Section 10
Electric Switchboards: 0 Through 600 Volts

10.1. Scope

This section provides specific dimensions and details for service and meter equipment that is assembled by the manufacturer in freestanding, self-supporting switchboards.

10.2. General Requirements

Applicants must meet the following requirements when they plan to install electric switchboards.

A. Ensure that switchboard service and meter equipment is built to the requirements of this section.

B. Ensure that metering switchboard and panelboard drawings are submitted in triplicate to PG&E for review and approval. Drawings must contain specific Equipment Utility Service Requirements Committee (EUSERC) or *Electric and Gas Service Requirements* (*Greenbook*) drawing and sheet numbers for reference purposes.

C. Ensure that drawings submitted for Pacific Gas and Electric Company's (PG&E's) review and approval include the following information.

- The contractor's name and address.
- The applicant's name.
- The job location.

Before authorizing the manufacture of a switchboard, an applicant must consult his or her local PG&E service planner for specific general utility requirements.

NOTE: See the "2008-2009 Service Planning Contact Information" at the front of this manual on Page iv for specific contact numbers listed by area.

General utility requirements include the following:

- Horizontal bus-bar requirements.
- Service voltage, phase, and wires.
- Meter-panel requirements to determine the applicable rate schedule.
- Service-termination location.
- Switchboard and/or meter location(s).
- Size and number of service conductors.

PG&E will provide and install meters, metering transformers, test switches, and all secondary wiring from the metering transformers to the meter.

Applicants must ensure that separation exists between the meters and metering transformers for the following reasons.

- To ensure meter accessibility.
- To prevent metering inaccuracies.
- To prevent unacceptable environmental conditions.

Applicants must ensure that rigid steel conduit is installed between the meter and the metering transformers. The rigid steel conduit must be 1-1/4 inches minimum diameter and must be limited to three 90° bends ***unless*** the applicant provides sealable, accessible, exposed condulets.

Service-entrance conductors must enter the metering transformer compartment from one end and leave from the opposite end. The direction of the feed may be either from the top or from the bottom of the compartment.

Load conductors must ***not*** reenter or pass through a current transformer (CT) compartment.

When transformer-rated meters are installed for multiple applicants, there must be a separate service section for each installed meter and its associated service switch.

When applicants are installing totalized metering, they are required to install, own, and maintain nominal 1-1/4-inch metal conduit between the switchboard metering facilities.

Applicants should group self-contained meters and switches only when the following conditions are met.

A. Unmetered service entrance conductors and metered load conductors are ***not*** run in the same conduit raceway or wiring gutter.

B. Each meter position and each service switch or breaker is marked clearly and permanently and is identified by the building owner, or a representative of the building owner, to indicate the occupancy being served.

If PG&E installed the maximum number of service conductors required to meet the rating of the service termination facility or if PG&E identified available, spare landing positions on the terminating facilities, the following conditions apply when using those spare spaces as taps to metered loads.

A. **Overhead Service:** Applicants must locate the taps in a sealable compartment above and separated from the CT and/or metering equipment compartment.

B. **Underground Service:** Applicants must ensure that the taps are located in the underground service-termination pull section or pull box. In this instance, the applicant must ensure that the bus conductors terminate in a suitable, approved manner. Also, the applicant must ensure that the bus conductors are positioned so that the customer's incoming, service-entrance conductors and the tap connections do ***not*** encroach into PG&E's pulling area or interfere with PG&E's pull and termination facilities for service-lateral conductors.

10.3. Switchboard Service Section

A switchboard service section is the section of an applicant's switchboard provided specifically for terminating the service conductors and for housing the metering transformers (if required), revenue meters, test facilities, and service switch or breaker.

10.3.1. Standard Switchboard Service Section

Applicants must ensure that:

A. For all switchboard service sections with current ratings above 1,000 amperes, the manufacturer submits drawings, in triplicate, to PG&E for approval. See Figure 10-12, "Pull Section," on Page 10-23, for more information.

B. Switchboard drawings for ***all*** co-generation and self-generation installations are submitted to a local PG&E service planner for review and approval ***before*** the switchboard is constructed or built.

10.3.2. Specifically Engineered Switchboard Service Sections

A switchboard design that does ***not*** conform to the EUSERC standards is considered specially engineered. Typical examples are:

- Switchboards over 3,000 amperes.
- Switchboards with service-breaker ratings too large for the standard switchboard service section.
- Multimeter service sections.

The general arrangement of the specially engineered switchboard service sections must follow, as nearly as possible, the requirements for standard switchboard service sections, as described in Subsection 10.3.1., "Standard Switchboard Service Section," and the requirements described in Subsection 10.3.3., "Requirements for All Switchboard Service Sections."

10.3.3. Requirements for All Switchboard Service Sections

This subsection describes the general requirements for all switchboard service sections and applies to all applicants.

A. The general arrangement and spacing of CTs and the methods of mounting CTs must conform as closely as possible to the illustrations in Figure 10-1 through Figure 10-6 on Pages 10-6 through 10-14.

B. Mount the socket meters that are used with metering transformers on hinged panels. Mount the self-contained meters on nonhinged panels.

C. When a hinged meter panel is located behind an enclosure door, leave a clear space of at least 11 inches between the meter panel and the door. That is the minimum space required to mount the meter.

D. The meter panels must open at least 90° after the meters and test facilities are in place. If needed, applicants must increase the width of the section to meet these requirements.

E. Applicants must provide a clear space in the back of a meter panel for the secondary wiring and associated equipment.

F. For ***hinged meter panels***, applicants must provide at least the minimum dimensions between the facility's meter panel and the nearest bus, as shown in Figure 10-1 through Figure 10-6 on Page 10-6 through Page 10-14.

G. For ***nonhinged meter panels***, applicants must provide a clear space of at least 4 inches to any barrier or obstruction.

H. Applicants must ensure that the minimum clearance be maintained between meters as shown in Figure 10-11, "Standard Section for Self-Contained Meter Sockets, 0 Through 225 Amperes, Installed in Switchboards: Nonresidential," on Page 10-21, and Figure 10-12, "Pull Section," on Page 10-23.

I. An applicant must maintain a minimum clear space of 4 inches directly below the bottom slot of the meter test switch. This space permits test leads to be connected safely.

J. Applicants must ***not*** mount more than two self-contained meters on any removable meter panel.

K. Applicants must ensure that panels providing access to metering transformers or a service-terminating pull section are no larger than 9 square feet in area. Removable panels must have two lifting handles.

L. Applicants must ensure that the front edge of the CT bus bars are located in the same switchboard section, and in the same vertical plane.

M. Applicants must use either one-bolt or four-bolt connections for switchboards that are rated 1,001 amperes through 3,000 amperes and have 4-inch buses installed. For switchboards with 5-inch buses, use either two-bolt or six-bolt connections.

N. Applicants must ensure that buses are securely supported in the metering transformer compartment to withstand the mechanical stresses of a short circuit and to resist movement. The bus supports must ***not*** interfere when CTs either are installed or are removed. Do ***not*** use CTs to support the buses.

O. Applicants should ensure that the buses and CT mountings are designed so that each of the CTs can be removed from its mounting position directly through the access panel without disturbing any other CT. When using multileaf buses, orient the buses so that they appear "edgewise" when viewed from the access panel.

P. When using an aluminum bus, applicants must ensure that the aluminum bus bar is ***plated*** to prevent corrosion.

Q. Applicants must ensure that all electric meter panels and all equipment doors or panels that are intended to provide access to potential transformers (PTs) and CTs, are permanently marked or labeled to indicate the service voltage being supplied.

R. ***In switchboards rated over 800 amperes, applicants must ensure that the bus bars extend from the termination section and service landing lugs into the CT compartment.*** In switchboards with multiple meters, the bus bars must extend from the termination section and service landing lugs to the meter sockets in multimeter boards.

S. Switchboard manufacturers must provide accessories, such as additional Belleville washers, at the time of delivery and/or installation.

T. Switchboards must meet all of the design and test conditions of Underwriters Laboratories (UL) UL891, "Standard for Switchboards."

U. Applicants must ensure that bus arrangement and supports are provided. An ***exception*** is the neutral bus, which may be located on either sidewall.

V. Applicants must locate the CT compartment on the supply side of the service-section main switch or breaker.

W. Applicants must ensure that only metering conductors pass through this CT compartment.

X. Applicants must ensure that a neutral, bus-bar extension is provided in the instrument transformer compartment ***above*** the lower CT bus support when the service-section phase buses are supplied from the horizontal cross busing.

Y. Applicants must ensure that the return flanges for the lower- and upper-meter panel supports do ***not*** project more than 3/4 inch up or down from the adjacent switchboard panels.

Z. Applicants must ensure that each bus has a connector that accepts a stranded conductor with the ampere capacity of the service-section main switch or breaker.

AA. Applicants must ensure that the power-leg bus for a 4-wire delta service is identified.

AB. Applicants must ensure that a removable link is installed in the right-side phase bus when using the service section for three-phase, 3-wire service.

10.3.4. Standard Switchboard CT Compartment, 0 Through 1,000 Amperes, Single-Phase or Three-Phase, 3-Wire Service

Applicants must ensure that the following requirements are met. These requirements apply specifically to this type of CT compartment.

