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9. Non-Residential Services (Commercial, Industrial, and Agricultural)

This section describes Power Company requirements for single-phase and three-phase direct-connect or current transformer (CT) rated non-residential services. CT-rated equipment is required for single-phase service greater than 400 amps (A) and three-phase services greater than 200 A.

All non-residential customers are responsible for coordinating service requirements with the Power Company prior to material purchase and installation.

A list of approved meter sockets is posted online at: https://www.pacificpower.net/working-with-us/builders-contractors/electric-service-requirements.html and https://www.nockymountainpower.net/working-with-us/builders-contractors/electric-service-requirements.html and https://www.nockymountainpower.net/working-with-us/builders-contractors/electric-service-requirements.html

9.1 General Requirements

- 1. All meter socket enclosures shall be ring-type.
- 2. Acceptable meter sockets are those manufactured in accordance with current EUSERC, ANSI-C12, and UL/ANSI-414 requirements.
- 3. A main disconnect is required when more than six services are connected. If an existing installation expands beyond six services, a main disconnect shall be installed.
- 4. NEC-approved load calculations are required when the sum of distribution section ampacities exceeds the pulling section ampacities. (See NEC Article 220, *Branch-Circuit, Feeder, and Service Calculations*.)
- 5. Each service shall have a lockable and easily accessible disconnect in sight of the meter socket location. If the disconnect is not in sight of the meter socket, a label shall be placed at the meter socket location indicating the location of the disconnect.
- 6. All required labels shall be correctly installed before the service is energized. Labels shall:
 - a. be permanently affixed to the equipment
 - b. be of sufficient durability to withstand the local environment. Engraved metal or hard plastic labels are required.
 - c. not be attached to removeable covers.
 - d. be kept current for the life of the facility.
- 7. Each metered service and associated breaker shall be labeled to identify the unit address. Service will not be connected until permanent labels are attached.





- 8. A minimum vertical clearance of at least 48 inches (48") from the center of the lowest meter to the final grade is required. However, in installations of three or more ganged meters, a minimum vertical clearance of 36 inches (36") to the center of the lowest meter is acceptable if a minimum 36 inches (36") wide, flat, permanent surface (such as a concrete pad or walkway) below the meter is provided at the final grade and extends at least 18 inches (18") on either side of the meter cabinet.
- 9. On overhead services, the customer must furnish all lugs and connect conductors to the lineside terminals. The customer is responsible for bringing the service entrance conductor to the connection of the utility service drop.
- 10. For underground service, the Power Company will provide line-side cable and connectors, and will terminate on the line-side of the equipment.
- 11. Cable termination connectors should have two bolts per connector. When mechanical lugs are used, two setscrews per conductor should be used where feasible.
- 12. All unused openings shall be covered and secured by the customer.
- 13. Meters and metering equipment shall be located outdoors.

9.2 Direct-Connect Metering, Single Installations

The Power Company requires a direct-connect meter socket when the ampacity of a singlephase service entrance is 400 amps or less, or when the ampacity of a three-phase service is 200 amps or less. Required types are summarized in Table 17. Typical sockets and connections are illustrated in the figures in this section.

Direct-connect meter sockets serving continuous duty motors are limited to 60 hp or less at 120 V/208 Y or 120 V/240 V, three-phase, and 125 hp or less at 277 V/480 Y, three-phase.

Direct-Connect	Amperage	Socket Requirement	Figure
Single-phase	100 A max.	EUSERC 304	Figure 31
Single-phase	200 A max.	EUSERC 305	Figure 31
Single-phase, overhead only	201 - 400 A	EUSERC 302B	Figure 33
Single-phase, overhead and underground	201 - 400 A	na	Figure 33
Network	200 A max.	EUSERC 305	Figure 32
Three-phase	100 A max.	EUSERC 304	Figure 32
Three-phase	200 A max.	EUSERC 305	Figure 32

Table 17—Direct-Connect Socket Requirements

Notes:

1. If the socket of an existing three-phase, direct-connect, three-wire service is being replaced, a EUSERC seven-jaw safety socket configured for a three-phase, three-wire meter is required (see EUSERC 304/305, Note 12). This type of three-phase, three-wire service is not approved for new construction.



