Electric Service Installation Manual

A guide for successful installation of residential, commercial and industrial electrical services.

FIFTH EDITION

Hawaiian Electric Company
Hawaii Electric Light Company
Maui Electric Company

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

Earle H. Ifuku
Manager
Customer Installations Department

July 2006

Aloha!

I am proud to present the newest 5th Edition of the Electric Service Installation Manual (ESIM) for your use. The ESIM is a publication of the Hawaiian Electric utilities and provides our customers on the islands of Oahu, Hawaii and Maui with the guidelines, technical standards and requirements for residential, commercial and industrial electric service and meter installations.

The ESIM provides many basic examples of common service installations. However, it is not intended to supersede or override Public Utilities Commission approved Company tariffs or federal, state or local laws, rules or regulations such as; the National Electric Code (NEC), Electric Utility Service Equipment Requirements Committee (EUSERC), Occupational Safety and Health Administration (OSHA), Occupational Safety and Health (DOSH), and the Public Utilities Commission (PUC) General Orders. Where this ESIM conflicts with other agencies, the most stringent ruling shall take precedence.

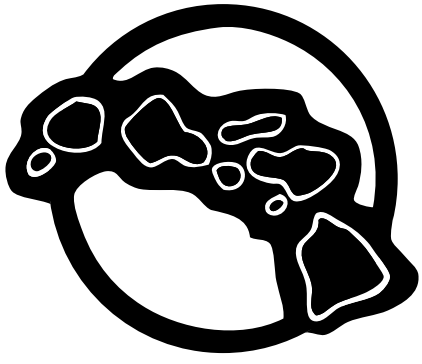
The release of the 5th Edition of the ESIM represents a significant milestone in providing our customers with a professional guide for successful service installations. I want to thank all of the Team members from Hawaiian Electric Company, Hawaii Electric Light Company, Maui Electric Company as well as our Advisory Committee members for their key contributions. Mahalo Nui Loa!

We will periodically revise the ESIM to reflect major changes in our guidelines, technical standards and requirements. If you are not presently on our mailing list, we encourage you to contact us at 543-7070 so that we may notify you of any updates. Thank you for the opportunity to serve you.

Sincerely yours,

Earle H. Ifuku

Electric Service Installation Manual



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Fifth Edition

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First printing: August 2006

ESIM Summary

The purpose of the latest revision to the ESIM is to eliminate the number of repetitive and redundant information, correct discrepancies and to condense and reduce the size of the manual to make it more user friendly.

The following is a brief overview of the changes that were made to the ESIM.

Section 1 General Requirements

- Combined Sections 1, 2, 3, 4 and renamed General Requirements.
- Removed Service Request form.
- Removed Definitions.
- Removed EUSERC notes.
- Removed Service Connection notes.
- Removed Transformer Installation notes.
- Removed Meter & Misc. Service Equip. on Customer Property notes.
- Removed Ownership and Maintenance of Facilities notes.
- Removed Loss or Damage notes.
- Removed Customer Equipment Responsibility notes.
- Removed Right of Access notes.
- Removed Aluminum Service Entrance Conductor notes.
- Removed Operating and Instrument Transformer notes.
- Removed Metering notes.
- Removed Two Services notes.
- Removed Locked Area notes.
- Removed Protective and Controlling Equipment notes.
- Added One Call System Information.
- Added Easement Area Notes.
- Added Two or more building on one lot notes.
- Added Net Metering contact information.

Section 2 Overhead Service

- Combined Sections 5, 6 and renamed Overhead Service.
- Removed redundant diagrams and details.
- Replaced 2-1/2” Galvanized Mast with 3”.
- Revised #4 mast guy wire to 3/16” wire rope.
- Revised Swimming Pool clearances.
- Revised Overhead service drop height clearance diagram.
- Revised temporary meter pole diagram.

Section 3 Underground Service

- Combined Sections 7, 8 and renamed Underground Service.
- Removed redundant diagrams and details.
- Revised Underground Service diagrams.
- Revised Duct Details.
- Included Marker Tape in Duct Details.
- Added additional Temporary service stand details.
- Added Transformer Pad details.
- Revised Transformer pad clearance details
- Updated handhole and manhole standards.
- Added retaining wall requirements.
- Removed handhole grouping detail.

Section 4 Metering

- Renumbered from Section 9.
- Divided into two sections, Self-contained and Transformer-rated metering.
- 5 subsections.

1. General

    - Added plan and elevation drawing clearances from equipment or structures.
    - Added meter relocation note when enclosing garage or carports.
    - Added photographs of meter working space clearance.
    - Consolidated the requirements for Electrical Room, Meter Closet, or Enclosed Area.
    - Added photos showing clearances for Freestanding Meter Enclosure.
    - Added viewing window requirement for Freestanding Meter Enclosure.
    - Added Diagram of Freestanding Steel-pole Structure .
    - Added NEC Tap rule.

2. Self-contained Metering

    - Removed the 175 Amps requirement for transformer-rated metering and went to rating of meter socket. Added note to alert customer.
    - Added table for number of jaws for self-contained metering only.
    - Added switchboard enclosure door notes.
    - Added table of meter mounting heights for different conditions.

3. Instrument Transformer-rated Metering

    - Added table for number of jaws for transformer-rated metering only.
    - Added that maximum sets of cable for CT can installation.
    - Added photos for installing CT mounting brackets in can.

- Added switchboard blank and meter socket panel notes.
- High-voltage switchgear customer notes.

4. Specialized Metering

    - Added pulse metering requirements.
    - Added requirements for telephone connection to a CT can.
    - Added contact numbers for different types of customer generation for the 3 companies. Also, added reference for net metering.

5. Grounding

    - Updated all grounding drawings in conjunction with City consensusy filling out a Request for service form.

Section 5 Other Requirements

- Section 10 Removed.
- Section 11 Renumbered to Section 5.
- Moved street lighting section to back of section.
- Removed Transformer Pad details. (relocated to section 3)
- Removed Operating clearance details. (relocated to section 3)
- Removed handhole and manhole standards. (relocated to section 3)
- Revised vertical clearance on pole details.
- Clarified Switching and Protection.
- Added Residential Customer Emergency Generator notes.

Contents

CHAPTER

1

General Requirements

About this book

Electric Service Installation Manual describes requirements for new electric services and metering. It is published jointly by Hawaiian Electric Company, Maui Electric Company, and Hawaii Electric Light Company for use by engineers, contractors, home owners, developers, and architects.

The installation of a new electric service is a cooperative effort between the customer and the power company. The purpose of this manual is to identify the responsibilities of each party.

General

In this manual, the terms "power company," "electric utility," and "utility" refer to the same thing – your local electric power company.

Service installations must meet the latest requirements of the power company, the National Electrical Code (NEC), Electric Utility Service Equipment Requirements Committee (EUSERC), applicable ordinances of the respective counties, federal and state laws including those of the Occupational Safety and Health Administration (OSHA), the Division of Occupational Safety and Health (DOSH), and the Public Utilities Commission General Orders.

Contact the power company early, when requesting electric service.

To request electrical service, contact the applicable company. See Figure 1-1 for contact information. Be prepared to provide this information:

- Name(s) of the applicant, owners, architect, electrician, and consultant.
- Mailing address of the applicant.
- Business address, occupation, and social security number of the applicant.
- Whether the applicant is the owner, agent, tenant, etc. of premises.
- Location of the premises. For example: address, tax map key, district, subdivision, lot number.
- The date the applicant will be ready for service. For commercial developments, also dates for construction power, testing, and permanent service.
- The purpose for the service. Include a description of the equipment, desired voltage, and load.
- Rate schedule desired, if an optional rate schedule is available.
- Required product references:
  - Meter elevation diagram
  - Single-line diagram
  - Plot plan, to scale

- Load calculations
- Civil and mechanical drawings, if required

• Required for commercial services:

- Four copies of the meter equipment drawing showing switchboard, meter pedestal, switchgear, and the manufacturers' design drawings of the switchboard/switchgear in reference to EUSERC drawings.
- Meter room location layout.
- Building elevations showing power company facilities.
- Layout and positioning of meter enclosure (front and rear views), pedestal or steel post structure.

• Other information as the power company might reasonably require.

In addition, for large residential customers, subdivision and commercial projects, complete and submit a Request For Electric Service.

One-Call System

Before digging near any utility facilities, call Hawaii's One-Call Center at 1-866-423-7287. For information on Hawaii's One-Call System, visit www.callbeforeyoudig.org.

Power company representatives are available to provide additional information, interpretation of requirements, or advice with regard to specific projects requiring electric service.

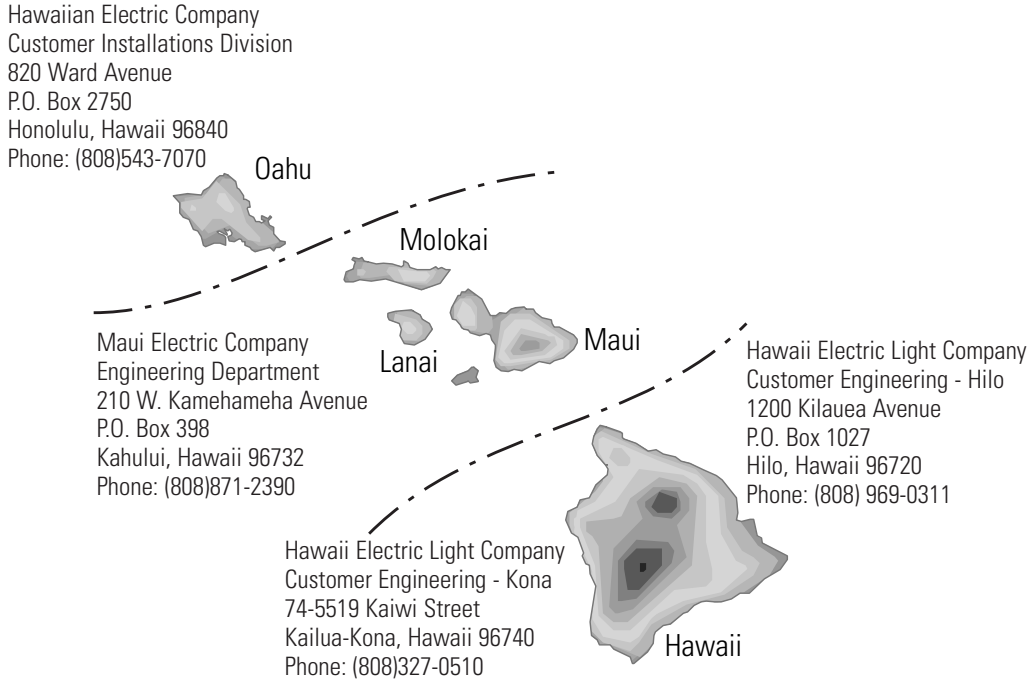


Figure 1-1. Power company service areas.

Tampering

Tampering with power company property is a criminal offense prosecuted under Hawaii Revised Statutes 269-71, 708-825, 708-826, or 708-827. The judgment may require payment of triple damages.

Locked Areas

Readily accessible, unlocked spaces are strongly preferred, for metering facilities and other equipment owned by the power company. When metering facilities or other equipment owned by the power company must be located in vaults, rooms, or other enclosed areas which are locked by the customer, the requirements described below must be met:

- Areas locked by the customer must be protected by doors or covers, fitted with a hasp which will accommodate a padlock or cylinder lock which will accommodate a Best Universal Lock Company cylinder. The power company will supply and install the padlock or core. If the room containing metering and related equipment is accessible to both the utility workers and the customer, the utility will also supply a core or padlock which will accommodate a utility master key and a customer-owned key, similar to the arrangement for access doors. The customer-owned key will operate only that lock and will not open other locks operable by the utility's master key. Doors leading into such areas must be arranged so as to be readily opened from the inside by any person who may be inside the area, in accordance with the egress requirements of the latest edition of the National Fire Protection Association Life Safety Code.
- In situations similar to the paragraph above, but where two or more customer/utility master locks may be required, the customer instead supplies an accessible location for a utility key-box (Supra-S Key Box or equivalent), and a master key to all access doors along the route to rooms that contain power company equipment and to doors to rooms containing both customer and utility equipment. The customer furnishes the key-box, unless otherwise specified by the power company.
- If the customer plans to make modifications or additions which would render the metering facilities or other equipment inaccessible, the customer must consult with the power company before making such modifications or additions, and make arrangements satisfactory to the utility for continued access by its workers.

Easement Areas

Construction is not permitted on an easement or access “granted” to the power company. Because easement dimensions vary, consult with the utility early, if construction is planned near easements.

Two or More Buildings on One Lot

If more than two dwellings or buildings are located on the same lot, consult with the power company to determine acceptable locations for service attachment and metering. Do this before proceeding with the electrical wiring of the buildings.

General Service Requirements, 2 kV to 15 kV Service

This section covers permanent electric service of 5,000 kVA or less, delivered at a nominal voltage of 2,400 volts or more, but not more than 15,000 volts. See Chapter 5, Other Requirements, for service connection configurations. Additional requirements for temporary service are contained in the utility's tariff. For services greater than 5,000 kVA, consult with your power company for the requirements.

Equipment Furnished by Customer

The customer furnishes, installs, and maintains all protective and controlling equipment, and all necessary transforming equipment, except for instrument transformers used by the power company for revenue metering. See Closed Transition Switching (see below) for metering information. The controlling equipment must be readily accessible to and operable by power company workers at all times. When controlling equipment is in a locked area, the lock shall conform to requirements indicated under Locked Areas or Equipment. Customer equipment must not be connected ahead of the utility's meter.

Drawings

The customer submits four copies of the drawings. Include drawings for protective and controlling equipment, and the revenue metering compartment and equipment. Include one-line and schematic diagrams showing:

- For protective and controlling equipment: the type, size, and ratings for normal current, load break, interrupting and fault-close, and latch
- For relays: the style, type, and proposed settings
- Location and ratio of customer's instrument transformers, potential transformers
- Fuse sizes and locations
- Meter panel layout

Incorporate the power company's comments from the review process before the drawings are used to manufacture the equipment.

Switchgear Bus

When the power company's service terminates in the customer's switchgear, the bus between the utility's service termination and the customer's protective equipment must be fully insulated for 15 kV. The minimum spacing, as measured from the outside

surfaces of the cables or bare bus, is not less than 7-1/2 inches between phases, and not less than 6 inches from phase to ground or to the nearest un-energized surface. The length of bus between the service termination and the protective equipment must not exceed 6 feet. The requirement for insulated bus will be waived for services of 100 amps or less, when it is connected to the utility's system and fused by the utility.

Instrument Transformers

Instrument transformers which are used by the utility for revenue metering, are not available for use by the customer.

Closed Transition Switching

For customers with two services and circuit breaker protective equipment, the preferred configuration allows the utility to transfer the customer's load from one service to the other by closed transition switching, not open transition switching. This prevents the inconvenience of momentary service interruptions during planned switching by the utility for maintenance or other purposes. See Chapter 5, Other Requirements, Switching and Protection, for additional information.

Parallel Operation

When the customer plans to operate generators in parallel with the utility's system, the customer must apply to the utility for permission, and discuss the requirements for parallel operation.

Net Metering

If net metering is being considered, contact your local power company to discuss the requirements.

HECO contact: Ronald Richmond
Energy Services Department
Customer Efficiency Programs
Hawaiian Electric Company
Telephone: (808)543-4784

MECO contact: Ray Okazaki
Engineering Department
Maui Electric Company
Telephone: (808)871-2340

HELCO contact: Laura Rogers
HELCO Engineering Department
Hawaii Electric Light Company
Telephone: (808)327-0519

CHAPTER

2

Overhead Service

General

Overhead services will not be supplied to any building or premise in an area where city and/or county regulations require that services be underground. The customer or contractor must obtain approvals from the city and/or county prior to energizing service.

Service Drop

The power company will, at its expense, furnish and install a single span of service conductors from its pole or other aerial support, to the customer's approved point of attachment. The utility will connect to the service entrance conductors, provided such support is of a type acceptable to the utility and complies with all applicable ordinances and requirements.

Service Drop Attachment

For the location of the service drop attachment, see Figures 2-1, 2-2 and 2-3. Service drops must be installed at heights and locations such that the service drop conductors are:

- Running free of obstruction from trees, structures, poles, masts, antennas, vents, flood lights, etc.
- Readily accessible for installation, inspection and maintenance.
- Installed where the weatherhead and point of attachment are safely accessible.
- Attached at only one point on the building.
- Substantially supported at the building.

For supply conductors of 0 to 750 volts, a lateral and horizontal clearance of at least 3'-0" is required between the supply conductors and nearby buildings, bridges, or other structures to which the supply conductor is not attached, and on which people might work (except generating stations and substations). See GO 6.

Supply conductors of 0 to 750 volts must have a vertical clearance of at least 8'-0" above buildings and bridges (or other structures, which do not ordinarily support conductors and on which men can walk) whether attached or unattached.

Service drops must be installed so that they clear fire escapes, exits, windows, doors and other points at which human contact might be expected, a horizontal distance of at least 3 feet as shown below. See also: General Order 54.8 part 84b.

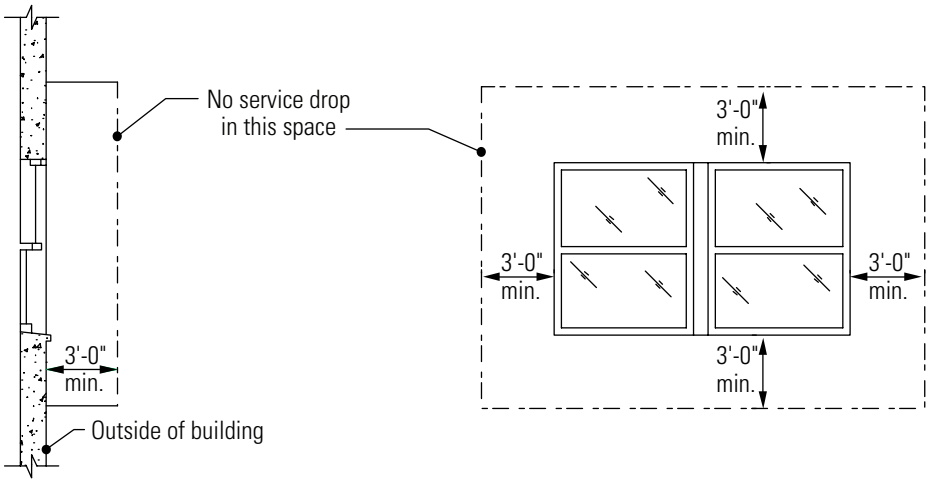


Figure 2-1. Service drop clearances from windows.

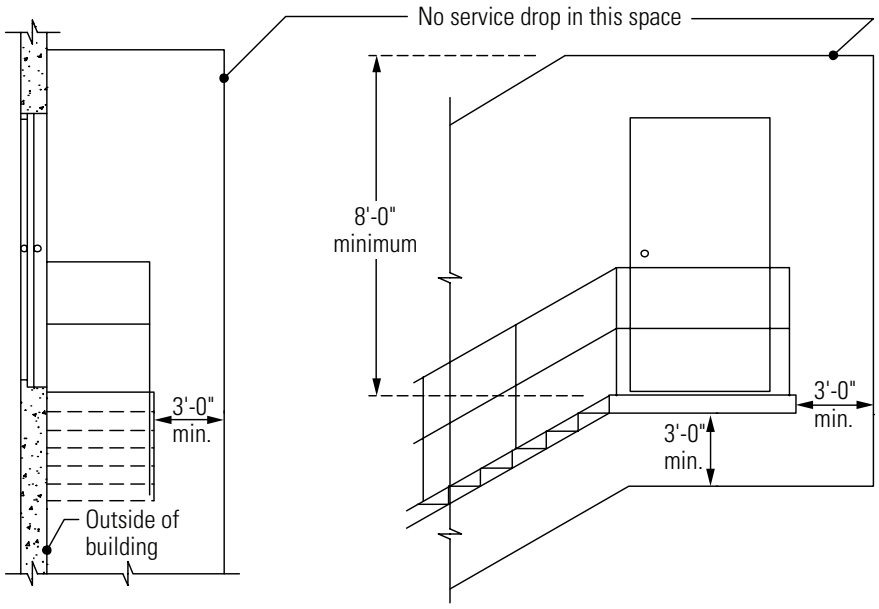


Figure 2-2. Service drop clearances from doors, balconies, stairways, walkways, etc.

Location of Overhead Services

The preferred service attachment is on the corner of the residence, not more than four feet in either direction from the corner. The side from which the meter is to be served shall be designated by the power company.

If overhead lines are along the rear property line, the point of attachment for the service may be located near, or at the rear corner of the residence. The conduit and wiring necessary to connect the point of attachment to the meter must be provided by the customer, and installed within four feet from the front corner of the residence.

All service locations are subject to the power company's approval.

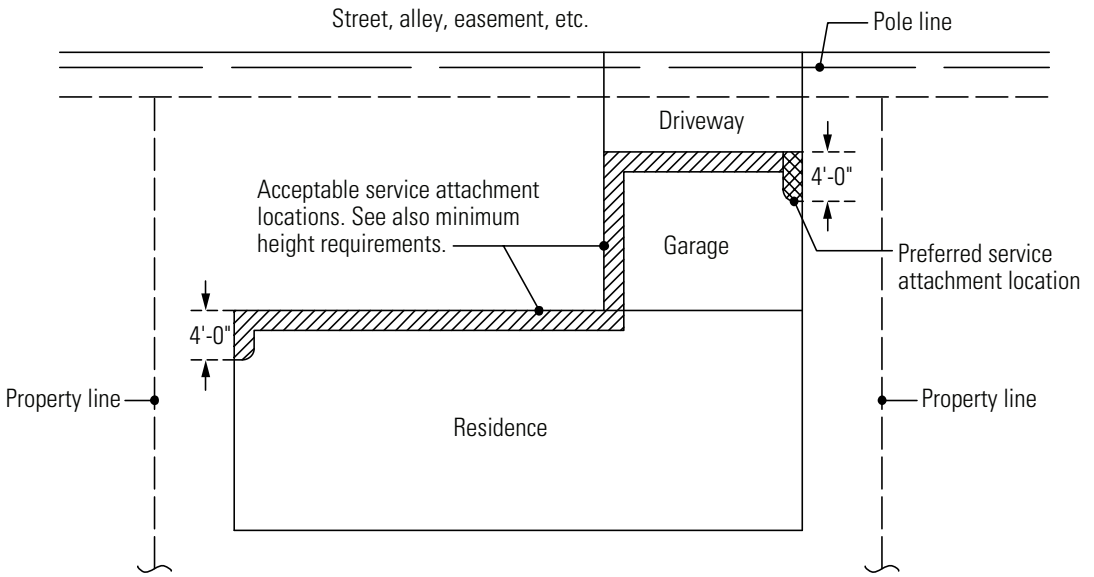


Figure 2-3. Location of overhead residential services.

Methods of Attaching Service Drops

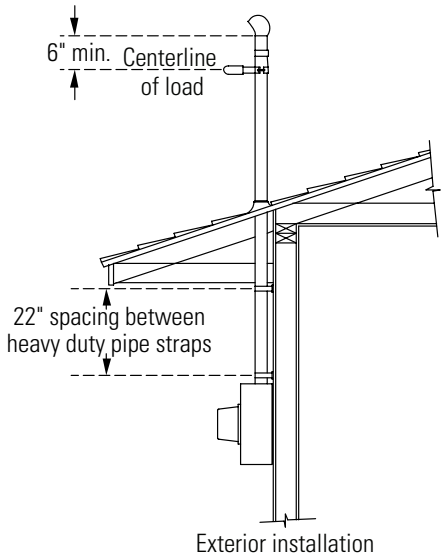
The power company:

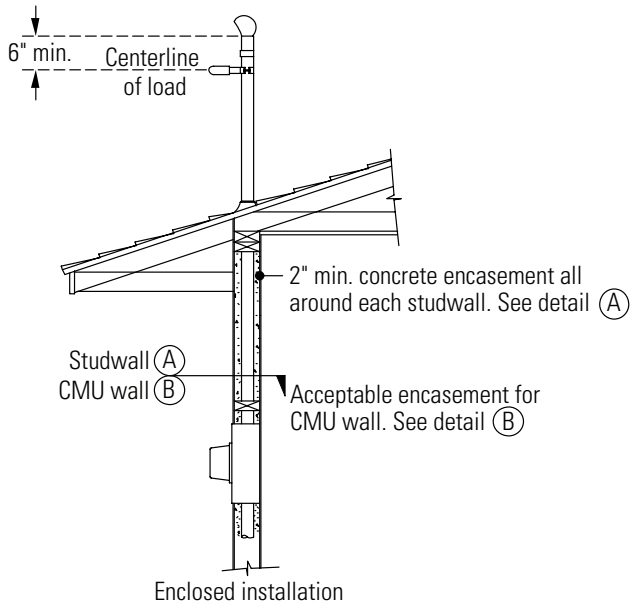
- Designates the location of the service mast, and the minimum height above ground for the point of attachment of the service drop.
- Supplies the insulator and hardware for attaching the service drop at the customer's mast.
- Makes the tap at the service drop conductors.

All conduit, masts, and hardware must be rigid galvanized conduit.

Masts, conduit, and other equipment must be grounded and bonded as required by the latest edition of the NEC.

All structures must be able to safely support workers and equipment required to make the connections.





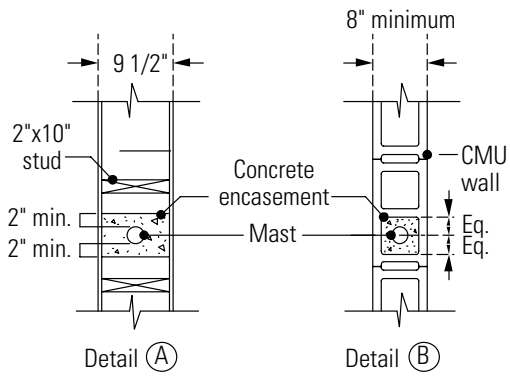
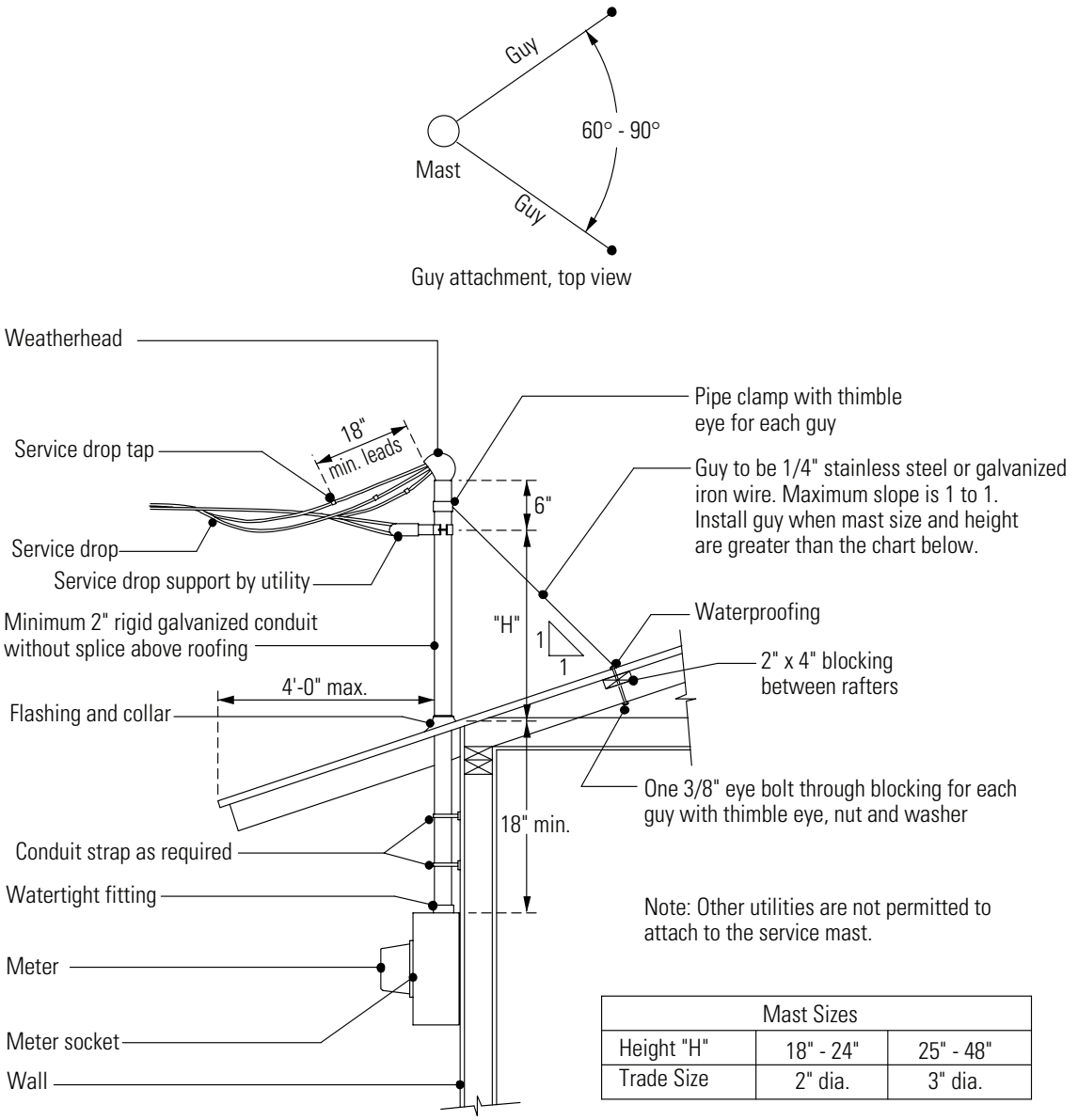


Figure 2-4. External/internal mast attachment. See Figure 2-5 for mast height requirements.



Mast Sizes		
Height "H"	18" - 24"	25" - 48"
Trade Size	2" dia.	3" dia.

Figure 2-5. Alternate methods for attaching service drops using guyed mast installed through roof.

Service Entrance Conductors

The customer's service entrance conductors must be long enough to reach the service drop tap, plus an additional 18 inches for forming a drip loop.

Swimming Pool Clearances for Utility Service Drop

Where possible, avoid installing utility service drops above public and private swimming pools.

The drawings below illustrate the minimum clearances, when utility service drops are installed above swimming pools. Refer to the latest edition of the NEC for minimum height requirements.

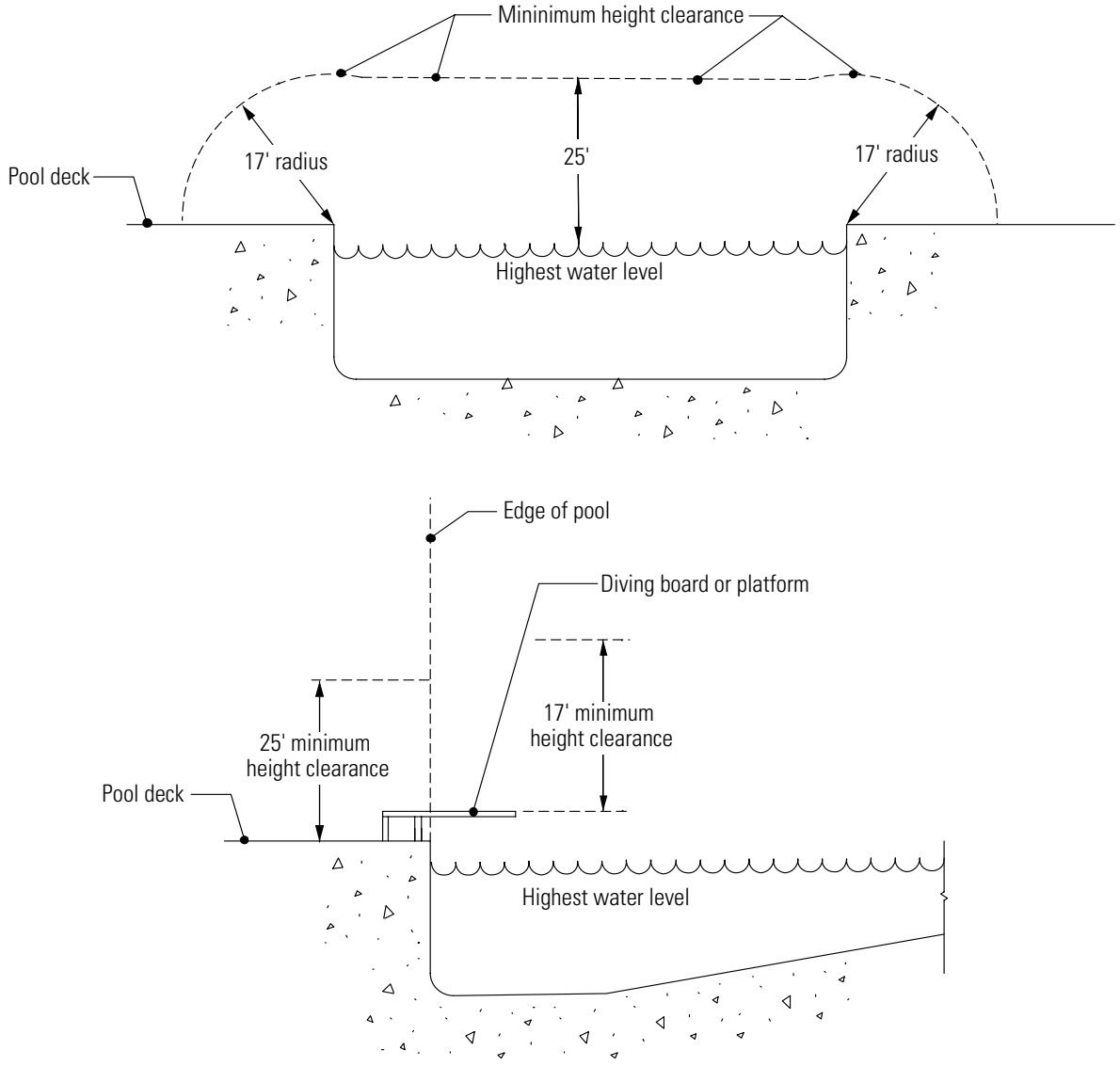
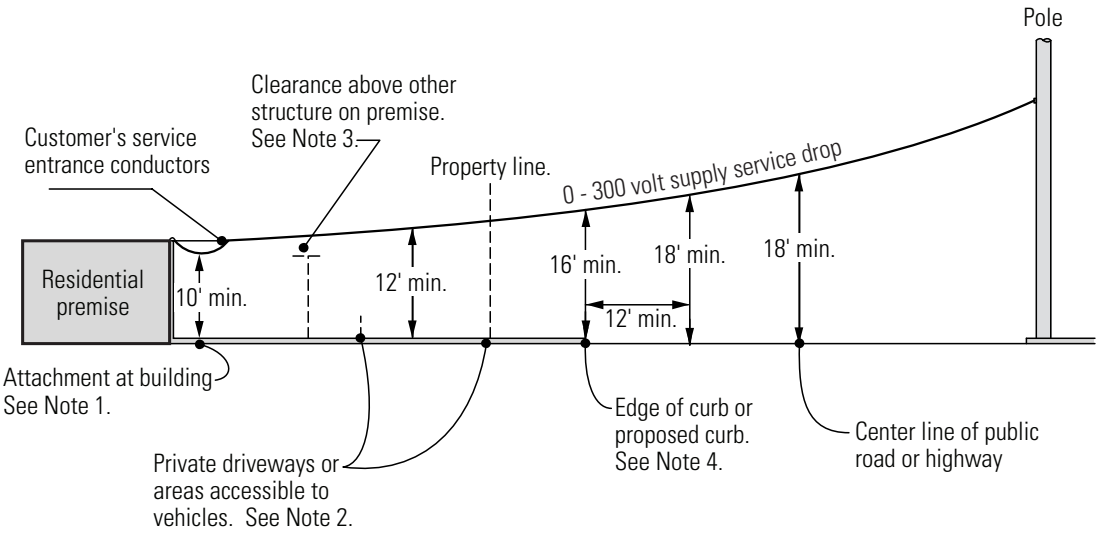


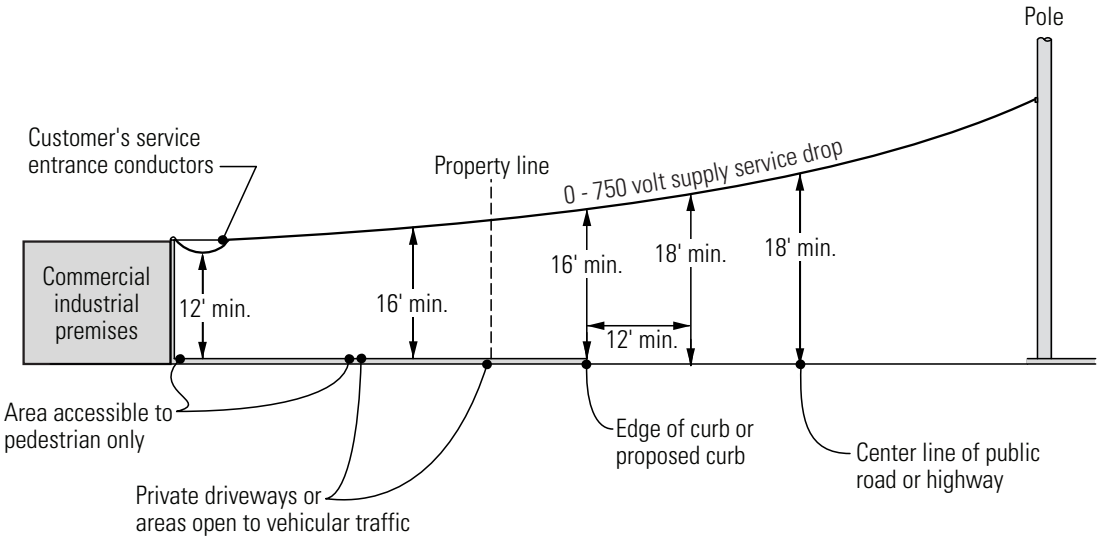
Figure 2-6. Swimming pool clearances for utility service drops.