A. The bus dimensions are a minimum of 1/4 inch by 2 inches and a maximum of 3/4 inch by 2 inches.

B. The barrier must be constructed of insulating, nontracking material and have a minimum of 24 vent holes that are 3/8 inch in diameter.

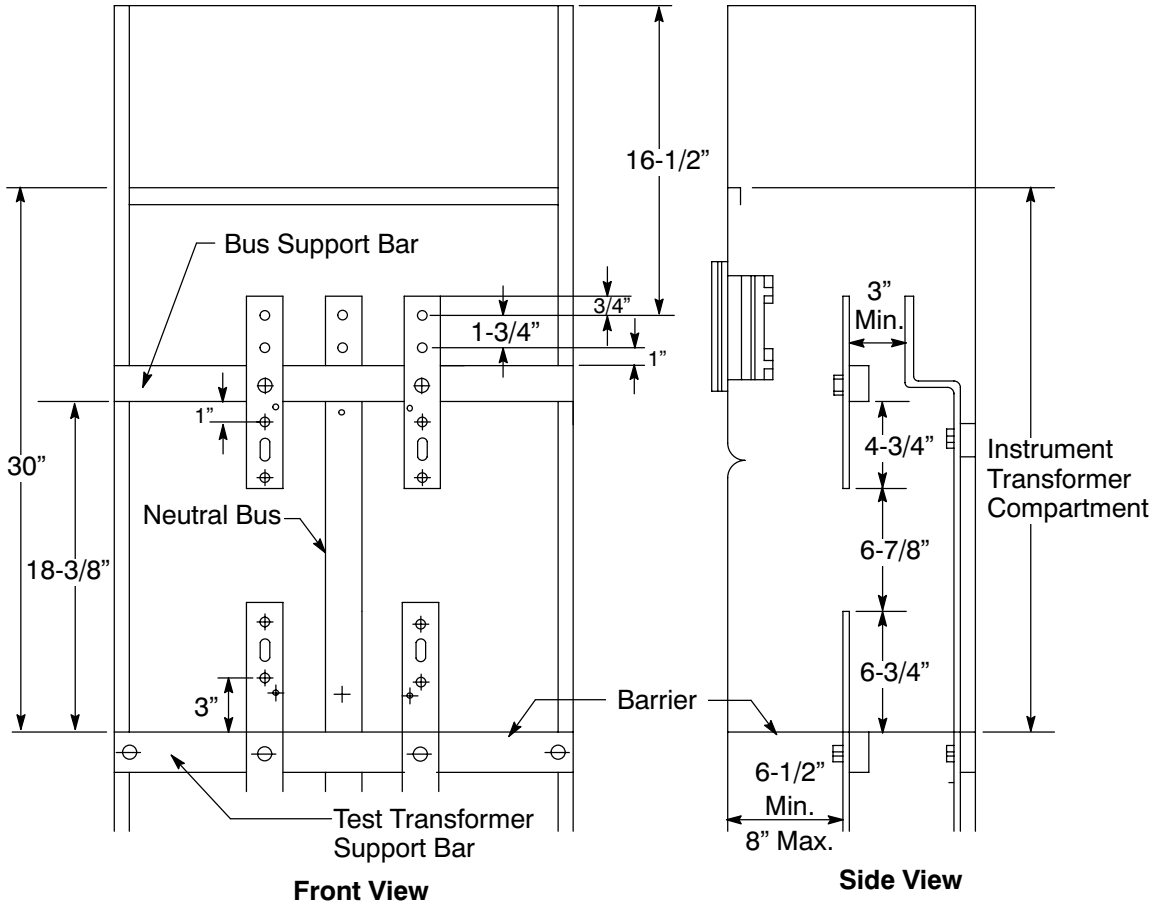


Figure 10-1
Standard Switchboard, CT Compartment, 0 Through 1,000 Amperes, Single-Phase or Three-Phase, 3-Wire Service

10.3.5. Standard Switchboard CT Compartment, 0 Through 1,000 Amperes, Three-Phase, 3-Wire and 4-Wire Services

The following requirements specifically apply to this type of CT compartment. Applicants must:

A. Ensure that the bus dimensions are a minimum of 1/4 inch by 2 inches and a maximum of 3/4 inch by 2 inches.

B. Ensure that the barrier is made of an insulating, nontracking material and has a minimum of 24 vent holes that are 3/8 inch in diameter.

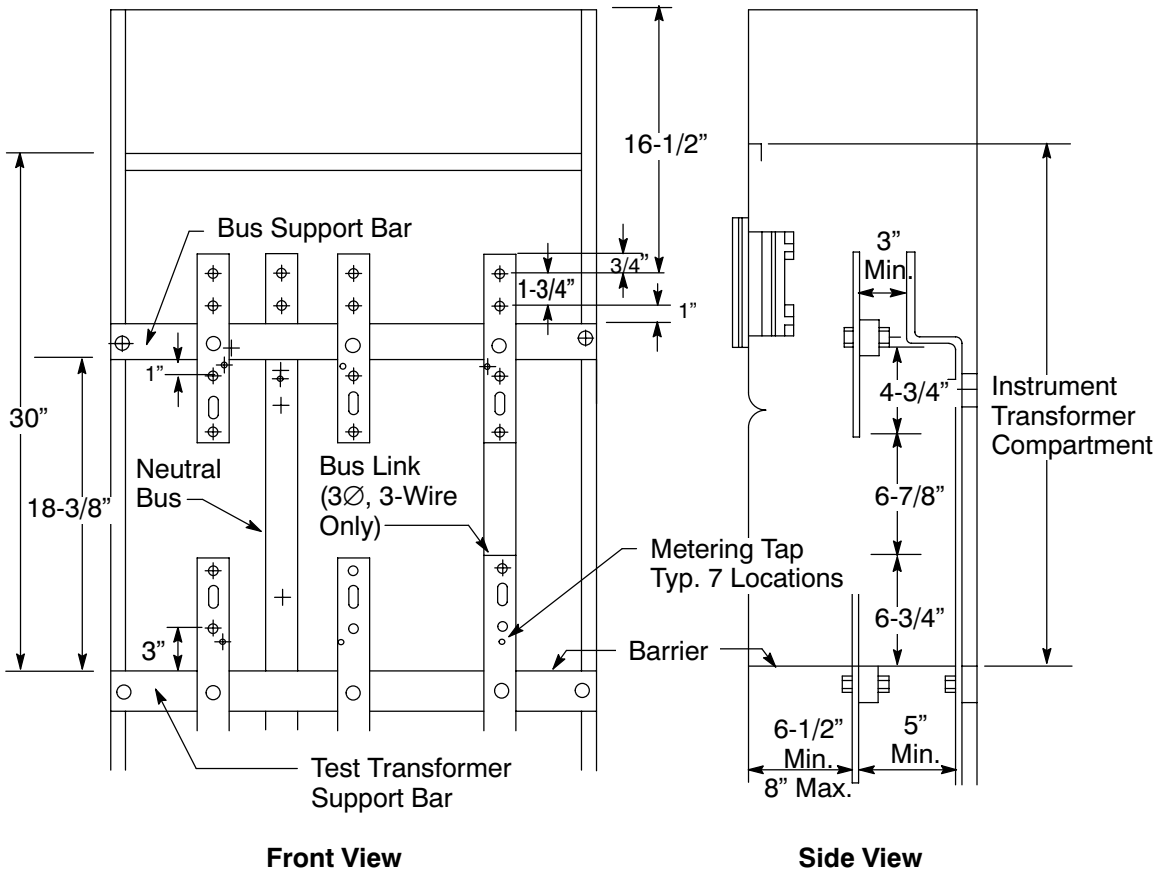


Figure 10-2
Standard Switchboard, CT Compartment, 0 Through 1,000 Amperes, Three-Phase, 3-Wire and 4-Wire Services

10.3.6. Standard Switchboard CT Compartment, 1,001 Amperes Through 3,000 Amperes, Single-Phase or Three-Phase, 3-Wire Service

The following requirements specifically apply to the CT compartment shown in Figure 10-3, "Standard Switchboard, CT Compartment, 1,001 Amperes Through 3,000 Amperes, Single-Phase or Three-Phase, 3-Wire Service," on Page 10-8. Applicants must:

A. Ensure that the buses are anchored so that they will remain in position when the removable section is out.

B. Ensure that the bus corners are rounded to prevent damaging the insulation.

C. For underground services, ensure that the buses extend into the pull section.

D. Be aware that the maximum permissible bus unit consists of four 1/4-inch by 4-inch bars spaced 1/4 inch apart.

E. Ensure that the barrier is a minimum of 45 inches and a maximum of 50 inches above the standing surface.

F. For a single-phase switchboard, ensure that the neutral bus is located at the side of the compartment.

G. Ensure that the switchboard manufacturer secures the removable bus link to the upper- and lower-CT bus units using 1/2-inch hex-head (Grade 5) steel bolts with 2-1/4-inch diameter Belleville washer and nut.