- 2. For four-wire delta services, the high (power) leg conductor must be identified by orange marking, and located on the right hand bus position. The bus shall also be marked and readily identified.
- 3. Consult the Power Company for non-typical services that may not require a safety socket.

Figure 31—Non-Residential, Single-Phase, Direct-Connect Socket with Required Safety Socket, EUSERC 304 and 305











Typical Services Connections

The figures below show typical service connections.







Section 9



Figure 35—Three-Phase Socket Connection Diagram, Front View

9.2.1 Non-Residential Underground Service Meter Pedestals

Pedestals may be used for non-residential underground service installations. Figure 36 shows the approved pedestal (EUSERC 308).







9.2.2 Non-Residential Underground Service, Free-Standing Meter

Free-standing installations may be used for non-residential underground service. The installation requirements for direct connection, underground service, free-standing meters are listed below. These requirements are in addition to the general requirements in this section.

Requirements:

- 1. The customer shall consult the Power Company to determine the location of the freestanding meter socket.
- 2. The free-standing meter socket shall meet all local ordinance requirements.
- 3. The meter socket shall be protected from damage by use of barrier posts or other suitable protection approved by the Power Company.
- 4. The customer shall furnish, install and maintain approved steel or wood post(s). If a wood post is used, it shall be no less than 6" × 6" (nominal) and pressure-treated with an American Wood Preservative Association approved preservative.

The typical meter installations for steel posts and wood posts are illustrated in Figure 37 and Figure 38.



Figure 37—Underground Service to a Free-Standing Meter Socket, Steel Post





Figure 38—Underground Service to a Free-Standing Meter Socket, Wood Post

9.2.3 Non-Residential Overhead Service, Free-Standing Meter

Free-standing installations may be used for non-residential overhead service. The installation requirements for direct connection, overhead service, free-standing meters are listed below. These requirements are in addition to the general requirements in this section.

Requirements:

- 1. Wood poles shall be of sound timber. The pole or timber must be free of any defects that may weaken the wood, such as sucker knots and spike knots larger than ½ of any face. Cracks greater than ½ -inch (½") wide are not permitted. No visible wood decay is allowed.
- 2. The pole height must provide required clearance for the Power Company's service drop and any other attachments. The customer shall install the meter socket and service equipment on a wood pole no less than 25 feet (25') long and 5 ½ inches (5 ½") in diameter at the top, or a (nominal) 6"× 6" × 25' timber, set no less than 60 inches (60") below ground level, with suitable backfill. The pole or timber shall be pressure- or thermallytreated with an approved preservative.
- 3. The pole or timber shall be easily accessible by Power Company power-lift aerial equipment.





- 4. In unstable soil, conductor lengths in Table 18 may be reduced; guying or bracing shall be required.
- 5. The conductor must be at least 24 inches (24") in length outside the weatherhead.

Figure 39 shows a typical installation of overhead service to a meter mounted on a pole.







Service Size 200 A	Utility Service Length without Guying	Utility Service Length with Guying	
or Less	60' Maximum	90' Maximum	
201 - 400 A Service	45' Maximum	90' Maximum	
401 A and Above	Consult the Power Company		

9.3 Direct-Connect Metering, Multiple Installations

This section describes the additional requirements for direct-connect, non-residential, singlephase and three-phase installations with more than one metered service.

Before being energized, the meter socket shall be properly wired and grounded, and all necessary permits shall be in place. The three styles of metering socket equipment approved for use are: ganged, modular, and switchboard.

Figure 40, Figure 41, and Figure 42 are examples of multiple metering services for three-phase and single-phase configurations.

These requirements are in addition to the general requirements in this section.