Notes:

1. The point of attachment of service drop conductors to a building, above areas or sidewalks accessible only to pedestrians, shall not be less than 10 feet. Refer to General Order (GO) 6, Rule 54.8B(2) and National Electric Code (NEC) 230-24(b), for further clarification.
2. The minimum vertical clearance above private driveways or areas accessible to vehicles, for residential purposes only, shall not be less than 12 feet. Refer to GO 6, Rule 54.8b(2) and NEC 230-24(b), for further clarification.
3. The minimum vertical clearance above structures, which do not ordinarily support conductors and on which men can walk whether attached or unattached, shall be 8 feet. Refer to GO 6, Rule 54.8 Service Drops, 0-750 Volts, for specific conditions under which minimum clearances may be modified.
4. Service drop conductors shall have a vertical clearance of not less than 18 feet above public thoroughfares, except that this clearance may grade (slope) from 18 feet, at a position not more than 12 feet horizontally from the curb line, to a clearance of not less than 16 feet at the curb line. Refer to GO 6, Rule 54.8B(1), for futher clarification.
5. The radial clearance between supply service drop conductors and communication service drop conductors shall not be less than 24 inches. Where within 15 feet of the point of attachment of either service drop, this clearance may be reduced to 12 inches. Refer to GO 6, Rule 54.8C(4), Clearance Between Supply Service Drops and Other Conductors.

Figure 2-7. Service drop clearances, residential premises.



Notes:

1. The radial clearance between supply service drop conductors and communication service drop conductors shall be not less than 24 inches. Where within 15 feet of the point of attachment of either service drop, this clearance may be reduced to 12 inches.
2. The minimum vertical clearance above bridges, fences, walls or other structures upon which people can walk, is 8 feet. For vertical clearance above buildings, See Rule 54.8B3 GO 6.

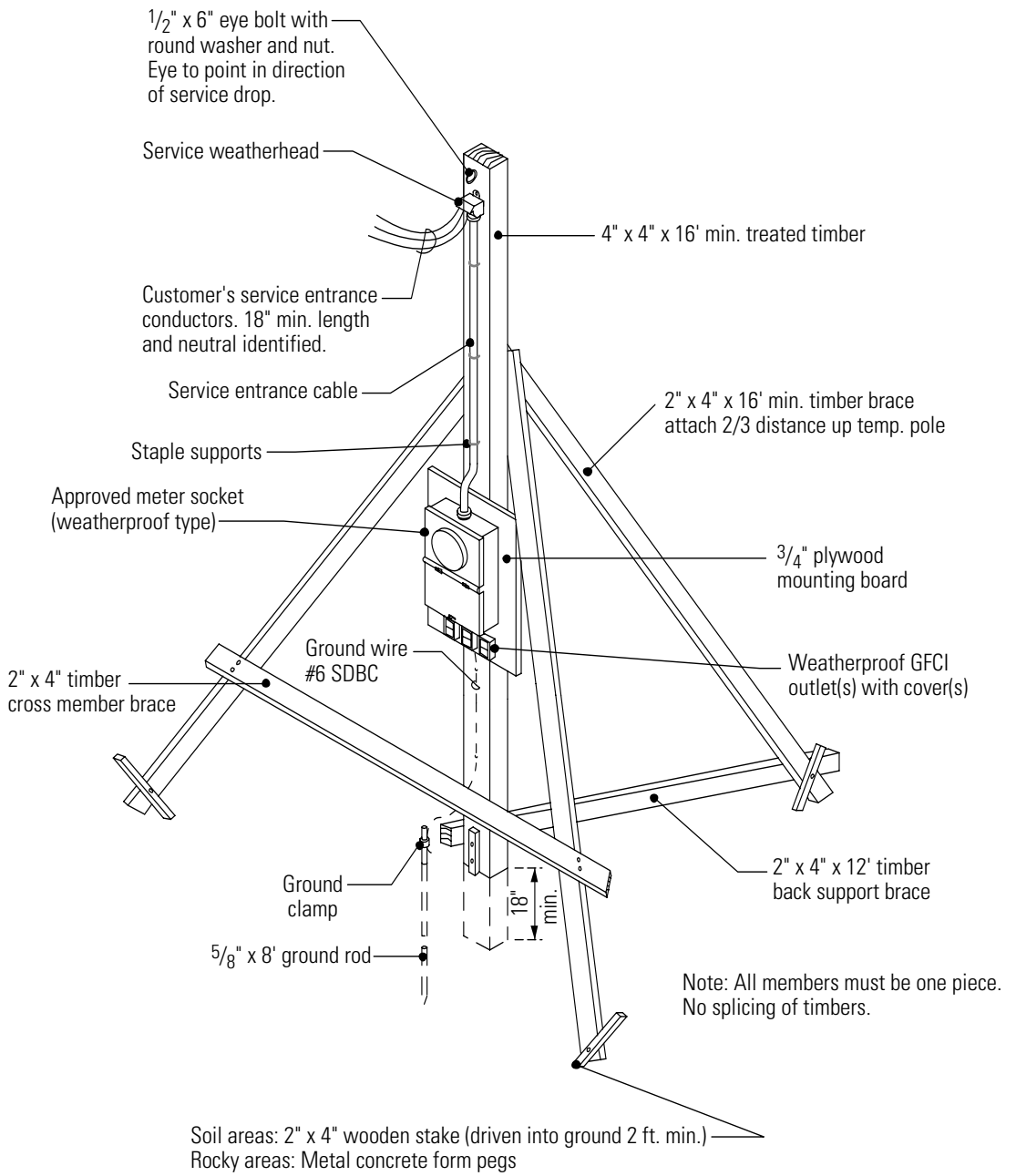
Figure 2-8. Service drop clearances, commercial premises.

Temporary Service

The customer furnishes a sturdy stand per power company standards, and locates it where specified by the power company. If the stand is to be in service for longer than one year, consult with the utility for additional requirements.

All timbers may be rough. Attach braces to the stand, and secure the stand with bolts or nails. Attach the wood brace at a point two-thirds of the height of the stand, above ground. All materials must be for outdoor use. Buried portions of stand and stake(s) must be treated and tamped. All facilities must meet NEC requirements.

For pole heights over 15 feet, consult with the utility's engineering department.



Note: Customer's connection to ground must be 25 ohms or less. If the ground connection is greater than 25 ohms, the customer is required to install a second ground rod in accordance with NEC 250.56.

Figure 2-9a. Temporary overhead service stand, isometric view.

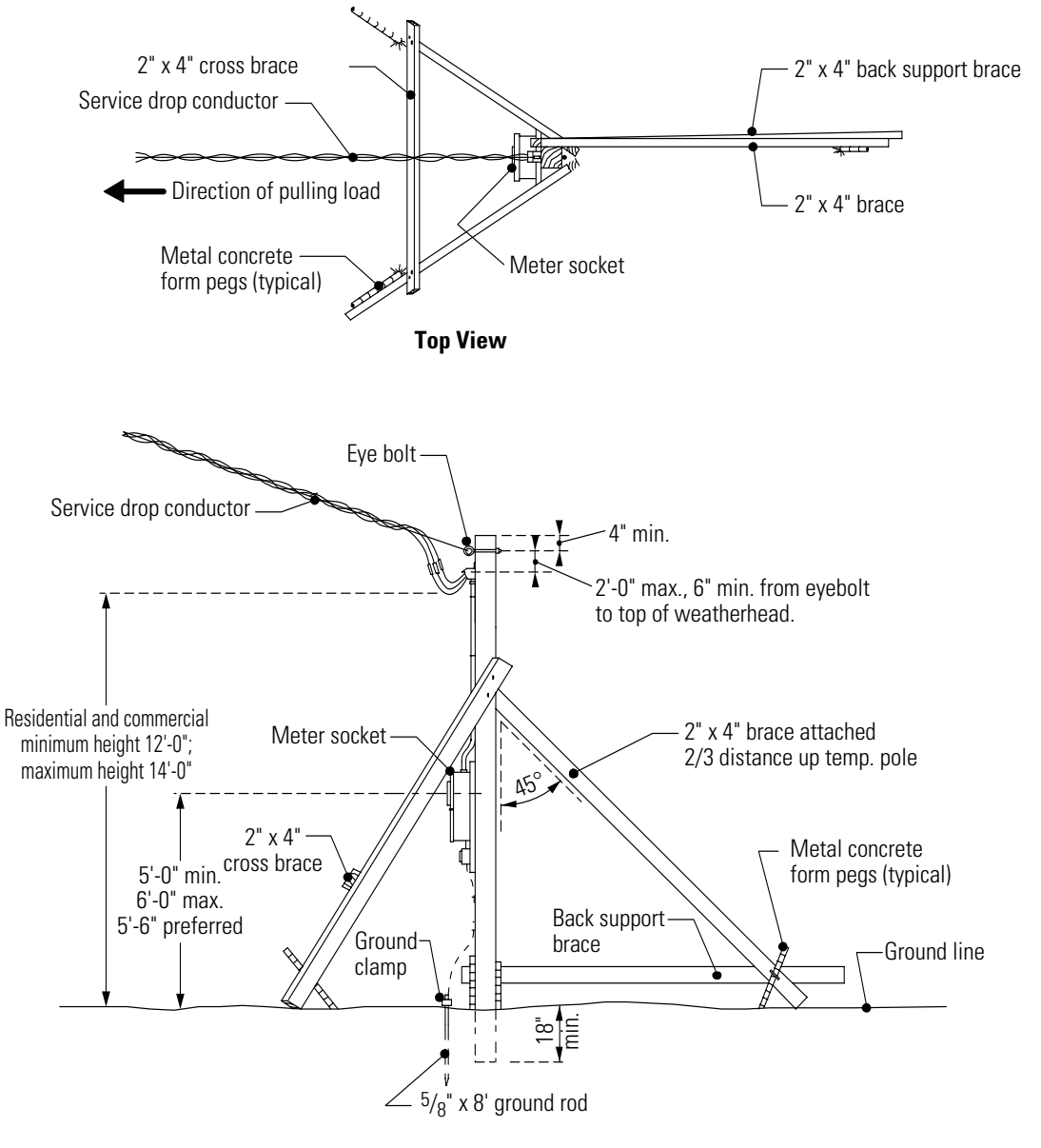


Figure 2-9b. Temporary overhead service stand, top and side views.

CHAPTER

3

Underground Service

General

The customer (or the customer's contractor) is responsible for contacting the power company prior to commencement of construction. The utility will determine the appropriate design for the underground service. The company also inspects all trenching prior to the burial/covering of conduits.

If the customer requests underground service, or if the city or county requires underground service by ordinance, service may be provided by the installation of an underground riser to an existing pole or from an existing underground distribution system. The customer is required to provide and install all conduits, handholes, or pullboxes, trenching, and backfill. Consult the power company prior to construction, for a cost estimate and other requirements.

City and county inspection and approval will be required, prior to the installation of the underground service by the power company.

For long service runs, or runs with many bends, the customer may be required to install a pull box or handhole. A maximum of two 90 degree bends is allowed on conduits, between the property line and the meter socket. For conduit runs involving two 90 degree bends or more, contact the power company for specifications.

Conduits for service conductors must be Schedule 40 PVC, direct-buried at a depth of at least 18 inches. Conduits under driveways must be Schedule 40 PVC encased in concrete and buried at a depth of at least 18 inches, or Schedule 80 PVC direct-buried at a depth of at least 24 inches. Conduits in easements must be Schedule 40 PVC concrete encased. The minimum radius bend for 2-inch conduits is 18 inches. The minimum radius bend for 3-inch conduits is 24 inches.

All ducts in a single uninterrupted run shall be of the same schedule PVC – transitioning of different schedules is not allowed.

The trench must be at least 8 inches wide for 2-inch conduit, and at least 9 inches wide for 3-inch conduit.

Use care when excavating near the service stub – the service line is energized. Contact the power company if you are unable to locate the conductor stubs.

The customer may be required to install a pad for a padmount transformer within his property, if the service run is too long to be served by the secondary system, or if required due to load.

Underground Service from Overhead

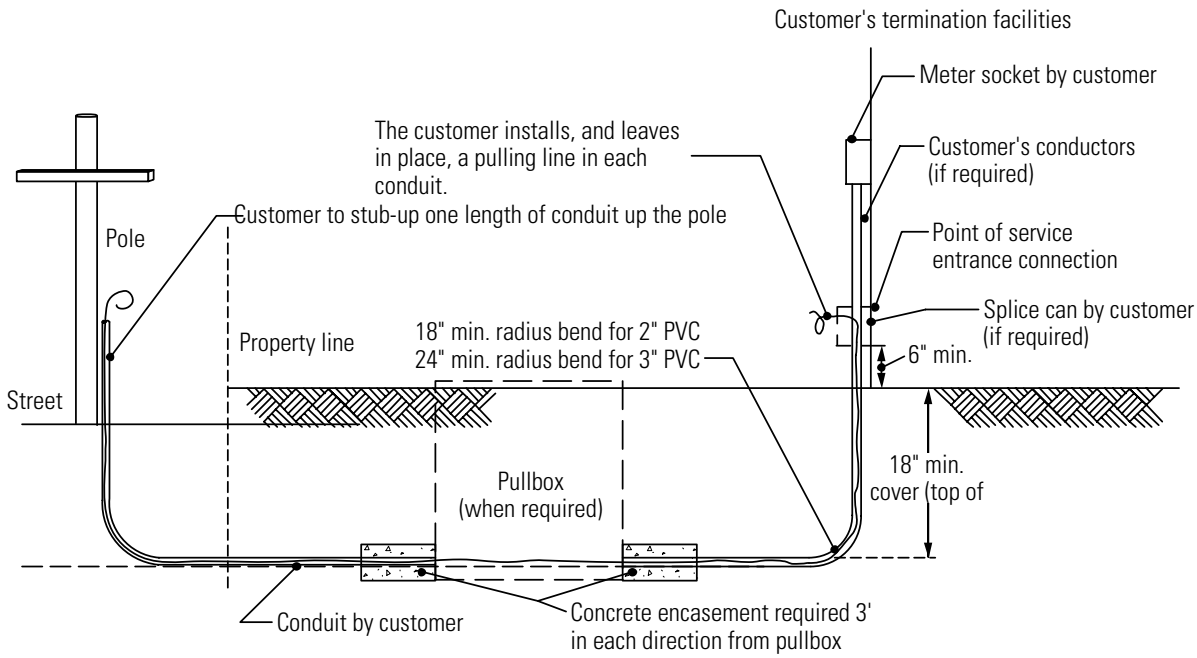


Figure 3-1. Underground service from overhead distribution.

Underground Service from Underground

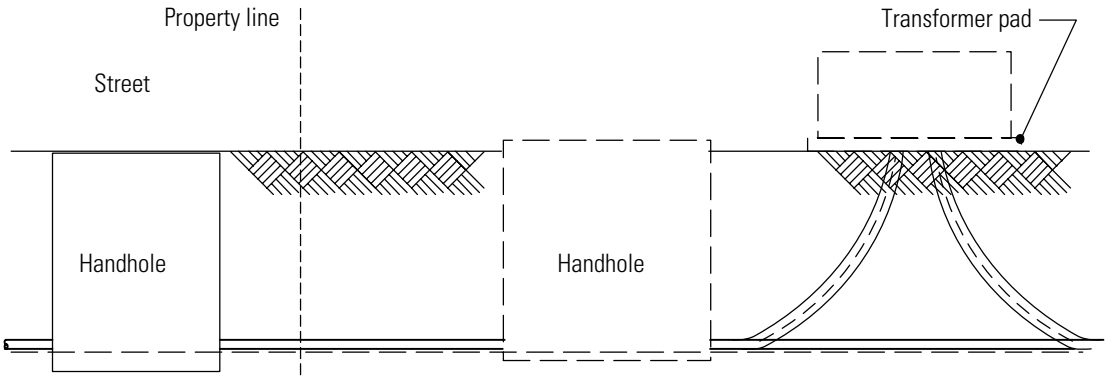


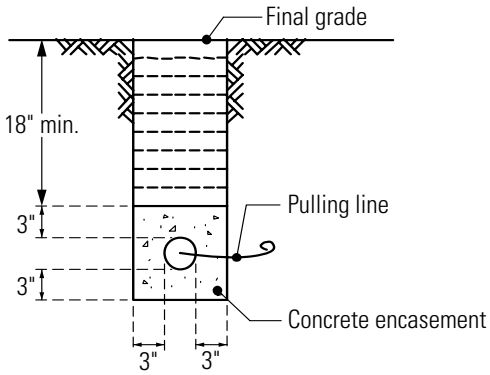
Figure 3-2. Underground service from underground distribution.

Type A backfill is beach sand, earth, or earth and gravel. If earth and gravel, the maximum rock size is 1 inch, and the mixture contain not more than 50% rock particles by volume.

Type B backfill is beach sand, earth, or earth and gravel. If the earth and gravel, the mixture must pass through a one-half inch mesh screen and contain not more than 20% by volume of rock particles.

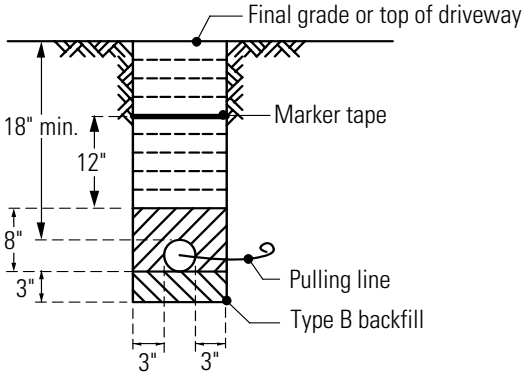
If the normal material in the bottom of the trench is not Type B, an additional 3 inches must be excavated and Type B backfill added.

Trenching and Backfilling



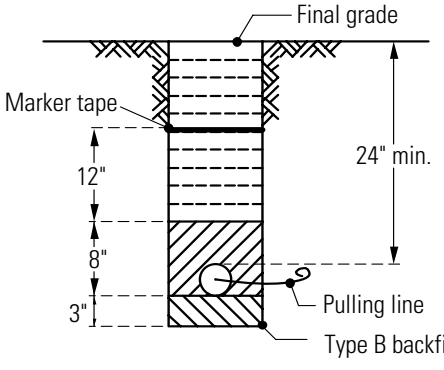
Duct is Schedule 40 PVC. The duct is encased in a 3-inch minimum concrete envelope. (Driveways, commercial, easements)

Residential Driveways, Commercial, Easements



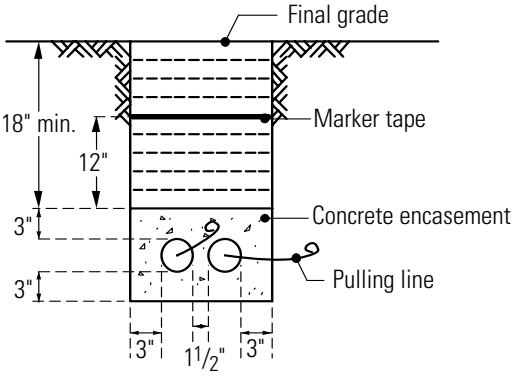
Duct is Schedule 40 PVC.
Residential driveways Schedule 80 PVC

Residential, Residential Driveways



Duct is Schedule 80 PVC, with Type B backfill. If the material in the trench has rock 1-inch or greater and more than 20% rock by volume of rocks, excavate an additional 3-inches, and backfill with Type B backfill.

Public Rights of Way



Commercial installation. Ducts are Schedule 40 PVC and encased in concrete as shown. Check with utility for state requirements.

Easements, Commercial

Figure 3-3. Trenching and backfilling.

Marker Tape

Electrical warning marker tape is required above all direct-buried conduits, and for concrete-encased conduits in the state highway right-of-way. Place market tape 12 inches above backfill or encasements. Market tape must conform to HECO specification M0302.

Underground Utility Duct Separation

Concurrently Installed

When concurrently installed, ducts installed parallel to gas, water, oil, other pipe systems, or other foreign substructures, must be separated by at least 12 inches from any of those items. Ducts installed crossing, must be separated by at least 6 inches.

Independently Installed

When independently installed, ducts for supply conductors must be separated from communication ducts and buried cables or conductors by at least of 3 inches of concrete, or at least 4 inches of brick masonry, or at least 12 inches of earth.

Recessed Conduit in Walls

Consult with the power company, before installing conduit in walls.

Conduit for conductors is Schedule 40 PVC, encased in concrete, and installed from the meter socket or pullbox, down the wall and into trench with a bend. The minimum radius bend is 18 inches.

The conduit must be 2-inch Schedule 40 PVC when the service conductors are no larger than #2 AL. See Figure 3-4 for details.

When the size of the service conductors is 3/0 or 350 MCM, the conduit size must be 3 inches, unless otherwise specified by the utility. The requirement for 2 inches concrete encasement is maintained.

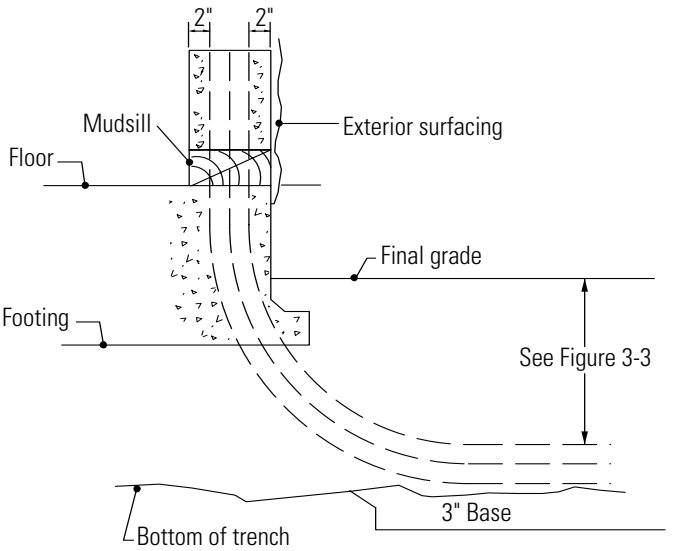


Figure 3-4. Recessed conduit in a wall.

Splice Can

If the size of the service is greater than 100 amps, a splice can, as specified by the power company, must be installed ahead of the meter socket. The conductors must terminate in the splice can, with 18 inches extra for splicing. Mount splice cans not less than 6 inches, nor more than 3 feet from the finished grade to the bottom of the splice can. The splice can must have provisions for seals which will be installed by the power company. If more than one conductor per phase is required, contact the power company for splice can sizes.

Size of Conduit (min.)	Size of Service Cable (min.)	Size of Service Cable (max.)	Size of Splice Can
2"	#2 AL	#1/0	10"W × 12"H × 6"D
3"	#3/0 AL	#4/0	12"W × 18"H × 8"D
3"	#350 MCM AL	#350 MCM CU	18"W × 24"H × 10"D
3"	#3/0 Quad	#350 Quad	24"W × 30"H × 12"D
4"	#500 MCM AL	#500 MCM CU	24"W × 30"H × 12"D

Table 3-1. Splice can size requirements.

Connect a duct to the meter socket or splice can (if required) using a Schedule 40 PVC conduit bend and Schedule 40 PVC conduit.

Temporary Service

The customer furnishes a sturdy stand, per power company standards, and locates it where specified by the power company. If the stand is to be in service for longer than one year, consult with the utility for additional requirements.

All timbers may be rough. Attach braces to the stand, and secure the stand with bolts or nails. Attach the wood brace at a point two-thirds of the height of the stand, above ground. All materials must be for outdoor use. Buried portions of stand and stake(s) must be treated and tamped. All facilities must meet NEC requirements.

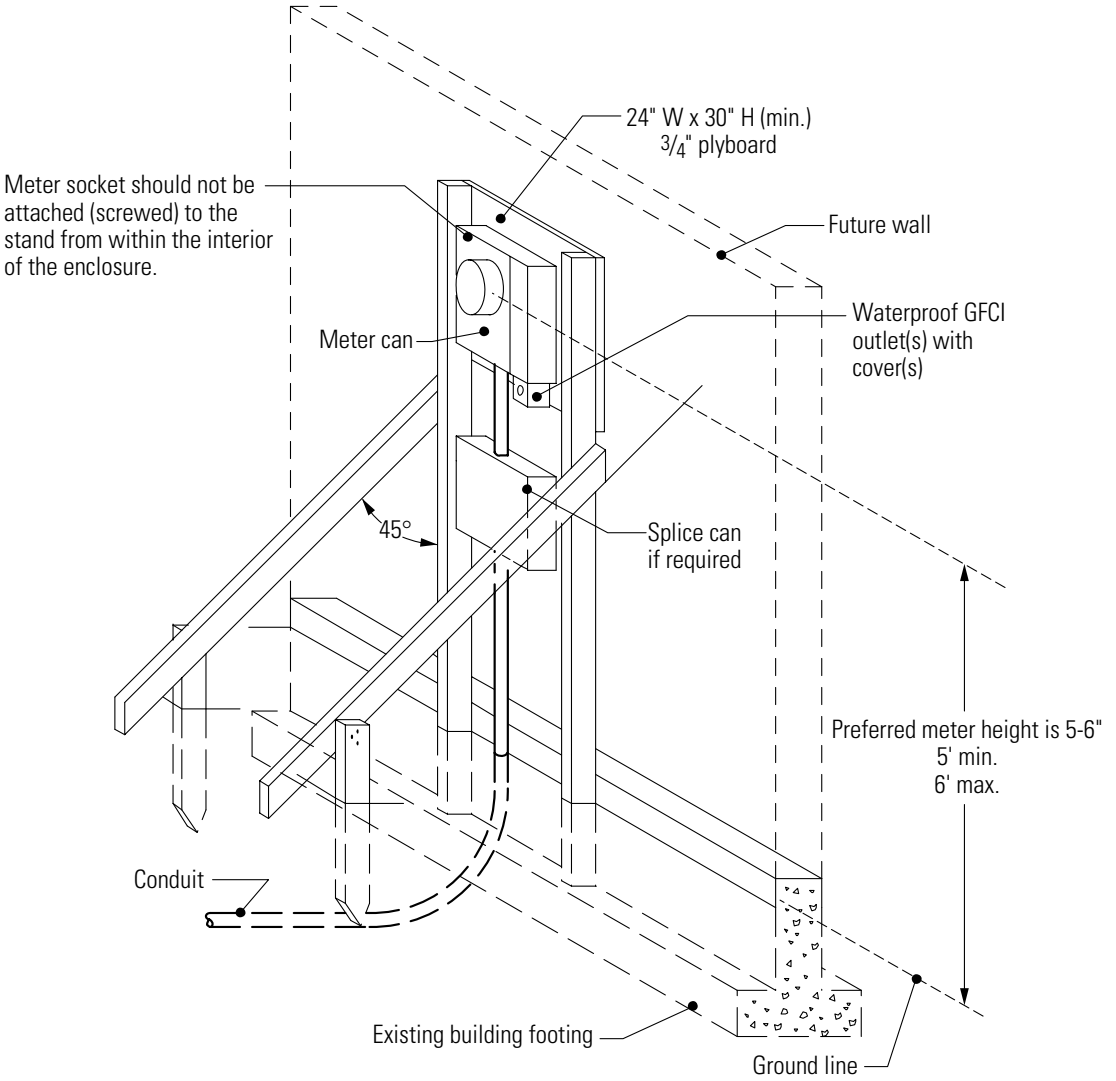
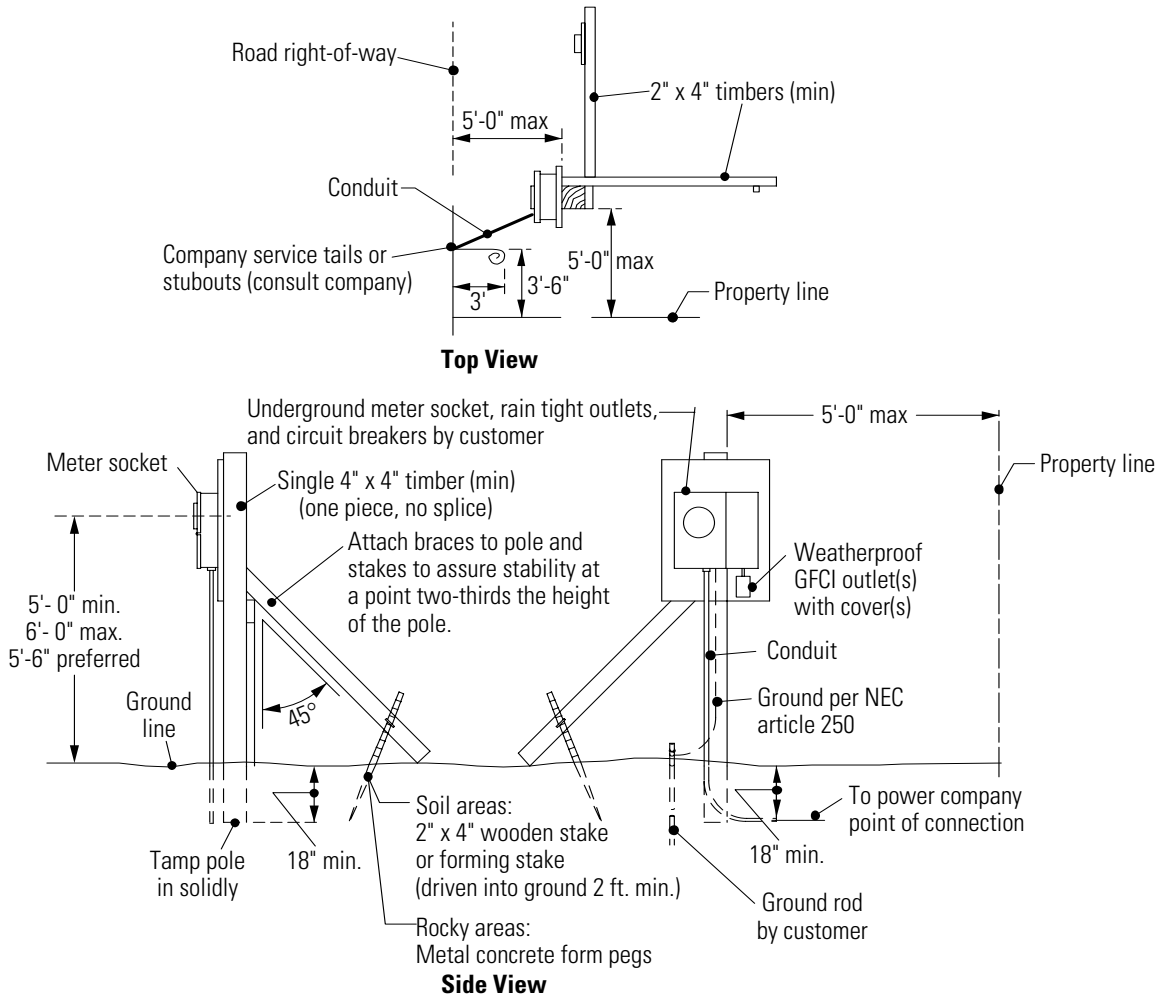


Figure 3-5. Temporary / permanent service stand, isometric view.



Notes:

1. Consult with the utility's customer engineering division when connecting to service box.
2. Customer shall furnish a sturdy pole and locate it as specified by company. Pole to be in service for one year or less. Customer shall consult the utility if the pole is to be in service over one year. All timbers may be rough.
3. Braces shall be attached to pole stakes with bolts or nails in such a way as to assure stability. Attach wood brace at a point 2/3 the height of the pole above ground. Buried portions of pole stake(s) shall be treated and tamped.
4. Customer does all necessary trenching and backfilling.
5. Customer locates and exposes (18" min.) company's service tails. Due caution should be taken while excavating, as company's cables are energized.
6. Customer to install a 13" x 24" (minimum) pullbox for the company to splice in.
7. No splicing of timber.
8. In rocky areas, iron form pins may be used in lieu of 18" minimum bury.
9. Electrical facilities shall be installed per NEC.
10. All materials for outdoor application.
11. Meter must face road or driveway.

Figure 3-6. Temporary service stand.

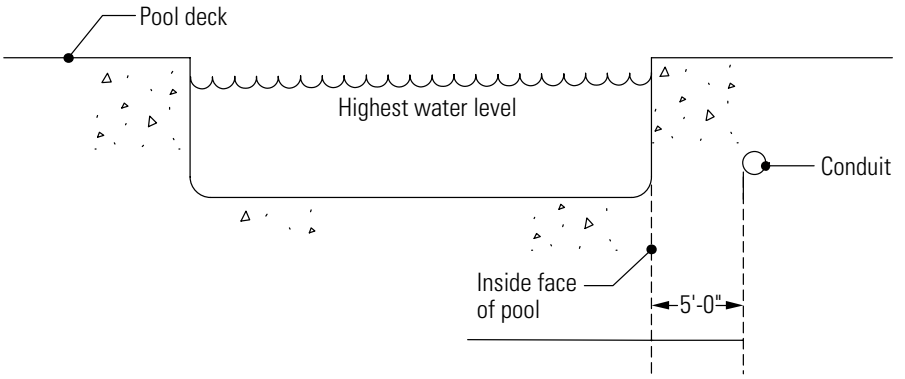
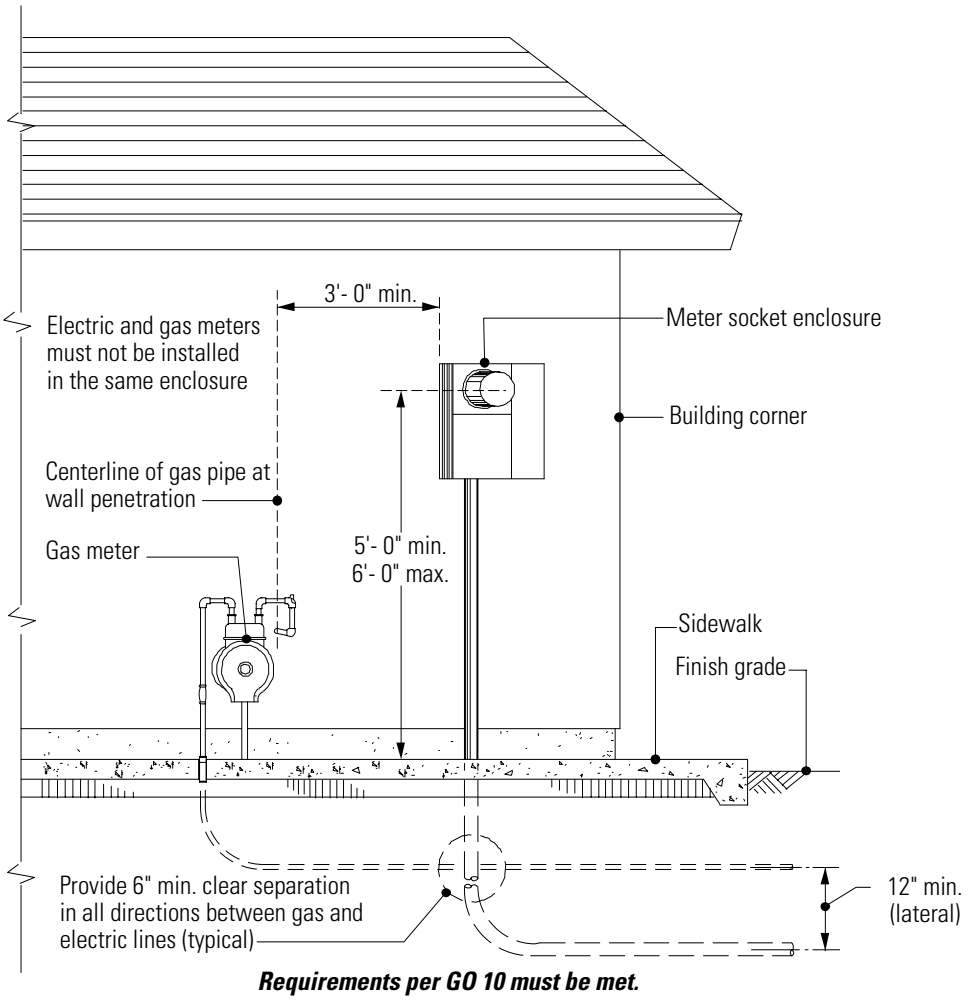


Figure 3-7. Underground service clearances for swimming pools.



Requirements per GO 10 must be met.

Figure 3-8. Clearances between residential electric and gas meters.

Transformer Pads

Location

Requirements for the location of pads for transformers and other equipment include:

- No permanent or temporary structure or object may be erected or placed within 2’-0" for single-phase, and 4’-0” for three-phase, of the edge of the concrete pad, or within 8’-0" in front (10’-0” for 25 kV equipment).
- When the concrete pad is located in the vicinity of existing or future combustible material or combustible buildings, the customer must provide safeguards as outlined in the NEC, subject to the approval of the city and building inspector.
- The front side of the concrete pad must face vehicular access, and be free of obstruction at all times.
- When parts of building structures are located directly over the concrete pad, a minimum clearance of 9’-0" from the surface of the pad is required.
- The customer must provide and install adequate protection for transformers. Consult with power company for type and location.

Customer Responsibilities

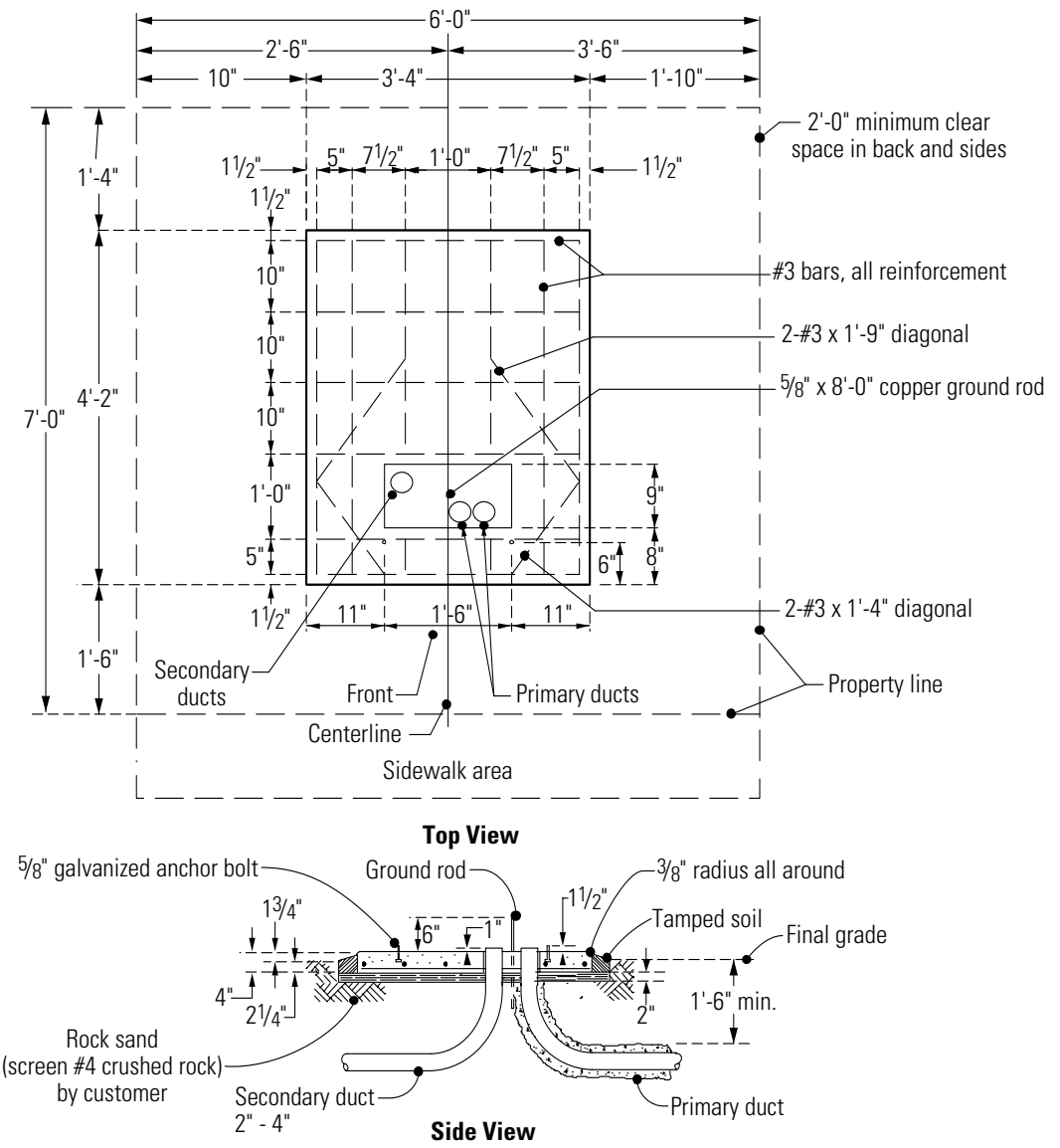
The customer is responsible to:

- Furnish materials and construct the facilities for the padmount transformer including the concrete pad, primary and secondary ducts, and anchor bolts. When required, the concrete curb and rock fill around the pad must be furnished and installed by the customer.
- Install the duct from the pad to the riser pole or handhole as designated on the plan. The duct is PVC Schedule 40 pipe. Bends due to changes of grade, must have a minimum radius of 20’-0". After the conduits are installed, the customer must pass a smooth bullet-shaped wooden test mandrel through the entire length of each conduit to test for freedom from burrs and obstructions. All ducts must contain a muletape pull line, Wesco catalog #0728-9200 or equivalent. Use select backfill.
- Grade sufficiently around the pad site to prevent future filling in of the pad. When required, construct a retaining wall of suitable material to prevent future filling of pad.
- Compact by rolling the site in accordance with city and county specifications for compacting sidewalk areas.