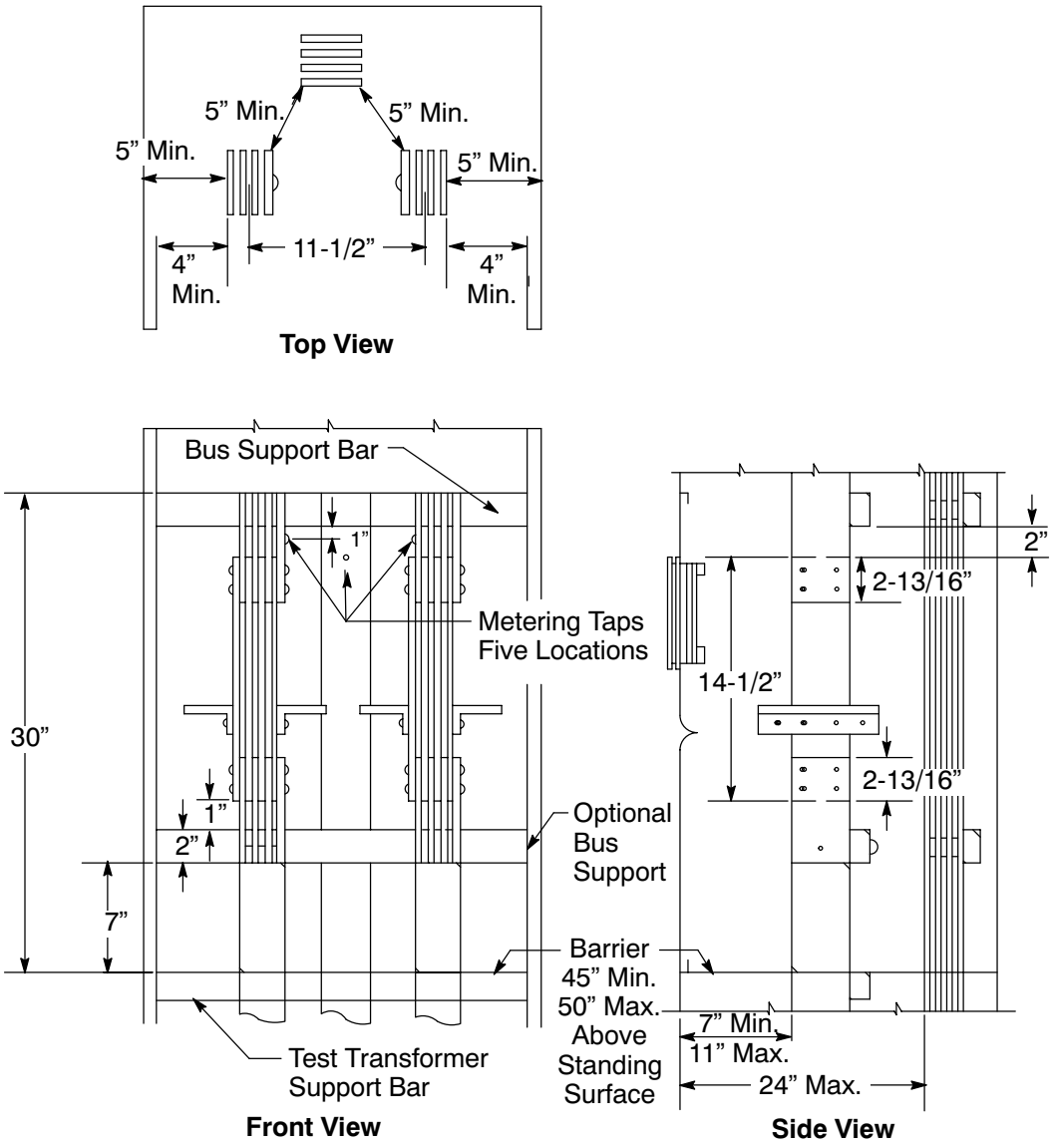


Figure 10-3
Standard Switchboard, CT Compartment, 1,001 Amperes Through 3,000 Amperes, Single-Phase or Three-Phase, 3-Wire Service

10.3.7. Standard Switchboard, CT Compartment, 1,001 Amperes Through 3,000 Amperes, Three-Phase, 4-Wire Service

The following requirements specifically apply to the CT compartment shown in Figure 10-4, "Standard Switchboard, CT Compartment, 1,001 Amperes Through 3,000 Amperes, Three-Phase, 4-Wire Service," on Page 10-10. Applicants must:

A. Ensure that the buses are anchored so that they will remain in position when the removable section is out.

B. Ensure that the bus corners are rounded to prevent damaging the insulation.

C. For underground services, ensure that the buses extend into the pull section.

D. Be aware that the maximum permissible bus unit consists of four 1/4-inch by 4-inch bars spaced 1/4 inch apart.

E. Ensure that the barrier is a minimum of 45 inches and a maximum of 50 inches above the standing surface.

F. Ensure that the switchboard manufacturer secures the removable bus link to the upper- and lower-CT bus units using 1/2-inch hex-head (Grade 5) steel bolts with 2-1/4-inch diameter Belleville washers and nuts.

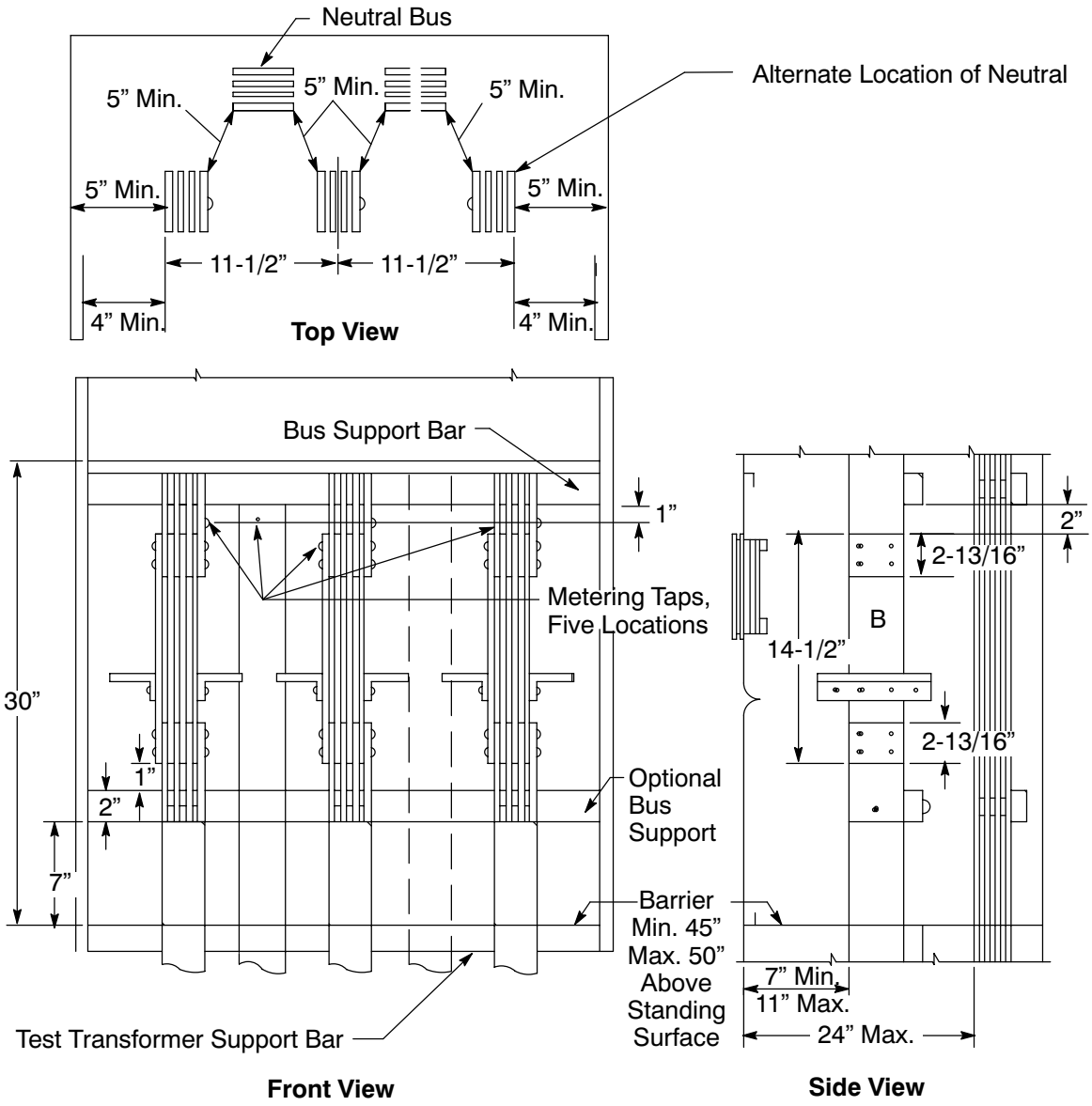


Figure 10-4
Standard Switchboard, CT Compartment, 1,001 Amperes Through 3,000 Amperes, Three-Phase, 4-Wire Service

10.3.8. Standard Switchboard CT Compartment, 3,001 Amperes and Larger, Three-Phase, 3-Wire Service

The following requirements specifically apply to the CT compartment shown in Figure 10-5, "Standard Switchboard, CT Compartment, 3,001 Amperes and Larger, Three-Phase, 3-Wire Service," on Page 10-12. Applicants must:

