3/8-inch maximum size;

C. Cement content will be a minimum of 190 pounds per cubic yard.;

D. Compaction may be by any suitable means that assures elimination of voids and does not damage the conduit;

E. Water reducing admixture ASTMC494 Type A will be used to increase the workability of the concrete. Admixtures with calcium chloride are not acceptable. Admixtures will be applied per manufacturer recommendations.

F. Artificial color is not required.

10. **Backfill.**

a) Conduit Bedding

1. Bedding will be defined as that material supporting, surrounding, and extending to one foot (305 mm) above the facility.
2. Where mechanical protection is not used, bedding material will be clean sand, pea gravel, or native free-draining granular material having a sand equivalent of not less than 30 or having a coefficient of permeability greater than 1.4 inches/hour.1/ Clean sand may be jetted where Permitted.
3. Where concrete protection of conduit is used, six inches of well-dampened earth will be placed over concrete protection in the trench two hours after the concrete is poured. Backfilling of the Trench excavation may then be completed.

b) Backfill — General

1. Backfill will be considered as starting one foot (305 mm) above the pipe or conduit, or at the top of concrete bedding over the pipe or conduit. All material below this point will be considered bedding.

2. Rocks greater than six inches (152 mm) in any dimension will not be permitted in backfill placed between one foot (305 mm) above the top of any pipe or conduit and one foot (305 mm) below pavement subgrade.

3. Rocks greater than two and one-half inches (64 mm) in any dimension will not be permitted in backfill placed within one foot (305 mm) of the pavement subgrade.

4. The native material obtained from project excavations may be used as backfill provided that all organic material, rubbish, debris, and other objectionable material are first removed. Backfill soil will be approved by the governing agency.

c) Mechanically Compacted Backfill

1. Backfill will be mechanically compacted by means of tamping rollers, vibrating rollers, stompers (impact-type pavement breakers), wackers, or other hand-held mechanical tampers.

2. Prior to mechanically compacting backfill, determine proper moisture content of soil. Optimum moisture in all soil types is desirable for obtaining required compaction.

3. Material for mechanically compacted backfill will be placed in horizontal layers of thickness or lifts, which, prior to compaction, will not exceed the thickness specified below for the various types of equipment.

   A. Hand-directed mechanical tampers and walk-behind vibratory plates — maximum uncompacted lift thickness of four inches (102 mm).

   B. Rolling equipment, including sheepsfoot (both vibratory and nonvibratory), grid, smooth-wheel (nonvibratory), pneumatic-tired and segmented wheels — maximum uncompacted lift thickness of one foot (305 mm).

   C. Impact, free-fall, or stomping equipment — maximum uncompacted lift thickness of three feet (914 mm).

4. Mechanically compacted backfill will be moistened or dried as necessary to obtain optimum moisture level (plus or minus two percent). Each layer will be evenly spread and compacted until the specified relative compaction has been attained.

5. Method of measuring relative compaction and any test requirements will be in accordance with agency permit requirements.

d) Backfill Compaction Requirements

Backfill will be densified to the following minimum relative compaction. See Figure 100–1.

1. 85% Relative Compaction:

   A. Between subgrade and the upper three feet (914 mm), measured from the pavement surface (or finished grade where there is no pavement);

   B. Outside the traveled roadway, shoulders, and other paved areas;

C. Under sidewalks.

2. 90% Relative Compaction:

A. In upper three feet (914 millimeters), measured from the pavement surface (or finished grade where there is no pavement), within the existing or future traveled roadway, shoulders, and other paved areas (or areas to receive pavement);

B. Within engineered embankments;

C. Where lateral support for existing or proposed structures.

3. 95% Relative Compaction:

A. Within State Highways;

B. Where pavement is placed directly on the compacted backfill, the top six inches (152 mm) immediately under the pavement will meet this requirement.

e) Sand Slurry Backfill

All trenches 10 inches or less in width and other trenches when directed by VPU or as required by agency permit and as required elsewhere in this specification will be backfilled using sand slurry with a minimum one sack per cubic yard of cement.[1/] California Department of Transportation jobs Requiring sand slurry backfill will have minimum 1-1/2 sacks per cubic yard of cement.

f) Base

1. Base material will be reconstructed to the same dimensions (thickness, and so forth) and with the same or equivalent materials used in the original work.

2. Where the original thickness is six inches (152 mm) or less, the base material may be compacted in one layer. Where the original thickness is more than six inches (152 mm), the base material will be compacted in two or more lifts of approximately equal thickness and the maximum compacted thickness of any one layer will not exceed six inches (152 mm).

3. The relative compaction of each layer of compacted base material will not be less than 95 percent.[2/]

g) **Pavement Resurfacing**

1. Temporary Resurfacing[3/]

A. Unless permanent pavement is placed immediately, temporary pavement will be placed immediately after backfilling. Temporary bituminous resurfacing two inches (51 mm) thick will be placed and maintained wherever excavation is made through pavement or driveways. In sidewalk areas, the temporary resurfacing will be at least one inch (25 mm) thick; in all other areas it will be at least two inches (51 mm) thick. At major intersections and other critical locations a greater thickness may be required.