Allow 5 working days advance notice, for inspections by the power company.

The power company must have:

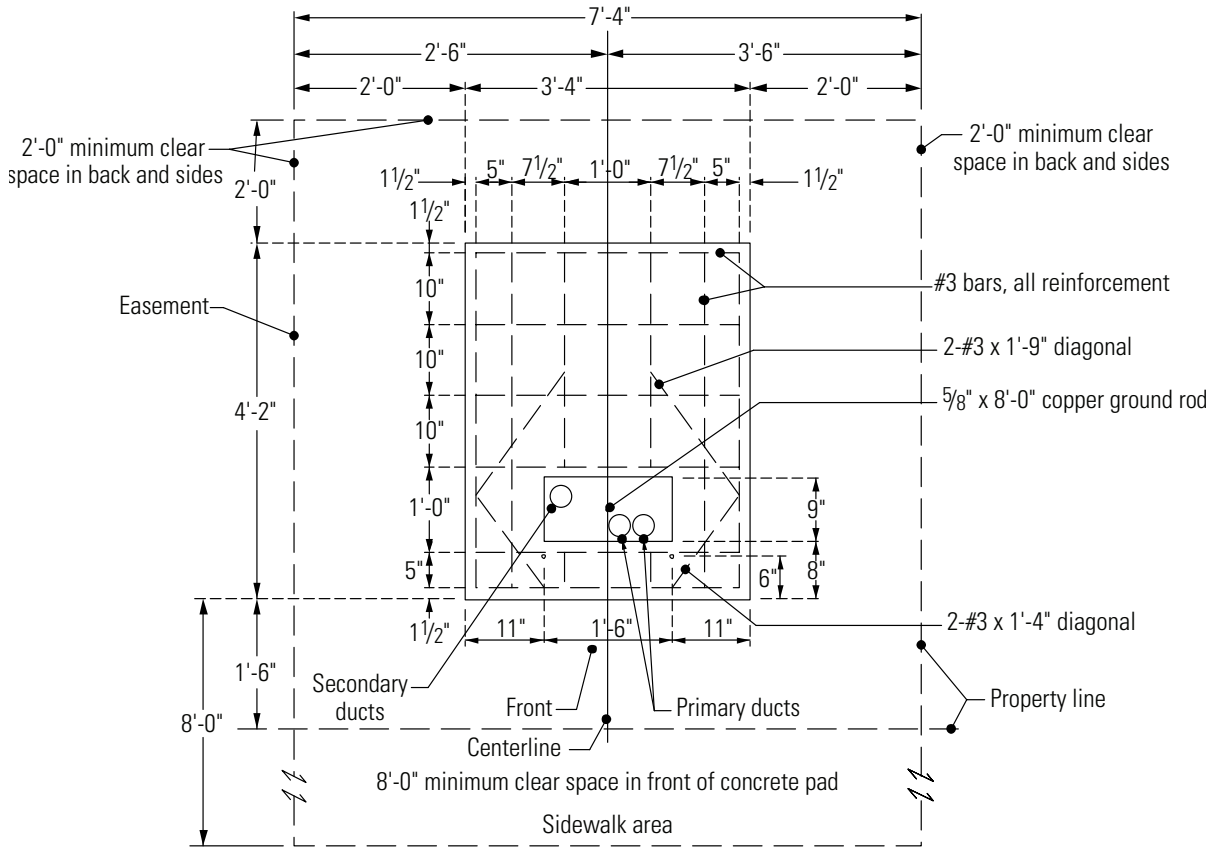
- 24-hour access to the transformer without passing through locked areas.
- A minimum of 10’-0" wide vehicular access to the transformer.



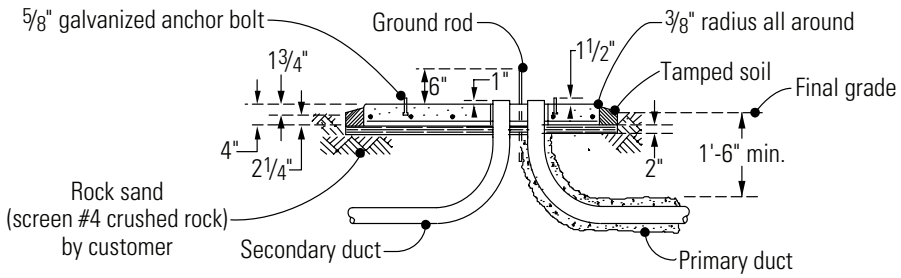
Notes:

1. Grade and compact the pad site so that the higher front corner matches the concrete sidewalk grade. The lot shall have a slope not greater than 1/2" per foot toward the sidewalk.
2. Grade sufficiently around the lot site to prevent future filling in of the lot. When required, the customer shall construct a retaining wall of suitable material to prevent future filling in of the lot.
3. Compact by rolling the lot site in accordance with C&C of Honolulu standard specifications for compacting sidewalk areas.
4. Excavate a trench 4'-0" wide and 2'-0" deep from main trench to pad site. Trench shall be backfilled by customer after HECO installs cables.
5. Excavate an area 3'-8" x 2" deep after lot is compacted. This area shall be filled with #4 lava rock.
6. Furnish and install precast concrete pad after HECO installs cable.
7. Refer to HECO material drawing 011249 for details of concrete pad.
8. Sloping terrain from back and sides of pad may begin from easement.

Figure 3-9. Concrete pad for a single-phase padmount residential transformer.



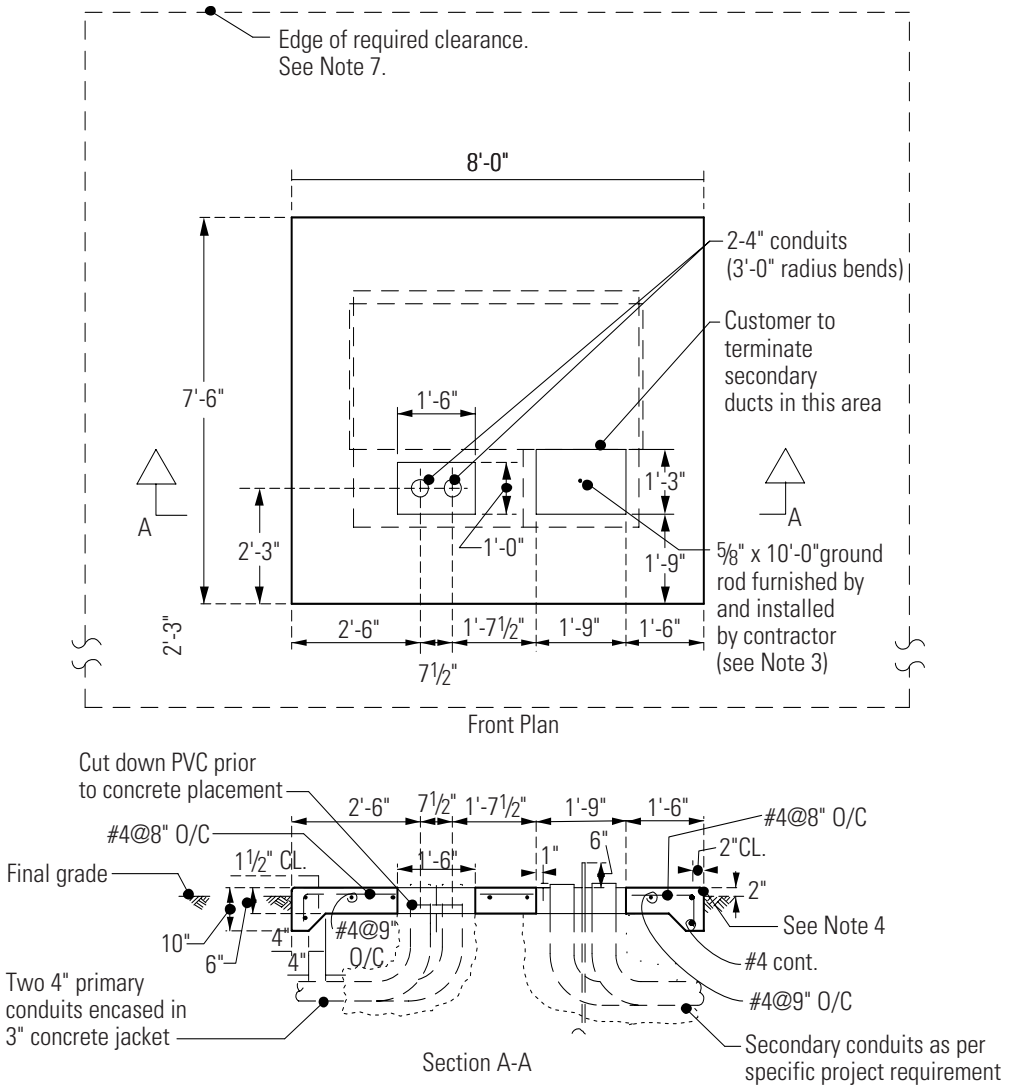
Top View



Notes:

1. Compressive strength of concrete shall be 3,000 PSI at 28 days.
2. Top of pad shall be smooth, true, level and other exposed surfaces shall be smooth and free from defects.
3. Concrete shall be cured by approved method (ASTM A15).
4. Reinforcing bars shall be clean deformed bars.
5. All items shall be furnished in place complete by customer.
6. HECO easement as marked for each transformer.
7. Typical installation. Refer to plot plan, primary and secondary one line diagram, and duct encasement details for duct requirements.

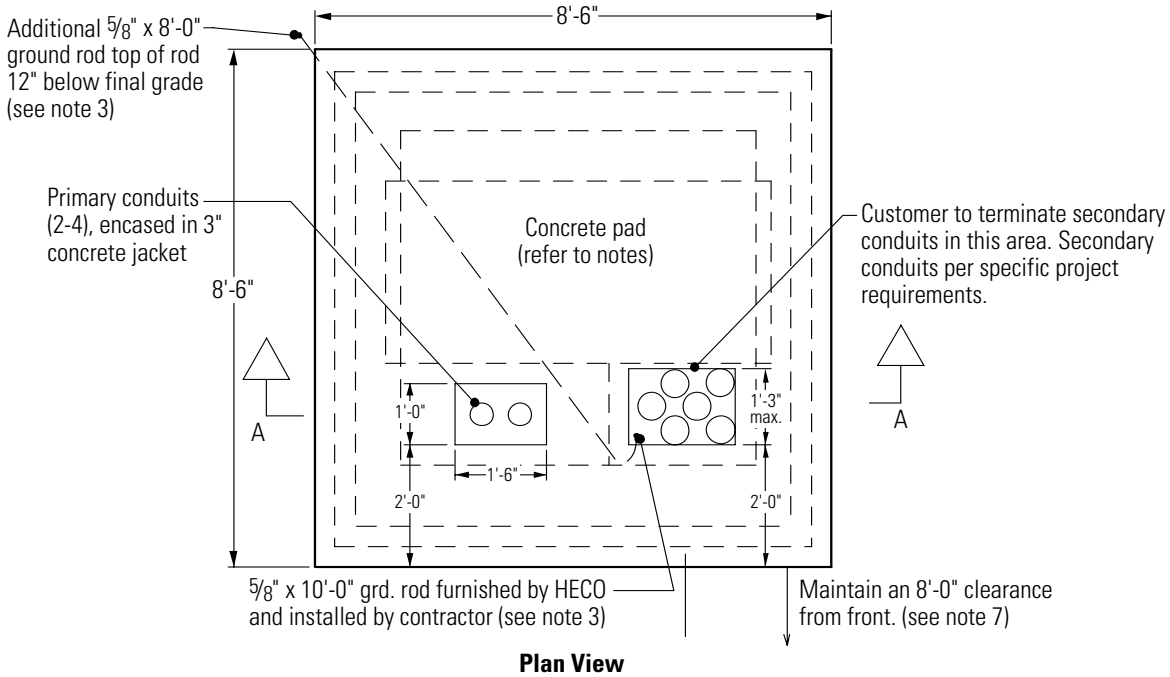
Figure 3-10. Concrete pad for a single-phase padmount commercial transformer.



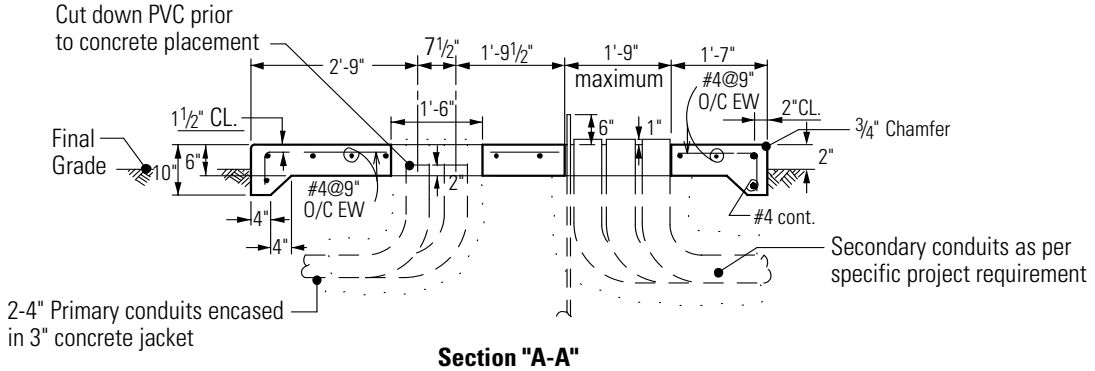
Notes:

1. Refer to std. 30-5000 for locations and clearances.
2. Refer to std. 22-2005 for 3 phase padmounted transformer requirements.
3. 5/8" diameter x 10'-0" ground rod (stock code 193457) furnished by utility and installed by customer. If ground resistance is more than 25 ohms, install additional 5/8" diameter x 8'-0" ground rod (stock code 101527) and connect 4/0 bare copper ground wire between ground rods. A minimum of 6'-0" shall be maintained between the driven ground rods. A second ground rod will probably be required when soil resistivity is greater than 67 ohm-meters.
4. Concrete: 3000 PSI compressive strength in 28 days. Moisture cure concrete pad a minimum of 7 days. Do not install transformer until concrete compressive strength reaches 1,500 PSI minimum or after 14 days.
5. Reinforcing: ASTM A615, Grade 40 minimum.
6. Locate, secure, and cap all conduits before pouring pad. Top of concrete to be smooth and true, wood-float finish, free of defects, as per city and county specifications. Round all exposed edges to 3/4" chamfer.
7. Maintain a relatively level, minimum clearance of 2'-6" from the sides of the pad, 2'-0 from the back of pad, and 8'-0" in front of pad. Extend concrete pad an additional 8'-0" in front if located in planting area.

Figure 3-11. Concrete pad for a 75-300 kVA three-phase padmount transformer.



Plan View



Section "A-A"

Notes:

1. Refer to std. 30-5000 for locations and clearances.
2. Refer to std. 22-2005 for 3 phase padmounted transformer requirements.
3. 5/8" diameter x 10'-0" ground rod (stock code 193457) furnished by utility and installed by customer. If ground resistance is more than 25 ohms, install additional 5/8" diameter x 8'-0" ground rod (stock code 101527) and connect 4/0 bare copper ground wire between ground rods. A minimum of 6'-0" shall be maintained between the driven ground rods. A second ground rod will probably be required when soil resistivity is greater than 67 ohm-meters.
4. Concrete: 3000 PSI compressive strength in 28 days. Moisture cure concrete pad a minimum of 7 days. Do not install transformer until concrete compressive strength reaches 1,500 PSI minimum or after 14 days.
5. Reinforcing: ASTM A615, Grade 40 minimum.
6. Locate, secure, and cap all conduits before pouring pad. Top of concrete to be smooth and true, wood-float finish, free of defects, as per city and county specifications. Round all exposed edges to 3/4" chamfer.
7. Maintain a relatively level, minimum clearance of 2'-6" from the sides of the pad, 2'-0 from the back of pad, and 8'-0" in front of pad. Extend concrete pad an additional 8'-0" in front if located in planting area.

Figure 3-12. Concrete pad for a 500-750 kVA three-phase padmount transformer.

Clearances Around Padmount Transformers

Consult with the power company's engineering department prior to installation of transformer pad. Required minimum clearances include:

- 8'-0" front clearance, for hot stick operation. Power company handholes and manholes may be installed within this 8'-0" clearance.
- The slope of a grade in front of the pad must not exceed 1/4" rise to 1'-0" run. Keep the slope at a flat grade.
- Sloping terrain may begin no closer than 2'-0" from the end of the transformer pad, and from the same elevation as the flat grades.
- Sloping terrain is restricted to a 1'-0" rise per 2'-0" run, or flatter.
- The maximum height of sloping terrain is 7'-6".

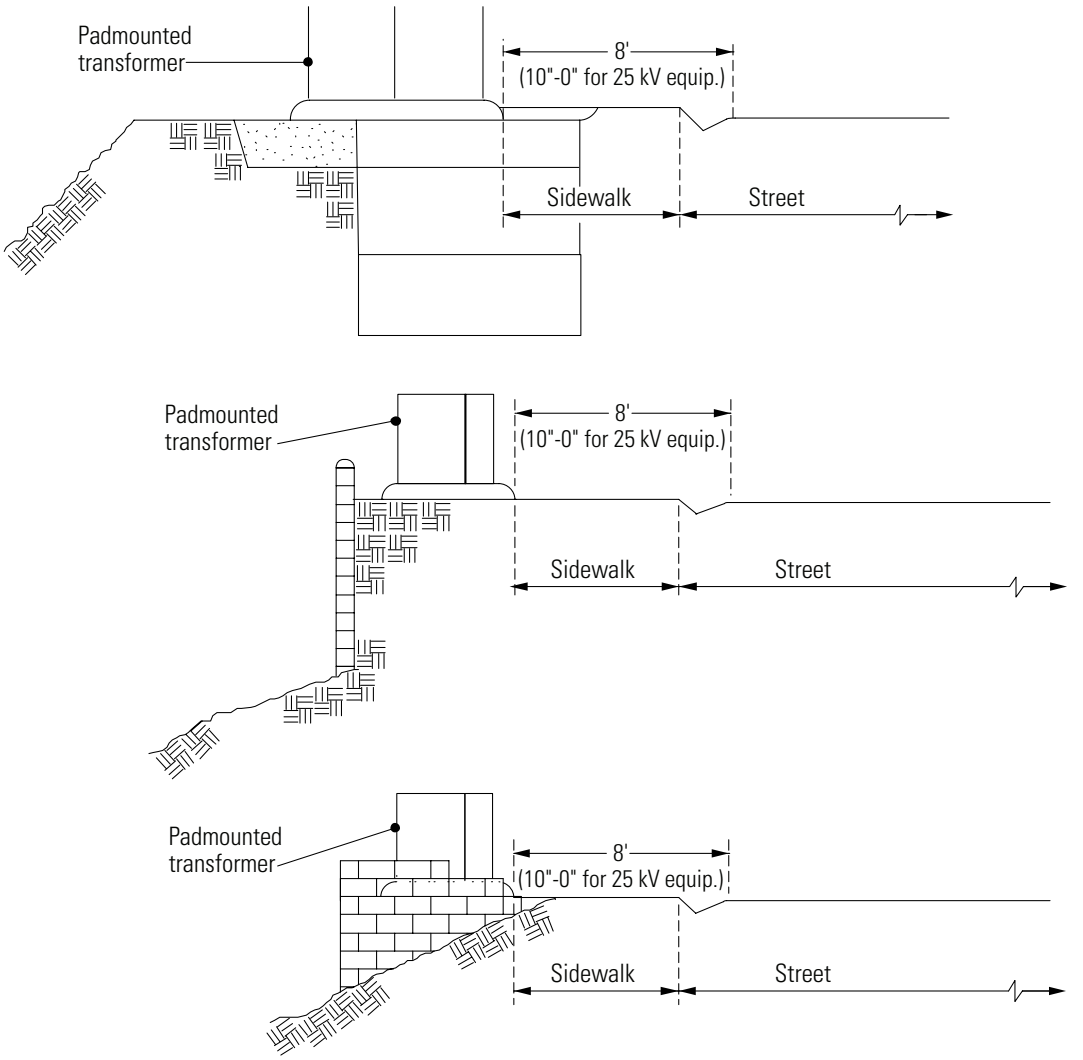
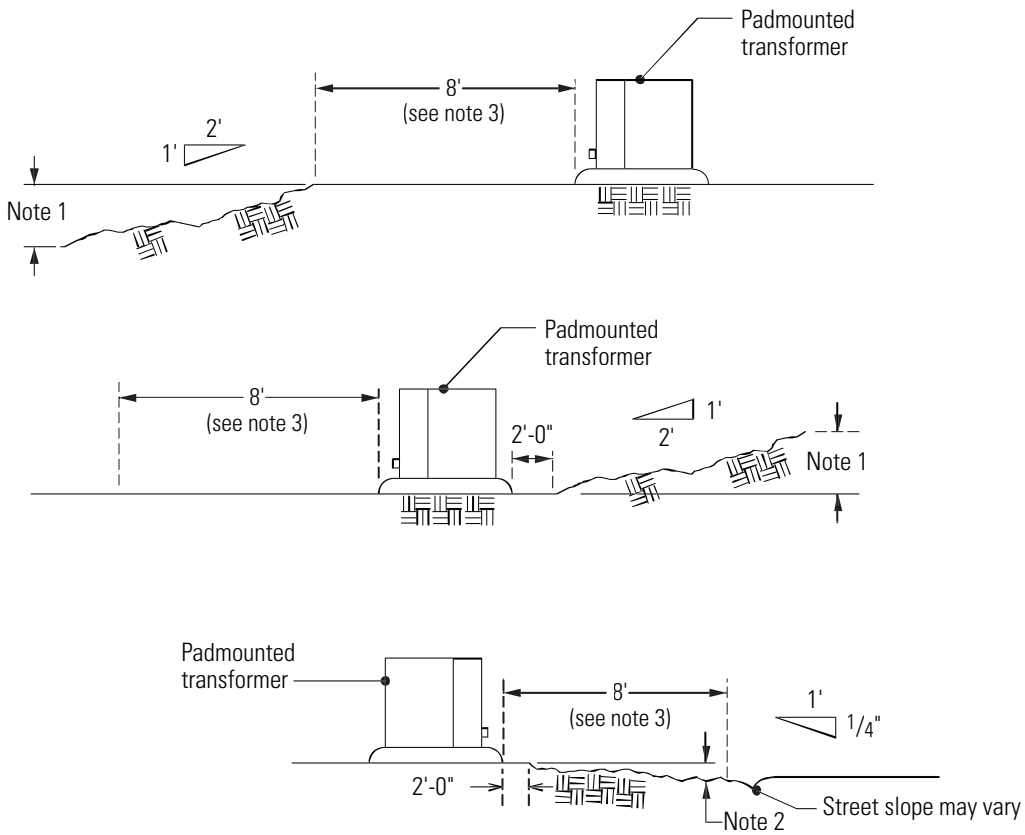


Figure 3-13a. Clearances around padmount equipment.



Notes:
1. Sloping terrain may begin 2'-0" from the end of the transformer pad and from the same elevation and is restricted to a 1'-0" rise to a 2'-0" run. Maximum of height of sloping terrain shall be 7'-6".
2. In front of transformer pad, the slope may not exceed a 1'-0" horizontal run to 1/4" vertical rise.
3. 10'-0" for 25 kV equipment.

Figure 3-13b. Clearances around padmounted equipment.

Underground Construction

Handholes and Manholes

Size, Type	Drawing Number	Description
13" x 24" handhole	30-2006	Non-concrete service box
17" x 30" handhole	30-2006	Non-concrete service box
24" x 36" handhole	30-2006	Non-concrete service box
2' x 4' handhole	30-2005	Precast concrete handhole
3' x 5' handhole	16949	Non-vehicular rated extension for Type 35 handhole
3' x 5' handhole, precast	15501	Non-vehicular rated and areas where normal water level is more than 2'-6" below surface grade
3' x 5' handhole, type 35V	18841	Non-vehicular rated and areas where normal water level is less than 2'-6" below surface grade
3' x 5" handhole	HE Spec. M7901	Non-vehicular rated and areas where normal water level is less than 2'-6" below surface grade
4' x 6' handhole, type 46M, 5' x 7' handhole , type 57M	16687	Non-standard, traffic rated
4' x 6' handhole	18842	Non-vehicular rated
4' x 6' handhole, type 46V	18847	Light vehicular rated
4' x 6' manhole, precast	26919	Traffic rated
4' x 6' handhole, 5' x 8' manhole, 6' x 11' manhole	26922	Non-vehicular rated handhole, pre-cast top slab
4' x 6' handhole, 5' x 8' manhole, 6' x 11' manhole	26923	Light traffic rated, handhole and manhole pre-cast components
5' x 7' handhole, type 57	18843	Non-vehicular rated
5' x 7' handhole, type 57V	18848	Light vehicular rated
5' x 8' manhole, precast	26920	Traffic rated, 6' x 9' outside dimensions
6' x 11' handhole, type 611	18844	Non-vehicular rated
6' x 11' handhole, type 611V	18849	Light vehicular rated
6' x 11' manhole, precast	26921	Traffic rated, 6" wall
6' x 14' manhole	71133	Structural plans, traffic rated
6' x 14' manhole, type 614	71467	Structural plans, traffic rated, 25 kV, 46 kV, 69 kV applications
6' x 11' manhole, type 614V	71468	Traffic rated
7' x 9' manhole, type No. 2	18776	Traffic rated
7' x 16' manhole, type No. 4	15588	Traffic rated
Miscellaneous details	16688	Handholes, manholes, non-vehicular rated and traffic rated. Pulling irons, duct entry covers and neck.

Table 3-2. Handhole and manhole equipment.

Retaining Walls

When pads cut into hillsides, these requirements apply:

- The concrete area must be at least 3-1/2" thick. For drainage, slope the concrete toward the front or sidewalk. Gravel may be used instead of concrete.
- Retaining walls, fences, and foundations are installed by the customer, and are outside the easement area.
- Retaining walls must be of sufficient height to protect the equipment from erosion and run-off of dirt and water. A drainage swale behind the wall must be installed to divert water around the equipment.
- Retaining walls must meet state and city codes and requirements for retaining walls. (Must be submitted for utility company review.)
- For walls taller than 24" high, acceptable protection such as a fence must be installed at the top of the wall to prevent falls. Alternatively, the wall can be extended to a sufficient height to prevent falls.
- Weep holes, if required, must not drain in the area occupied by power company equipment.

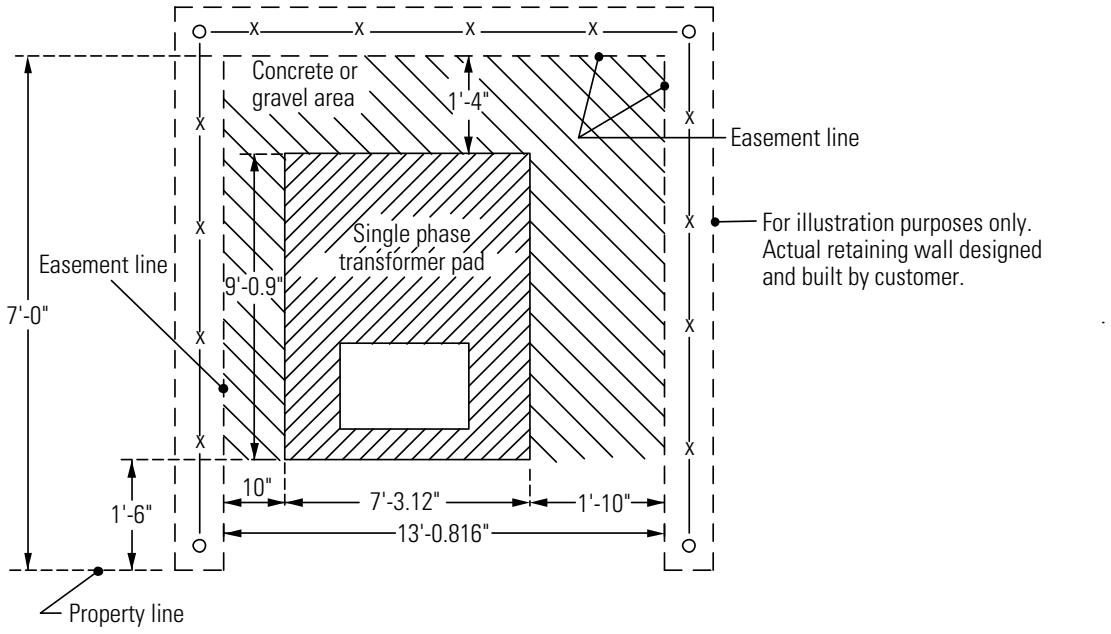


Figure 3-14. Retaining walls near electrical equipment.

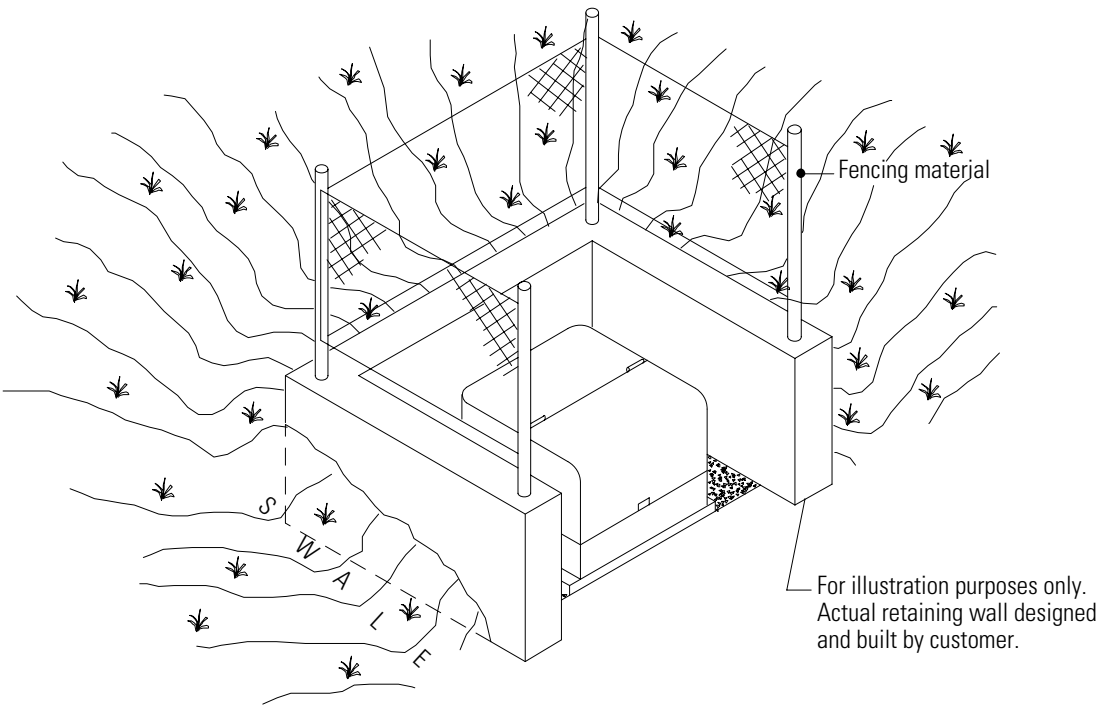


Figure 3-15. Retaining wall with fencing material.

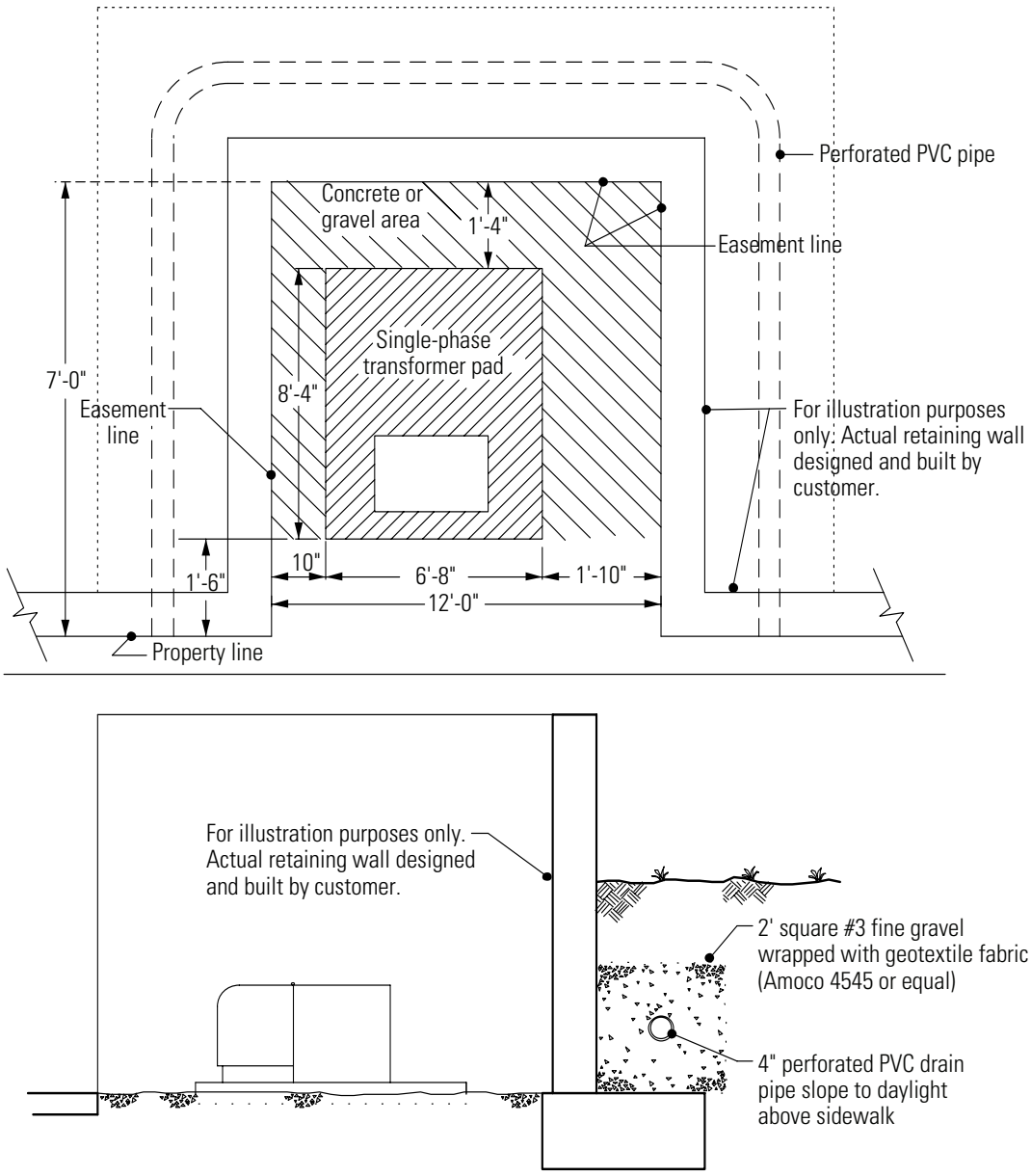


Figure 3-16. Retaining wall with drainage protection when weep holes are required.

Figures 3-14, 3-15, and 3-16 show a single-phase padmount transformer. The same slope and wall requirements apply to other equipment such as three-phase padmount transformers and switchgear. For all applications, the slopes and walls are outside the designated clear zones for the equipment installed.

CHAPTER

4

Metering

Introduction

This chapter describes the installation of the meter itself. In addition to these requirements, meter installations must conform to NEC requirements, and to local regulations.

This chapter has the following subsections:

- General information which applies to all meter installations.
- Self-contained metering for single-phase residential services of 320 continuous amps and less, and all three-phase and commercial services of 200 amps or less.
- Instrument transformer metering for residential single-phase services over 320 continuous amperes, three-phase and commercial services over 200 amps, and for all services over 600 volts.

General Information

Power Company Responsibilities

The power company provides, installs, owns, and maintains its meters, instrument transformers, test switches, and other metering accessories.

Customer Responsibilities

The customer provides, installs, and maintains the following for company meters:

- Meter sockets, including plastic covers for open sockets
- Conduits and raceways, connectors and lugs, and wiring (except wiring for instrument transformer metering which is supplied by the power company)
- Splice cans
- Protective equipment, including main breakers and switches

And where applicable:

- Meter enclosures
- Instrument transformer enclosures with transformer mounting brackets
- Meter centers
- Switchboards/switchgears
- Submit four sets of the manufacturer's switchgear drawings to the power company for approval before equipment fabrication or construction. Include the electrical service one-line diagram, elevation of metering equipment, plot plan of location of metering equipment, and manufacturer's design drawings of switchgear in reference with applicable EUSERC drawings. One set of drawings will be returned to the sender with approval or required corrections. Submit the drawings well in advance. The power company requires 3 months to review, plan, and order metering equipment for primary service.