Requirements:

- 1. Metering conductors shall not pass through adjacent metering compartments except in enclosed wireways.
- 2. A test bypass facility (TBF) with rigid insulating barriers shall be furnished, installed, and wired or bussed to the meter sockets. TBF cover panels shall be sealable and fitted with a lifting handle.
- 3. A pull box section is required for two or more services and must meet EUSERC 343.
- 4. For ganged meters, where the face of a cabinet exceeds the depth of the adjacent meter cabinet, clearances shall be in accordance with EUSERC 353 and Section 4.
- 5. For switchboard metering installations, the customer must provide a concrete pad for switchboard metering service sections and pull boxes.

Figure 40-Non-Residential Ganged Meter Socket Installation







Figure 41—Non-Residential Modular Meter Socket Installation





9.3.1 Pull Box

Pull box requirements are as follows:

Requirements:

- 1. The termination pull box for Power Company conductors shall meet the requirements of EUSERC 343 and 343A.
- 2. The customer shall provide an approved method by which to make multiple taps outside of the pull box.
- 3. Only Power Company conductors are allowed inside the pull box. Customer-owned devices (such as limiters, fuses, etc.) shall not be installed in pull boxes.



The customer shall not:

- 1. Terminate their principal (main) grounding electrode conductor in the Power Company's sealed termination pull box.
- 2. Use the termination pull box as a junction point for grounding or to ground the electrode conductors.







				,
Total Service	"W"		"Y "	``X ″
Amps	3-Wire	4-Wire	Depth	Lug Height
0-200	10 1⁄2″	14″	6″	11″
201-400	10 1⁄2″	14″	6″	22″
401-800	16 ½″	22″	11″	26″
801-1200	22 1⁄2″	30″	11″	26″

Table 19— Minimum Pull Box Dimensions

(Applies to the Power Company Portion of the Pull Box)

9.4 CT Metering, Up to 800 A

This section describes metering requirements for services rated up to 480 V and 800 A.

Motor loads with horsepower values greater than 60 hp at 120 V/208 Y, three-phase, and 125 hp at 277 V/480 Y, three-phase shall be metered with current transformer metering.

Table 20 identifies customer-provided material for CT metering. The Power Company will provide and install the meter, a meter test switch, current transformers, and secondary metering wiring.

Provided by customer	See	Notes
Meter socket	EUSERC 339	CT-metering socket
CT cabinet	Table 22	 A weather-tight, NEMA 3R-rated EUSERC CT cabinet sized in accordance with Table 22. The door shall be hinged and capable of being sealed
		EUSERC CT mounting base rated for 50,000 A fault current
CT mounting base	Section 9.4.3	Cable termination can only be made on the manufacturer-supplied studs/connectors of the transformer mounting base.
		 No alteration of the transformer mounting base is allowed
Conduit	Section 9.4.5	The conduit between the meter socket enclosure and the CT cabinet, see Section 9.4.5.
Connectors / terminations		Connectors for the load-side conductors to CT mounting base, as well as overhead service.
Bonding	Section 9.4.6	Bonding per Section 9.4.6 for all meter and CT enclosures.

Table 20—Customer-Provided Material





9.4.1 Meter Socket Enclosures for CT Meters

Figure 44—Meter Socket Enclosure for CT Meters, EUSERC 339



Table 21—CT Meter Socket Types, EUSERC 339

Type of Service	Socket Type
Single-phase	6-jaw
Three-phase	13-jaw

9.4.2 CT Cabinet

The CT cabinet consists of two parts, the enclosure and the mounting base for the current transformers. The cabinet is exclusively for Power Company metering equipment.





Figure 45—CT Cabinet, Mounting Base Orientation Options



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Requirements:

- 1. Only equipment associated with Power Company metering shall be permitted in the CT cabinet.
- 2. The door shall have factory-installed hinges for side opening and shall be sealable.
- 3. The door shall be equipped with a device to hold it in the open position at 90° or more.
- 4. The top of the CT mounting base shall not be more than 72 inches (72") above the finished grade.
- 5. The customer's service entrance conduits must exit the cabinet on the load side of the CT.
- 6. Customer conductors are not permitted in the Power Company's termination space.
- 7. The customer shall not terminate their principal (main) grounding electrode conductor in the CT cabinet or use it as a junction point for grounding or grounding electrode conductors.
- 8. For multiple metered circuits, a separate termination pull box must be provided for the Power Company service lateral. The CT cabinet shall not be used as a load distribution center.