A. Ensure that the buses are anchored so that they will remain in position when the removable section is out.

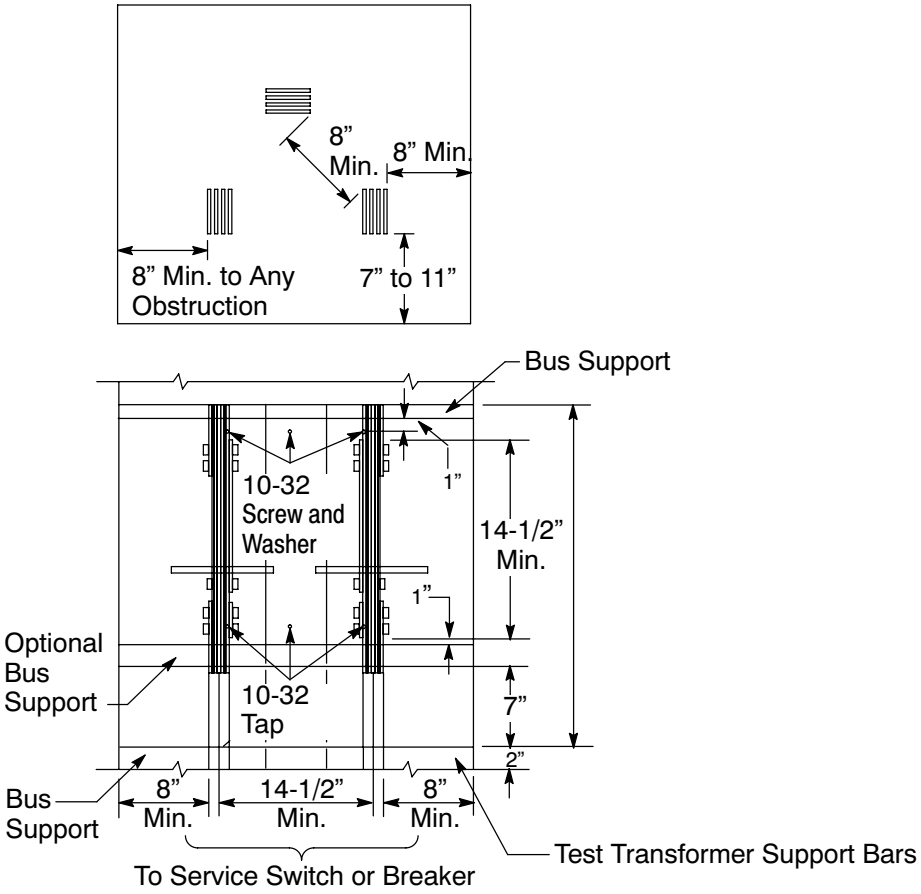
B. Ensure that the bus corners are rounded to prevent damaging the insulation.

C. For underground services, ensure that the buses extend into the pull section.

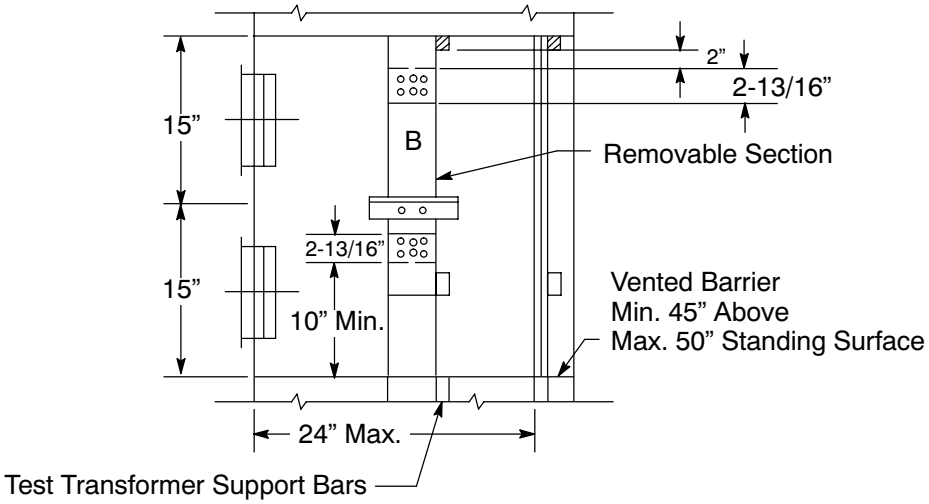
D. Be aware that the maximum permissible bus unit consists of four 1/4-inch by 4-inch bars spaced 1/4 inch apart.

E. Ensure that the barrier is a minimum of 45 inches and a maximum of 50 inches above the standing surface.

F. Ensure that the switchboard manufacturer secures the removable bus link to the upper- and lower-CT bus units using 1/2-inch hex-head (Grade 5) steel bolts with 2-1/4-inch diameter Belleville washers and nuts.



Front View



Side View

Figure 10-5
Standard Switchboard, CT Compartment, 3,001 Amperes and Larger, Three-Phase, 3-Wire Service

10.3.9. Standard Switchboard CT Compartment, 3,001 Amperes and Larger, Three-Phase, 3-Wire or 4-Wire Service

The following requirements specifically apply to the CT compartments shown in Figure 10-6, "Standard Switchboard, CT Compartment, 3,001 Amperes and Larger, Three-Phase, 3-Wire or 4-Wire Service," on Page 10-14. Applicants must:

A. Ensure that the buses are anchored so that they will remain in position when the removable section is out.

B. Ensure that the bus corners are rounded to prevent damaging the insulation.

C. For underground services, ensure that the buses extend into the pull section.

D. Be aware that the maximum permissible bus unit consists of four 1/4-inch by 4-inch bars spaced 1/4 inch apart.

E. Ensure that the barrier is a minimum of 45 inches and a maximum of 50 inches above the standing surface.

F. Ensure that the switchboard manufacturer secures the removable bus link to the upper- and lower-CT bus units using 1/2-inch hex-head (Grade 5) steel bolts with 2-1/4-inch diameter Belleville washers and nuts.