Labels

The customer provides a permanent label at each meter socket, and at the main service disconnect, to identify the space served. For example: Identify the number of the apartment, suite, or unit. The name of the customer may be on the label, but is not required. In addition, the street address is required if the meter installation serves more than one street address.

Acceptable labels include engraved laminated phenolic (or equivalent) nameplates, or adhesive-type labels with 3/8-inch minimum block lettering. Felt-tip pens and label-maker tapes are not permanent markings. Labels must be installed before service is connected. Thereafter, keep labels current, legible, and accurate.

Conditions for Energizing

A meter will be installed and the service energized when:

- The customer's metering equipment is installed and approved by the power company.
- The customer's main service breaker or switch is installed.
- The local inspection authority has approved the installation. Typically, the local authority is the city or county building department.
- For certain situations, the company may require that the customer's contractor be present at the time of energization.

Meter Location

Metering equipment is installed at a convenient location on the customer's premises which is approved by the power company. If multiple meters are installed, all meters are installed at one central location.

The metering location must be free from obstructions, abnormal temperatures, corrosive atmospheres, and vibrations.

All meters, metering equipment and enclosures must be readily accessible at all times (24 hours) by power company personnel for emergencies, meter reading, inspection, testing, and maintenance in accordance with the tariff.

Locating Residential Meters

Meter sockets for residential services are located within 4 feet of a corner of the residence or building nearest the street. The preferred corner is at the front of the residence, outside the garage, on the side wall.

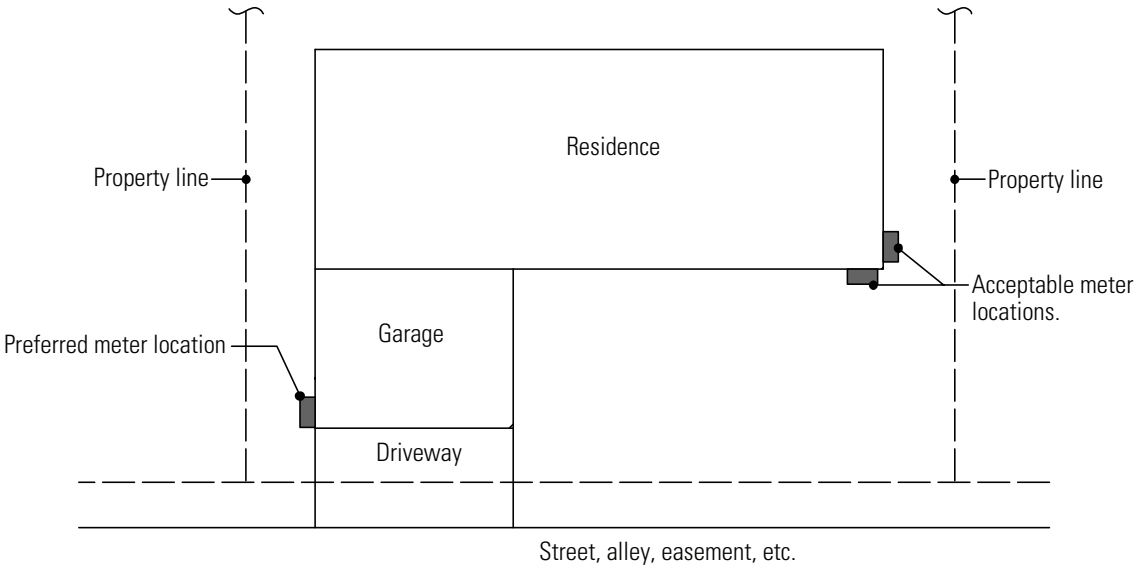


Figure 4-1. Locations for residential meters.

Meter Locations for Commercial and Industrial Services

Locate metering on ground level unless approved by the utility. Because of the variations in commercial and industrial facilities, the power company must approve the meter location for these services. Submit a one-line diagram, plan view, and meter elevation drawings for approval. On the plan view and elevation drawings, indicate all equipment or structures near the metering equipment.

Unacceptable Meter Locations

- Locations not readily accessible such as inside garage walls, carports, breezeways, or areas that may be enclosed. If renovations are made to a carport, garage, patio, or a similar structure that will enclose metering equipment, the customer must relocate the metering equipment to an accessible location.
- On doors, windows, or around doors or window openings. Allow a clearance of not less than 6 inches between the meter can and any door, doorway, or window opening, or the width of a swinging door or window.
- In an elevator shaft or hatchway.
- In a stairwell.
- In an attic or area not in general use.
- In a restroom, bath, shower, powder, or toilet room.
- Near moving or rotating machinery.
- Near any high-voltage compartment, switchboard or other bare or exposed live parts, unless the meter is at least 5 feet from such parts and is effectively screened or separated by a barrier from those parts.

- Enclosed areas used for trash chutes, storage, or janitorial rooms.
- Where the meter protrusion could obstruct and create a hazard to pedestrian and/or vehicular traffic.
- Where noise levels exceed 85 decibels. See Hawaii OSHA regulation 12-200-9, *Protection Against Noise Exposure*.
- Do not install metering equipment in a generator room.
- Where excessive moisture, abnormal temperature, vibration, fumes, dust, salt spray, corrosive atmosphere or similar deteriorating agents are present.
- Near gas lines/equipment, maintain required clearances.
- In an area protected by alarm systems, security gates or doors, guard dogs, etc., unless approved by the power company.
- On any portion of a building where future landscaping, fencing, or other building construction will make the meter inaccessible.
- Fenced-in areas, such as along freeways.
- On power company poles unless approved by the power company.
- On piers, docks, or berths. Install metering equipment for piers, docks or berths at a minimum of 10 feet from the edge of the water, or in compliance with the requirements set forth by the authority having jurisdiction.

Clearances Around Meters

Allow the following clearances around metering equipment:

- Clearance around the meter: 6 inches above, and to the side of the meter socket enclosure or instrument transformer enclosure, to any obstruction.
- A clearance in front of metering equipment of 4 feet by 4 feet by 7 feet with no obstructions such as walls, fences, trees, hedges, or other structures or equipment.

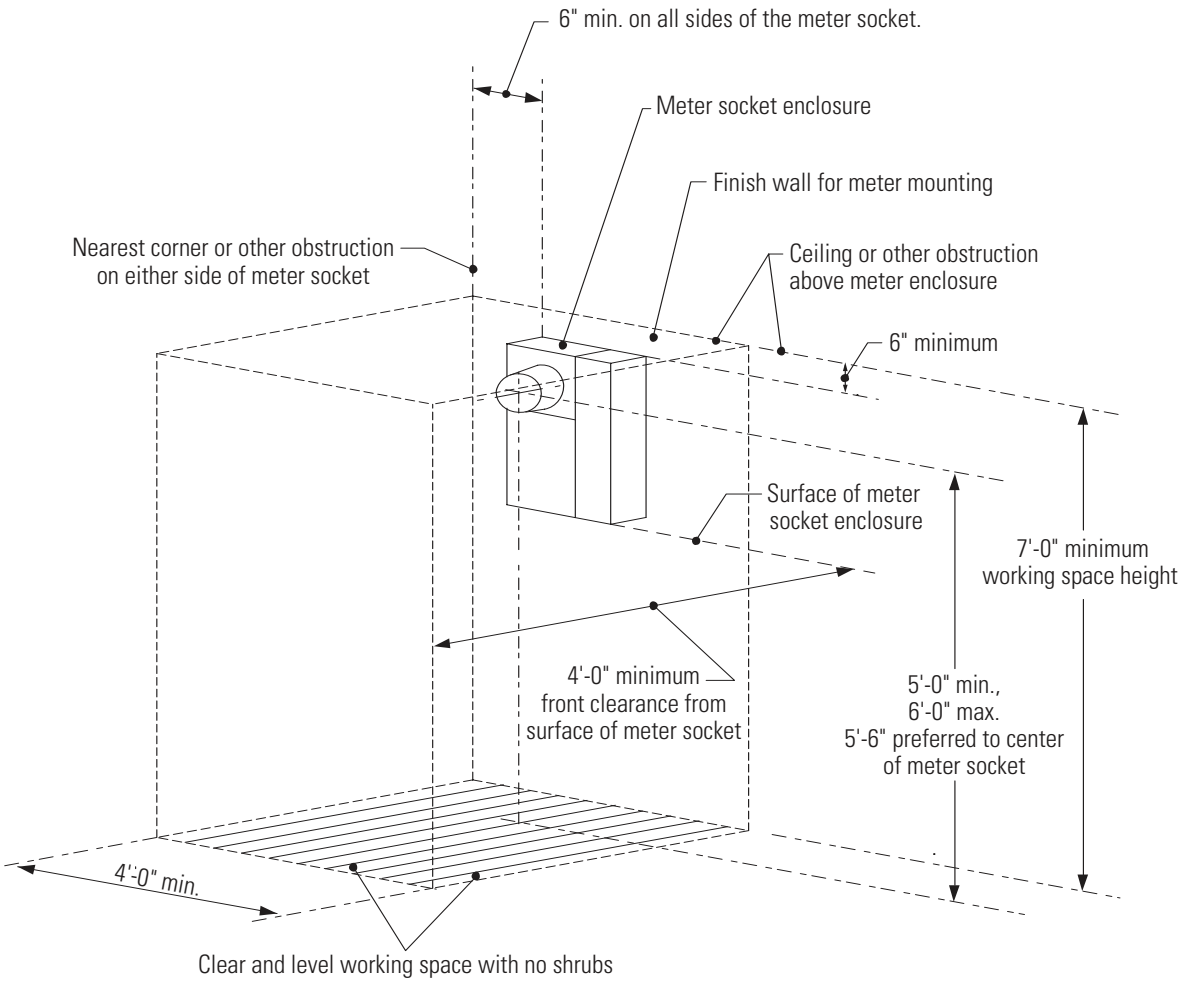


Figure 4-2. Clearances around meters.

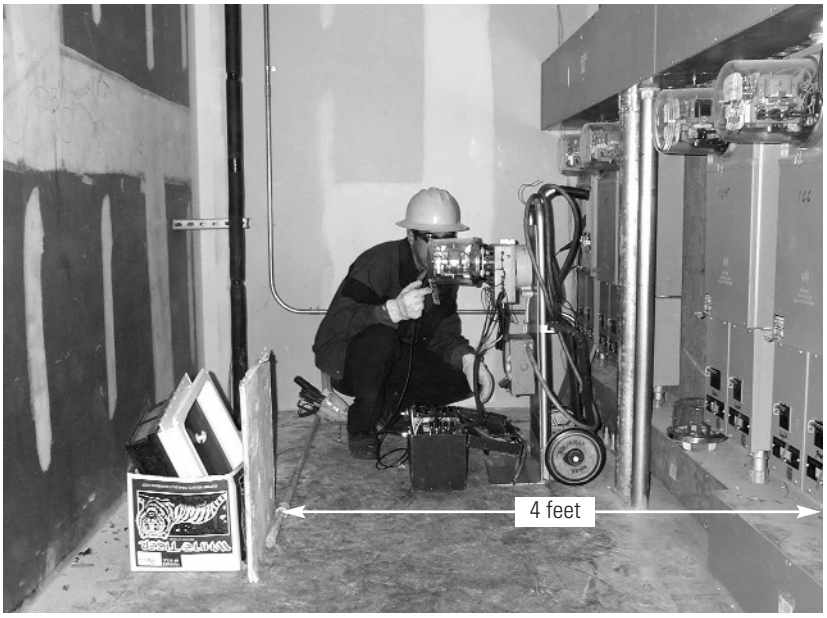


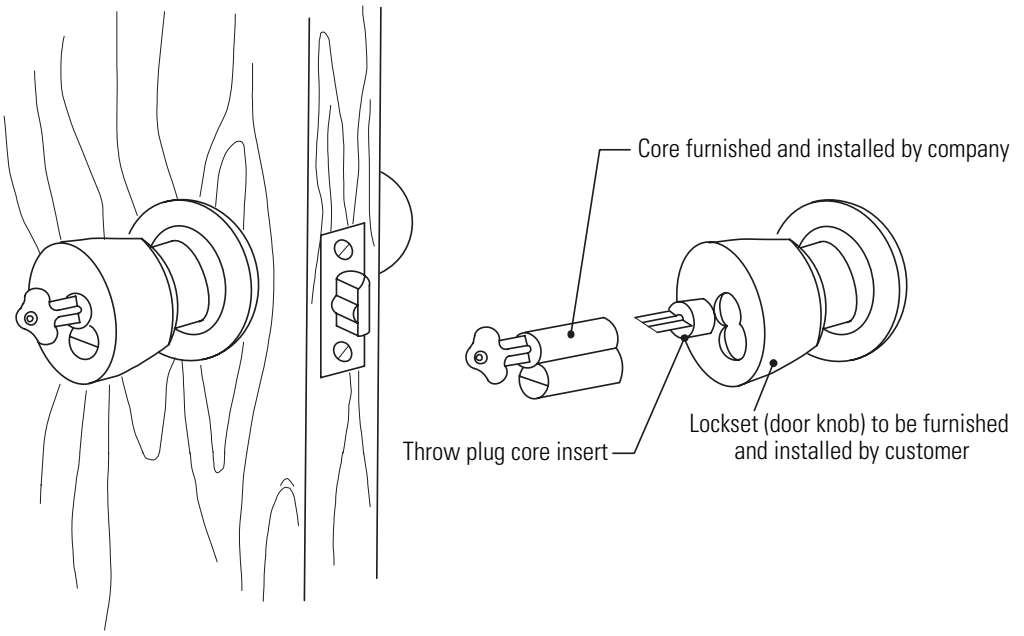
Figure 4-3. Meter electricians performing meter test. Notice the need for workspace clearance between the meter socket panel, and the pole on the floor.

Electrical Rooms, Meter Closets, and Other Enclosed Areas

If the meter or metering equipment will be installed in a electrical room, meter closet, or enclosed area, submit drawings of these installations to the power company prior to construction, for review and approval.

Access

If the customer locks the doorway to the facility, the lock will be keyed to the power company's Best (brand) key core. Alternatively, contact the power company's Customer Installations Department for other locking means, such as the use of a key box or Supra lock box near the doorway.



Typical lockset installation

Notes:

1. The lockset is furnished and installed by the customer.
2. Core and individual keys are furnished and installed by the power company.
3. All locksets must accommodate the power company's Best (brand) core insert.
4. Consult with the power company prior to installation.

Figure 4-4. Door locksets.

Doors

Entry into an electrical room, meter closet, or enclosed area must be through a vertical doorway that can be opened from the exterior of the building, or an entryway acceptable to the power company. The door must be at least 3 feet wide and 6 feet 6 inches high. Neither the ceiling, nor door, nor doorframe shall interfere with the clearances necessary for the installation or maintenance of service and metering equipment. Center double-door frames or similar framing must not obstruct the required workspace clearance in front of metering equipment.

Communication Equipment

Telephone, CATV, data processing equipment, etc. are permitted in an electrical room, meter closet, or enclosed area under the condition that the installed equipment does not obstruct or violate the required working space clearances. Communication equipment must not be installed such that it can contact or open into metering equipment. Grounding of communication equipment must not alter or reduce the integrity of the electrical service grounding system.

Foreign Equipment

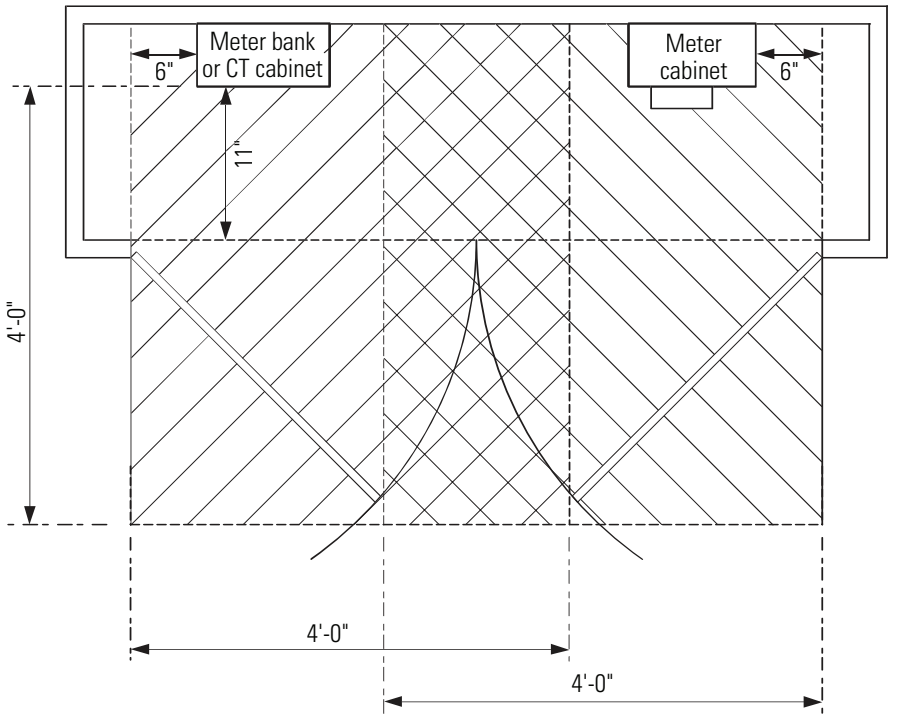
Equipment not permitted in electrical meter rooms, meter closets, or enclosed metering areas includes:

- Gas equipment, including piping systems.
- Mechanical equipment.
- Storage of miscellaneous equipment, materials, liquids, etc.
- Wet filled batteries, battery charging equipment, generators.
- Irrigation and outdoor garden/landscaping sprinkler controllers.
- Water heaters or boilers including any piping systems under pressure

Exception: Sprinkler piping systems and sprinkler heads are allowed in these installations if required by the local fire or building codes. The appropriate inspection authority shall determine placements and shielding of sprinkler heads. When placing sprinklers, maintain all required metering and workspace clearances.

Illumination and Electrical Outlets

The electrical room, meter closet, or enclosed area must be well lit in accordance with local building and NEC requirements. Provide a minimum illumination of 50 foot-candles. Install electrical outlets in accordance with local building codes.

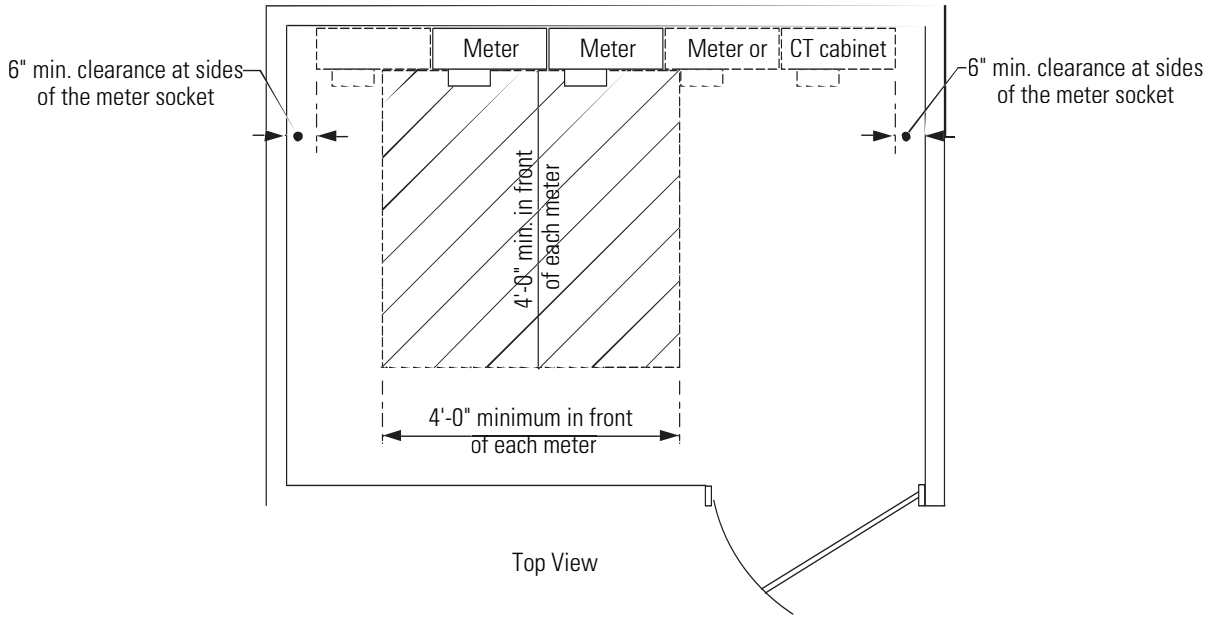


Top View

Notes:

1. Provide at least 11 inches clearance between the face of the meter socket panel and the closet door.
2. The height of the meter closet must be at least 7 feet.

Figure 4-5. Meter closet working space.



Provide 6" minimum height clearance above all meter sockets.

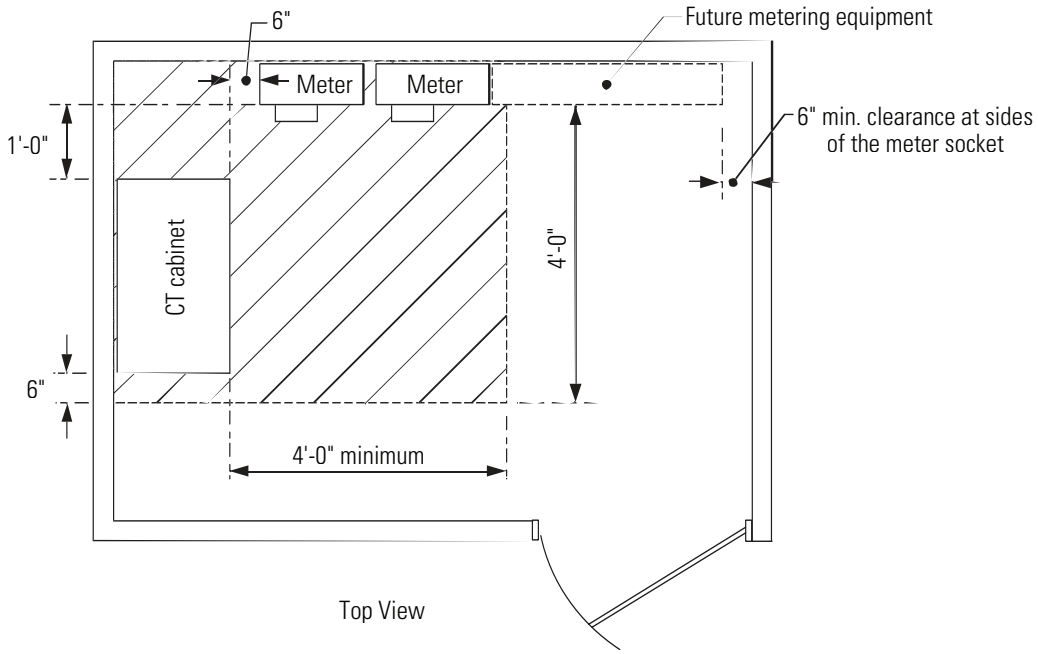


Figure 4-6. Meter room working space.

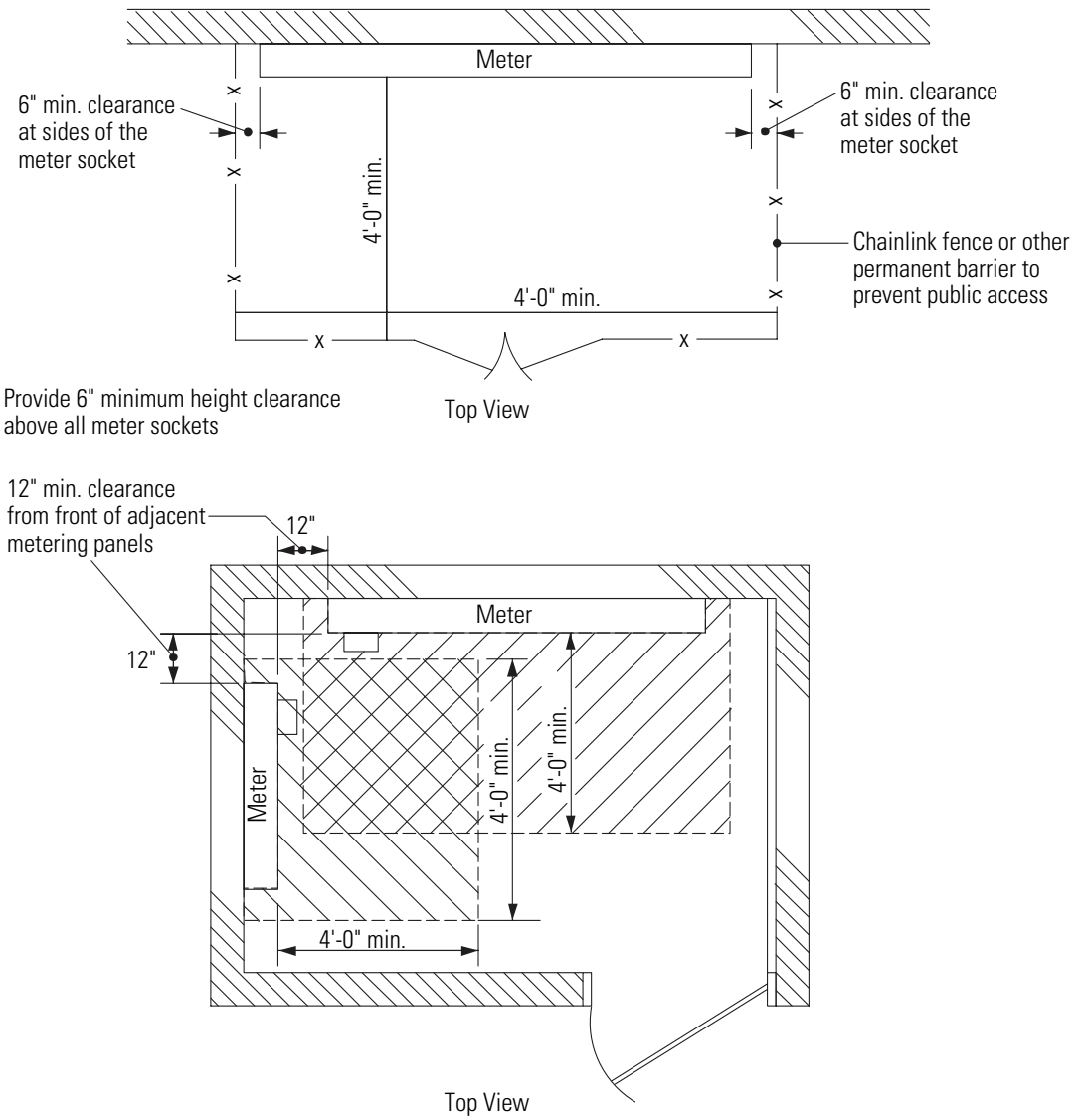


Figure 4-7. Enclosed area working space.

Freestanding Meter Enclosure, Pedestal, and Steel-Post Structure

Freestanding meter enclosures, pedestals, and steel-post structures are permanent, self-supporting enclosures or structures constructed for installing or housing electric service and metering equipment. They are acceptable for installing service and metering equipment when:

- Equipment cannot be installed on an exterior wall, and
- Adequate wall space in an approved location is not available, or
- There is no facility or building near the area of service for this equipment. Examples: Traffic signal service, irrigation service.

Enclosures, cabinets, or equipment installed outdoors must be rain-tight and have a 3R rating or higher, by NEMA. Enclosures, cabinets, or equipment subjected to corrosive environments (for example, near coastal areas) should have a NEMA 3R Stainless Steel rating. The customer may elect to use stainless steel equipment.

Freestanding Meter Enclosure

A freestanding meter enclosure is an enclosure that houses or provides physical protection for service and metering equipment.

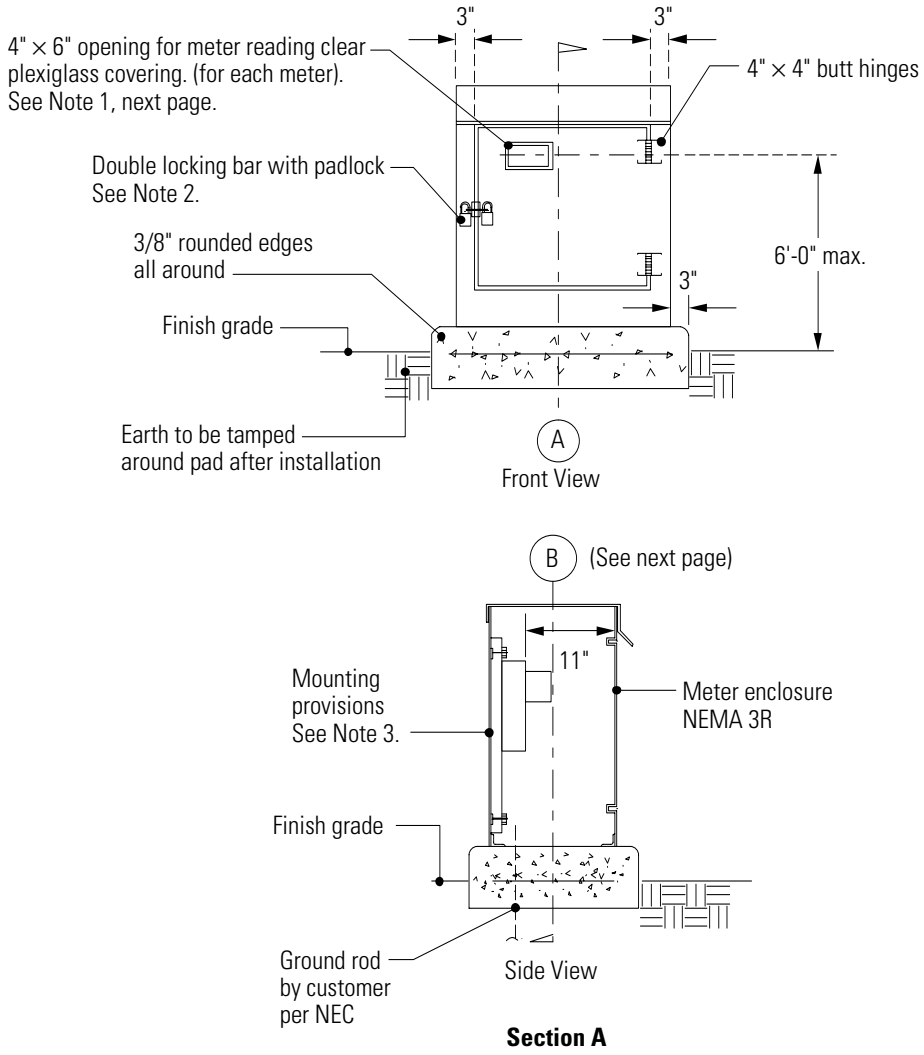


Figure 4-8a. Free-standing meter enclosure.

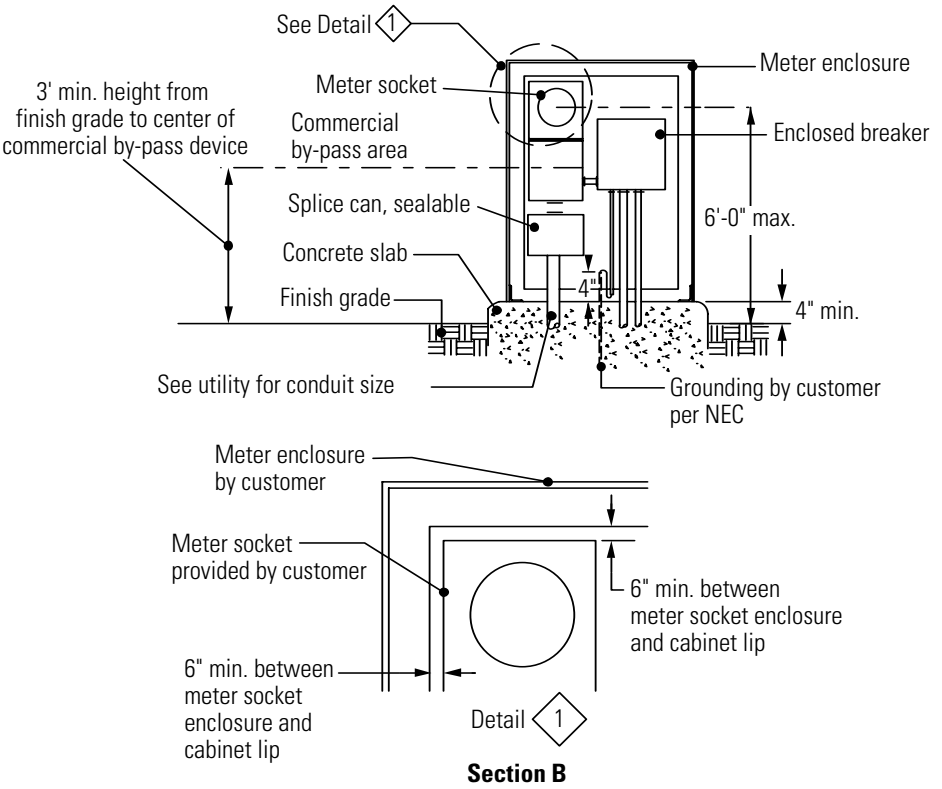


Figure 4-8b. Free-standing meter enclosure.

Notes:

1. The 4" x 6" meter viewing window is aligned over the meter so the meter can be easily read. The meter is placed so the window will face the public access way. This applies to only rate schedule G and R. A viewing window is not required for rate schedule J or demand accounts.
2. The customer and the power company to provide one padlock each.
3. Metering equipment is mounted within the enclosure by metal brackets, metal struts, or plywood. Plywood backboards have a minimum thickness of three-quarters inch and are pressure- and termite-treated (example: Wolmanized).
4. All enclosure sections needing power company access have at least 4 feet workspace clearance in front of the section doors. Any enclosure sides that are not accessible must have a minimum clearance of 2 feet to allow maintenance.
5. Provide a minimum clearance of 6 inches from the top and sides of the meter socket panel to the enclosure lip (if applicable). Provide a minimum clearance of 11 inches from the face of the meter socket panel to the enclosure's door.
6. For commercial installations, the meter socket is mounted so the center of the commercial by-pass is not lower than 3 feet from the finish grade. The maximum height of the center of the meter socket is not greater than 6 feet from the finish grade.
7. Secure the enclosure to a concrete pad with 4-5/8 inch diameter anchor bolts. Reinforce the concrete pad with #4 bars at 12 inches on-center. The concrete pad has a minimum thickness of 6 inches, and cured at 3000 PSI strength for 28 days.
8. The finished ground surrounding the enclosure must be level and clear to allow for the use of a ladder.
9. Paint the enclosure with one coat of shop primer followed by two coats of epoxy enamel finish.

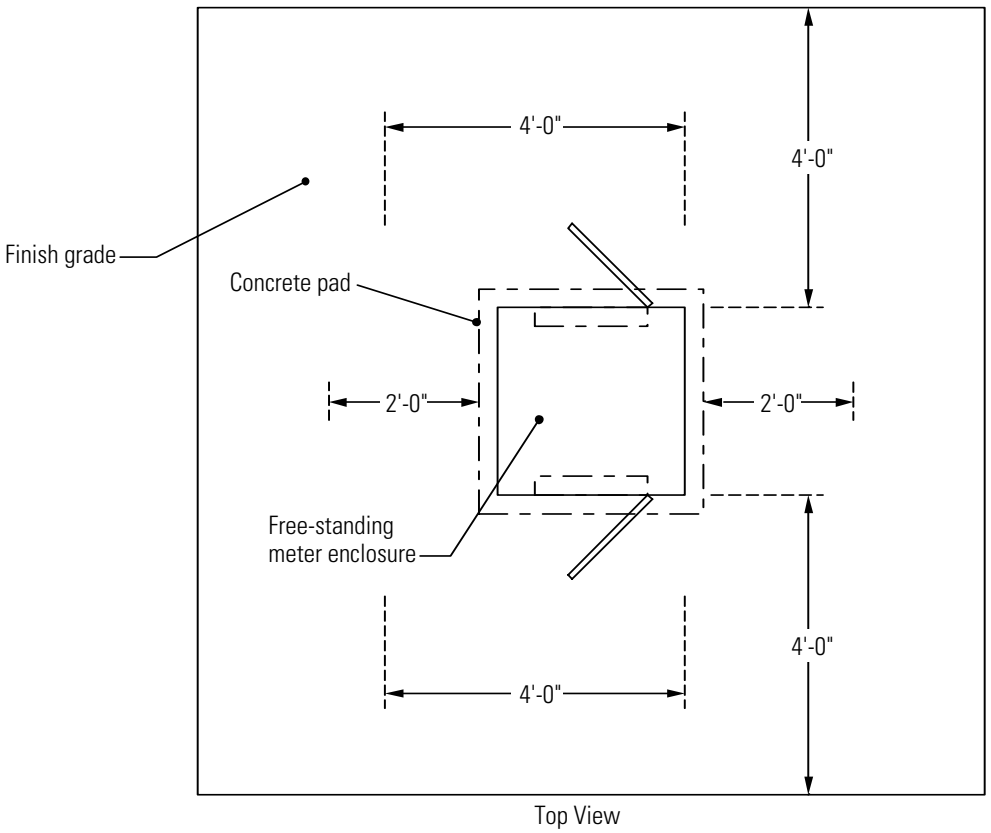


Figure 4-9. Free-standing meter enclosure working space.

Figure 4-10. A free-standing meter enclosure must allow a 6-inch clearance at top and left side of meter socket to the enclosure rim, to allow the meter electrician to see and align the meter blades to the meter socket jaws.

Free-Standing Meter Pedestal

A free-standing meter pedestal is an enclosure prefabricated at the factory for use for service and metering equipment.

Submit manufacturer's drawings of the meter pedestal to the power company before purchasing. The power company will need to physically inspect and accept the meter pedestal before installation.