Type of Service	EUSERC # for	Minimum Cabinet Dimensions			EUSERC # for CT Mounting	
	CT Cabinets	Width Heig		Depth	Base	
Single-phase, 401-800 A	316, 317	24″	48″	11″	328A	
Three-phase, 201-800 A	316, 318	36″	48″	11″	329A	

Table 22—CT Cabinet Requirements

Notes:

- 1. Where both line and load conductors enter or exit from the top or bottom of the cabinet a larger cabinet is required.
 - a. The dimension of the cabinet shall be 48"W × 48"H × 14"D. (These dimensions are greater than EUSERC 316 and 318 minimums.)
 - b. The cabinet shall have two sealable, hinged doors with handles.
- 2. The door shall have factory-installed hinges for side opening and shall be sealable.

Meter Socket Location:

- 1. For single-hinged CT cabinets the meter socket shall be located opposite the hinged side, and not above or below the cabinet.
- 2. For dual-hinged CT cabinets, the meter socket can be mounted on either side of the cabinet but not above or below it.

Figure 46 shows a typical installation of wall-mounted CT metering.







Figure 46—CT Metering, Wall-Mounted, Service Below 600 V, 800 A Maximum

9.4.3 CT Mounting Base and Cable Termination

CT mounting bases shall conform to EUSERC 328A, Figure 47, or EUSERC 329A, Figure 48. EUSERC 328B and 329B are also acceptable.

Requirements:

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- 1. The CT mounting base shall meet the ratings for the available fault current at the location installed (50,000 A minimum).
- 2. For existing four-wire delta services, the high (power) leg conductor must be identified by orange marking, and located on the right hand bus position. The bus shall also be marked and readily identified.
- 3. The mounting base shall accept bar-type current transformers only.
- 4. No alteration of the mounting base is allowed.
- 5. Line and load-side cable terminations on EUSERC 328A or 329A CT landing pads require two bolts per connector.
- 6. Cable termination can only be made on the manufacturer-supplied studs of the transformer mounting base.



Figure 47—CT Mounting Base Single-Phase, Three-Wire, 800 A Maximum, EUSERC 328A







Figure 48—Mounting Base, Three-Phase, Four-Wire, 800 A Maximum, EUSERC 329A

9.4.4 CT Metering, Free-Standing

The Power Company allows free-standing installations on posts.

Free-standing installations are owned by the customer.

Installation requirements for service to free-standing installations are listed below. These requirements are in addition to the general requirements given in this section.

Requirements:

- 1. The customer shall consult the Power Company to determine the location of the freestanding meter installation.
- 2. The free-standing meter socket shall meet all local ordinance requirements.
- 3. The meter socket shall be protected from damage by use of barrier posts or other suitable protection approved prior to installation by the Power Company.
- 4. The CT cabinet must be properly supported with a minimum of two three-inch (3") steel posts with installed caps, or two wood post no less than 6" × 6" (nominal) and pressure-treated with an American Wood Preservative Association approved preservative. When equipment is less than 72 inches (72") apart, it shall be bonded according to the NESC.





5. The customer shall furnish, install and maintain posts, hardware, conduit, fittings, and concrete pads sufficient to support the metering.

Figure 49 illustrates a typical meter installation using steel posts.



Figure 49—CT Metering for Free-Standing Installations, 600 V, 800 A Maximum

9.4.5 CT Metering Conduit

The customer must provide conduit between the meter socket and the CT cabinet. When installing conduit, the following requirements shall be met:

Requirements for a meter within 12" of a CT cabinet:

- 1. Conduit shall be one-inch (1") IMC, Schedule 40 PVC, or greater.
- 2. Proper fittings and bushings shall protect metering conductors.

Requirements for a meter greater than 12" and up to 50' from the CT cabinet:

- 1. The meter socket must be visible from the CT cabinet.
- 2. Conduit runs must be less than 50 feet (50').
- 3. Conduit shall be 1 1/4" IMC or greater.
- 4. Conduit runs may not have more than three bends totaling 270°. No single bend greater than 90° is allowed.
- 5. Pull lines are required in all conduits.
- 6. Removable conduit fittings shall have sealing provisions.
- 7. LB connectors are not allowed between the CT cabinet and the meter socket.