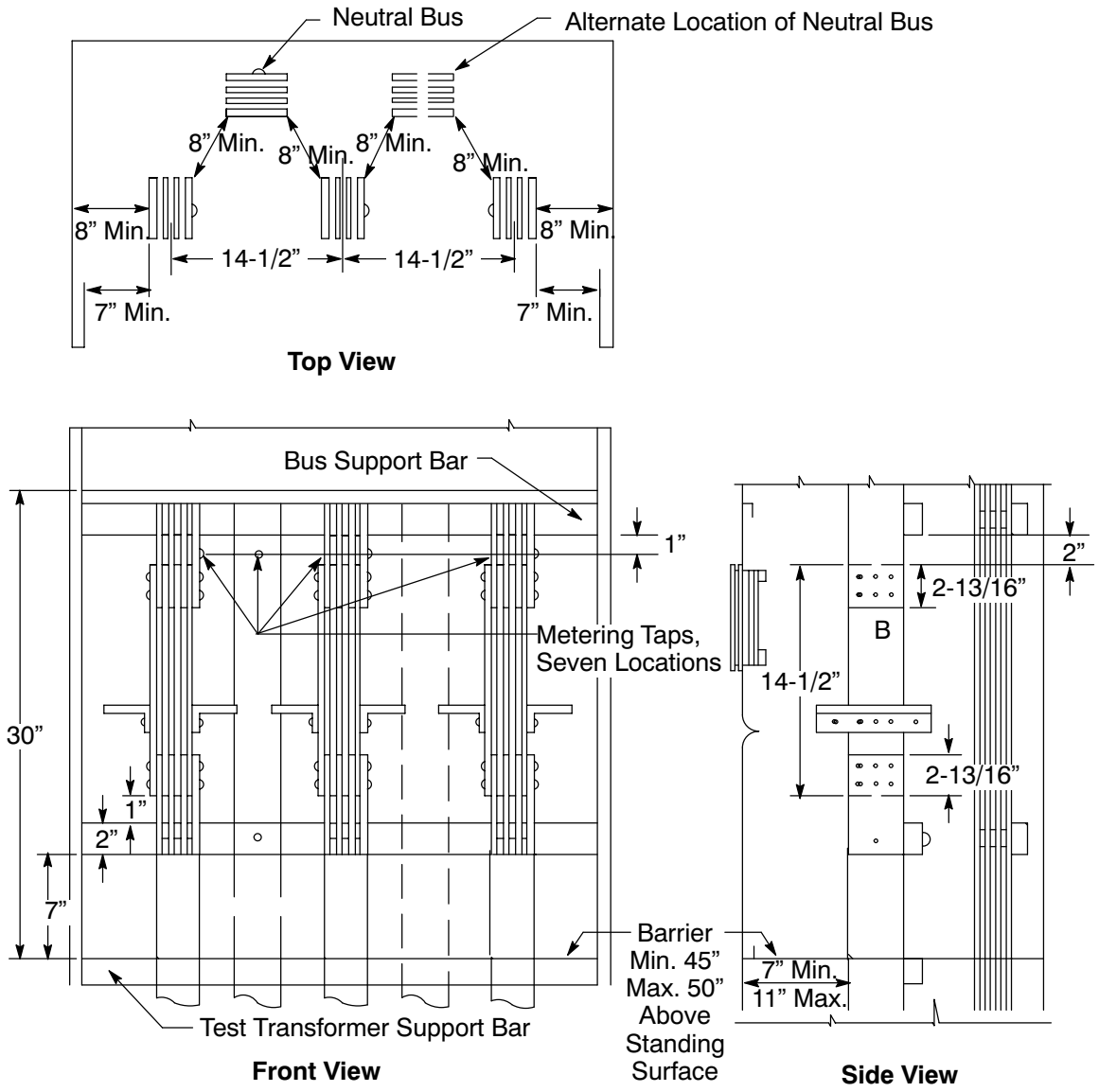


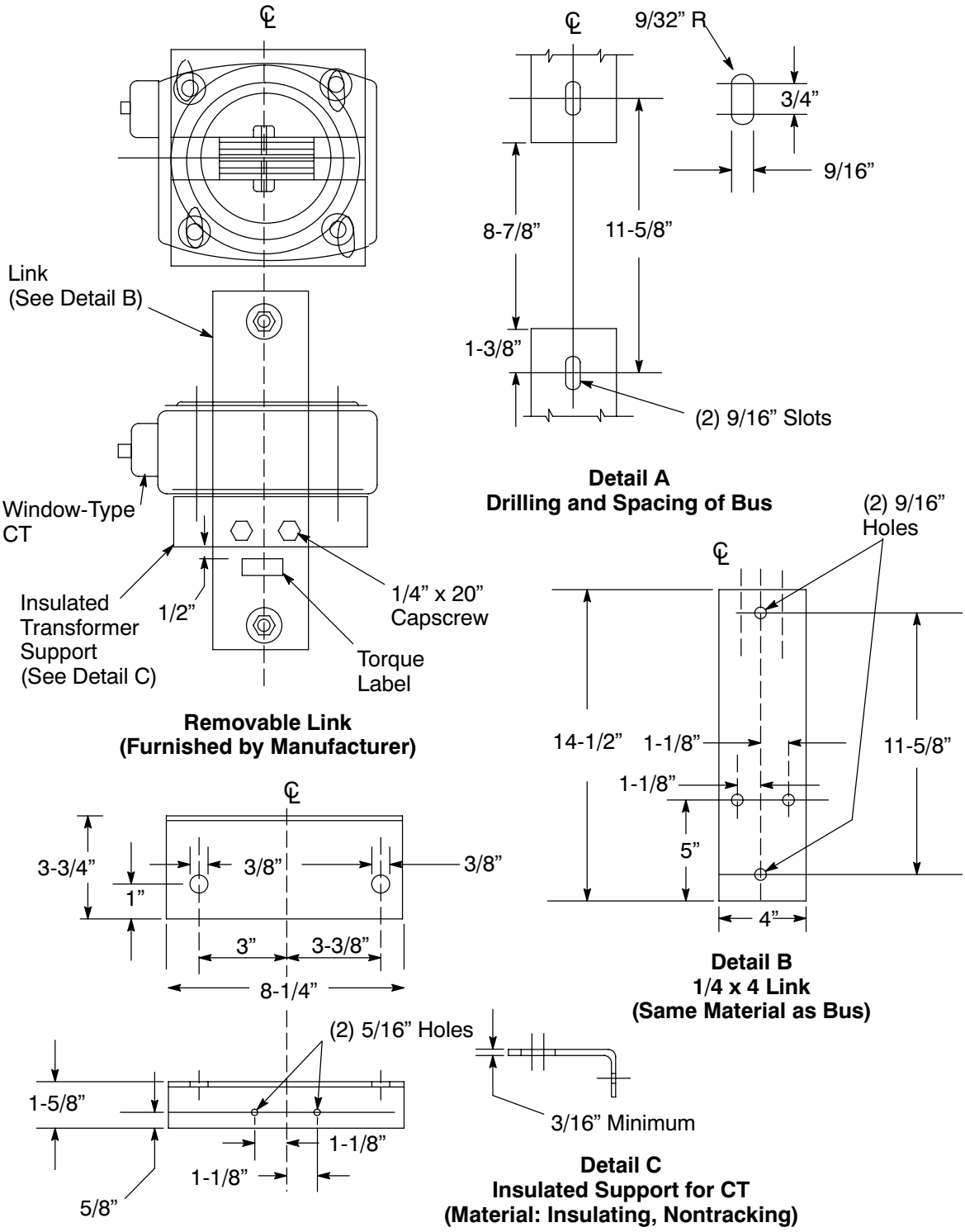
Figure 10-6
Standard Switchboard, CT Compartment, 3,001 Amperes and Larger, Three-Phase, 3-Wire or 4-Wire Service

10.3.10. Removable Link Assemblies

The removable link assemblies for 0 through 600-volt CT compartments from 1,001 amperes through 3,000 amperes and 3,001 amperes and larger are shown in Figure 10-7 through Figure 10-10 on Page 10-16 through Page 10-19.

Applicants may use either a one-bolt connection, as shown in Figure 10-7, "Switchboards, 0 Through 600 Volts, CT Compartment, 1,001 Amperes Through 3,000 Amperes, Removable Link and CT Support (One-Bolt Configuration)," or a four-bolt connection, as shown in Figure 10-8, "Switchboards, 0 Through 600 Volts, CT Compartment, 1,001 Amperes Through 3,000 Amperes, Removable Link and CT Support (Four-Bolt Configuration," on Page 10-17, for switchboards that are rated 1,001 amperes to 3,000 amperes and have 4-inch buses installed.

Switchboards with 5-inch buses typically are rated at 3,001 amperes and above. Use either ***two bolts***, as shown in Figure 10-9, "Switchboards, 0 Through 600 Volts, CT Compartment, 3,001 Amperes and Larger, Removable Link and CT Support (Two-Bolt Configuration)," on Page 10-18, or ***six bolts***, as shown in Figure 10-10, "Switchboards, 0 Through 600 Volts, CT Compartment, Removable Link and CT Support (Six-Bolt Configuration)," on Page 10-19.



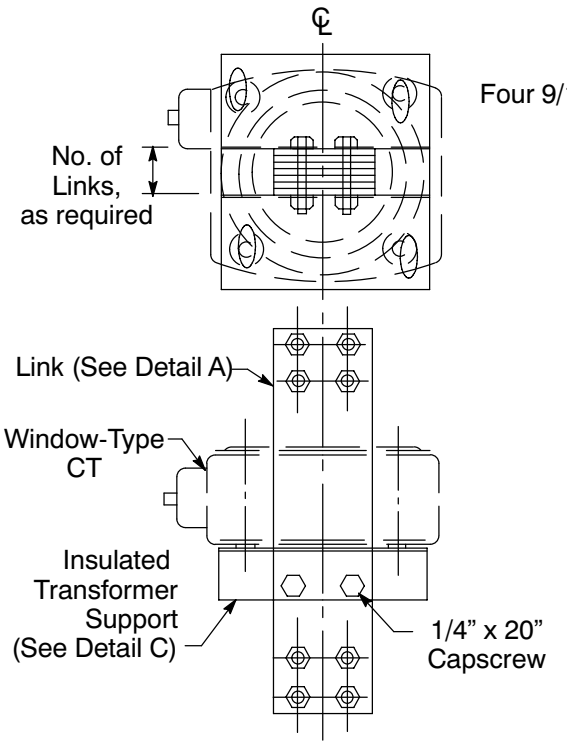
Removable Link
(Furnished by Manufacturer)

Detail A
Drilling and Spacing of Bus

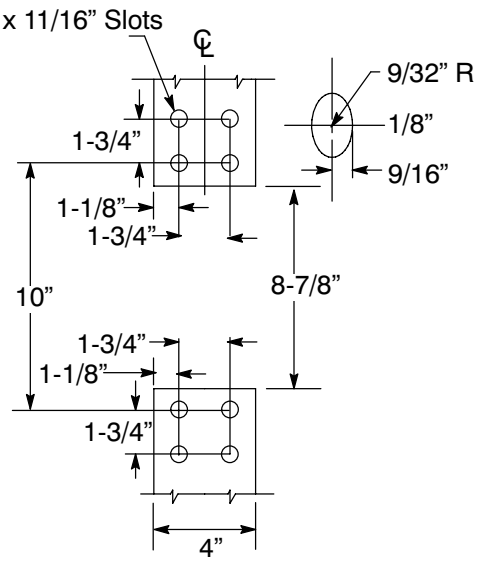
Detail B
1/4 x 4 Link
(Same Material as Bus)

Detail C
Insulated Support for CT
(Material: Insulating, Nontracking)

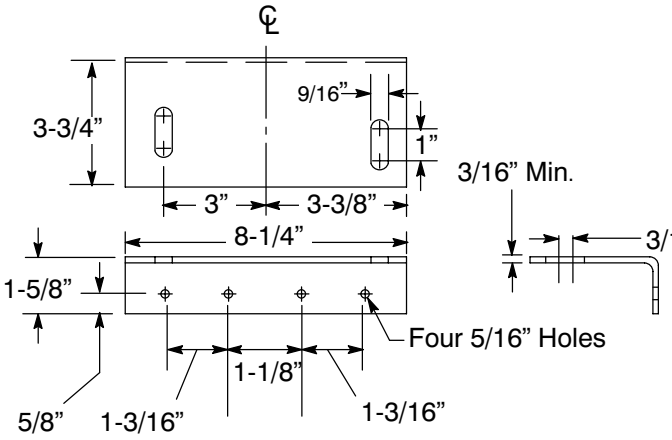
Figure 10-7
Switchboards, 0 Through 600 Volts, CT Compartment, 1,001 Amperes Through 3,000 Amperes, Removable Link and CT Support (One-Bolt Configuration)