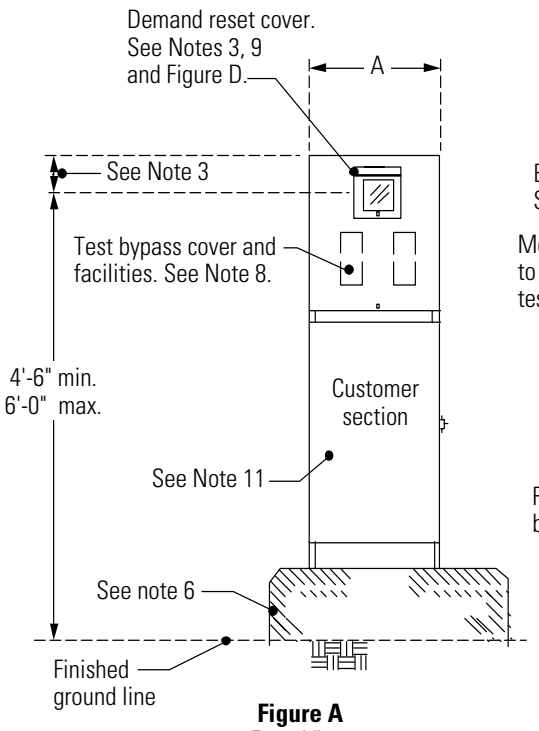


Figure A
Front View

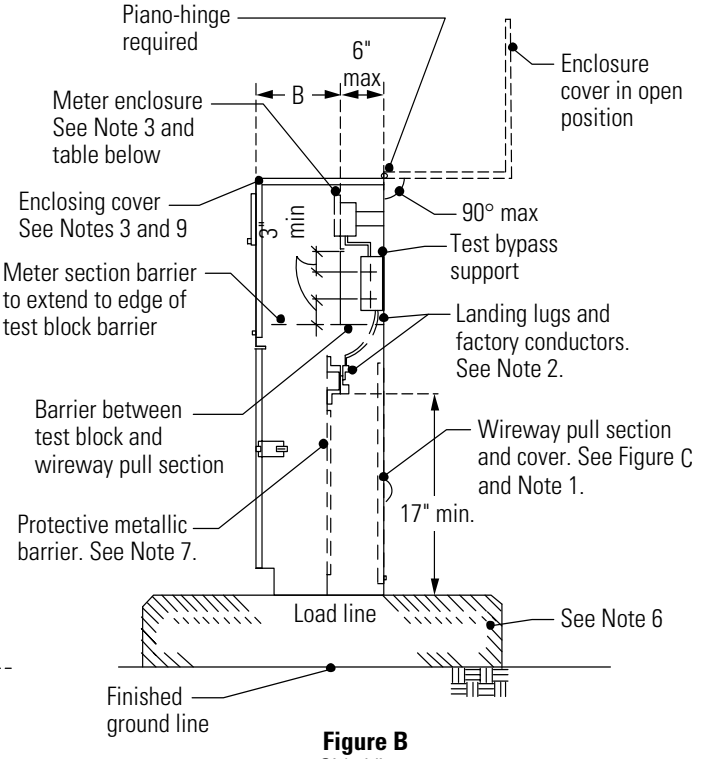


Figure B
Side View

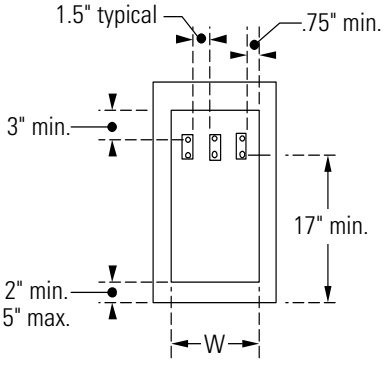


Figure C
Wireway Pull Section

Minimum dimensions, single-phase service

W	A	B	C
10.5"	20"	11"	9"

See also notes on the next page.

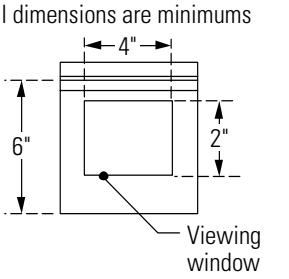


Figure D
Demand Reset Cover

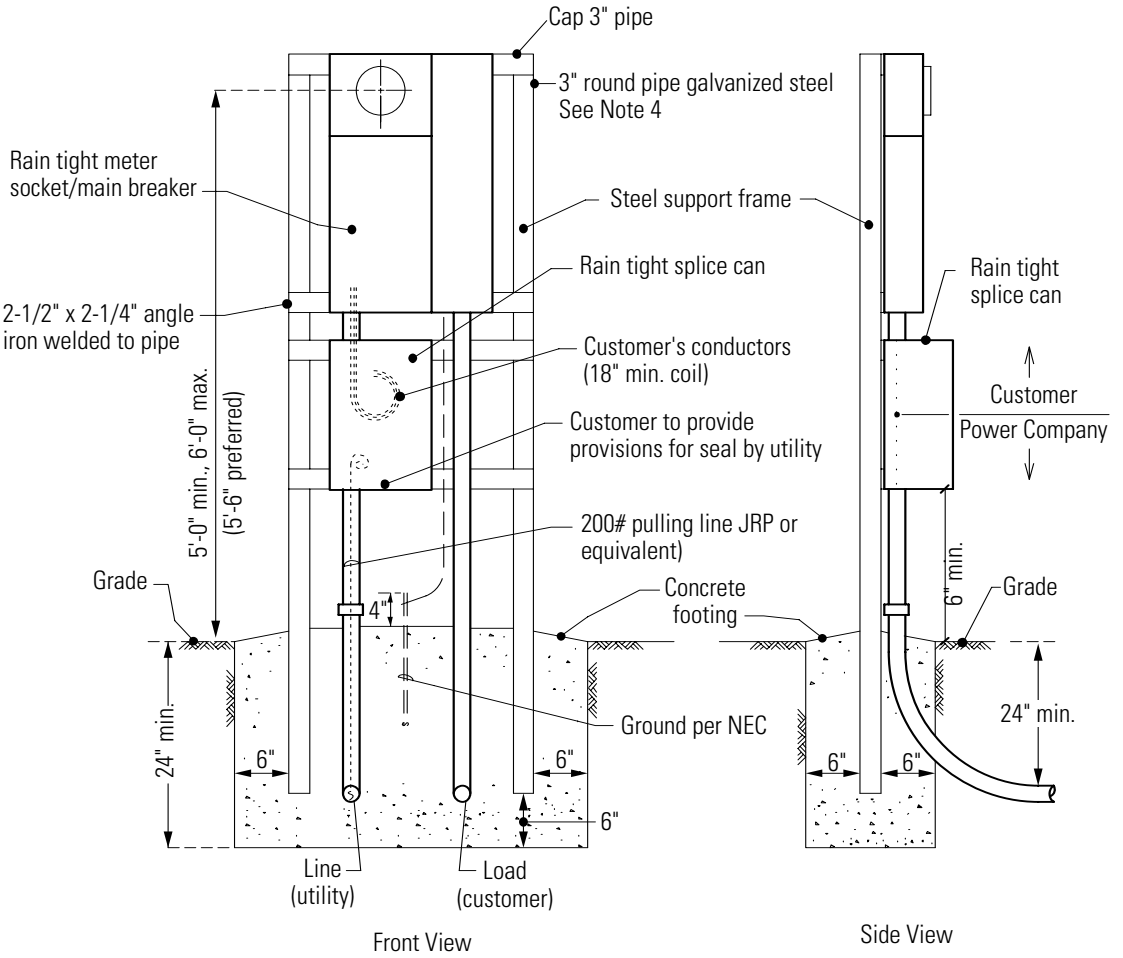
Figure 4-11. Free-standing meter pedestal.

Figure 4-11 Notes:

1. Wireways have the minimum dimensions shown in the table in Figure 4-11. The bottom of the wireway must accept a 3-inch (minimum) conduit.
2. Service conductors are terminated on landing lugs. The service termination lugs must be #6 through 250 kcmil pressure-type CU-AL listed. Insulated cables or bus shall be installed between the landing lugs and the commercial by-pass facility.
3. The meter is enclosed. The enclosure cover is hinged and weighs not more than 25 pounds. Allow a minimum clearance of 11 inches from the face of the meter socket to the enclosure cover. The enclosure cover has a demand reset cover constructed of steel. The reset cover has a hinged polycarbonate-viewing window with the minimum dimensions as shown in Figure D.
4. Do not install ringless sockets.
5. Internal equipment is secured without screws or nuts on the outer surface of the enclosure that may be loosened from the outside.
6. Consult the power company for the structural mounting and support of the pedestal.
7. Provide a protective metallic barrier (16-gauge minimum) between the power company wireway and customer distribution section. The protective barrier shall not have a clearance more than 1/4-inch between the power company wireway and customer section to prevent screws and bolts from protruding into the termination section. All unmetered (line side of meter) bus or cable shall be separated by suitable barriers from metered (load side of meter) bus or cable.
8. The pedestal is supplied with commercial by-pass blocks with rigid insulating barriers wired or bussed to the meter socket by the manufacturer. Connection sequence is Line to Load from left to right. Identify each Line and Load position with 3/4-inch (minimum) block letter labeling. Seal commercial by-pass cover panels, and fit them with a lifting handle. For panels exceeding 16 inches wide, install two lifting handles.
9. All power company compartments (meter cover, demand reset cover, and pull section) shall have provisions for the power company's seal or padlock.
10. Install warning labels indicating high voltage and instructing personnel to stay clear of the enclosure, on the wireway pull section cover and in front of the meter section hinged cover.
11. Enclosure similar to Pacific Utility Products USP-M015 series, or Tescoflex 26-000 models.

Free-Standing Steel-Post Structure

A free-standing steel-post structure is a structure made from metal pipes and brackets or supports to mount service and metering equipment.



Notes:

1. Do not use plywood backboards for mounting service and metering equipment – weathering can cause the board to warp or bend.
2. Mount the center of meter socket between 5 feet and 6 feet above the finished grade.
3. The finished ground surrounding the structure must be level and clear to allow for the proper use of a ladder.
4. If the structure will contain any instrument transformers, the support pipes must be 4-inch round pipe galvanized steel, installed to a minimum depth of 30 inches.
5. The power company is not responsible for insufficient structural design to support service and metering equipment. Have all meter support structures reviewed by a qualified professional.

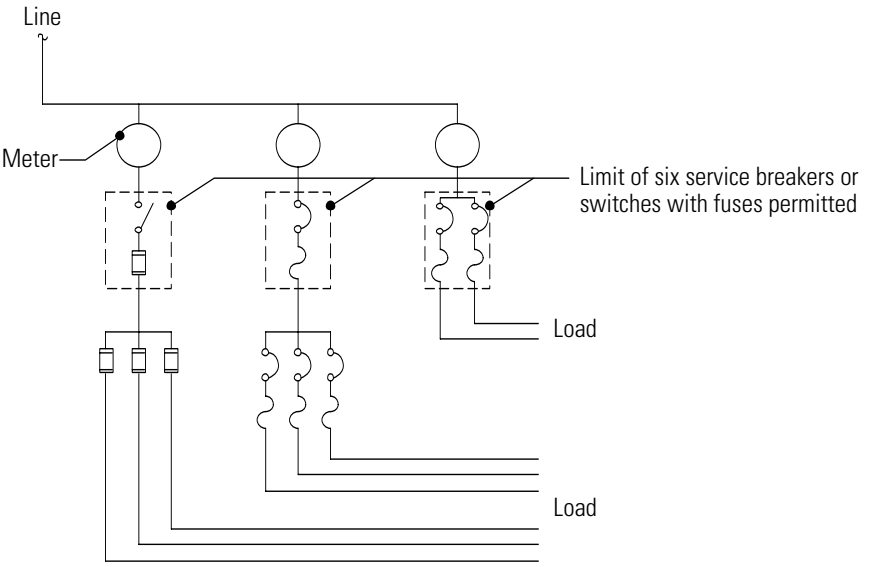
Figure 4-12. Free standing, steel post structure.

Meter and Main Service Disconnect Configuration

The customer must furnish and install a fusible switch, circuit breaker, or other approved disconnecting means to control the service and energy registered by a meter, before service is energized.

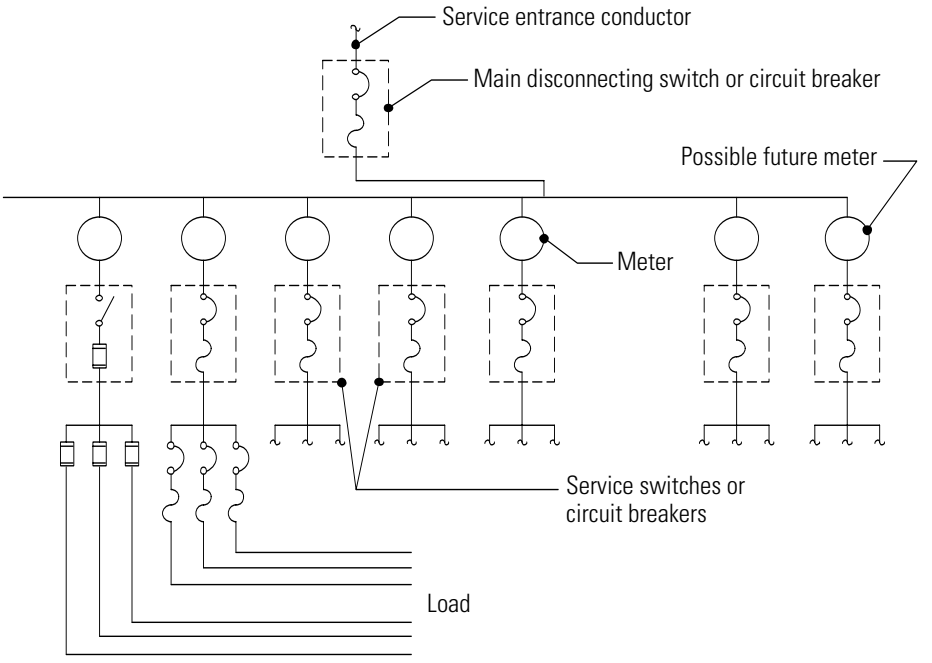
Typically, the disconnecting means or main service disconnect is on the load side, or after the power company's meters or metering equipment. These are exceptions:

- For a single set of service entrance conductors supplying a multi-meter installation of 7 or more meters with individual disconnecting means, the electrical code requires a main service disconnecting means on the supply side or before the meters.
- For a single set of service entrance conductors supplying a multi-meter installation of 2 to 6 meters with individual disconnecting means, a main service disconnecting means on the supply side or before the meters may be installed when it is determined that future growth will require more than 6 meters. Meter sockets or equipment for future growth shall be furnished and installed at this time.
- In accordance with NEC tap rules, Article 240 Overcurrent Protection, Code 240.21, Location in Circuit.



Multiple meter installation without main disconnecting switch

A. Six or fewer meters



Multiple meter installation with main disconnecting switch

B. Seven or more meters

Figure 4-13. Meter and main service disconnect configuration.

Conductors

The customer is responsible for sizing and installing the service entrance and load conductors in accordance with NEC requirements. Service entrance conductors shall not be sized smaller than the rating of the meter socket.

The customer must label the conductors and identify conductors by phase, neutral, ground or high leg where applicable. For example: 1-2-3-N-G, or black-red-blue-white-green. Use the colors indicated in Table 4-1 for marking three-phase commercial and industrial installations.

Service Voltage	Service Type	Phase A-B-C	Neutral	Ground
Secondary	120/208	Black-Red-Blue	White	Green
	240, 4-Wire	Black-Orange-Blue	White	Green
	277/480	Brown-Orange-Yellow	White	Green
Primary	Primary voltage	1-2-3	White	Green

Table 4-1. Color marking service conductors.

Meter Sockets

The following are general requirements for meter sockets:

- Only ring-type meter sockets are acceptable.
- Only UL (Underwriters Laboratory) and NEMA (National Electrical Manufacturers Association) rated meter sockets and enclosures designed to meet ANSI (American National Standards Institute) standards are acceptable.
- Metering equipment installed outdoors or exposed to the weather must be rain tight and have a NEMA 3R rating. Metering equipment installed in corrosive environments where enclosures will be subjected to salt spray, industrial discharge, etc., should be stainless steel with NEMA 3R rating.
- Conductor size and type (aluminum or copper) shall be in accordance with rating of meter socket. When the service requires parallel or multiple conductors, terminal lugs shall be rated and designed to accept parallel or multiple conductors. Do not use single terminal lugs to terminate multiple conductors.
- Cap or plug unused openings of meter sockets or metering enclosures. Use rain-tight plugs outdoors.
- Install sockets level, plumb, and secured to a permanent or acceptable structure.
- Bond meter socket enclosures to the grounding system in accordance with NEC.
- Do not recess meter sockets or metering equipment within exterior walls, without approval from the power company.

Switchboard and Switchgear General Requirements

Switchboards and switchgear used for service entrance equipment and for power company metering must be constructed in compliance with latest revision of EUSERC (Electric Utility Service Equipment Requirements Committee) specifications. The customer has these responsibilities:

- Submit four sets of manufacturer's design drawing of switchboard to power company for approval, before equipment fabrication or construction. Design drawings of switchboard must reference applicable EUSERC drawings. One set of drawings will be returned to the sender with approval or required corrections.
- Metering compartments and unmetered sections must not be used for splicing or making taps. Separate unmetered buses or cables with barriers from metered buses or cables. Metered buses or cables must not enter or pass through unmetered bus or cable compartments or sections.
- All removable panels and compartment covers or doors that enclose unmetered buses or cables must have provision for sealing or locking by the power company.
- Metering compartments or sections must be exclusively for the power company's metering equipment. Do not mount customer equipment such as ammeters, voltmeters, relays, instrument transformers, fuses, storage batteries, battery chargers, etc., in compartments designated for the power company, or on metering panels or metering compartment doors.
- Connect power for compartment heaters on the load side of metering. Install heaters so they do not interfere with the installation or removal of the power company's metering equipment.
- Ground and bond switchboard or switchgear in compliance with NEC requirements.
- See Meter and Main Service Disconnect Configuration section of this manual, and Figure 4-13 for installations of seven or more meters, if applicable.
- For remote meter installation for CT metering, the conduit (1-1/4 inch) run from the CT compartment to the meter socket must not be more than 50 feet total.
- Provide an acceptable concrete pad (4-inch minimum).
- If outdoors, the enclosure for switchboard or switchgear must comply with EUSERC specifications. Enclosure door(s) must be capable of being opened at least 90 degrees, and have a latch or locking system to hold the door(s) open. The enclosure must be weatherproof or NEMA 3R rated. An enclosure subject to corrosive environment should be stainless steel with NEMA 3R rating. Provide a minimum clearance of 11 inches from the face of the meter socket panel, to the enclosure door.

- If there is risk of vehicular contact, install post barriers to protect the switchboard or switchgear. See Figure 4-14 for post barriers.
- Refer to Table 4-3 for switchboard meter mounting heights.

Bollards

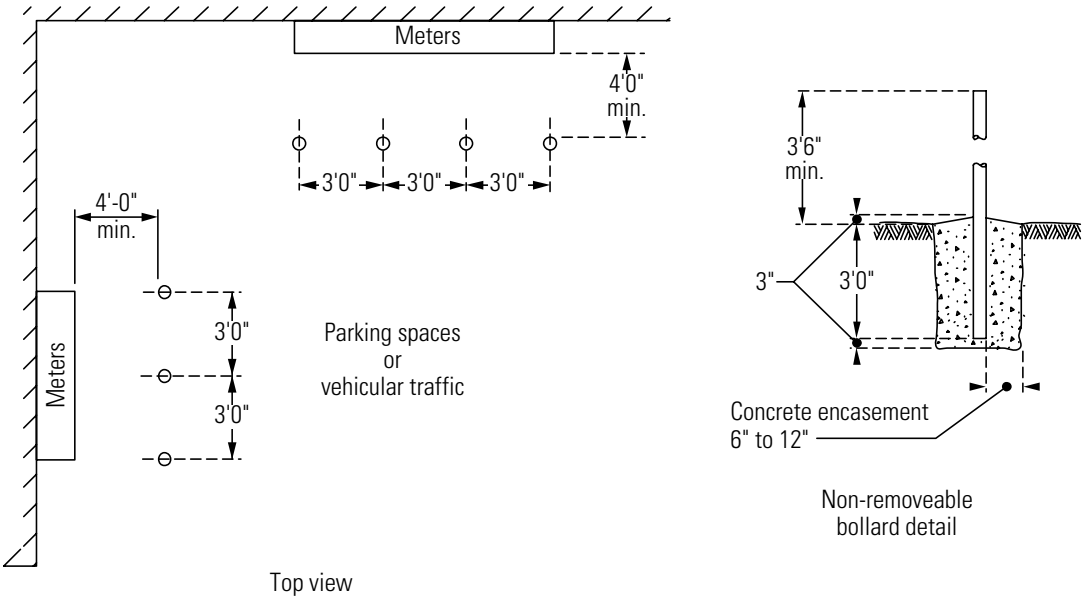


Figure 4-14. Bollards.

Protect metering equipment located in areas near vehicular traffic with permanent (not removable) barrier posts. Space the posts to prevent vehicular contact of service and metering equipment. Install the posts to allow at least 4 feet clearance in front of all metering equipment, and to allow metering panel doors to open a minimum of 90 degrees.

Use steel piping with a diameter of 4 inches and a minimum wall thickness of 0.188 inches, filled with concrete. Paint bollards yellow per ANSI spec. Z535.1 to comply with OSHA 1910.144 for color coding. A 2” wide strip of reflective tape must be placed 6” below the top of the post.

The concrete encasement surrounding the post must be at least 6 inches thick in stable soil, or 12 inches thick in sandy or unstable soil.

Before excavating, be sure to determine the location of all existing underground services.

Replacing an Existing Meter

Comply with the latest requirements of the power company, city, county, NEC, and EUSERC when replacing or upgrading service-entrance conductors and service and metering equipment. The power company will perform all work such as cutting seal(s) and temporarily removing meter(s) or metering equipment.

Keep Unmetered Conductors Separate

Service entrance conductors that are unmetered must be completely isolated from metered or load conductors. Unmetered line and metered load conductors must not be located in the same enclosed space, compartment, or wireway. Separate line and load conductors by barriers to easily distinguish them from each other. Line conductor wireways or compartments shall have provisions for sealing by the power company.

Sealing of Meters, Metering Equipment

The power company seals all meters, metering enclosures, metering equipment, and service entrance equipment on the line side of the meter. The power company must perform all work such as cutting seals or entering sealed enclosures or compartments.

Sub-Metering

Sub-metering or installing a meter after the power company's meter is not allowed for residential services.

Self-Contained Metering (0 to 600 Volts)

Self-contained meters carry total load current at the supplied service voltage. The customer furnishes, owns, installs, and maintains all self-contained equipment except for the meter itself. The power company provides, owns, installs, and maintains the meter for self-contained metering.

Self-contained metering is used for service loads of:

- 320 continuous amps or less for single-phase residential service
- 200 continuous amps or less for three-phase residential service and all commercial services

Note: Consider transformer-rated metering when future load plans are likely to exceed the rating for self-contained metering. See Current Transformer-Rated Metering, page 73. The customer must indicate future loads when submitting plans for transformer-rated metering.

Classification of Service			Self-Contained Meter Socket
Voltage	**Phases**	**No. of Wires**	**Number of Jaws**
120/240	1	3	4
120/208	1	3	5
240	3	4	7
120/208 Y	3	4	7
277/480 Y	3	4	7

Table 4-2. Number of meter socket jaws for self-contained meters.

The requirements for self-contained meter sockets are:

- A maximum ampacity rating not less than the ampacity rating of its associated main service breaker or disconnect, and not less than 100 amps.
- Install the fifth terminal for 120/208 volt, single-phase, three-wire (network) services in the 9 o'clock position. See Figure 4-16.
- Only plug-in-type jaws or terminals with stainless steel spring mounted retaining clips are acceptable.
- Before service is provided, the customer shall provide and install meter socket covers (plastic or glass) and meter bands for all blank meter sockets. Mark or identify the covers, so they can be returned to the customer after meters are installed. Cardboard inserts in place of plastic or glass covers are not acceptable. Also, do not use bladed plastic covers.

Residential Service

Self-contained meter sockets for single-phase residential service must not contain a commercial test by-pass/disconnect facility. Three-phase meter sockets for residential services must be equipped with a commercial test by-pass/disconnect facility.

320 Amp Self-Contained Metering

Class 320 metering is recommended for service demand loads from 42 kW to 72 kW. For this type metering:

- Use 320-amp self-contained metering for 120/240 volt, 4-jaw, single-phase residential services.
- The maximum load is 320 continuous amps. Use transformer-rated metering when present or projected loads exceed 320 continuous amps.
- Use a self-contained meter socket rated for 400 maximum amps. The socket must not contain a Manual Circuit Closing (MCC) by-pass, or a lever by-pass. Use a meter socket similar to Circle AW catalog numbers U404MC or U4042MC.

Commercial Service

Self-contained meter sockets for commercial installations shall be equipped with a commercial test by-pass/disconnect facility. The commercial test by-pass/disconnect (safety socket) facility makes it safe for power company personnel to work on a de-energized meter socket without interrupting service to the customer.

The maximum main circuit breaker rating shall not exceed the meter socket continuous amp rating.

Label the line and load terminals on by-pass terminals.

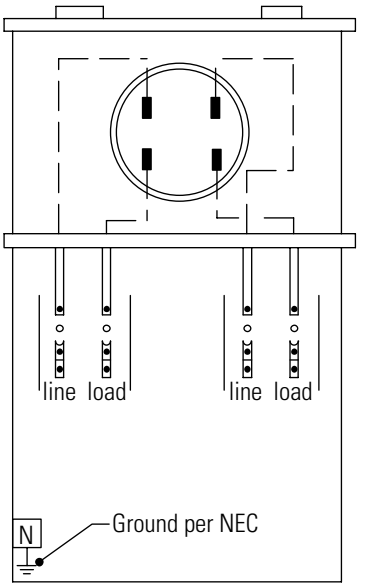


Figure 4-15. Meter socket wiring, 4-jaw, single-phase, 3-wire, 120/240 volts.

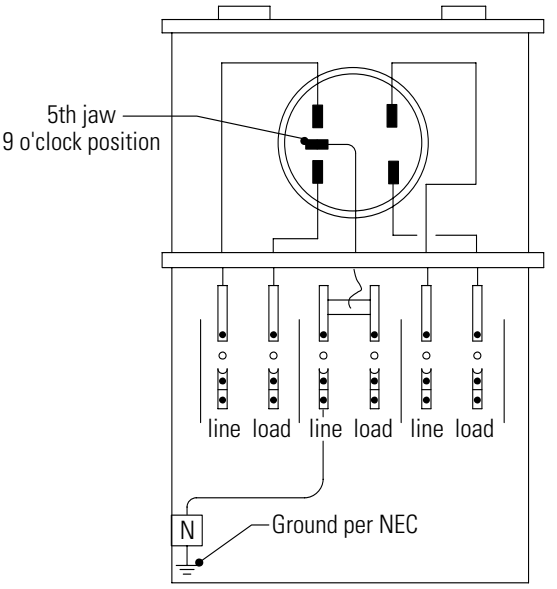
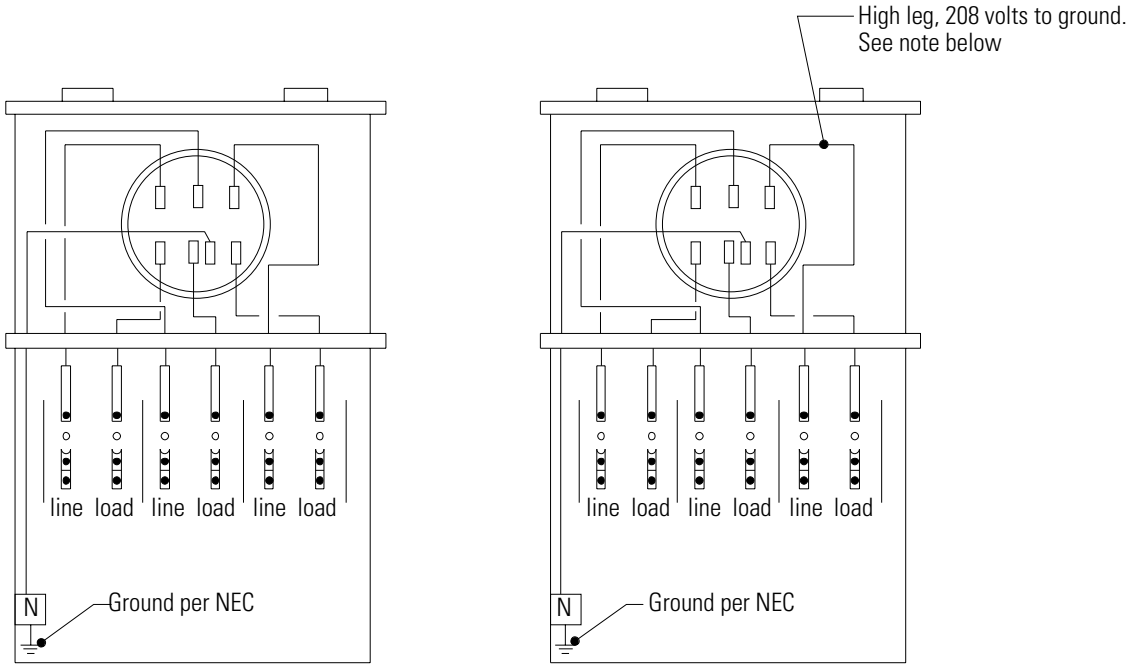


Figure 4-16. Meter socket wiring, 5-jaw, single-phase, 3-wire, 120/208 volts. .



7-Jaw
3 phase, 4-wire Y 120/208
or 277/480 volts

7-Jaw
3 phase, 4-wire delta, 240 volts

Note: For three-phase, 4-wire delta services, install the high leg (208 volts) at the upper-right meter jaw and mark it appropriately. To insure proper connections, the customer marks the high leg plainly at the weatherhead.

Figure 4-17. Meter socket wiring, 7-jaw socket.

Manual Circuit Closing (MCC) Bypass and HQ Sockets

Only meter sockets with safety test bypass blocks, or meter sockets that can be completely de-energized without affecting the customer, are acceptable. Meter sockets containing manual circuit closing bypasses, and HQ-type (lever bypass) meter sockets are not acceptable.

Grouped Meter Installations

A grouped meter installation is an arrangement of two or more individually mounted meter sockets installed at a single location. Grouped meters are usually supplied from a single electrical service. Submit the plan drawings showing the grouped meter installation to the power company for approval before purchasing metering equipment. Also, consult with the power company to determine an acceptable meter location.

Additional meter sockets or service equipment installed after the initial installation to be grouped or located at the same location of electric meters serving the premises, unless otherwise approved by the power company.

Grouped meters have the following mounting height requirements:

For grouped meters at locations ***accessible*** to pedestrian traffic or public contact: the meter mounting heights shall be between 5 feet and 6 feet, measured from the finish floor to the center of the meter socket.

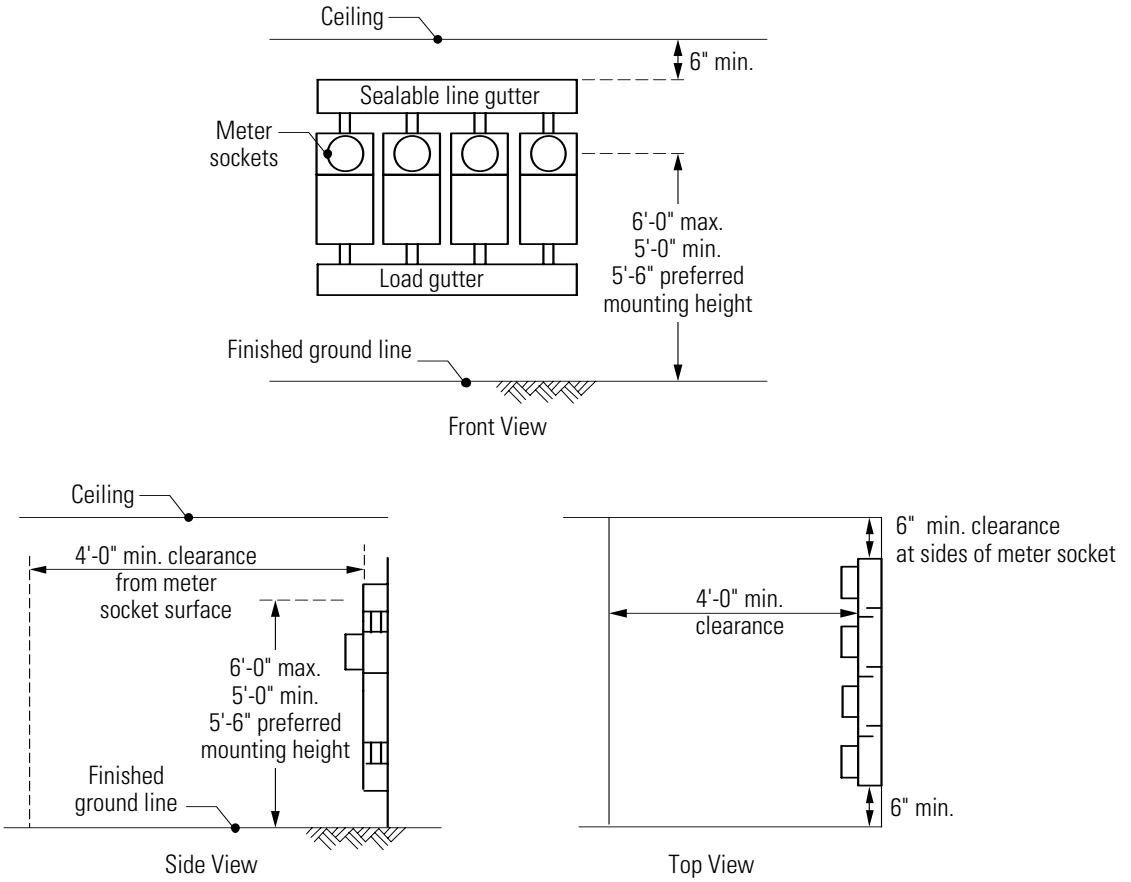


Figure 4-18. Grouped meters installed outdoors, and accessible to pedestrian traffic.

Notes:

1. Acceptable for residential single-phase service, and for commercial single-phase and three-phase services.
2. See Meter and Main Service Disconnect and Sequence section and Figure 4-13 for group meter installations of seven or more meters. Do not install the main service disconnect ahead (or line side) of meters for six or less grouped meters.
3. Provide provisions for sealing the line gutter. Load conductors shall not enter or run through a line gutter. Contact and coordinate with the power company for work that requires entering a sealed line gutter.
4. Mount the line gutter as close as reasonable to the meter sockets (within approximately 4") for ease of inspection and sealing.

For grouped meters at locations ***not accessible*** to pedestrian traffic or public contact such as in a meter room, meter closet, or an enclosed area that can be locked: the meter mounting heights shall be between 4 feet 6 inches and 6 feet 6 inches, measured from the finish floor or grade, to the center of the meter socket.

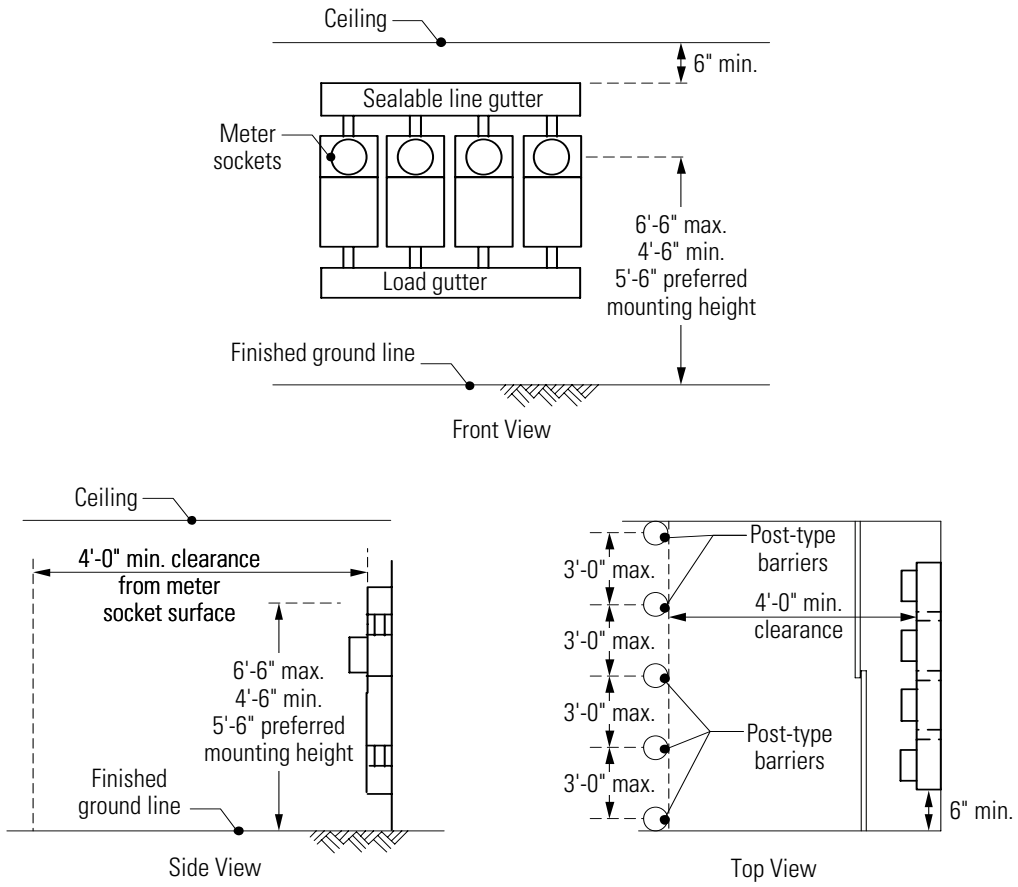


Figure 4-19. Grouped meters in a meter closet, and <u>not accessible</u> to pedestrian traffic.

Notes:

1. Acceptable for residential single-phase services and commercial single-phase and three-phase services.
2. Meter closets located in parking lots require post barriers. Maintain 4 feet workspace clearance. Spacing between posts shall be 3 feet.
3. See Meter and Main Service Disconnect and Sequence section and Figure 4-13 for grouped meter installations of seven or more meters. Main service disconnect shall not be installed ahead (or line side) of meters for six or less grouped meters.
4. Provide provisions for sealing the line gutter. Load conductors shall not enter or run through line gutter. Contact and coordinate with the power company for work that requires entering a sealed line gutter.
4. Mount the line gutter as close as reasonable to the meter sockets (within approximately 4") for ease of inspection and sealing.

Meter Centers

Meter centers or meter banks are prefabricated service entrance equipment that combines the service termination section, metering section(s), and distribution section.