9.4.6 CT Cabinet Bonding

The CT cabinet must be properly bonded and grounded per the NEC. Figure 50 illustrates one acceptable solution.



Figure 50—NEC-Accepted CT Cabinet Bonding, 600 V, 800 A Maximum

9.4.7 Combination Direct-Connect and CT Metering

Installations requiring both direct-connect and CT metering services shall meet the requirements of both types of services as described in the previous sections. An approved wall-mounted equipment installation is shown below. Switchboard combination units are also allowed. Refer to Section 9.5, *Switchboard Metering up to 4000 A* for requirements.





Figure 51—Combination Direct-Connect and CT Metering

9.5 Switchboard Metering up to 4000 A

A EUSERC-approved switchboard metering section is required when the service entrance rating is greater than 800 A. Switchboard metering may also be used for three-phase services over 200 A or single-phase services over 400 A.

The following table lists applicable EUSERC drawings for switchboard metering:

		EUSERC No.	Figure References
Switchboard	with remote meter socket	325, 326, 354	Figure 52
Termination	underground service	345	Figure 53
rerminauon	overhead service	348	Figure 54
	0 to 800 A, 1-phase 0 to 1000 A, 3-phase	319 320	Figure 56, Figure 57
CT compartment	1001 to 3000 A	322	Figure 58
	above 3000 A	324	Figure 59
Meter socket	remote mount	339	Figure 52

Table 23—EUSERC Switchboard References





Requirements:

- 1. The customer shall provide a drawing of the proposed service equipment, including EUSERC reference numbers and a mounting pad with dimensions, to the Power Company for review and approval. Power Company approval must be obtained prior to fabrication.
- 2. The customer shall provide and install:
 - a. Switchboard enclosure with CT compartment
 - b. Meter socket
 - c. Metering conduit–one-inch (1") minimum electrical non-metallic tubing (ENT) or flexible PVC for the metering secondary conductors
 - d. Locking equipment for the meter enclosure
 - e. Concrete mounting pad for the switchboard enclosure
 - f. A flat permanent surface (such as a concrete pad) extending a minimum of 36 inches (36") out from the switchboard in front of the CT compartment
- 3. The metering CTs shall be located in the CT compartment.
- 4. The CT compartment shall have a hinged door.
- 5. For a single service, the meter and test switch shall be mounted remotely (outside the cabinet).
- 6. Installing two or more metering services requires mounting on the compartments' hinged meter panels.
- 7. The metering conduit in the switchboard section shall terminate in the CT compartment in front of the CTs.
- 8. The door shall be equipped with a device to hold it in the open position at 90° or more.
- 9. Lugs for terminating the customer's ground wire (or other grounding conductors) shall be located outside the sealable section and shall be designed to allow the customer's neutral system to be readily accessible.
- 10. All pull and termination sections shall have full front access.
- 11. All removable cover panels shall have two lifting handles, and be limited to a maximum weight of 25 pounds.
- 12. The Power Company will terminate the line side service conductors using Power Companyprovided connectors on lug landings in the pull section.
- 13. Bus bars are required from the pull section for service above 800 amps. Termination lugs are required and shall meet EUSERC 347.
- 14. Any customer-owned locking equipment for the metering enclosure must allow independent access by the Power Company.
- 15. Only Power Company conductors are allowed inside the pull section.