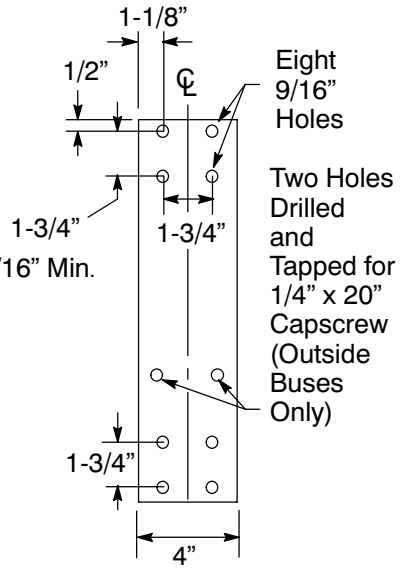
Removable Link Assembly
(Furnished By Manufacturer)



Detail A
Drilling and Spacing the Bus



Detail B
Insulated Support For CT
(Material: Insulating, Nontracking)



Detail C
1/4" x 4" Link
(Same Material as Bus)

Figure 10-8
Switchboards, 0 Through 600 Volts, CT Compartment, 1,001 Amperes Through 3,000 Amperes, Removable Link and CT Support (Four-Bolt Configuration)

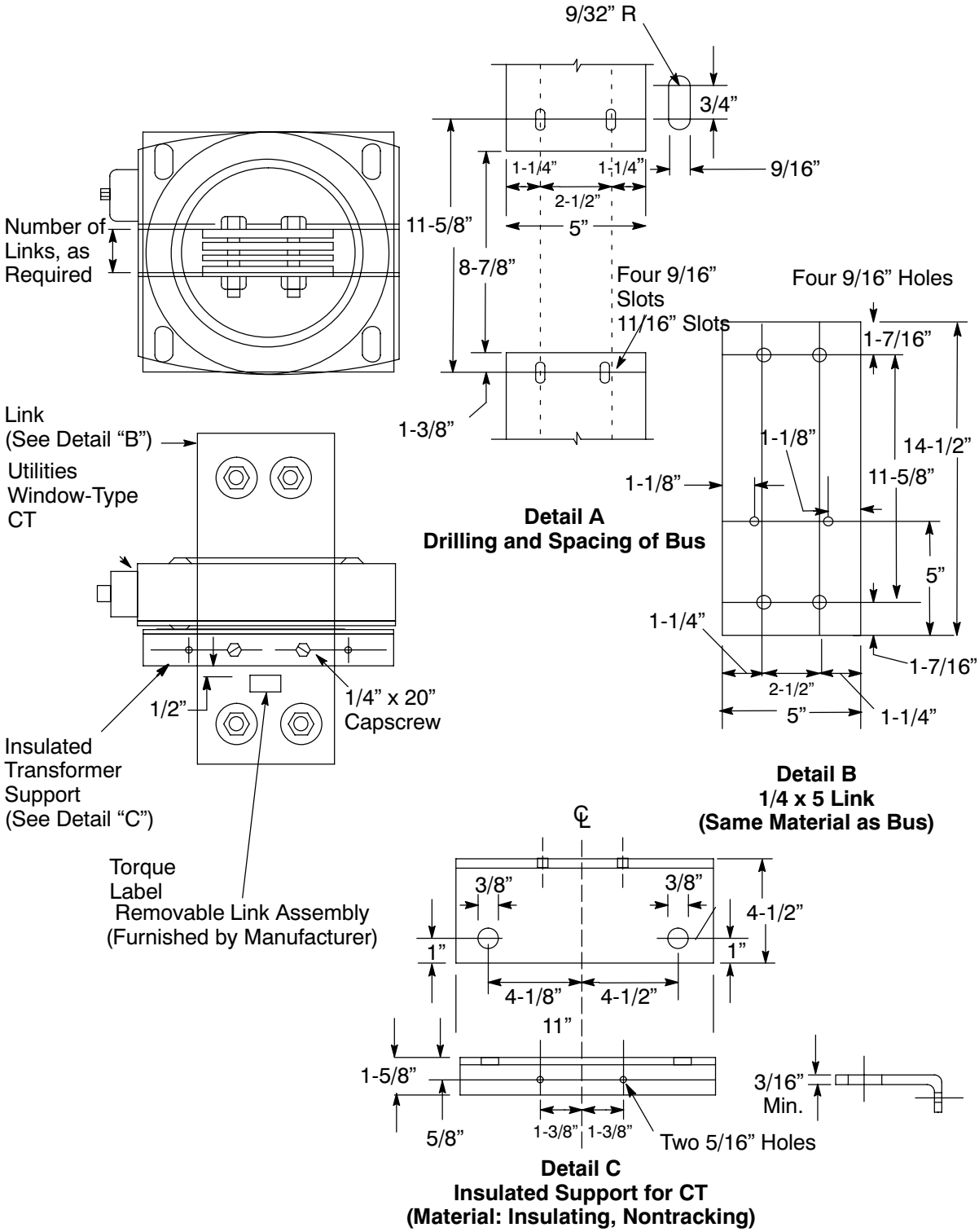
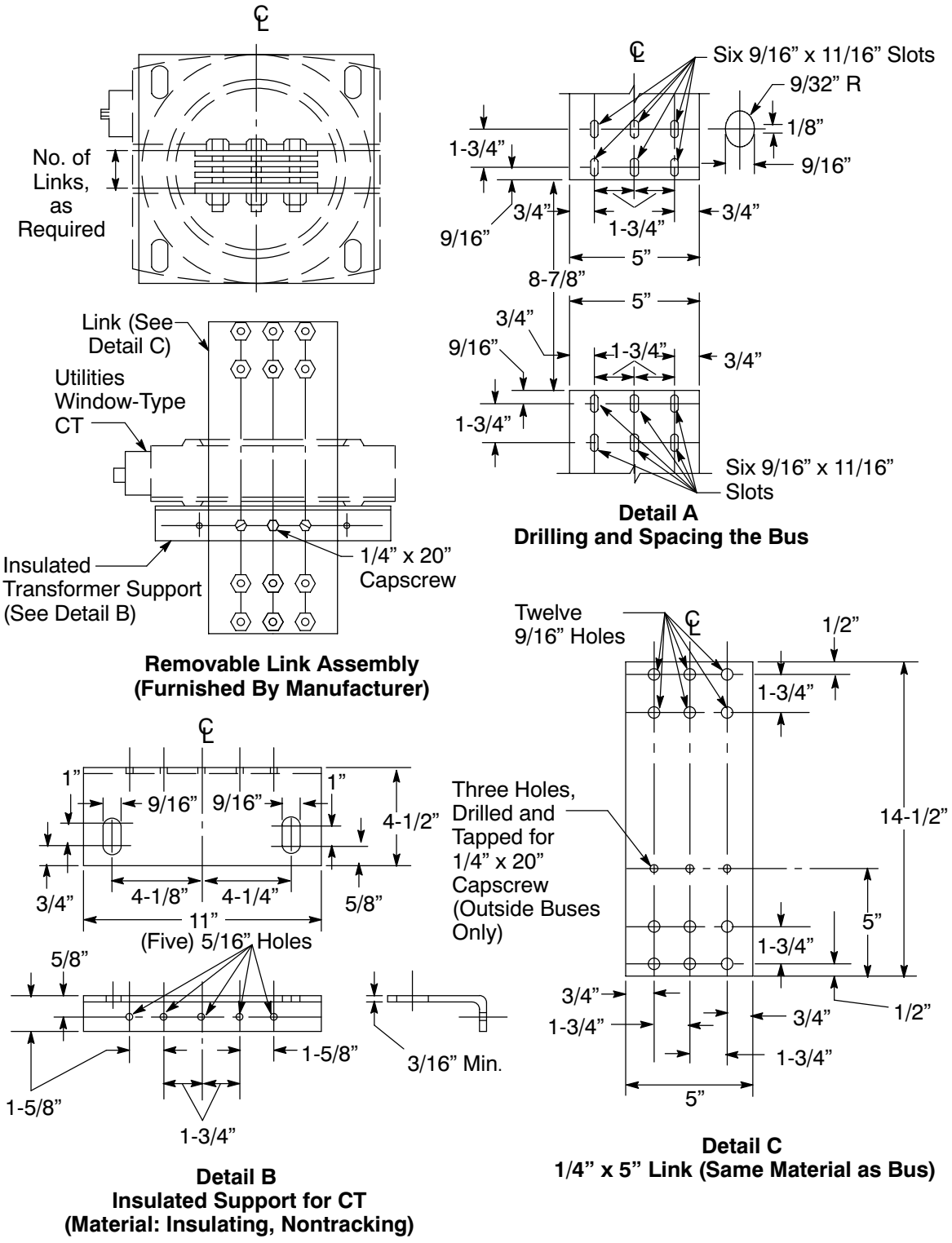


Figure 10-9
Switchboards, 0 Through 600 Volts, CT Compartment, 3,001 Amperes and Larger, Removable Link and CT Support (Two-Bolt Configuration)



Removable Link Assembly (Furnished By Manufacturer)

Detail A
Drilling and Spacing the Bus

Detail B
Insulated Support for CT
(Material: Insulating, Nontracking)

Detail C
1/4" x 5" Link (Same Material as Bus)

Figure 10-10
Switchboards, 0 Through 600 Volts, CT Compartment, Removable Link and CT Support (Six-Bolt Configuration)

10.3.11. Standard Section for Self-Contained Meter Sockets, 0 Through 225 Amperes, Installed in Switchboards: Nonresidential

These requirements apply specifically to switchboard service sections for nonresidential, 0-ampere through 225-ampere meter sockets. Applicants must:

A. Ensure that the manufacturer furnishes, installs, and wires or busses the test-bypass blocks to the meter socket with four, rigid, insulating barriers. Test blocks must conform to the requirements described in Section 9, "Electric Metering: Components."