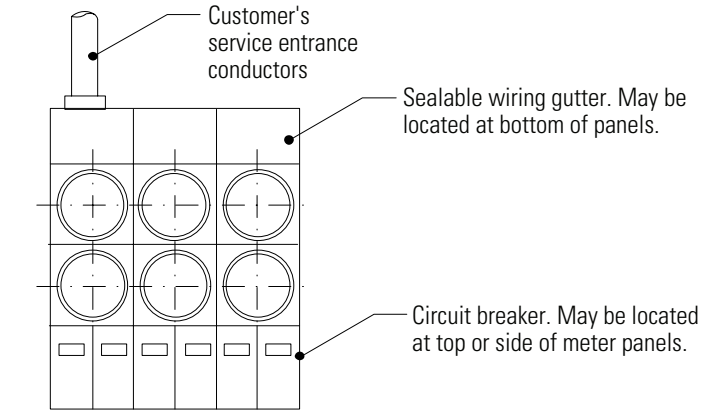
A meter center is installed where an individually metered distribution center is required. Meter centers are primarily used for multi-family dwelling units, commercial units, and light industrial applications. The following are requirements for meter center installations:

- Submit manufacturer's drawings showing dimensions of meter center for approval prior to ordering.
- Suitable barriers must separate the line (unmetered) bus and conductors from the load (metered) bus and conductors.

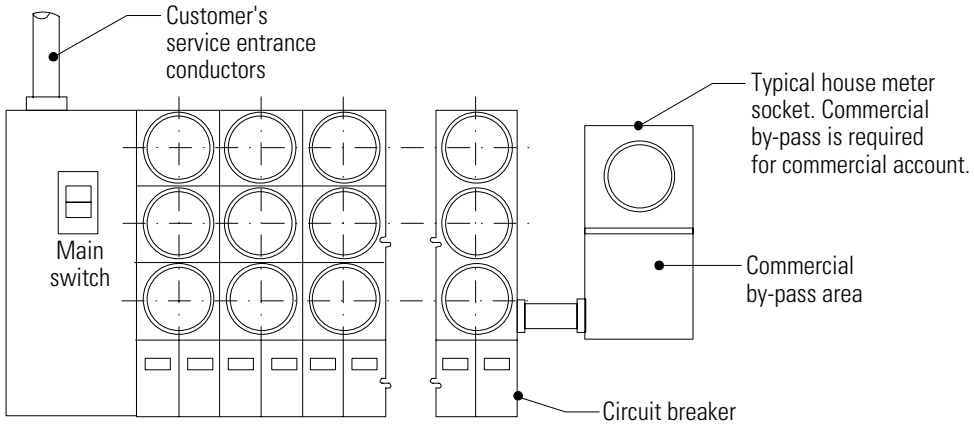
Equip ***house*** meter sockets with a commercial test by-pass facility.

Meter centers shall have the following meter mounting height requirements:

1. For meter centers in locations ***not accessible*** to pedestrian traffic or public contact such as in a meter room, meter closet, or an enclosed area that can be locked: Meter mounting heights are between 3 feet and 6 feet 6 inches, measured from the finish floor or grade to the center of the meter.
2. For meter centers in locations ***accessible*** to pedestrian traffic or public contact: Meter mounting heights, measured at the center of the meter, are between 4 feet 6 inches and 6 feet, measured from the finish floor or grade to the center of the meter.
    - Submit the manufacturer's catalog dimensional diagram and specification sheet for approval.

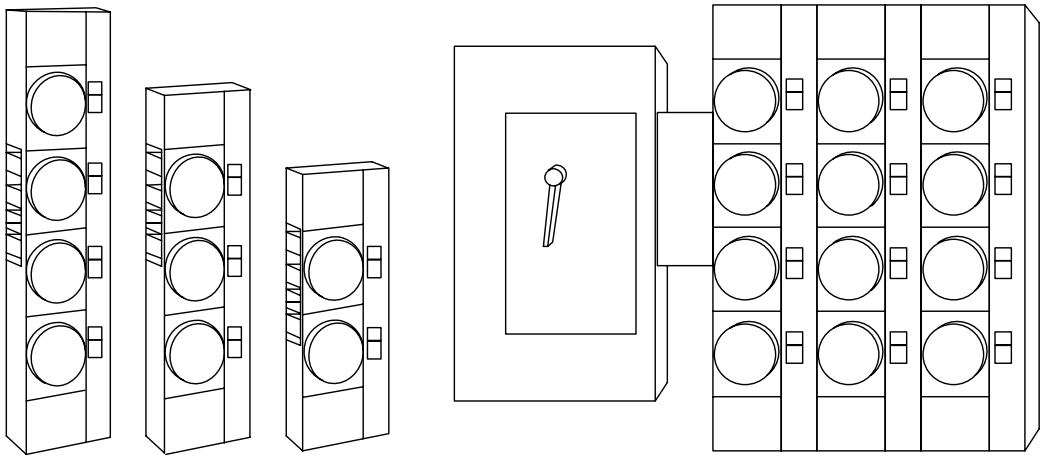


Six meters or less without main switch



Seven meters or more with required main switch

Figure 4-20. Quick-stack meter centers with meter socket breaker provisions. For single-phase service cubicles.



With spacer kit and stack units

Figure 4-21. Manufactured combination multi-meter service equipment.

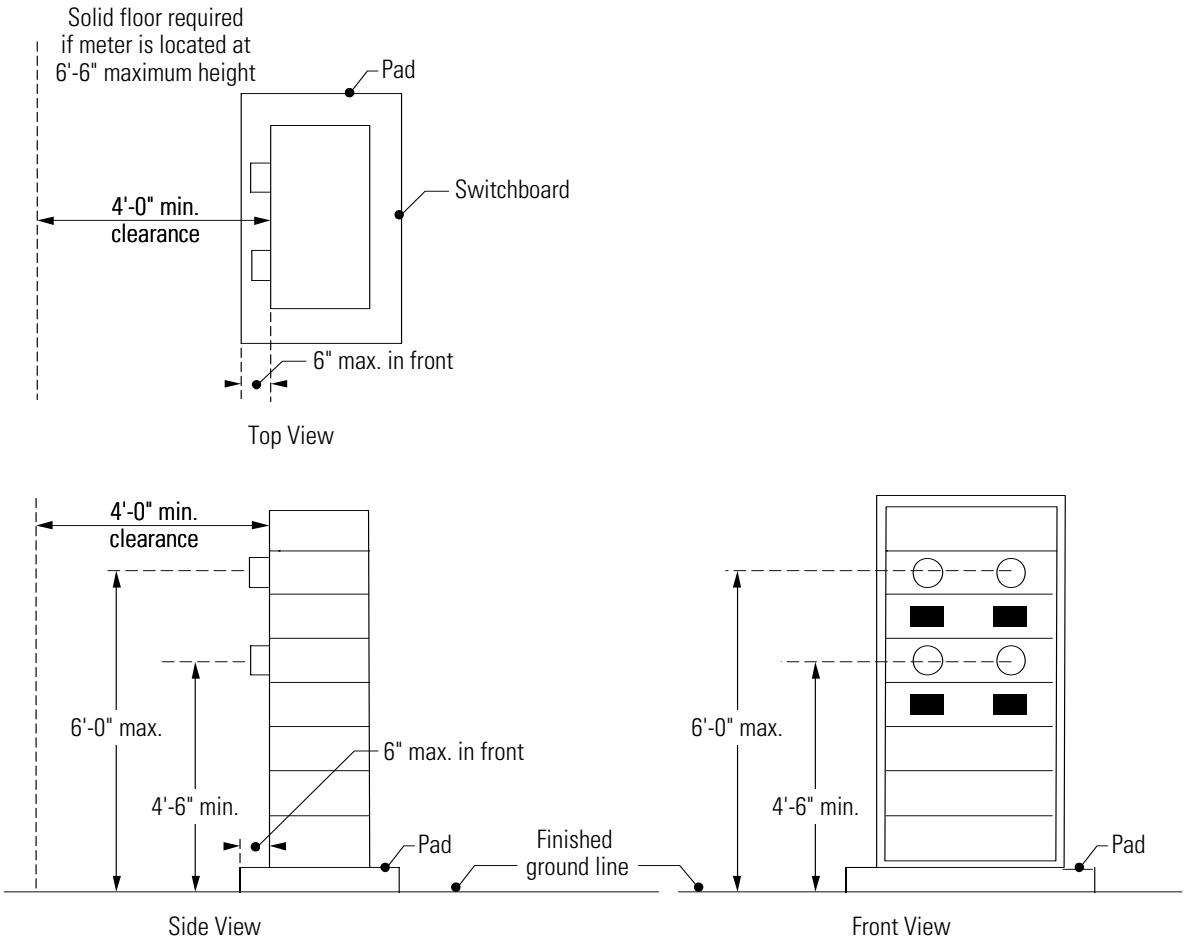


Figure 4-22. Meter heights and workspace clearance for outdoor switchboard <u>accessible</u> to public contact.

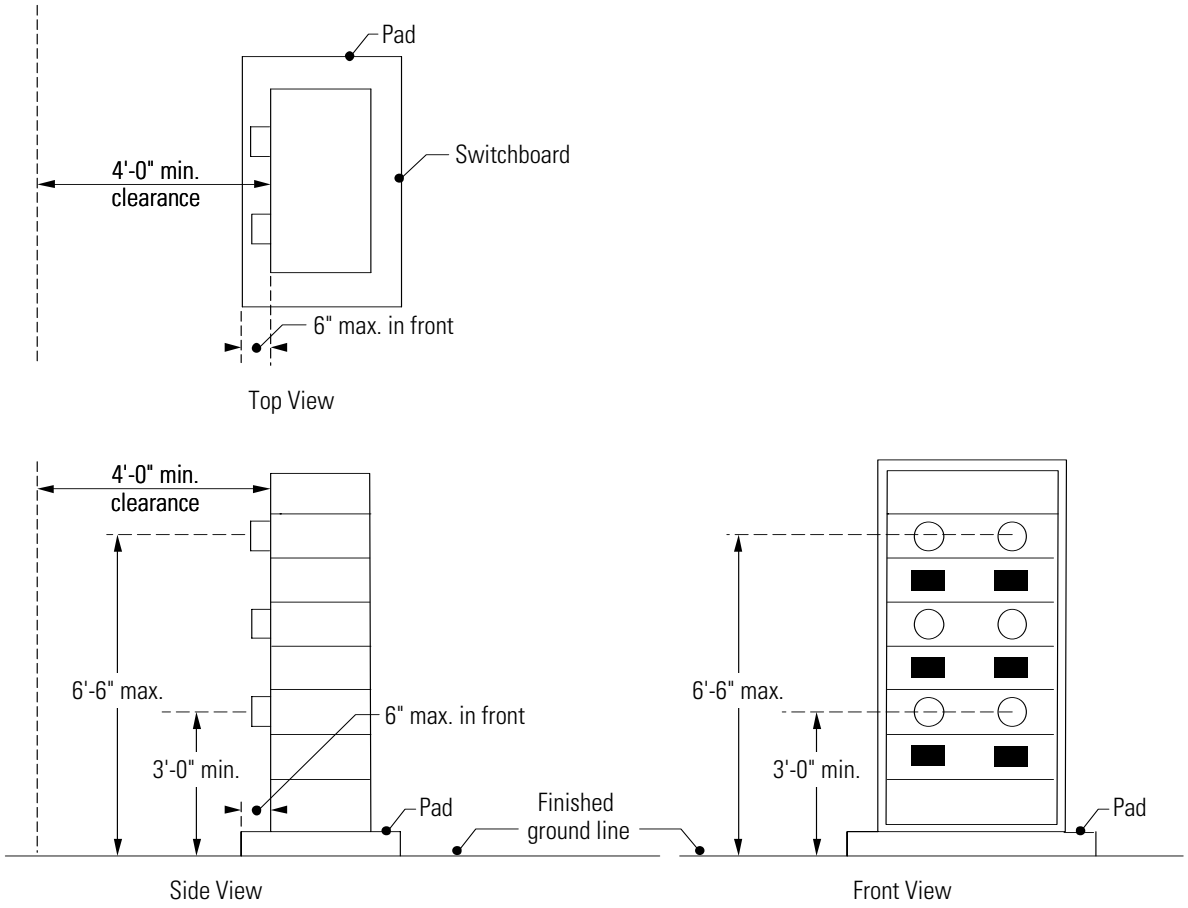


Figure 4-23. Meter heights and workspace clearance for indoor switchboard in meter room <u>not accessible</u> to public contact.

Notes:

1. For commercial installation, the minimum height is 3 feet from finish floor to the center of the commercial test by-pass area.

Meter Mounting Heights

Location and Description of Meter Installation	Service	Minimum	Preferred	Maximum	See Figure
Individual Meters					
Accessible to public contact	Residential, Commercial	5'-0"	5'-6"	6'-0"	
In a meter room, meter closet, or enclosed area not accessible to the public	Residential, Commercial	4'-6"	5'-6"	6'-0"	
Grouped Meters					
Accessible to public contact	Residential, Commercial	5'-0"	5'-6"	6'-0"	4-18
In a meter room, meter closet, or enclosed area not accessible to the public	Residential, Commercial	4'-6"	5'-6"	6'-6"	4-19
Free-Standing Meters					
Outdoors, free-standing meter enclosure	Residential, Commercial	3'-0"*	5'-6"	6'-0"	4-8b
Switchboard Meters and Meter Centers					
Accessible to public contact	Residential, Commercial	4'-6"	5'-6"	6'-0"	4-22
In a meter room, meter closet, or enclosed area not accessible to the public	Residential, Commercial	3'-0"*	5'-6"	6'-6"	4-23

Notes:

Meter heights are measured from finish grade or floor, to the center of the meter socket(s).

* Minimum height of 3 feet is measured from finish grade to center of the commercial test by-pass area.

Table 4-3. Meter heights.

Metering With Instrument Transformers

Instrument transformers (current transformers or CTs, and voltage/potential transformers or VTs) are used for metering when the electrical service exceeds the voltage and/or current ratings of self-contained meters.

The customer furnishes, installs, and maintains all equipment, conduits or raceways, and materials needed for instrument transformer metering. The metering equipment must be installed in a readily accessible location acceptable to the power company, and meeting the installation requirements described below.

The power company owns, provides, installs, wires, and maintains the meter, instrument transformers, test switch, and the wiring between these items.

Consult with the power company before purchasing, manufacturing, or installing instrument transformer metering equipment. Submit plans of the installation, and receive approval from the power company before purchasing or installing this equipment.

Current Transformer-Rated Metering (0 to 600 Volts)

Current transformers are used for metering when the load exceeds, or will exceed any of these load currents:

- 320 continuous amps for single-phase residential service, or
- 200 amps for three-phase residential service, or
- 200 amps for single-phase or three-phase commercial service.

Note: If the customer requests CT metering when load currents are below these requirements but not less than 100 amps, the customer will be charged for the equipment and labor to install CTs.

Classification of Service			Transformer-Rated Meter Socket
Voltage	**Phases**	**How Many Wires**	**How Many Jaws**
120/240	1	3	8
120/208	1	3	8
2400	1	2	5
7200	1	2	5
120/208Y	3	4	13
240 Delta	3	4	13
277/480Y	3	4	13
2400/4160Y	3	4	13
7200/12470Y	3	4	13
14400/25000Y	3	4	13

Table 4-4. Number of meter socket jaws for transformer-rated meters.

Current Transformer Cabinet Installation

Current transformers are mounted in cabinets or enclosures for safety and protection. The customer:

- Provides and installs the CT cabinet ahead of the main breaker or disconnect. Install the CT cabinet on the line-side of the main disconnect unless otherwise required by NEC and/or approved by the power company.
- Provide and install the meter socket, with the number of jaws to match the service type. See Table 4-4. The meter socket shall have provisions to install a test switch. Allow at least 6 inches clearance between the meter socket enclosure and the CT cabinet, when the meter socket and CT cabinet are mounted next to each other.
- Provide and install a 1-1/4" conduit between the meter socket and the CT cabinet. The conduit run must not exceed 50 feet in length or have more than two 90-degree bends.

- The minimum size of the CT cabinet is shown in Table 4-5. Use the next larger cabinet size if the conductor size is not listed, or consult with the power company.

Cabinet Size W" × H" × D"	Maximum Number and Size of Conductors
30 × 30 × 11	One #3/0 per phase or smaller
36 × 36 × 11	One 500 kcmil per phase or smaller
42 × 42 × 11	Three 500 kcmil per phase or smaller
36 × 48 × 11	Three 500 kcmil per phase or smaller with side entrance cables only
48 × 48 × 11	Consult the power company

Table 4-5. Minimum sizes for instrument transformer cabinets.

- Consult with the power company when installing more than four sets of 500 kcmil conductors per phase. CT cabinets are limited to no more than four sets of 500 kcmil conductors per phase, unless permitted by the power company. Use a switchboard when there are more than 4 sets of 500 kcmil conductors per phase.
- Inside the CT cabinet, install mounting brackets types C and Z, to mount transformers. Coordinate this with the power company. See Figures 4-24, 4-25 and 4-26.

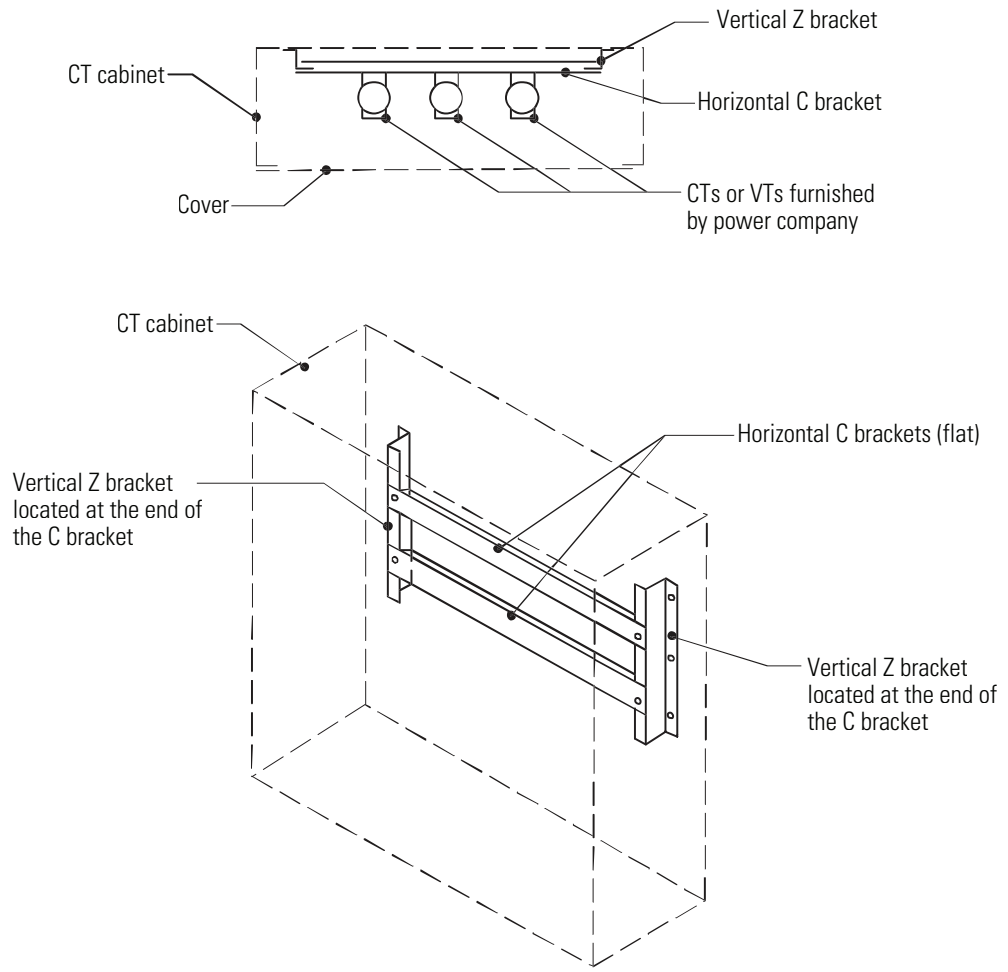


Figure 4-24. Instrument transformer cabinet with C and Z bracket mounting.

Connect the horizontal C brackets to the vertical Z brackets as shown. Do not tighten C brackets for field adjustments. See Figure 4-24, inset.

HECO only: Center the brackets within the CT cabinet and secure the Z brackets to the CT cabinet with 3 self-tapping screws spaced evenly apart.

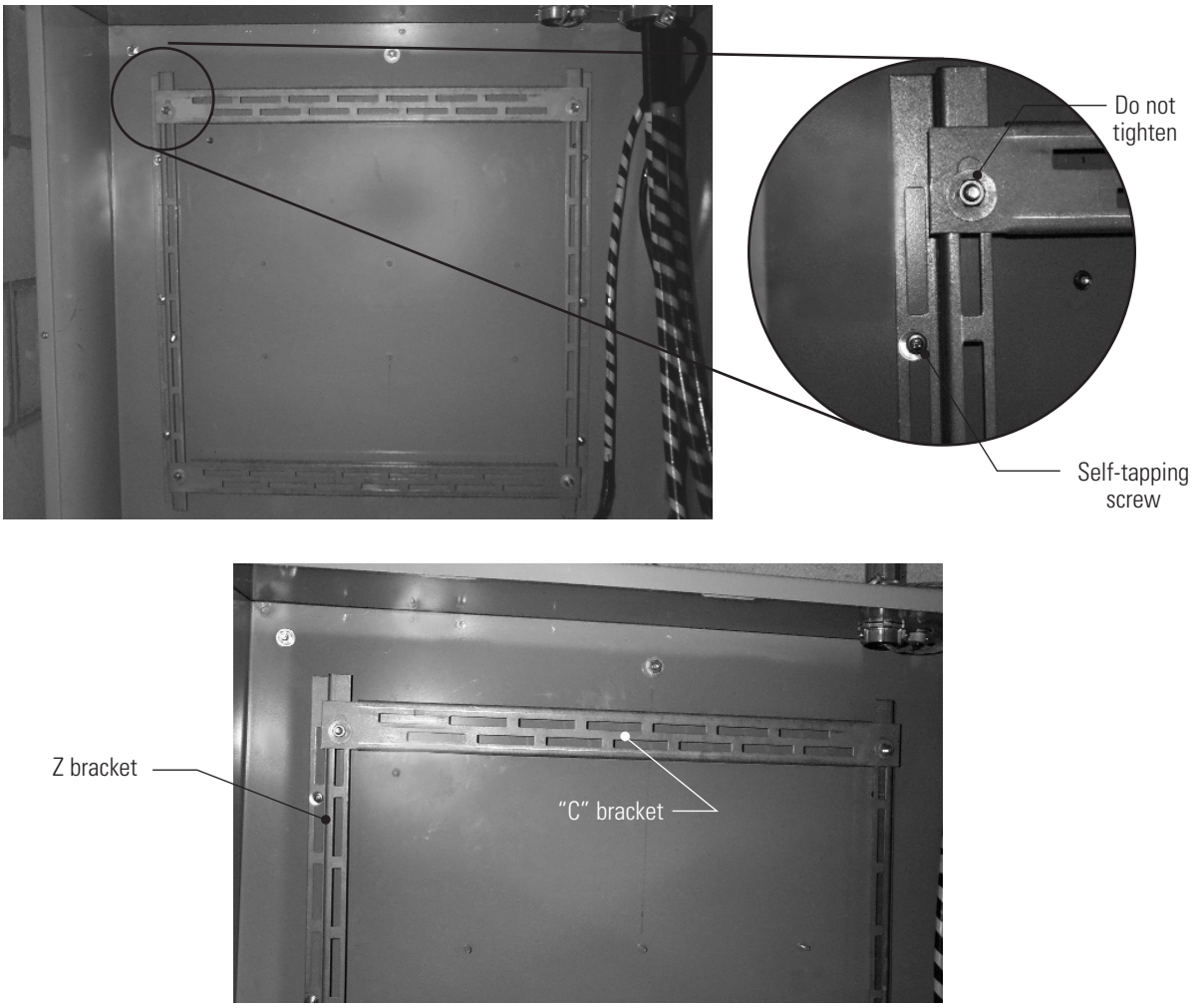


Figure 4-25. C and Z bracket installations.

Bond the CT cabinet and meter socket enclosure per the NEC. The grounding electrode conductor shall not pass through CT cabinet or power company-sealed enclosures unless authorized by the power company.

The top of the CT cabinet must not exceed 6 feet above the finish floor or grade, unless approved by the power company. The bottom of the CT cabinet must not be lower than 12 inches above the finish floor or grade.

The CT Cabinet must have two fixed solid handles for lifting. CT cabinets 42 inches wide or more, must have two-piece covers.

CT cabinets and meter sockets installed outdoors must be UL listed and weatherproof with a NEMA 3R rating. Enclosures subjected to corrosive environments, excessive moisture or salt spray should be Stainless Steel (SS) with a class rating of NEMA 3R.

Only conductors associated with metering shall be permitted in the CT cabinet. No splices or feeder taps.

The cabinet shall have provisions for sealing by the power company.

Provide sufficient conductor lengths within the CT cabinet for the installation of CTs and the termination of conductors.

HECO only: Provide a minimum of 2 full coil loops in the cabinet, or sufficient conductor lengths to terminate at both the splice can and main breaker or disconnect switch.

Mount the CT cabinet level and secure to a permanent or acceptable structure. Plywood backboard is not an acceptable support for CT cabinets mounted outdoors.

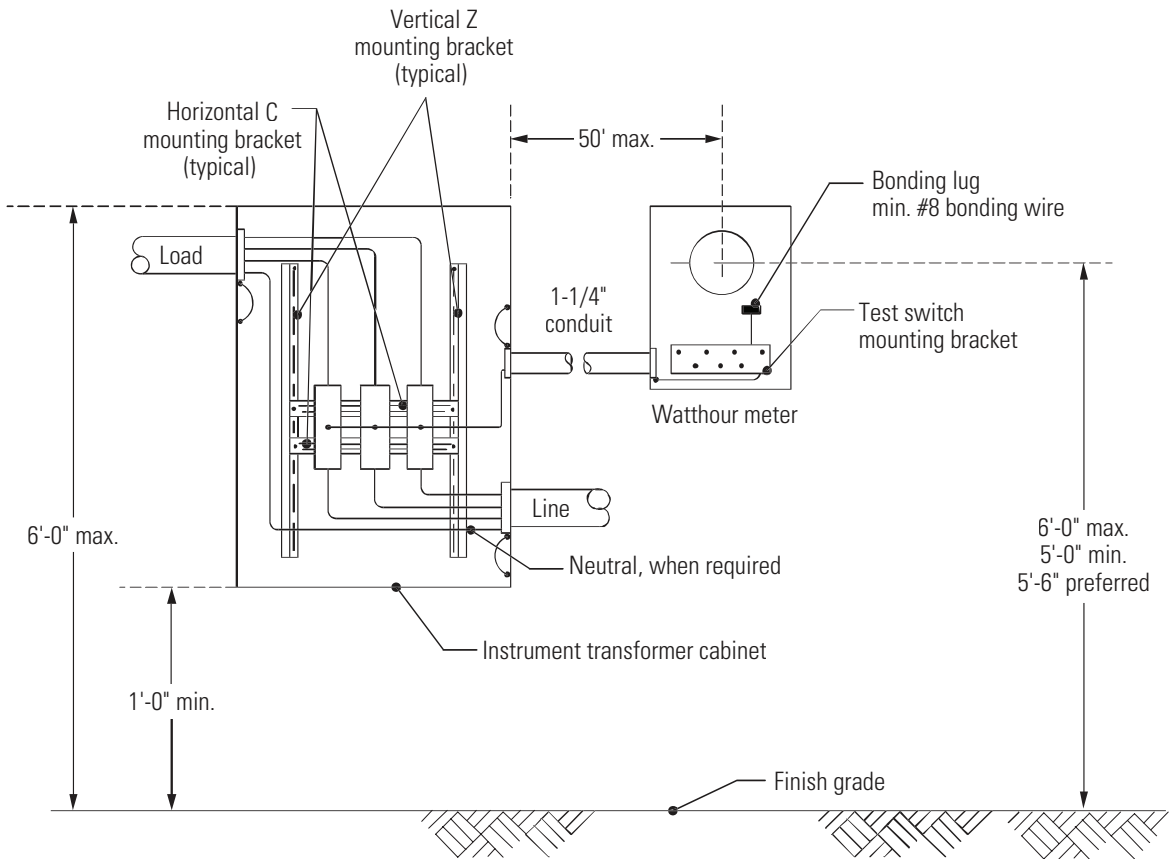


Figure 4-26. Instrument transformer cabinet installation (with rigid conduits).

Notes:

1. Consult with the power company prior to installation.
2. HECO only: Customer to supply sleeves for splicing all conductors other then 350 and 500 kcmil.

Switchboard Installation with Instrument Transformers

The following are customer responsibilities:

- The metering compartment or CT compartment must be on the supply side (line side) of the main breaker or disconnect.
- For CT compartment door with a meter socket panel and a blank panel (see EUSERC drawings 325, 326 & 332), place the meter socket panel at the lower section of the compartment door with the blank panel placed above. Secure both the meter socket panel and the blank panel together, to operate as a single door.
- Install the meter socket panel door so the test switch opening is located on the hinge side of the door.
- Locate the ground conductor connection to the ground rod (or grounding electrode system) in the main breaker compartment, or outside of the power company's sealable compartments.

Meter Mounting Heights (Up to 600 Volts)

Location, Description of Meter Installation	Service	Minimum	Preferrred	Maximum
CT Can				
Accessible to public contact	Residential, Commercial	5'-0"	5'-6"	6'-0"
Within a meter room, meter closet, or enclosed area not accessible to public contact	Residential, Commercial	4'-6"	5'-6"	6'-0"
Switchboard				
Accessible to public contact	Commercial	5'-0"	5'-6"	6'-0"
Within a meter room, meter closet, or enclosed area not accessible to public contact	Commercial	4'-6"	5'-6"	6'-0"

Note: Heights are measured from finish grade or floor, to the center of the meter socket.

Table 4-6. Mounting heights for transformer-rated meter installations for secondary services up to 600 volts.

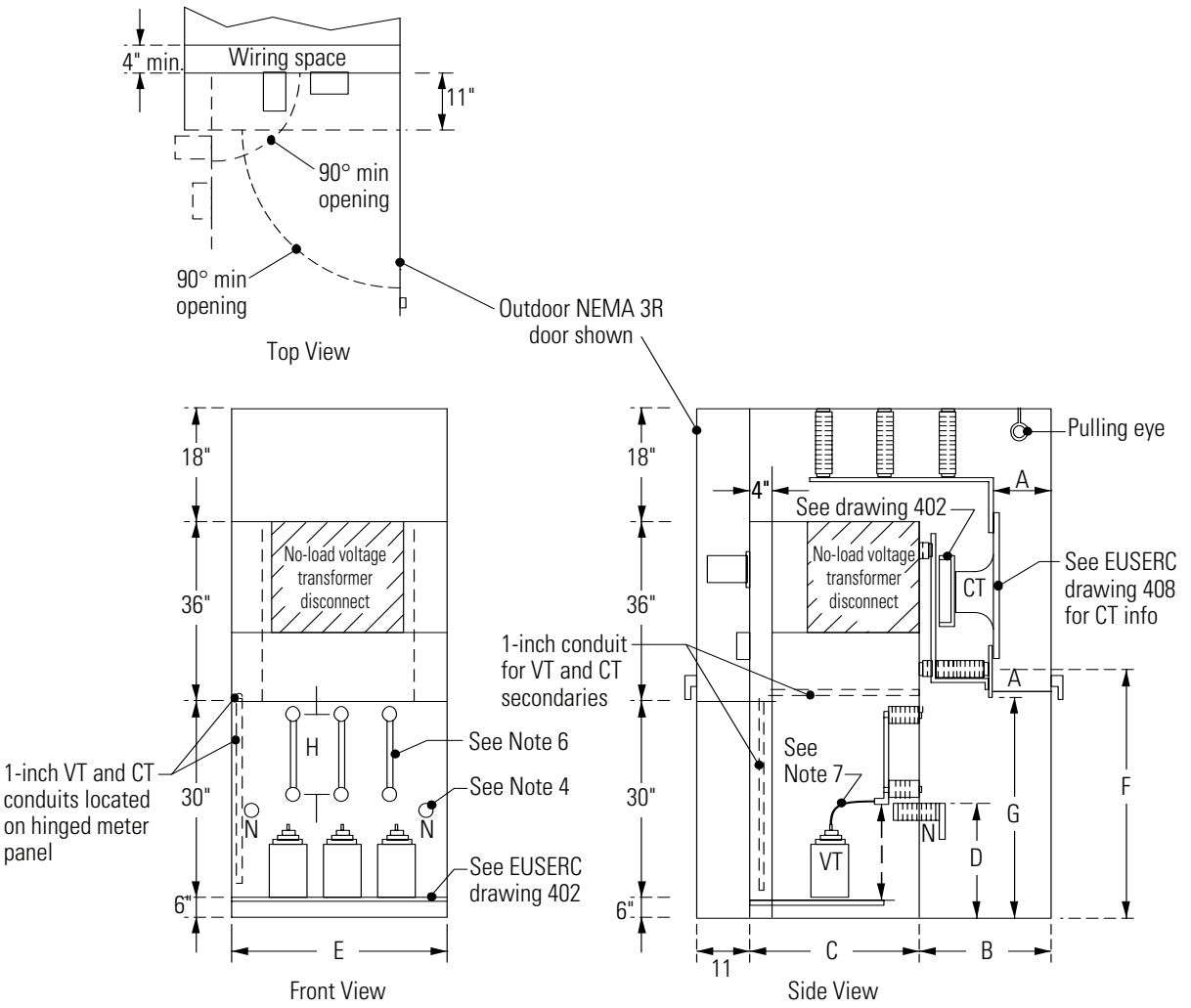
High Voltage Metering (Over 600 Volts)

The voltage and service type supplied to a customer depends on the load, rate schedule, and type of electric service available in the locality.

HECO only: The power company supplies and installs the primary voltage, current transformers and potential transformers for metering. HECO also furnishes and installs the meter(s), test switch(s) and associated wiring.

Switchgear used for service entrance equipment and power company metering must comply with EUSERC specifications. The customer has these responsibilities:

- Switchgear must be designed so the power company's voltage/potential transformers are tapped before or on the line-side of the power company current transformers. Also, switchgear must have a VT disconnect with an interlock system and viewing window of disconnect blades. See EUSERC drawing 400.
- Switchgear VT fuse mounting clips must be constructed to accommodate current limiting fuses. The customer is responsible for supplying primary fuses for potential transformers. Also, the customer supplies the primary leads from the fuse holders to VT terminals.
- Furnish switchgear with insulating boots or covers, or an insulated bus at CT termination points. Provide grounding knobs on line and load side of bus at each current transformer location for safety grounds.
- Furnish switchgear with 1-inch conduit for secondary wiring of instrument transformers. See Figure 4-27.
- Provide self-shorting and non-shorting terminal blocks (6-point terminals) for instrument transformer secondary wiring. Consult the power company for specifications and requirements.
- Switchgear must have mounting racks or supports for potential transformers.
- Permanently label switchgear metering compartments with machine engraved laminated phenolic (or equal) tags. Use quarter-inch white letters and numbers on red-colored material that is readily visible and attached to metering compartments. See EUSERC drawing 400.
- Switchgear must have adequate space between panels and facilities to install meter(s), test switch(s), and auxiliary devices furnished by the power company. Consult with the power company for wiring space requirements behind the meter.
- Do not mount equipment on the floor or ceiling within 6 inches of the switchgear.



Notes:

1. See Table 4-1 for clearances, dimensions.
2. For rear access door details, see EUSERC drawing 400, Sheet 2, Note 8.
3. Consult power company for wiring space requirements behind panel. Flush-mounted meters require a minimum of 10 inches wiring space.
4. Consult power company for neutral bushing details, shown here as a thru-wall insulator mounted on either side of the VT compartment.
5. Primary taps for VTs must be connected to the line-side of metering CTs.
6. Customer to supply HV leads with lugs from fuse holder to VT terminals.
7. Customer to supply and stock VT fuses similar to Cuttler Hammer 15 CLPT-5E, Cat #677C452G03.

Figure 4-27. Metering enclosure for high voltage (2,400 to 25,000 volts). Reference: EUSERC drawing 402, sheet 2, revision 4, 2004.

Specifications	2400V	4160/4800V	7200/17000V	20800/25000V
Minimum bare bus clearance, phase to ground	3-1/2"	3-1/2"	6"	7-1/2"
Minimum bare bus clearance, phase to phase	5"	5"	7-1/2"	9"
Dimension A	5" min 10" max	5" min 10" max	8" min 10" max	9" min 15" max
Dimension B	24"	24"	24"	36"
Dimension C	24"	24"	24"	36"
Dimension D	12" min	12" min	12" min	12" min
Dimension E	36" min	48" min	48" min	60" min
Dimension F	42" min 48" max	42" min 48" max	42" min 48" max	56" min 60" max
Dimension G	36" min	36" min	36" min	48" min
Dimension H, fuse mounting clip center	8-1/2"	8-1/2"	11-1/2"	15"
Dimension H, fuse ferrule diameter	1-5/8"	1-5/8"	1-5/8"	1-5/8"
Dimension I	18"	18"	18"	Consult power company

Table 4-7. Meter enclosure clearances. Refer to Figure 4-27.

Primary Metering on a Power Company Pole

Contact the power company's Customer Installations Department for the requirements for outdoor pole-mounted metering.

Specialized Metering

Pulse Metering Output (KYZ Output)

Pulse outputs, also called KYZ outputs, are dry contact signals sent from the power company's meter, to report consumption in kilowatthours (kWh), and when applicable, kilovarhours (kVARh). KYZ outputs can be delivered in a three-wire format from Form C contacts, or in a two-wire format from Form A contacts. These pulses are proportional to energy usage, and can be used by the customer to monitor and control energy consumption.

To apply for this service, make a service request to the utility's Customer Installations Department. When that service request is received, a representative from that department will call to get further information including:

- The maximum rate at which the EMS (pulse receiving equipment) can accept pulses. The pulse receiving equipment must be compatible with the utility company's metering equipment.
- The customer's demand in kilowatts, or load.

The power company will review the request, then send a written proposal for the service to the customer.

The customer pays all costs for this service, as explained in Rule 13 of the utility company's tariff, Section D, Paragraph 5. This charge includes the cost for a meter that provides KYZ pulses, an isolation relay board to prevent interference with revenue metering, and installation of the service. This charge is for kilowatthour (kWh) pulses only. An additional charge will be assessed for kilovarhour (kVARh) pulses. In the future, the customer might be assessed a monthly charge for maintenance of this service.

Requirements for receiving pulses vary according to the physical setup of the customer's metering installation. For a metering switchboard installation, the isolation relay can be mounted on the door of the metering compartment. For other installations, such as a meter socket installation, the customer provides a sealable junction box to house the isolation relay, mounted adjacent to the meter socket. If the installation is outdoors, the junction box must be NEMA 3R rated. The junction box must be bonded and grounded, with 3/4" conduit used to connect the splice box to the meter socket.