B. Placement of permanent resurfacing will be performed within two weeks after the placement of temporary resurfacing unless otherwise specified by the governing civil

agency.

2. Permanent Resurfacing — General[4/]

All surface pavement damaged or removed as a result of the excavation work will be reconstructed to the same dimensions, except for pavement thickness below, and with the same type material used in the original work. Resurfacing will be one inch (25 mm) greater in thickness than existing pavement.

3. Asphalt Pavement

A. Edges of the surface surrounding a patch repair must be free of water, foreign material, or dust. The prepared edges should be tack coated to ensure a bond between them and the patch material. Enough time should be allowed for the emulsion to "break" and most of the water to dry out before the patch-mix is placed.

B. Asphalt pavement will be compacted to a density of 95 percent. To ensure a good surface seal along the cut (joint) line, a four-inch (102 mm) wide band of emulsion will be applied over the joint at the surface level, covered with a light coating of sand.

C. Upon completion, the pavement will be true to grade and cross section. When a ten-foot (3.05 m) straightedge is laid on the finished surface parallel to the centerline of the excavation, the surface will not vary from the edge of the straightedge more than 1/8" (3.17 mm).

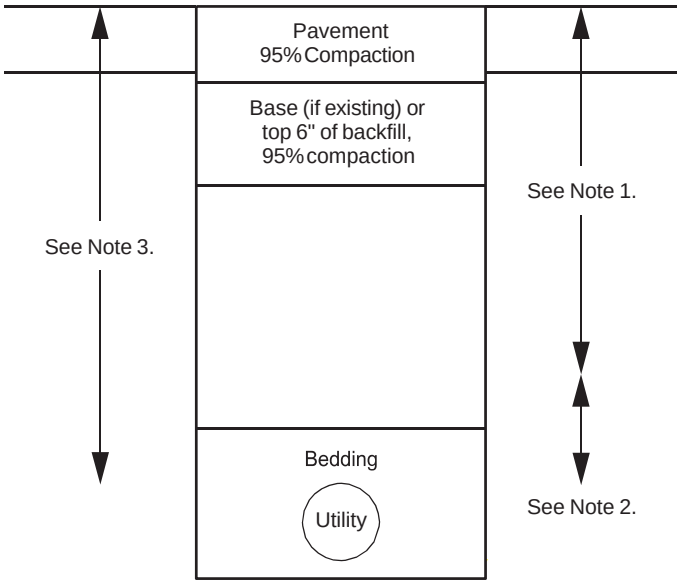
4. Concrete Pavement

A. Concrete will be reconstructed with the same type of material used in the original work or approved substitute. Concrete will be placed on a subgrade sufficiently dampened to ensure that no moisture will be absorbed from the fresh concrete.

B. Immediately after being mixed, the concrete will be deposited on the subgrade to the required depth over the entire width of the section.

C. The concrete surface will be finished true to grade and cross section. Upon completion, the surface will be free of any unevenness greater than 1/8" (3.17 mm) when checked with a ten-foot (3.05 m) straightedge placed on the surface of the pavement.[1/]

Figure 100–1: Backfill Minimum Relative Compaction



Note(s):
1. Upper three-foot zone — backfill material will be 90% relative compaction,
2. Lower zone to utility — backfill material will be 85% relative compaction.
3. The overall cover (depth), utility clearances, and construction are governed by the California Public Utilities Commission.

h) **Mandrelling , cleaning , and Pullrope Installation.**

1. All mandrelling must be done in the presence of VPU Inspector.

2. A mandrel will be pulled through each conduit upon completion of the duct bank and compaction of the trench backfill.

3. The mandrel must be sized to the smallest inside conduit diameter for a straight or riser conduit run.

4. All cement, sand, and foreign matter will be removed. If obstructions are found that cannot be removed by cleaners so as to pass the specified mandrel, the conduit will be removed and relaid at the Contractor's expense.

5. Except for long pulls defined below, a 1/4-inch diameter polypropylene pull rope, with a minimum breaking strength of 1,100 pounds, will be left in each conduit. A three-foot length of rope will be left projecting from the conduit at each substructure, and securely tied there. Where the approved conduit plug is used the rope will be securely tied to it.

6. Long pulls are defined as 1,000-foot straight-pull or 800-foot with one or more 90-degree bends. Conduit for long pulls will have a 3/8-inch diameter polyethylene pull rope with a minimum strength of 3,000 pounds left in it instead of the 1/4-inch rope. Another option besides the use of ropes is a pull tape.

7. All pull rope and pull tape will be new. Used ropes and tapes are not acceptable.

i) **Railroad Crossings.**

1. All conduit within railroad rights-of-way must have a minimum of four feet of cover from bottom of rail.

2. When specified on the working drawing, the following is required:

   A. HDG conduit (or steel casing) when under the rail bed;

   B. Full concrete encasement on conduit not under the rail bed;

   C. Installation of marker signs (furnished by VPU) at designated locations;

   D. Installation of a marker tape (Alarmoline, Cat. No. AL-6100-YE) directly above conduit, one foot below grade.