B. Ensure that the metered conductors do ***not*** pass through the adjacent metering compartments, except in enclosed wireways.

C. Ensure that the meter panels are removable with a maximum of two meters per panel.

D. Ensure that the cover panels for the test-bypass block are sealable and fitted with handles. Panels more than 16 inches wide must have two handles.

E. Ensure that outdoor or rain-tight enclosures are used, as shown in Figure 10-25 through Figure 10-28, "Outdoor or Rain-Tight Enclosures for Switchboards," on Page 10-34.

F. When a neutral is required for metering or testing, ensure that an insulated neutral terminal is provided behind each test-bypass cover panel. The terminal must be readily accessible when the cover panel is removed and must be individually connected to the neutral bus with a minimum Size #8 American wire gauge (AWG) copper wire.

G. Ensure that factory-installed, full-width, insulating barriers are located at the bottom of each test-bypass compartment. The insulating barrier must deflect a 1/2-inch maximum from a 25-pound downward force.

H. For three-phase, 4-wire service, ensure that the seventh jaw is connected to the body of the neutral lug with an AWG #12 copper wire.

I. For three-phase, 4-wire, delta-connected service, ensure that the right-hand, test-bypass block (i.e., two poles) is identified as a power leg.

J. For three-phase, 3-wire service, ensure that the bus is installed to connect the line and load poles together at the top of the center test-bypass block and the fifth jaw is connected to this bus using an AWG #12 copper wire.

K. For single-phase, 3-wire service, ensure that the center test-bypass block is omitted.

L. For single-phase, 3-wire, 120/208-volt service, ensure that the center test-bypass block is omitted and the fifth jaw is connected to the body of the neutral lug with an AWG #12 copper wire.

M. Ensure that the meter panels are removable. However, they must ***not*** be removable when the meter is in place. Ensure that the meter socket is attached to the meter panel, and yet is supported independently from the meter panel.

N. Ensure that each line and load position is identified clearly by using 3/4-inch (minimum), block-letter labeling.

O. Ensure that all of the meter panels are sealable and all of the securing screws are captive.

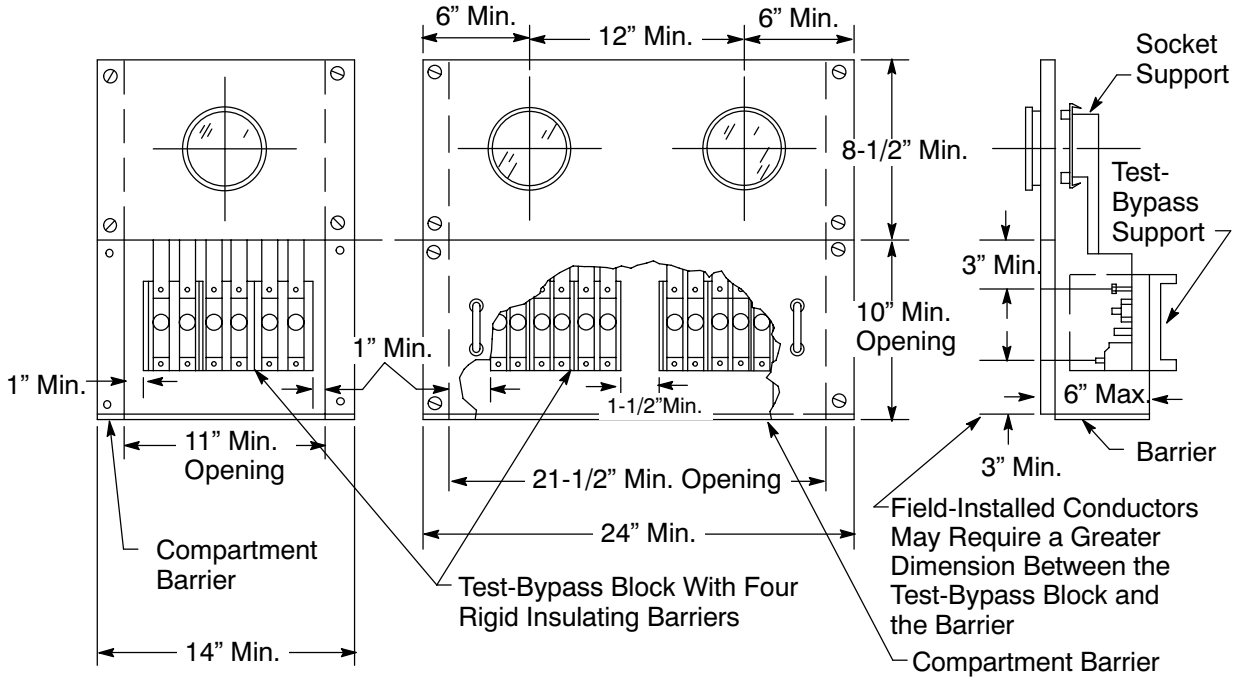


Figure 10-11
Standard Section for Self-Contained Meter Sockets, 0 to 225 Amperes, Installed in Switchboards: Nonresidential

10.3.12. Service Terminations for Underground Services

NOTE: For overhead services where conductors go into the bottom-fed termination section, the applicant must connect the service-entrance conductors to the line side of the bus stubs in the metering-transformer compartment.

PG&E will pull and terminate its service conductors when terminating facilities that are provided by the applicant as shown in Figure 10-12, "Pull Section," Figure 10-13, "Separate Pull Box," and Figure 10-14, "Bottom-Fed Service Section," all on Page 10-23. The requirements for pulling and terminating service are provided in the following paragraphs.

Applicants must:

A. When the service section is served from a pull section, ensure that the bus or cable conductors either must:
   - Enter through the side or back in the sealable section above the CT compartment, as shown in Figure 10-12 on Page 10-23.
   - Enter by means of horizontal cross-busing in back of the metering compartment.

B. Ensure that all pull and terminating sections provide full-front access.

C. Ensure that all of the cover panels for the pull section have all of the following attributes.
   - Are removable and sealable.
   - Have two lifting handles.
   - Are limited to a maximum size of 9 square feet in area.

D. Ensure that the power leg for a 4-wire delta service is identified effectively at the point of termination ***before*** making the service connection.

E. Ensure that the minimum width of the pull section has the dimensions specified in Table 10-1, “Minimum, Bottom-Fed, Pull-Section Dimensions,” on Page 10-23.