In all cases, the customer pulls their wires to the isolation relay. Coordinate this work with the utility to ensure that the wires are pulled safely. The utility then makes the pulse-output connection to the customer's wire at the isolation relay. The customer installs, owns, and maintains all equipment on the load side of the isolation relay. The utility will provide the customer with the pulse weight value (kilowatt-hour per pulse) to use with their energy management system.

The accuracy of the customer's pulse or alarm receiving equipment is the responsibility of the customer and the manufacturer of that equipment. The utility is not responsible or liable for inaccurate readings or inaccurate data generated, or for faulty pulse information supplied to the customer.

For load control information, the customer must ***not*** connect to, or utilize the utility's revenue metering instrument transformers (CTs or VTs).

The power company reserves the right to modify the pulse characteristics furnished to the customer when necessary, due to changes in metering equipment, instrument transformers, isolation relay board, etc.

Remote Interrogation Via Telephone

For rate Schedule P, and large Schedule J service requests (demand of 200 kW or greater), the customer provides a telephone connection to the meter including the conduit, telephone jack, associated wiring, etc., to allow the power company to remotely read the meter. The customer provides a dedicated or shared (for example, fax, modem, etc.) ***analog*** telephone line for remote interrogation of the meter. Contact the utility's Customer Installations Department for details.

For a telephone line connection to the meter, the customer provides:

Telephone Connection to Current Transformer (CT) Cabinet

- Run a 3/4-inch conduit from the telephone service panel to a junction box (JB) installed next to the meter socket. The JB must be sized to adequately house and wire an RJ-11 telephone jack (6" × 6" × 4" minimum). Connect the 3/4-inch conduit from the JB to the meter socket.
- Pull a CAT 5E telephone cable from the telephone service panel to the JB. Terminate the cable in the JB with an RJ-11 telephone jack. Also, terminate the cable to an RJ-11 jack at the telephone service panel. Label the RJ-11 jack at the telephone service panel "HECO Meter" (the applicable power company name) and the telephone number.
- If the telephone line is a shared line, a line-sharing device must be installed in or near the telephone service panel. The line-sharing device will require 120 VAC power.
- The installation must comply with NEC requirements.

Telephone Connection to Switchboard

- Run a 3/4-inch conduit from the telephone service panel to the meter socket compartment of the switchboard. Install the conduit on the hinge side, near the front corner of the meter socket compartment door.
- Pull a CAT 5E telephone cable from the telephone service panel to the meter socket compartment. Run the telephone cable along the hinge side of the compartment door to the meter socket. Terminate the cable in the compartment with an RJ-11 telephone jack. Leave the telephone jack hanging near the meter socket with some cable slack for field adjustment. Also, terminate the cable to an RJ-11 jack on the telephone service panel end. Locate the jack within the panel.
- Label the RJ-11 jacks "HECO Meter" (the applicable power company name) and the telephone number.
- If the telephone line is a shared line, a line-sharing device must be installed within or near the telephone service panel. The line-sharing device will require 120 VAC power.
- The installation must comply with NEC requirements.

Totalized Metering – Commercial and Industrial, Primary Voltage

For new installations where the expected demand or load cannot be serviced and metered at a single point, the utility may specify that totalized metering be installed. Installations with more than one distribution feeder serving a single location, usually require totalized metering to provide a single metering point. For these installations, totalized metering is installed at no charge to the customer. Also, depending on the

number of distribution feeders, the type of metering scheme, and the distance between metering points, the utility may require that telephone line (analog) connections be provided to each meter, for totalized metering.

Similarly, when a service requires more than one distribution feeder, and the distance between the metering points of the feeders is greater than 50 feet, telephone line connections to the meters are required, for totalized metering. The meters are totalized through this telephone line communication. Alternatively, if the customer requests that the totalized meter be physically placed at their location, metering points for the feeders must be less than 300 feet apart. Note that additional raceway and other charges may be assessed.

The customer submits plans to the power company for approval, when requesting totalized metering. The customer pays the additional cost for installing totalized metering equipment.

Customer Generation

No electrical connections shall be made to the service entrance conductors or electrical service equipment without written approval from the power company. The customer must notify the power company, prior to installation of any emergency or standby sources of electric service. This applies to all permanent or portable emergency or standby sources, designed to energize the customer's electrical system.

Three types of customer generation

Three types of customer generation are available. Contact the indicated power company division/department, and follow the noted requirements for approval:

Parallel Operation, With Sales to the Power Company

HECO customers

- Contact HECO's Power Purchase Division at (808)543-4340.

MECO customers

- For power generation up to 100 kW, contact Maui Electric Company at (808) 871-8461.
- For power generation greater than 100 kW, contact HECO's Power Purchase Division at (808)543-4340.

HELCO customers

- For power generation up to 100 kW, contact HELCO's Engineering Department at (808)969-0322.
- For power generation greater than 100 kW, contact HECO's Power Purchase Division at (808)543-4340.

Parallel Operation Without Sales to the Power Company

HECO customers: Contact HECO's Energy Services Department at (808) 543-4750

HELCO customers: Contact HELCO's Customer Services Department (808) 969-0134

MECO customers: Contact MECO's Engineering Department (808) 871-2390

Stand-By or Emergency Generators (Permanent or Portable)

The customer submits to the utility for approval, building plans approved by the city and the county. Submit these plans to the utility's Customer Installation's Department. Include a one-line diagram showing the interconnection scheme of the stand-by or emergency generator, service and metering equipment location (top view), and service and metering equipment elevation.

Do not install emergency generators in locations where metering facilities could be subject to noise levels in excess of 85 dB.

Per the NEC, place a sign at the service entrance equipment indicating the type and location of the on-site emergency or stand-by power source.

Before any connection is made to an emergency power source, isolate and separate all ungrounded conductors from utility's normal supply.

Emergency or stand-by power sources must only be utilized when the power company can not provide normal service.

The emergency transfer device or scheme shall be designed, constructed, and installed to prevent the customer's emergency power source from feeding back into the utility's distribution system.

Conductors intended for emergency or stand-by power source must not be installed in the same conduits or raceways as the utility's service entrance conductors.

A main transfer switch is not required for an emergency or stand-by power source when separate circuits, independent from the customer's electrical system, are used to serve specific equipment.

Meter Requirements for Self-Contained Metering (0-600 Volts)

The following metering requirements apply to customers with written approval from the power company to interconnect an external generator and the utility's system, and have service loads that permit self-contained metering.

New Installations

Depending on the generation agreement and metering scheme, two watthour meters may be used to obtain the delivered and/or received energy. In this instance, the customer provides and installs two meter sockets for metering. The power company provides, installs, seals, and maintains the meter(s).

Existing Installations

Depending on the generation agreement and metering scheme, two watthour meters may be used to obtain the delivered and/or received energy. In this instance, the customer provides and installs an additional meter socket for metering. The power company provides, installs, seals, and maintains the meter(s).

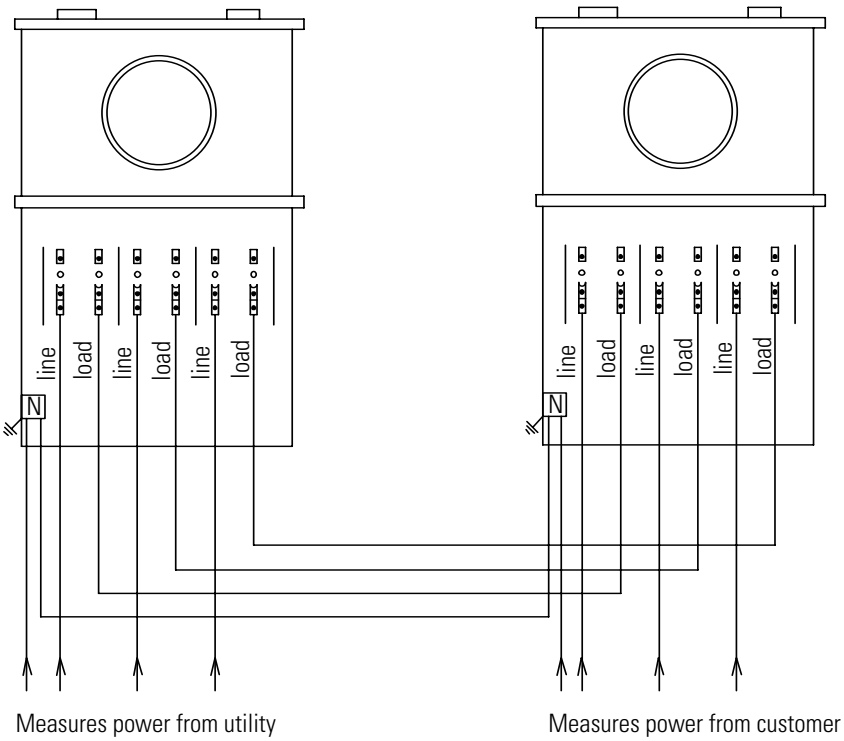


Figure 4-28. Interconnection wiring, two self-contained meters for a commercial service, 0-600 volts. Example shown: 4-wire wye, 120/208 volts or 277/480 volts.

Meter Requirements for Current and/or Potential Transformer Metering

The following metering requirements apply to customers with written approval from the utility to interconnect an external generator and the power company's system with service loads that require current transformers and/or potential transformers for metering.

New Installations

Non Schedule P and Large J Customers

Depending on the generation agreement and metering scheme, two watthour/demand meters may be used for metering – one as the primary meter and the other as a back-up meter. In this instance, the customer provides and installs two meter sockets, and interconnecting conduits. The power company provides, installs, seals, and maintains the instrument transformer and meter(s).

For Schedule P and Large J Customers

Depending on the generation agreement and metering scheme, two watthour/demand/varhour meters may be used for metering – one as the primary meter and the other as a back-up meter. In this instance, the customer provides and installs two meter sockets, with interconnecting conduits. The customer also provides analog telephone line connections to the meter(s). The power company provides, installs, seals, and maintains the instrument transformer and meter(s).

Existing Installations

For Non Schedule P and Large J Customers

Depending on the generation agreement and metering scheme, two watthour/demand meters may be required for metering – one as the primary meter and the other as a back-up meter. In this instance, the customer provides and installs an additional meter socket, and interconnecting conduits. The power company provides, installs, seals, and maintains the instrument transformer and meter(s).

For Schedule P and Large J Customers

Depending on the generation agreement and metering scheme, two watthour/demand/varhour meters may be required for metering – one as the primary meter and the other as a back-up meter. In this instance, the customer provides and installs an additional meter socket, and interconnecting conduits. The customer also provides analog telephone line connections to the meter(s). The power company provides, installs, seals, and maintains the instrument transformer and meter(s).

Wiring Requirements

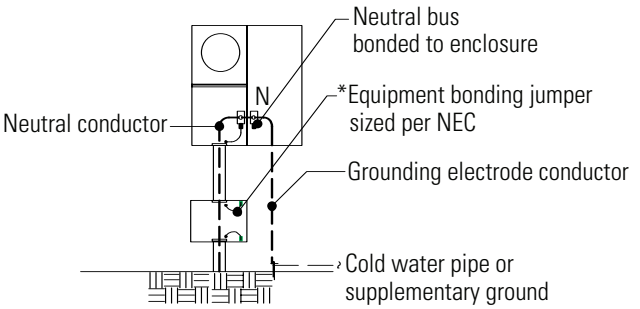
The customer contacts the power company to determine the responsibilities for the installation, wiring, and maintenance of instrument transformers and test switches.

The customer marks each meter socket to indicate direction of power flow, if applicable.

HELCO only: The customer provides and installs the color-coded conductors. HELCO will terminate all wiring within the instrument transformer cabinet.

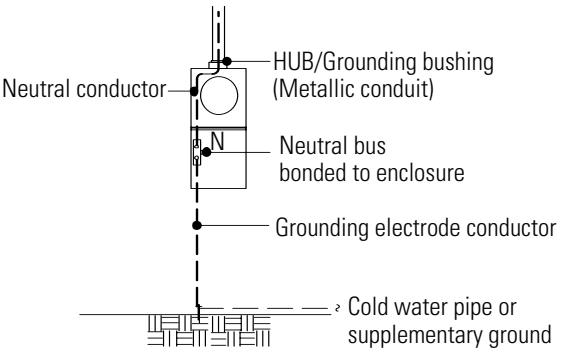
Service Entrance Grounding and Bonding

Figures 4-29 through 4-35 show typical grounding and bonding practices. The methods shown in these figures meet NEC requirements, but are not necessarily the only acceptable grounding and bonding methods.

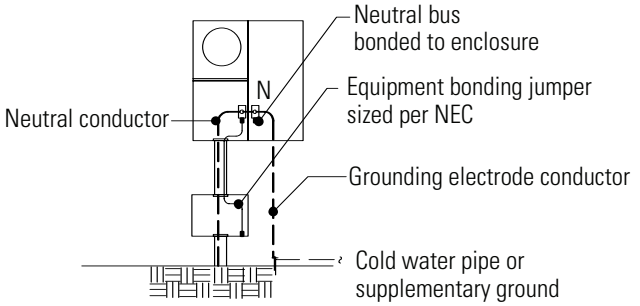


Metallic Conduits

***As an alternative, a continuous bonding jumper can be used to bond service enclosures and conduits**

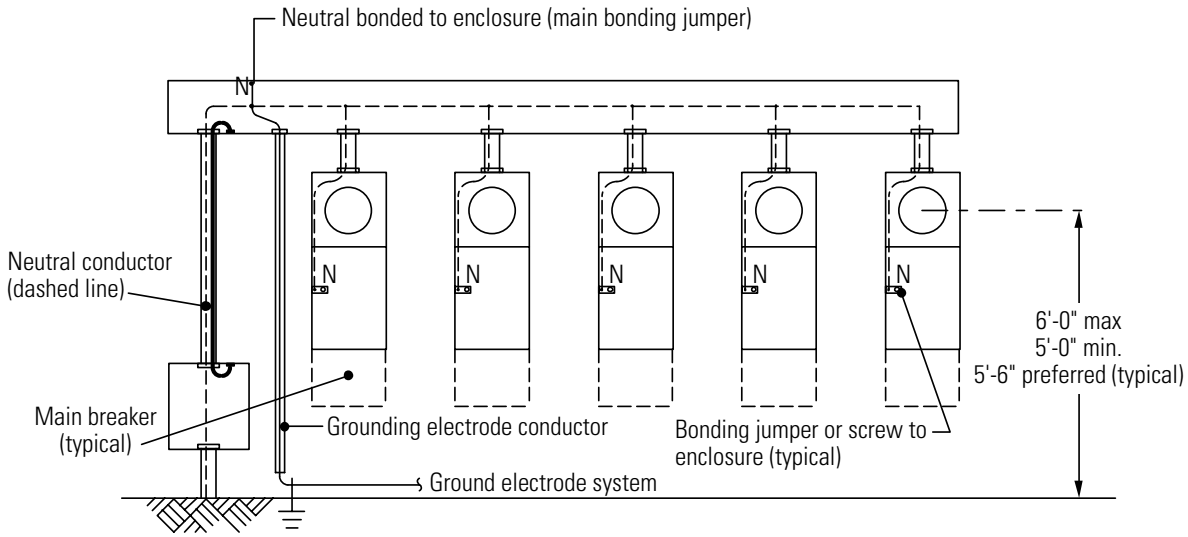


Grounding and Bonding Diagrams for Dwelling Services



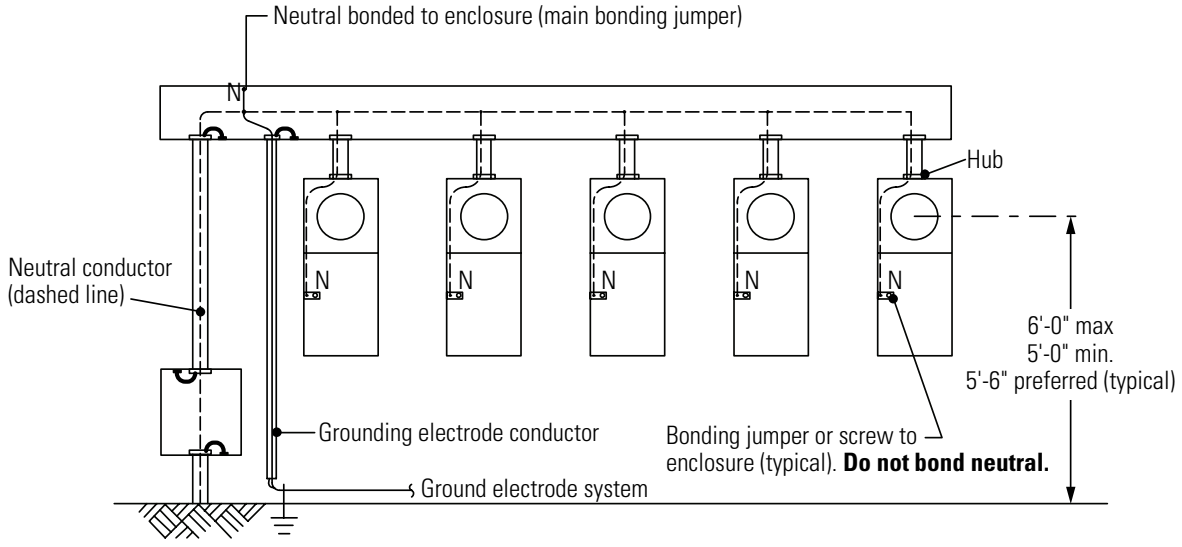
Non-Metallic Conduits

Figure 4-29. Service entrance grounding and bonding diagrams for typical overhead and underground dwelling services.



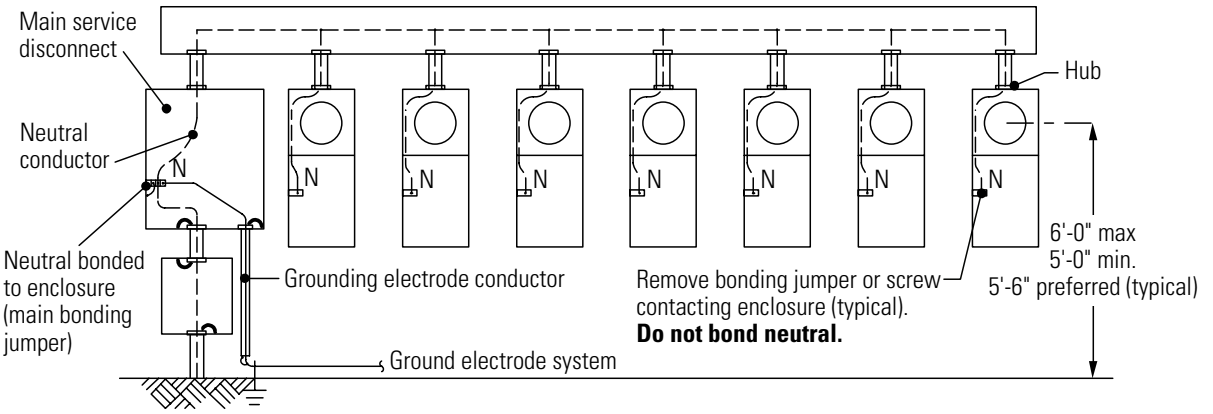
Size all grounding and bonding conductors in accordance with NEC.

Figure 4-30. Service entrance grounding and bonding, multi-meter installation with non-metallic conduits.



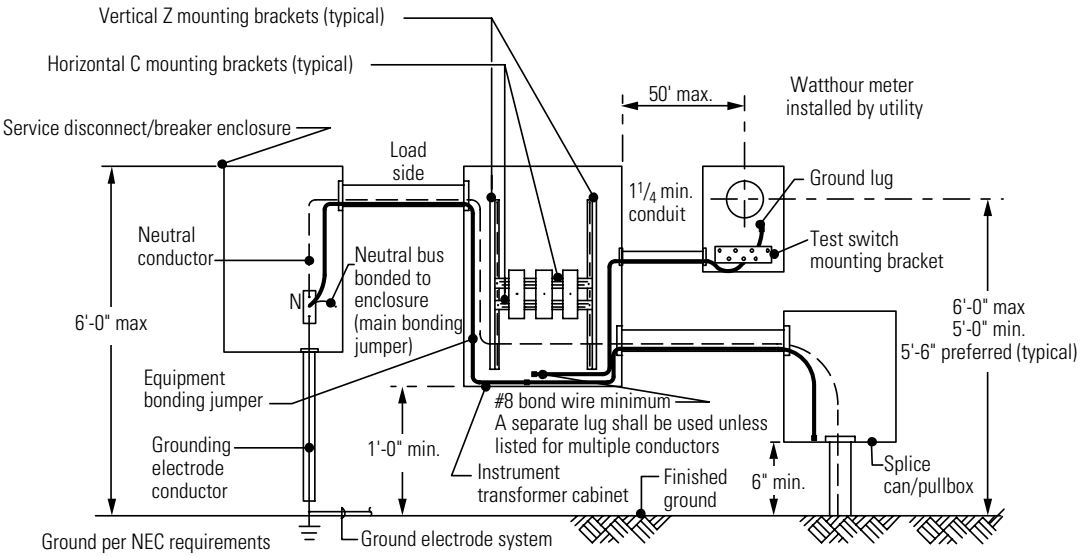
Size all grounding and bonding conductors in accordance with NEC.

Figure 4-31. Service entrance grounding and bonding, multi-meter installation with metallic conduits.



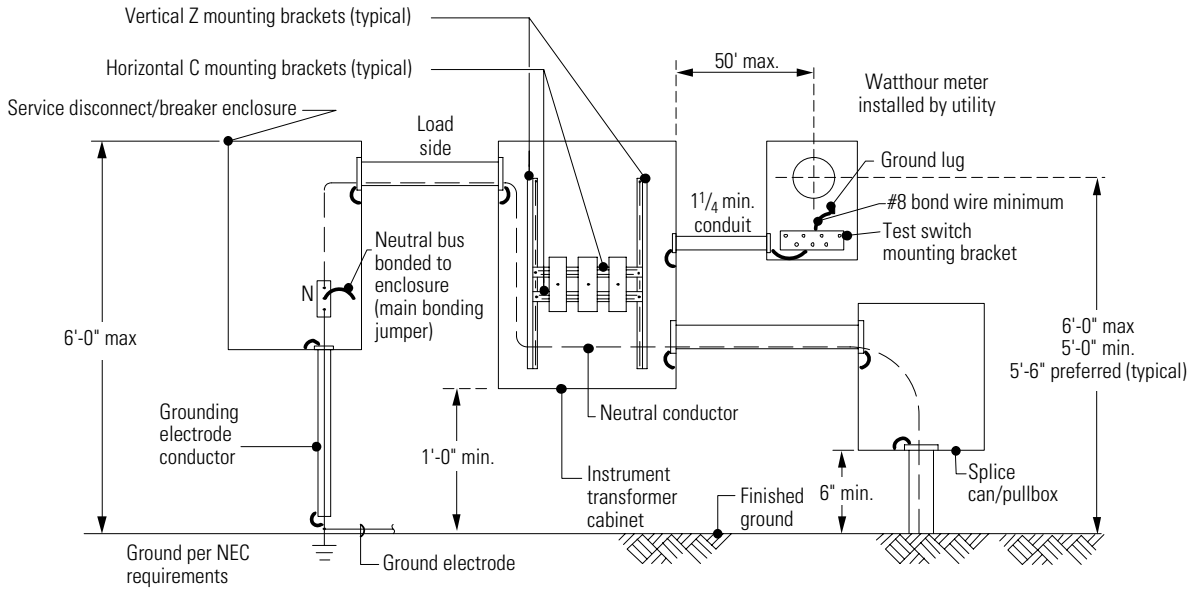
Size all grounding and bonding conductors in accordance with NEC.

Figure 4-32. Service entrance grounding and bonding, multi-meter installation with main breaker ahead, for seven or more meters, with <u>metallic</u> conduits.



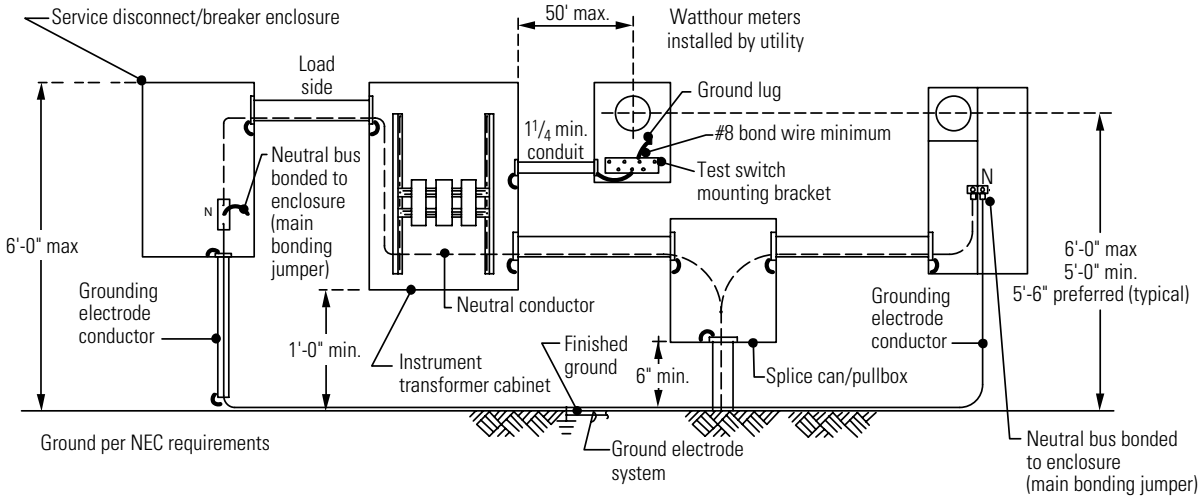
Size all grounding and bonding conductors in accordance with NEC.

Figure 4-33. Service entrance grounding and bonding, CT service with <u>non-metallic</u> conduits.



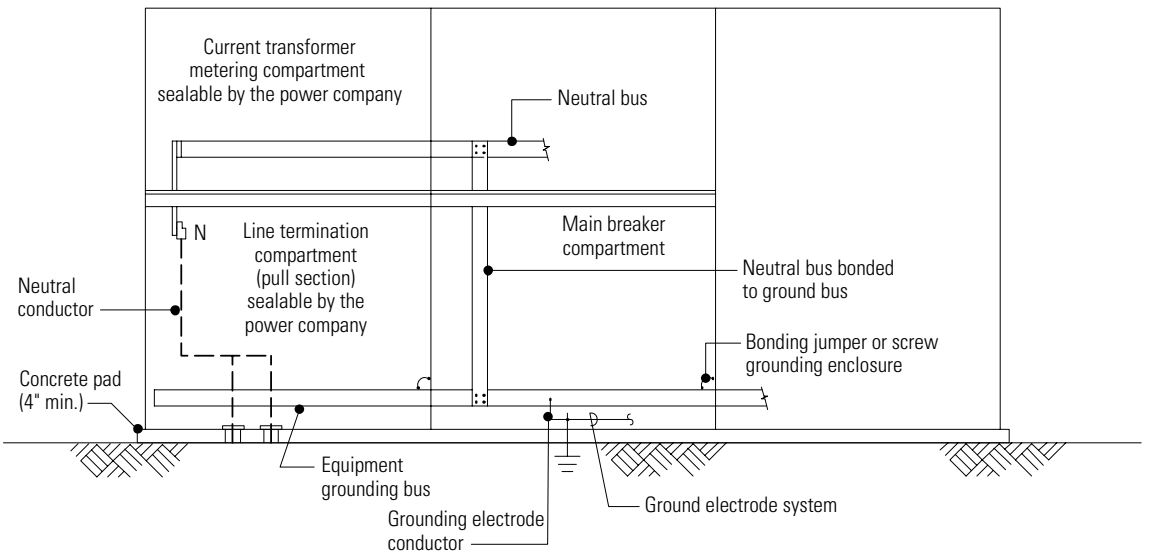
Notes:
1. As an alternate, a continuous bonding jumper can be used to bond service equipment enclosures and conduits.
2. Size all grounding and bonding conductors in accordance with NEC.

Figure 4-34. Service entrance grounding and bonding, CT service with <u>metallic</u> conduits.



Notes:
1. As an alternate, a continuous bonding jumper can be used to bond service equipment enclosures and conduits.
2. Size all grounding and bonding conductors in accordance with NEC.

Figure 4-35. Service entrance grounding and bonding, CT service and self-contained meter, with <u>metallic</u> conduits.



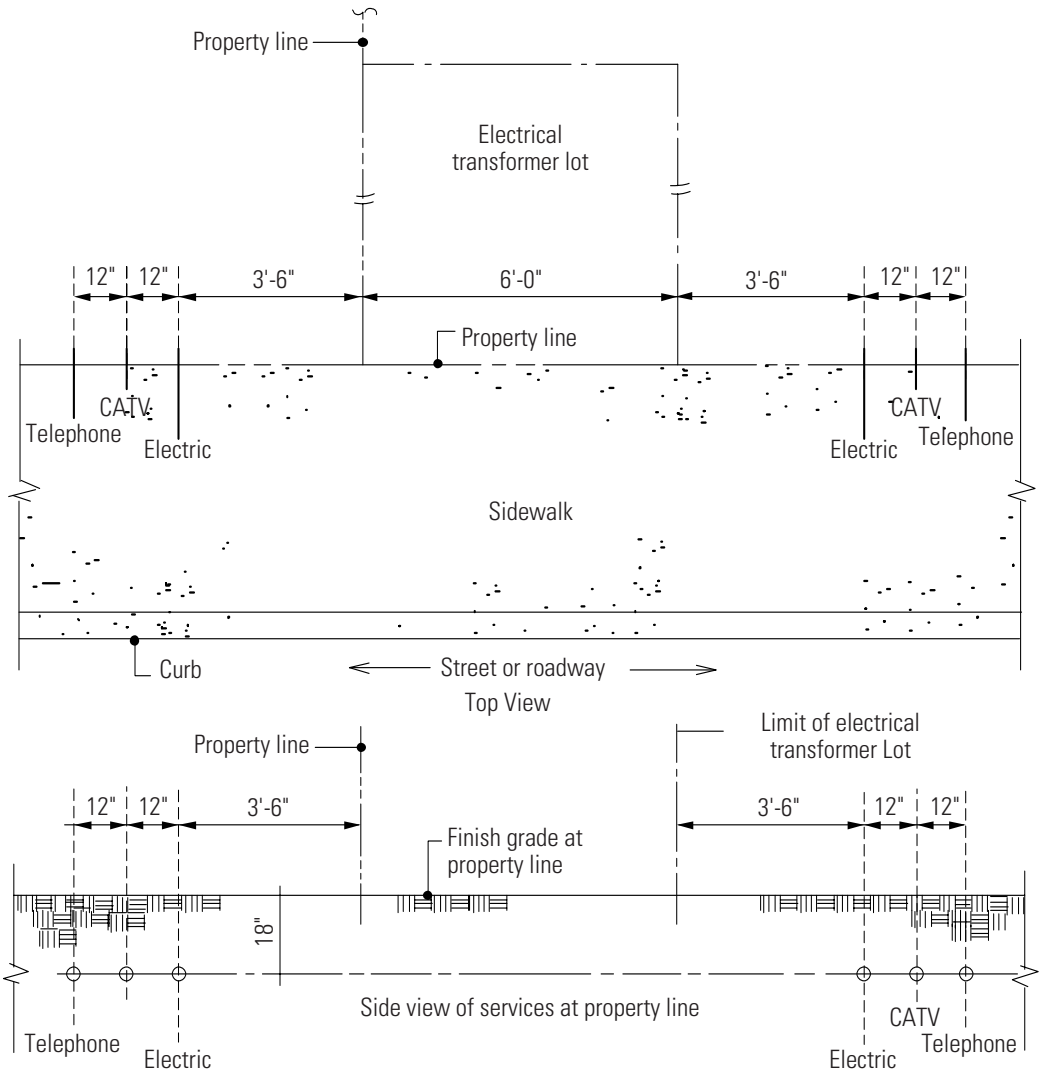
Notes:
1. Grounding electrode conductor connection to ground rod/ supplementary ground system shall be in non-sealable compartment. Do not install ground rod in-line termination compartment unless approved by the power company.
2. Size all grounding and bonding conductors in accordance with NEC.

Figure 4-36. Service entrance grounding and bonding, metering switchboard with non-metallic conduits.

CHAPTER

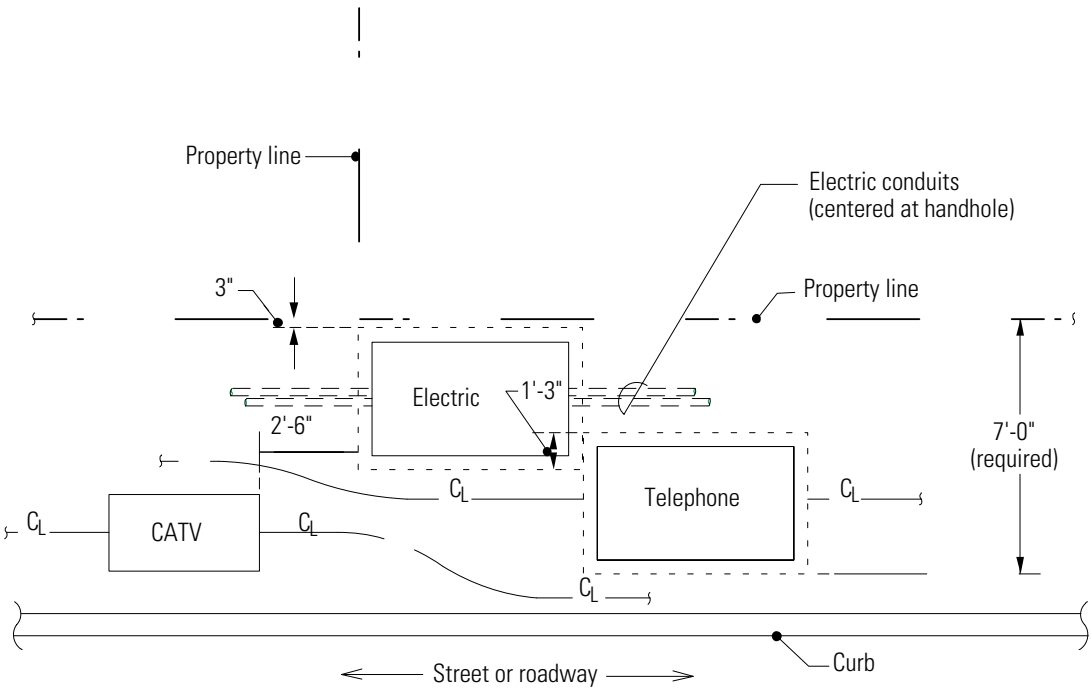
5

Other Requirements



Install utility boxes within the sidewalk area in accordance with city and county requirements.

Figure 5-1. Separation of underground services at the property line.



Typical handhole grouping (not to scale)

Figure 5-2. Typical handhole grouping.

Switching and Protection

Service Connection Configurations

Automatic Transfer Equipment – Commercial Service 0 to 600V

Equipment may be installed to automatically transfer the customer's load from a de-energized preferred service to an energized alternate service, and to return to the preferred service either by automatic open transition return, automatic close transition return, or by manual closed transition return performed by power company workers. The requirements for either of these optional methods of operation are:

Automatic Transfer with Automatic Open Transition Return

Transfer equipment must automatically transfer the customer's load from a de-energized preferred service to an energized alternate service after an adjustable time period set by the utility, from zero to thirty seconds following interruption of the preferred service.

When the preferred service is restored, the equipment must make an automatic-open transition return to the preferred service after an adjustable time period set by the utility, from one to ten minutes following restoration of preferred service. However, if during this time period the alternate service is interrupted, the equipment may make an

automatic open transition return to the preferred service, without waiting for the completion of the time delay period, if the preferred service is energized.

The protective and controlling equipment in the preferred and alternate services must be designed to prevent paralleling the services during automatic transfer in either direction.

The transfer equipment should have a Normal-Closed Transition selector switch as defined in this section, and have suitable interlocks so the customer can not parallel both services but the utility can parallel both services when necessary to allow a manual closed transition transfer in either direction. This switch must be sealed with a lock, as specified by the utility and elsewhere in this manual.

Automatic Transfer with Automatic Close Transition Return

Transfer equipment must automatically transfer the customer's load from a de-energized preferred service to an energized alternate service after an adjustable time period set by the utility, from zero to thirty seconds following interruption of the preferred service.

When the preferred service is restored, the equipment must make an automatic close transition return to the preferred service after an adjustable time period set by the utility, from one to ten minutes following restoration of preferred service. However, if during this time period the alternate service is interrupted, the equipment may make an automatic open transition return to the preferred service, without waiting for the completion of the time delay period, if the preferred service is energized.

The automatic close transition return operation must include the closing of the preferred service, followed by the instantaneous (no time delay) opening of the alternate service.

The transfer equipment should have a Normal-Closed Transition selector switch as defined in this section, and have suitable interlocks so that the customer can not parallel both services but the utility can parallel both services when necessary to allow a manual closed transition transfer in either direction. This switch must be sealed with a lock as specified by the utility, and elsewhere in this manual.

Automatic Transfer with Manual Closed Transition Return by the Power Company

Transfer equipment must automatically transfer the customer's load from a de-energized preferred service to an energized alternate service after an adjustable time period set by the utility, from zero to thirty seconds following interruption of the preferred service.

The customer must notify the utility's load dispatcher as soon as practical whenever the equipment automatically transfers to the alternate service.

The utility will manually make a closed transition transfer of the customer's load from the alternate service to the preferred service as soon as feasible after the preferred service is restored. However, if the alternate service is interrupted, the equipment may make an automatic open transition return to the preferred service if the preferred service is energized.

The protective and controlling equipment in the preferred and alternate services must be

interlocked to prevent paralleling the services during automatic transfer in either direction.

The transfer equipment should have a Normal-Closed Transition selector switch as defined in this section, and have suitable interlocks so that the customer can not parallel both services but the power company can parallel both services when necessary to allow a manual closed transition transfer in either direction. This switch must be sealed with a lock as specified by the utility, and elsewhere in this manual.

Additional Requirements

In addition to the requirements described above, automatic transfer equipment must comply with the following requirements:

- Install automatic transfer equipment in compliance with the applicable requirements in the manufacturer's manual.
- The transfer equipment must have provisions for locking or blocking open, either service, and must have targets to indicate whether each service is Open or Closed, if this can not be determined by a visible air gap. This requirement is in addition to the requirements as stated under the Disconnecting Equipment paragraph in this section: Protective and Controlling Equipment Commercial Service 2 kV to 15 kV.
- The transfer equipment must have provisions for changing either service to be preferred, so the preferred feeder can be changed by the utility.
- The transfer equipment must be accessible to power company workers at any time.
- The utility reserves the right to transfer the customer's load to the alternate service, and to block the automatic features temporarily to facilitate work or maintenance on the utility's system.
- The customer must obtain permission from the utility's load dispatcher before manually transferring to the alternate service.
- The customer must operate his equipment so it will not produce any adverse condition on the utility's system in conformance with the utility's tariffs.
- The customer must install bus fault protection to provide automatic transfer blocking of his facilities in the event of a bus fault.
- The utility reserves the right to determine if automatic open or close transition return is applicable to the given installation.
- All operational testing must be performed by the customer and witnessed by the utility's Test Division before the equipment is placed in service.