Section 9

9.5.1 Switchboard with Remote Meter Socket

Figure 52—Switchboard with Remote Meter Socket EUSERC 325, 326, 339, and 345





9.5.2 Service for Switchboard Enclosures

Switchboard Rating	Minimum Access Opening (W)		Termination	n Height (X)
	3-wire	4-wire	min.	max.
Below 400 A	Consult the Power Company			
400-800 A	24″	24″		
801-1200 A	24″	30″	42″	
1201-2000 A	30″	35″		72″
2001-3000 A	_	42″	CO //	
3001-4000 A	_	44″	60"	

Table 24—Minimum Dimensions for Switchboard Pull Boxes (Termination Enclosures)

9.5.2.1 Switchboard Metering, 2000 A Maximum

Figure 53—Installation for Combination Switchboard Sections with a Termination Enclosure, EUSERC 327, 345





Figure 54—Overhead Service Termination, Switchboard Service Section, EUSERC 348



9.5.2.2 Switchboard Metering, 4000 A Maximum





9.5.3 CT Compartment for Switchboards

A CT compartment is required for all switchboard enclosures.

Table 25—Switchboard CT	Compartment Summary
-------------------------	---------------------

Service Type	Rated Current	EUSERC Drawing
Single-phase, three wire	0 to 800 A	319
Three-phase, three/four-wire	0 to 1000 A	320
Three-phase, four-wire	1001 to 3000 A	322
Three-phase, four-wire	3001 to 4000 A	324

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Figure 56—CT Metering for Switchboards 0-800 A, Single-Phase, Three-Wire, EUSERC 319





Figure 57—CT Metering for Switchboards 0-1000 A, Three-Phase, Three- and Four-Wire, EUSERC 320



Figure 58—CT Metering for Switchboards 1001-3000 A, Three-Phase, Four-Wire Service, EUSERC 322





Figure 59—CT Compartment for Switchboards 3001 to 4000 A, Three-Phase, Four-Wire Service, EUSERC 324









9.6 Primary Metering for Service Above 600 V

Prior to making site plans for primary voltage services consult the Power Company. The following guidelines are intended to assist with preliminary planning. Primary metering is available at a maximum of 34.5 kV and 600 A.

Required clearances are provided in Section 4, Clearances.

The Power Company will provide primary voltage delivery to customers directly, without transformation, from the high-voltage or "primary" distribution system (standard for the location in which service is requested), if the following conditions apply:

- 1. Service at primary voltage will not, in the Power Company's judgment, adversely affect the operation of the Power Company's electric system or service to other customers.
- 2. The customer shall provide a means of disconnect and overcurrent protection on the load side and separate from the primary metering location. Such devices shall be in sight of, and not more than 100 feet from the primary metering location.
- 3. The customer shall provide specifications for protective devices and transformers, including core types and winding configurations with associated wiring, for prior written approval by the Power Company. Consult the Power Company for acceptable transformer configurations.

Figure 60 illustrates the protection and isolation switches required to provide primary service.

The customer is responsible for the operation and maintenance of all customer-owned equipment. The Power Company does not service, maintain, repair, or provide replacement parts for customer-owned equipment.

Figure 60—Connection Diagram, Primary Delivery Voltage





Section 9

9.6.1 Overhead, Pole-Mounted Primary Metering (34.5 kV Maximum)

The primary metering pole is the service point. The Power Company will provide and connect one span of overhead primary conductors to the customer's pole.



Figure 61—Overhead, Pole-Mounted Primary Metering

9.6.2 Underground, Pad-Mounted Metering (Up to 34.5 kV, 600 A Maximum)

The service point for underground primary voltage delivery is at the pad-mounted enclosure containing the metering equipment.







Figure 62—Underground Pad-Mounted Primary Metering Enclosure

Requirements:

- 1. The meter may be located on the primary metering enclosure, or post-mounted as shown in Figure 62.
- 2. The location of the metering vault will be mutually agreed upon between the customer and Power Company. The size of the metering vault will be specified by the Power Company.

9.6.3 Switchgear, Pad-Mounted Metering, EUSERC 400

Customers shall meet the requirements of EUSERC Section 400 when switchgear enclosures are required for metering primary voltage delivery services.

Requirements:

The customer shall provide/install:

- 1. Enclosure drawings for approval prior to fabrication
- 2. All necessary hardware per EUSERC, Section 400
- 3. A concrete vault for the switchgear metering enclosure

9.7 Metering in a Customer-Owned Substation

The customer shall consult the Power Company for the location of metering equipment for customer-owned substations. Power Company metering equipment is not allowed in these substations.