Automatic Transfer Equipment – Commercial Service 2 kV to 15 kV

Equipment may be installed to automatically transfer the customer's load from a de-energized preferred service to an energized alternate service, and to return to the

preferred service either by automatic open transition return or by manual closed transition return performed by power company workers. Automatic closed transition return is not allowed. The manual closed transition return method may not be available at all locations on the utility's system, and this option is offered subject to approval by the utility. The requirements for either of these optional methods of operation are:

Automatic Transfer with Automatic Open Transition Return

Transfer equipment must automatically transfer the customer's load from a de-energized preferred service to an energized alternate service after an adjustable time period set by the utility, from zero to thirty seconds following interruption of the preferred service.

When the preferred service is restored, the equipment must make an automatic open transition return to the preferred service, after an adjustable time period set by the utility, from one to ten minutes following restoration of preferred service. However, if during this time period the alternate service is interrupted, the equipment may make an automatic open transition return to the preferred service, without waiting for the completion of the time delay period, if the preferred service is energized.

The protective and controlling equipment in the preferred and alternate services must be designed to prevent paralleling the services during automatic transfer in either direction.

The transfer equipment should have a Normal-Closed Transition selector switch as defined in this section and suitable interlocks so that the customer can not parallel both services but the utility can parallel both services when necessary to allow a manual closed transition transfer in either direction. This switch must be sealed with a lock as specified by the utility and elsewhere in this manual.

Automatic Transfer with Manual Closed Transition Return by the Power Company

Transfer equipment must automatically transfer the customer's load from a de-energized preferred service to an energized alternate service after an adjustable time period set by the utility, from zero to thirty seconds following interruption of the preferred service.

The customer must notify the utility's load dispatcher as soon as practical whenever the equipment automatically transfers to the alternate service. The phone numbers to call are: HECO (808) 543-7466, HELCO (808) 969-6666, MECO (808) 871-7777.

The utility will manually make a closed transition transfer of the customer's load from the alternate service to the preferred service as soon as feasible after the preferred service is restored. However, if the alternate service is interrupted, the equipment may make an automatic open transition return to the preferred service if the preferred service is energized.

The protective and controlling equipment in the preferred and alternate services must be interlocked to prevent paralleling the services during automatic transfer in either direction.

The transfer equipment should have a Normal-Closed Transition selector switch as defined in this section and suitable interlocks so that the customer can not parallel both

services but the utility can parallel both services when necessary to allow a manual closed transition transfer in either direction. This switch must be sealed with a lock as specified by the utility and elsewhere in this manual.

Automatic Transfer Policy for Critical Loads

Customers may install their own automatic transfer equipment in place of utility's primary automatic transfer equipment.

Primary customers with critical loads (see definition below) are required to provide the following as a condition of service where necessary.

- Adequate vault space for the customer's or utility's primary automatic transfer equipment.
- Pay for the purchase and installation of primary automatic transfer equipment dedicated to serve their load.

Secondary customers that fit the critical load definitions are required to provide the following as a condition of service where necessary:

- Adequate vault space for the utility's primary automatic transfer equipment.

What is a critical load?

Critical loads include:

- Hospitals, vital military installations, communication facilities (television, common control program stations, civil defense, police, fire), civil defense control centers, major police stations, refineries, airports, vital navigational aids (VORTAC, OMEGA, LORAN, etc.), vital gas utility pumping stations, heavy industry, major shopping centers, large auditoriums, large movie theaters, stadiums, other facilities that regularly have large numbers of people present and/or total demand of 500 kVA or more.
- Any residential building, office building, hotel, retirement home, or other commercial structure that is equipped with an elevator or electric stairway, and is more than four stories high, and/or total demand of 1000 kVA or more

Additional Requirements

In addition to meeting the requirements of the above, automatic transfer equipment must comply with the following:

- The transfer equipment must have provisions for locking or blocking open, either service, and must have targets to indicate whether each service is Open or Closed if this can not be determined by a visible air gap. This requirement is in addition to the requirements as stated under the Disconnecting Equipment paragraph in this section: Protective and Controlling Equipment Commercial Service 2 kV to 15 kV.
- The transfer equipment must have provisions for changing either service to be preferred, so that the preferred feeder can be changed by the utility.

- The transfer equipment must be accessible to electric power company workers at all times.
- The utility reserves the right to transfer the customer's load to the alternate service and to block the automatic features temporarily to facilitate work or maintenance on the utility's system.
- The customer must obtain permission from the utility's load dispatcher before manually transferring to the alternate service.
- The customer must operate his equipment so that it will not produce any adverse condition on the power company's system in conformance with the utility's tariffs.
- It is highly recommended that the customer install bus fault protection to provide automatic transfer blocking of his facilities in the event of a bus fault.

Protective and Controlling Equipment – Commercial Service 2 kV to 15 kV

Services Which Can Not Be Fused By 100-Ampere Fuses Or Less

For these services, the customer must provide primary circuit breakers or equivalent between his equipment and the utility's source. The protective and controlling equipment must conform to the following requirements:

- The protective and controlling equipment must be installed as close as feasible to the power company's primary service termination.
- The total clearing time for opening the circuit to the customer's equipment must not be slower than the time plotted on the curve as indicated in Figure 5-3.
- The equipment must have a current rating capable of safely interrupting and closing into the maximum primary fault current available as specified by the utility. All equipment is to be rated for nominal 15 kV class operation with a minimum BIL of 95 kV, except for auxiliary power or potential transformers which must be rated for operation at the nominal voltage as specified by the utility.
- Provision must be made by the customer to safely disconnect and remove the protective and controlling equipment for maintenance without assistance from the utility. There must be a visible air gap to give positive indication that service has been disconnected from the customer.
- The protective equipment must be equipped with phase(s) and ground relays.

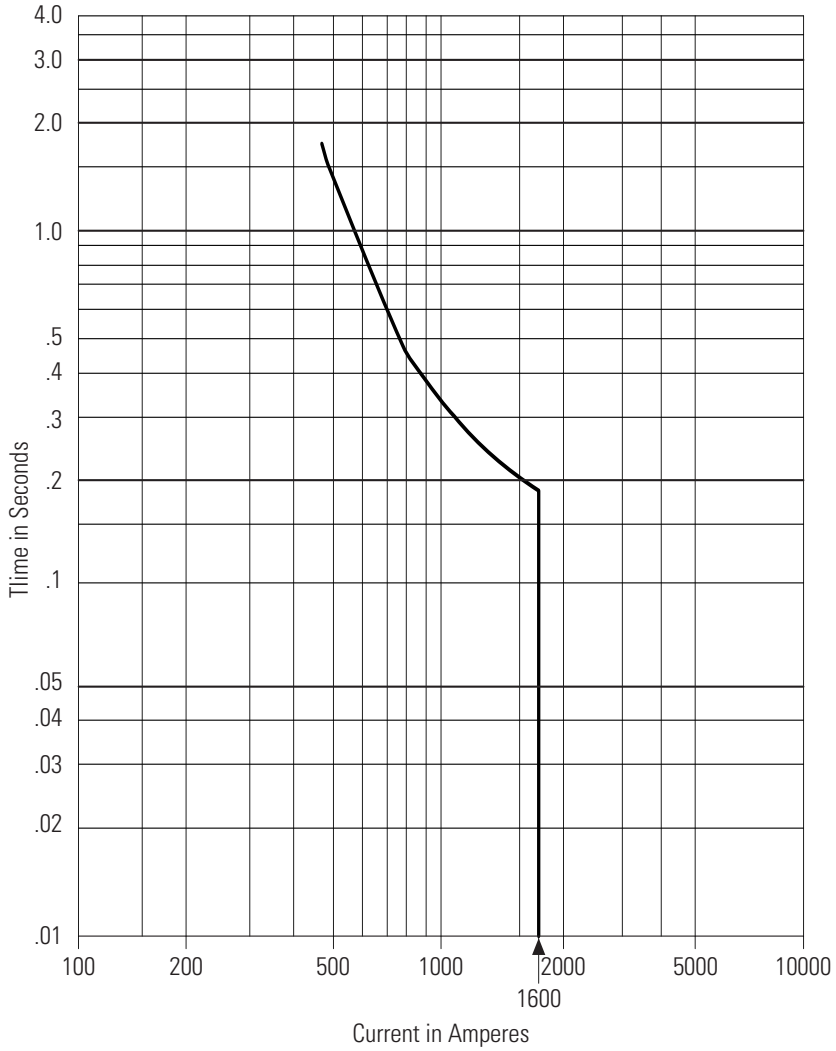


Figure 5-3. Time-current curve for a fuse protecting 2 kV to 15 kV services.

Services Which Can Be Fused By 100-Ampere Fuses Or Less

Location

The protective and controlling equipment must be installed as close as feasible to the utility's primary service termination.

Time-Current Characteristics

The total clearing time at corresponding current values for opening the circuit to the customer's equipment must not be slower than the maximum time plotted on the standard NEMA curve for 100 ampere Type N fuses.

Current and Voltage Rating

The fuses must have a current rating capable of safely interrupting the maximum

primary fault current available as determined by the utility. The fuses must be rated for operation at the nominal voltage as specified by the utility.

Type of Fuses

The fuses must be of a type designed for the specific application and location, such as outdoor or indoor.

Stocking and Replacement

Stocking and replacement of fuses must be the responsibility of the customer.

Fused Service from Overhead Source

When services fused by 100 ampere fuses or less are connected to the utility's overhead lines, the utility will normally fuse the services to the customer with 100 ampere NEMA Type N fuses. At many locations, a 40 ampere fuse will be the largest size the customer can install that will coordinate with the utility's fuse. Consequently, when the customer installs fuses of a size from 40 to 100 amperes inclusive, any fault condition which causes the customer's fuses to blow, may also blow or damage the utility's fuses. This may require the utility to replace its fuses before the customer's service can be restored.

Two Services

When fuses are installed in each of two services to the customer, switching from one service to the other must be by open transition.

Future Growth

When the customer chooses to install fuses initially, and his load then increases and is no longer fusible by 100 ampere fuses, it will be the customer's responsibility to design, furnish, and install protective and controlling equipment as specified.

Service Connection Configurations – Commercial Service 2 kV to 15 kV

Definitions and Symbols

Interlock	As used here: An electrical or mechanical switch-blocking arrangement which prevents two services from being paralleled.
Open Transition	Transferring customer's load from one service to another by opening the first service before closing the second service.
Closed Transition	Transferring a customer's load by closing the second service before the first service is opened.
Normal-Closed Transition Switch	A control switch which, in the normal position makes the interlock feature effective, and in the closed-transition position bypasses the interlock to permit the utility to parallel the two services.
NO	Normally open
NC	Normally closed

Table 5-1. Defintions for system protection and control circuits.

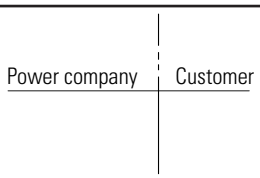
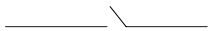
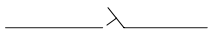
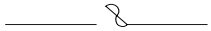
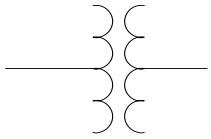
	The division line between the customer and power company in general defines the portion of the installation for which the customer is responsible for ownership and maintenance.
	3-Phase overhead line
	3-Single conductor primary cables
	Primary cable termination
	Circuit breaker or equivalent with disconnecting means
	Disconnect switch, non-load break
	Disconnect switch, load break
	Fused disconnect switch or fuse removable with hotstick
	Transformer

Table 5-2. Symbols.

Overhead or Underground, Single Source, Single Load

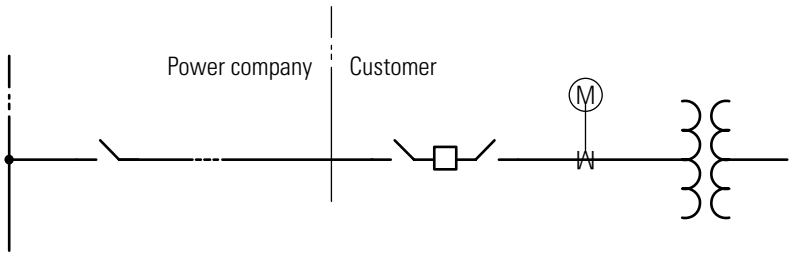


Figure 5-4. Protective and controlling equipment for services which can not be fused by 100 ampere fuses or less.

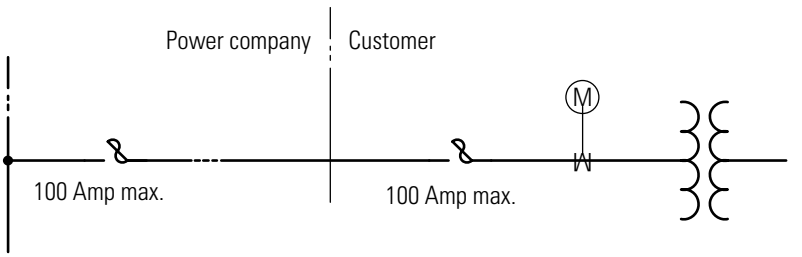


Figure 5-5. Protective and controlling equipment for services which can be fused by 100 ampere fuses or less.

For overhead primary services, the utility will, at its expense, furnish and install a single span of service conductors from its pole or other aerial support to the customer's first permanent support, provided such support is of a type and at a location approved by the utility. Further extensions of power company lines for service outside the customer's property will be made in accordance with the utility's tariff.

The location of the primary metering point will normally be the first permanent support inside the customer's property at which the utility terminates the source. The instrument transformers will be mounted on this structure by the utility on facilities provided by the customer.

When the customer's first point of permanent support is not a feasible metering point, or if the customer will be metered on the secondary side of his transformer, the metering will be located at a utility-approved location other than the first permanent support.

Overhead, Dual Source, Single Load

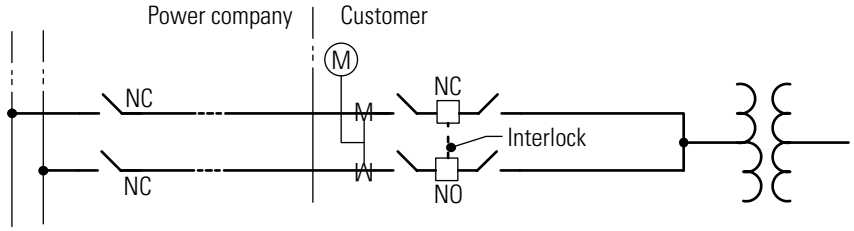


Figure 5-6. Protective and controlling equipment for services which can not be fused by 100 ampere fuses or less.

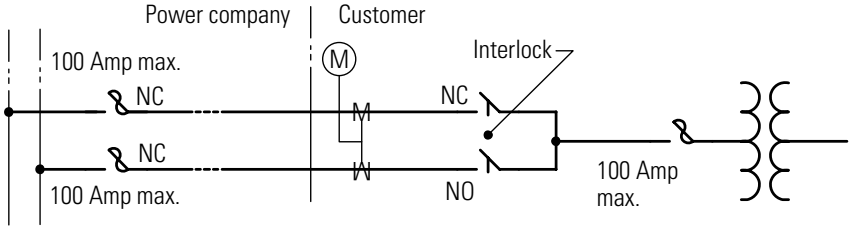


Figure 5-7. Protective and controlling equipment for services which can be fused by 100 ampere fuses or less.

Underground, Dual Source, Single Load

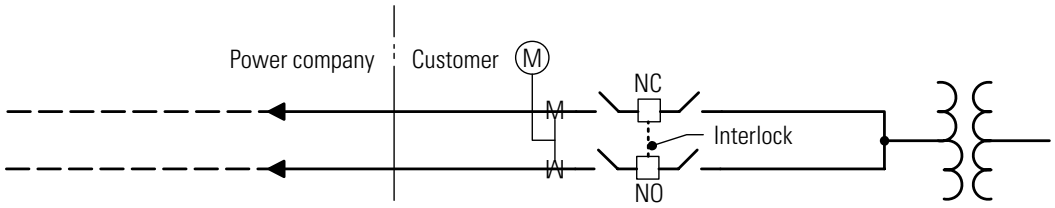


Figure 5-8. Protective and controlling equipment for services which can not be fused by 100 ampere fuses or less.

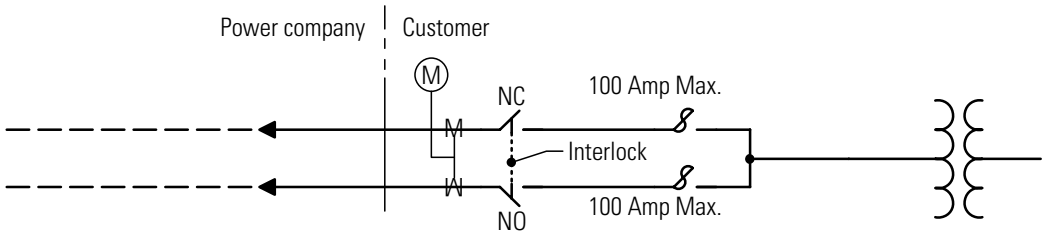


Figure 5-9. Protective and controlling equipment for services which can be fused by 100 ampere fuses or less.

The preferred fuse location is on the load side of disconnecting switches but it will be acceptable if fuses are installed on the source side of switches.

Underground, Dual Source, Dual Load

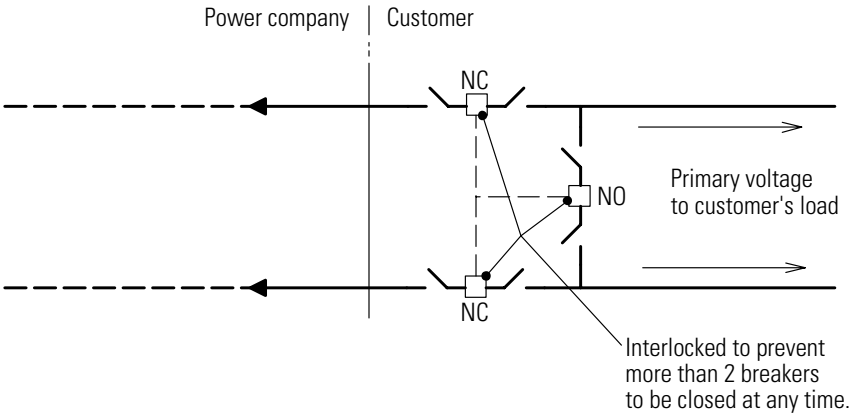


Figure 5-10. Parallel services.

The tie breakers shown in Figure 5-10 must be as close as practical to the incoming main breakers. If provision is made for manual closed transition switching by power company personnel, locate it as close as practical to the incoming main breakers. Any additional circuit breakers or switches must be installed or interlocked so that it will not be possible to parallel the power company's two continuously energized services.

The tie breaker shown in Figure 5-10 will not be satisfactory for paralleling the two services unless the breaker trip elements can be blocked to prevent possible tripping on parallel current flow during a switching operation.

The customer must install a single-phase indicating maximum demand ammeter in one phase of each service, to enable the utility to determine the demand load on each service. The ammeters must be installed on the load side of the utility's revenue metering equipment. The ammeters must be single-range with a 5-ampere full-scale rating. The ammeters may be switchboard type similar to Lincoln Type AD-2, or socket mounting type similar to Lincoln Type ADS manufactured by the Sangamo Electric Company. The customer may install indicating demand watthour meters in each service in lieu of the ammeters specified above.

Metering requirements for this type of service must be obtained from the utility.

The customer must obtain the approval of the utility to use fuse protection instead of circuit breakers.

Utility-Owned Switchgear

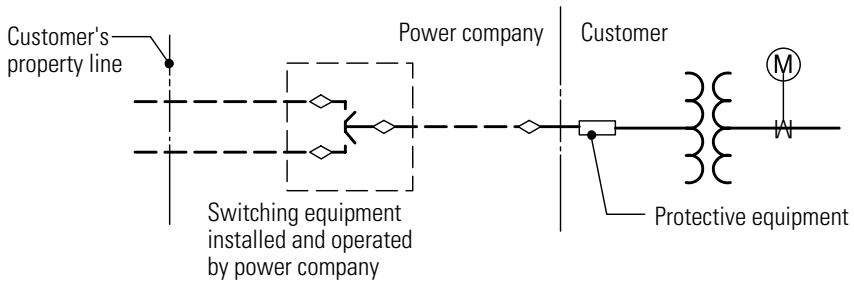


Figure 5-11. Service connection configuration, with utility owned switchgear.

For installations for which the advantages of a primary rate are desired but the nature of load does not warrant the cost of customer-owned switchgear, the customer may opt for utility-owned switchgear.

The switching equipment will be installed by the power company at the customer's expense on a concrete pad constructed by the customer on the customer's premises at a location and with accessibility as specified by the power company. A minimum clear space extending 6 feet in front of the primary switching compartment is required. The equipment will be locked with a power company lock and switching will be performed by the power company personnel only. The power company will maintain the switching equipment. No protective equipment will be provided or permitted to be installed within the switching equipment. The distance from the switching equipment to the customer's protective equipment shall not exceed 75 feet.

This option is available only to customers having a maximum demand up to 1000 kVA. If this option is taken and the demand exceeds 1000 kVA, the customer shall be required, if requested by the power company, to revise the equipment to meet requirements as specified in Figure 5-9.

A terminating pull-section must be provided by the customer in the area of his protective equipment, in accordance with the requirements of this manual.

Metering must be on the secondary side of the transformer, in accordance with applicable rate schedules.

Customer Generators

The utility allows parallel operation of customer generators on its electrical system, only with specific agreement with the customer.

An emergency or standby source may be utilized for times when normal service can not be provided. Notify the utility prior to installation of emergency or standby sources of electric service. This applies to all permanent or portable emergency or standby sources designed to energize the customer’s electrical system.

General requirements for customer generators include:

- A positive acting, UL-listed double-throw switch or transfer device is required. The switch and its configuration must be approved by the utility prior to purchase. The switch or transfer device is necessary for opening all ungrounded conductors from the utility's normal supply prior to the transfer to the emergency power source. The double-throw switch or transfer device must be designed, constructed, and installed so the customer's emergency power source does not feed back into the utility's distribution system.
- Upon receiving appropriate approvals, submit the building plans to the utility for review. The plans must include service equipment location, service elevations, and one-line diagrams. Electrical connections must not be made to the service entrance conductors or other equipment until the utility has approved the plans.
- Emergency generators must not be installed in locations where metering facilities are subject to noise levels in excess of 85 db. Refer to the meter section of this manual for acceptable meter locations.
- As prescribed by the National Electrical Code, place a sign at the service entrance equipment indicating the type and location of the on-site emergency standby power source.
- Conductors intended for the emergency or standby power source must not be installed in the same conduits or raceways as the utility's service entrance conductors.
- The customer provides the utility with a construction and installation schedule, as soon as possible.

Design and Operating Guidelines

This section covers general service and metering requirements which apply to generating systems of 500 kW or less, and operating at less than 600 volts, 60 Hertz. Consult with the power company for other generating systems.

When the customer plans to operate generators in parallel with the utility's system, the customer must apply to the utility for permission, and to discuss the detailed requirements that apply to parallel operations. As part of this procedure, the customer submits single-line diagrams showing the control, protection, and metering functions. Typical functions to be included are listed below. "Typical" is interpreted as possible functions. The specific functions actually implemented will be determined by the utility. Typical functions include:

- Synchronizing controls
- Voltage and frequency controls
- Over-voltage trip

- Under-voltage trip
- Current unbalance detection and trip
- Over-current trip
- Interlocking of main breaker
- Ground current detection
- Over-frequency trip
- Under-frequency trip
- Energy measurement
- Demand measurement
- VARh measurement (when Schedule P applies)

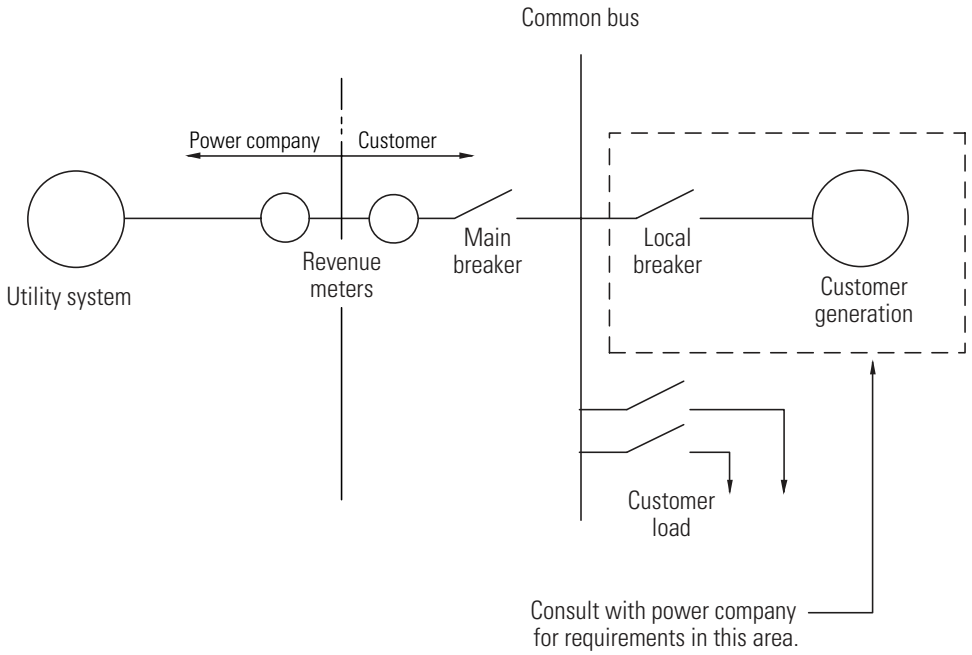


Figure 5-12. Functional diagram of a customer generation installation.

Residential Customer Emergency Generators

Be extremely cautious when using a portable generator during a power outage, or at any other time. Never plug a portable generator into a home's electrical system and attempt to backfeed power into the home's electrical panel. This is very dangerous to occupants, neighbors, and to power company workers. Electricity can back-feed not only into your own panel, but also out into the company's power system. Once backfeed reaches primary lines, it can reach in excess of 12,000 volts.

In addition to this safety hazard, you can destroy your generator. Power company crews routinely use ground clamps for their safety. If your generator tries to feed into this ground, the amperage drawn on your generator will greatly exceed its design limits. Furthermore, if the utility re-energizes power while your generator is connected to the system, the sudden reversal of power flow can destroy your generator.

Opening the home's main breaker does not adequately protect against these risks. The only safe way to use a portable generator is to plug individual appliances directly into the generator. This is how it was designed to be used. If you have special needs for back-up power during outages, consult a licensed electrician to discuss your options.

Street Lighting

Street Lighting From an Overhead Electrical Source

The customer installs and maintains conductors, conduits, separable connectors, fuse holders, and fuses between the luminaries and the utility's overhead secondary lines or service drop.

All parts of street light service drop, street lamps, and their supporting fixtures (including rods, braces and guys) must not be less than 1 foot above, or 2 feet below the level of messenger or conductors supported by messengers.

For street lighting systems in new subdivisions and roadway extensions, the customer must submit a set of drawings of his street lighting plans to the utility.

Height requirements for pole-mounted street light meter sockets are: 5' minimum, 6' maximum, with preferred mounting height of 5'-6" similar to outdoor meters accessible to pedestrian traffic, as shown in the Metering chapter of this manual.

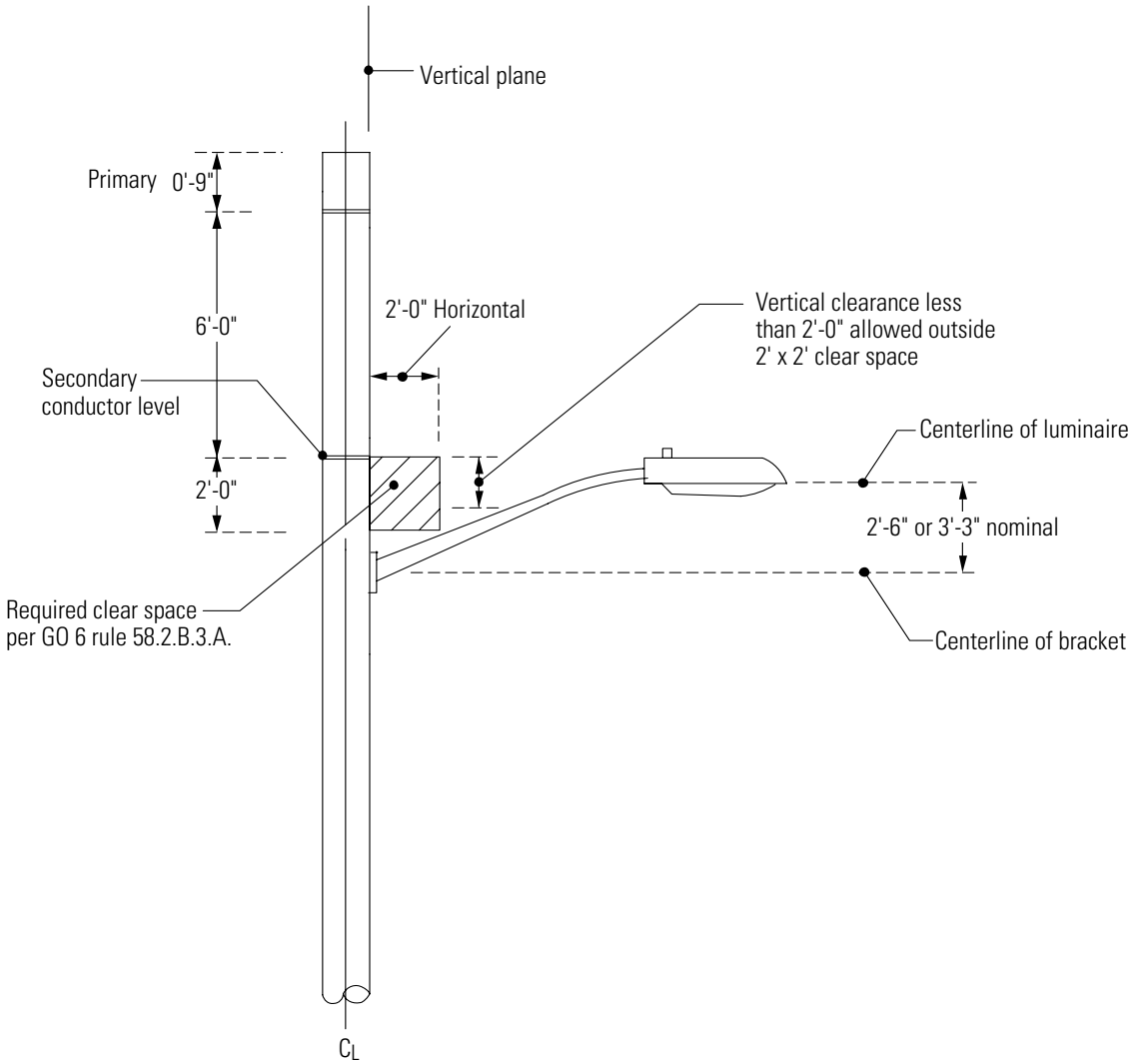
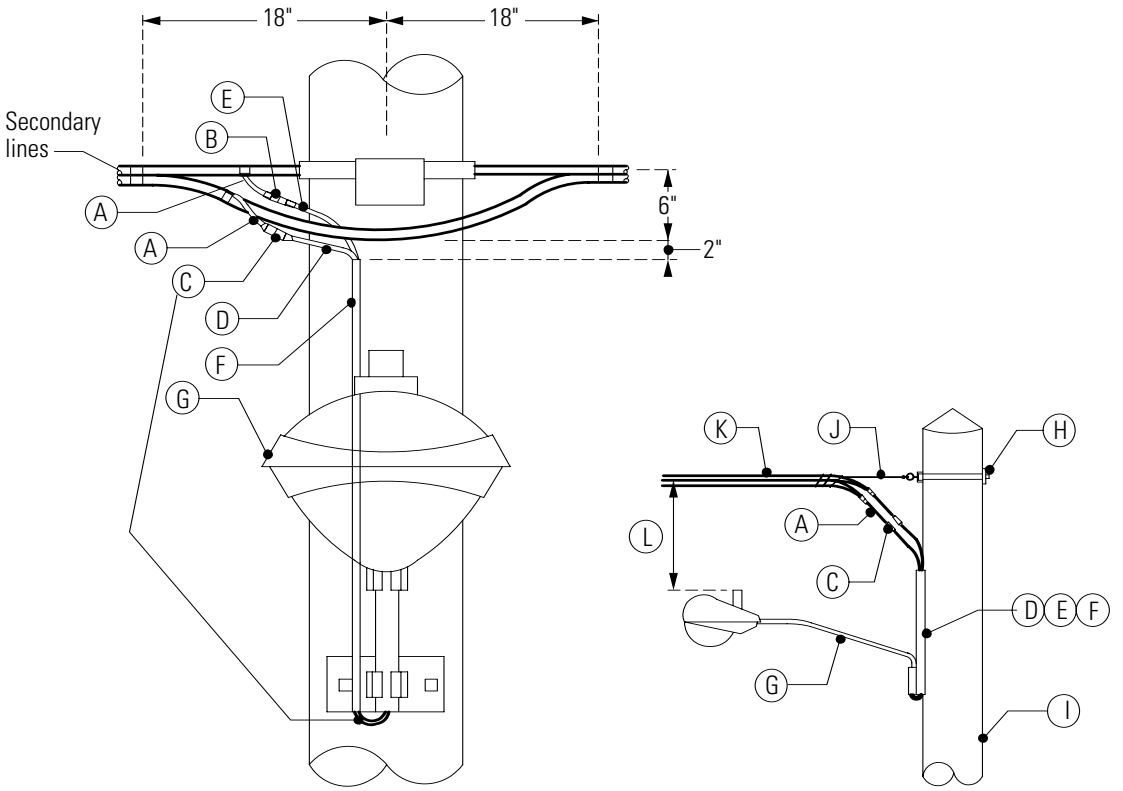


Figure 5-13. Street lighting from an overhead electrical source.



A
Customer's luminaire on wood pole supporting power company's secondary aerial cable.

B
Customer's luminaire on pole requiring a service drop.

A. No. 8 AWG 7-strand aluminum wire, RHW, of sufficient length to splice to the power company's lines. Coil the wire at the pole, pending splicing by utility.

B. In the line unfused, insulated separable connector, suitable for No. 8 AWG stranded aluminum wire on line side, No. 12 copper wire on load side.

C. In the line fuse holder and fuse suitable for No. 8 AWG stranded aluminum wire on line side and No. 12 AWG copper on load side.

D. No. 12 AWG RHW black, single conductor stranded wire.

E. No. 12 AWG RHW white, single conductor stranded wire

F. 3/4" PVC Schedule 80 conduit.

G. Luminaries and bracket.

H. Aluminum service drop anchor bolt, assembly furnished and installed by customer.

I. Wood pole by customer.

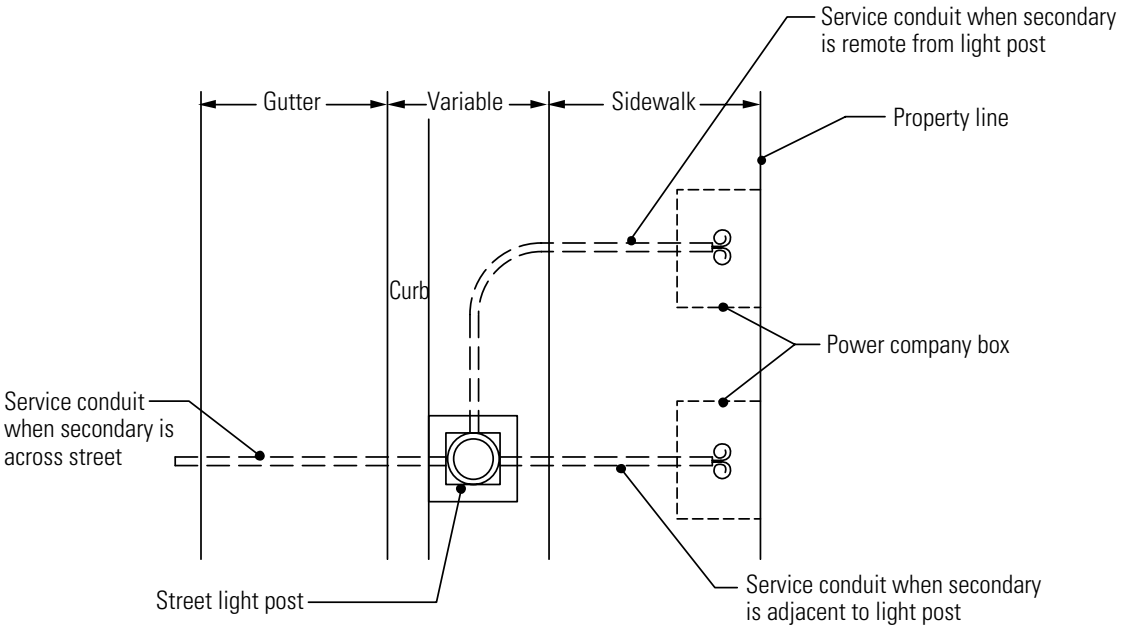
J. Preformed grip by customer.

K. Aluminum service drop by customer.

L. 12" minimum clearance between the light fixture and the utility service conductor. If not possible when service drop passes over luminaries, the utility will select a splicing point which will provide a passage to the right or left of luminaries to provide a 12" clearance.

Figure 5-14. Street lighting from an overhead electrical source, details.

Street Lighting From an Underground Electrical Source



Notes:

The customer provides and installs utility-approved No. 8 AWG Type RHW-USE copper or aluminum conductors, white neutral, black underground line in 1-inch diameter minimum rigid galvanized steel or ABS or PVC plastic conduit from fuses in post base to a point 6 inches from power company secondary conductors. Allow sufficient length for splice and coil at trench end of conduit. The ABS or PVC plastic conduit may be either type DB for direct buried, or type EB for encasement in a minimum of 3 inches of concrete.

The customer shall consult the power company to determine the point of connection to the power company's secondary conductors.

When splices cannot be made during installation of the power company's secondary conductors, run the street light conductors to nearest service tail.

Figure 5-15. Service conduit for street lighting.