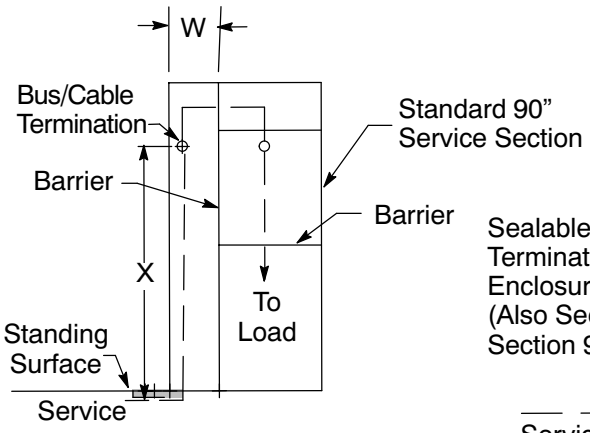


Figure 10-12
Pull Section

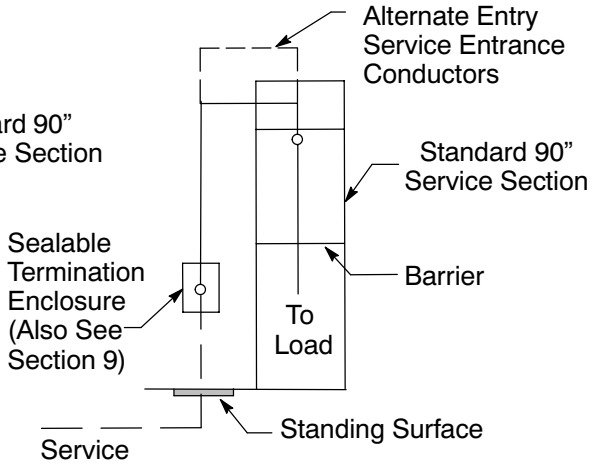


Figure 10-13
Separate Pull Box

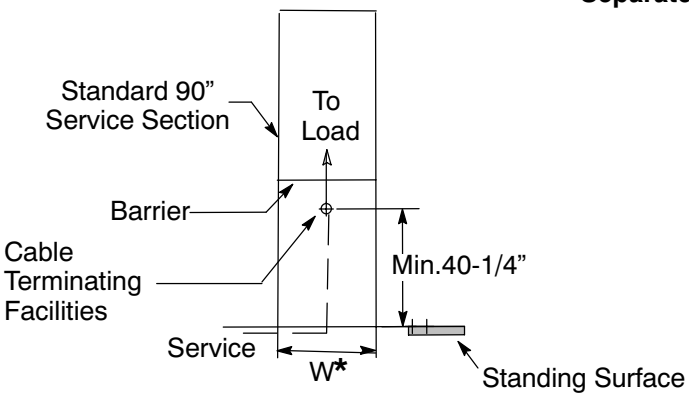


Figure 10-14
Bottom-Fed Service Section

***** The minimum width of the pull section must meet the requirements specified in Table 10-1 below.

Table 10-1 Minimum, Bottom-Fed, Pull-Section Dimensions

Switchboard Rating (Amperes)	Minimum Access Opening Dimension (W)[2]		Termination Height X
	3-Wire	4-Wire	
Below 400	Consult Serving Agency (All Measurements in Inches)		
400-800	24	24	42 Min.[1]-72 Max.
801-1,200	24	30	
1,201-2,000	30	35	
2,001-2,500	—	42	60 Min.-72 Max.
2,501-4,000	Bus Duct		

1 See Figure 10-14 above for the minimum termination height of a bottom-fed service section.

2 If the landing stubs in the termination bus are installed perpendicular to the back of the board, PG&E requires the enclosure dimensions to be wider to accommodate the cable installation.

10.3.13. Underground, Service-Termination Pull Section (Located Below Ground Level)

Applicants must follow the requirements in this subsection when underground, service-termination pull sections are located below the ground level.

A. **Back entry:** A service must enter the back of a switchboard pull section, as shown in Figure 10-15, "Switchboard Pull Section," located below, when the pull space has the required X dimension above or below the cable-terminating facilities, ***and*** the pull sections have the required Y depth, as shown in Table 10-2, "Pull Section Dimensions (Minimums) Below Ground Level," on Page 10-25.

B. **Side entry:** A service must enter the side of a switchboard pull section, as shown in Figure 10-15 below and in Figure 10-16, "Switchboard Pull Section Side View (W-Back, Low Entry), Front View (Y-Side, Low Entry)," located on Page 10-25, when the pull-section width equals or exceeds the minimum Y dimension and the pull-section depth equals or exceeds the W dimension. Also see Table 10-2 on Page 10-25 for minimum pull-section dimensions when entry is below the ground level.

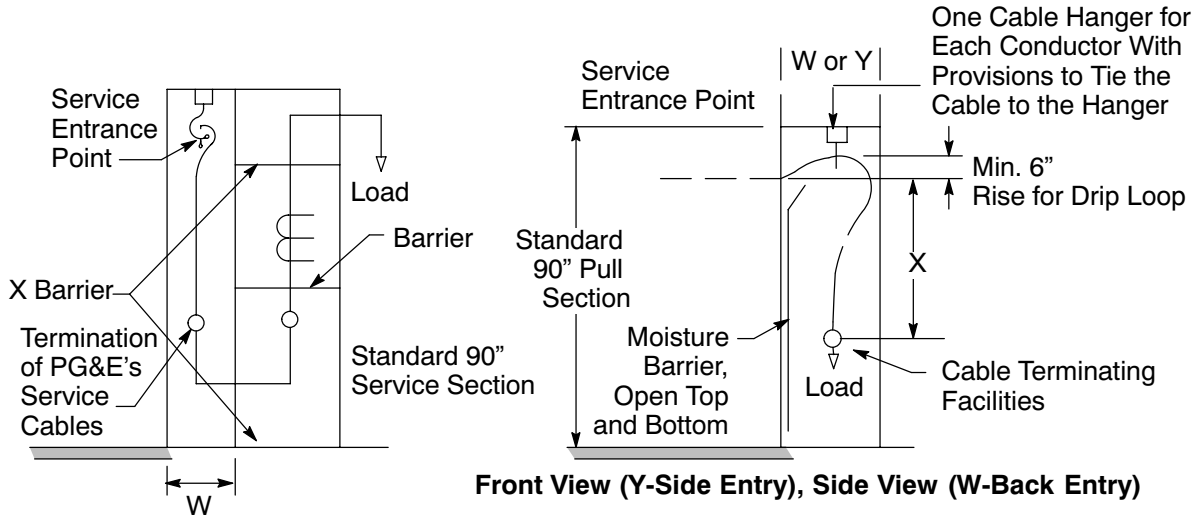


Figure 10-15
Switchboard Pull Section

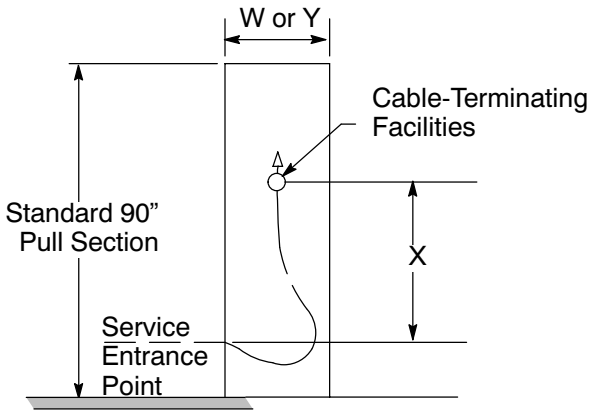


Figure 10-16
Switchboard Pull Section
Side View (W-Back, Low Entry), Front View (Y-Side, Low Entry)

Table 10-2 Pull Section Dimensions (Minimums) Below Ground Level

Switchboard Rating in Amperes	W[2]		X	Y [1- Side Entry, 2]
	1∅ 3-Wire	3∅ 4-Wire	Side or Back Entry	1∅ or 3∅ 3-Wire or 4-Wire
	All Measurements in Inches			
201-800	24	24	42	25
801-1,200	24	30	42	30
1,201-2,000	30	35	45	30
2,001-2,500	—	42	60	38
2,501-4,000	Bus Duct			

1 For side entry, the minimum width of the pull section must equal or exceed the Y dimension and the depth must equal or exceed the W dimension.

2 If the landing stubs in the termination bus are installed perpendicular to the back of the board, PG&E requires the enclosure dimensions to be wider to accommodate cable installation.

10.3.14. Underground Cable-Terminating Facilities in Pull Boxes or Pull Sections

Figure 10-17 through Figure 10-20 on Page 10-28 show diagrams and required dimensions for cable-terminating facilities in the pull boxes or pull sections. The following paragraphs describe the requirements for installing these facilities.

Applicants must:

A. Ensure that one landing position per phase is available for each 400 amperes of service capacity, as shown in Figure 10-17, "Landing Terminal Detail," on Page 10-28. Also, applicants must ensure that provisions have been made for stacking lugs.

B. Ensure that bolts are provided with nuts, flat washers, and pressure-maintaining spring washers.

C. Ensure that all parts are plated to prevent corrosion.

D. Ensure that bolts are secured in place unless working access is provided on both sides of the mounting bus. If both sides of the bus are accessible, one set of bolts may be used to provide two terminal-mounting positions, one on either side of the bus.

NOTE: "Secured in place" means the stud will not turn, back out, or loosen in any manner when subjected to normal, UL-approved torques while tightening or loosening terminal nuts. This includes cross-threaded situations.

E. In the terminal-mounting area, ensure that a radial clearance of 1-1/2 inches is provided between any bus (including bolts) and any other bus (including horizontal cross-busing) or grounded surface, as shown in Figure 10-18, "Spacing Requirements," on Page 10-28.

EXCEPTIONS: The following are exceptions from these requirements.

1. The minimum clearance to the back of the pull section or to the front of the pull-section cover may be 1 inch.
2. The neutral bus or termination may have a minimum clearance of 1 inch from any grounded surface.
3. Service cables passing over horizontal cross busing must have a minimum 2-1/2-inch radial clearance. This distance may be reduced to 1 inch if the horizontal bus is fully insulated.

F. Ensure that each cable-mounting position has at least 8 inches of unobstructed space in front of the entire mounting surface when all of the conductors are in place. This space must be accessible from the front of the pull section.

G. Ensure that the bus stubs are firmly secured to prevent bus misalignment and movement when the cables are installed. See Figure 10-19, "Buses Accessible From Only One Side (Bolts Must Be Secured in Place)," and Figure 10-20, "Buses Accessible From Either Side (Mounting Surfaces on Both Sides of Bus)," both on Page 10-28, for bus stub details through 2,500 amperes.

For nonresidential services, either single or three phase, 600 amperes and above, PG&E designs its facilities at 100% of the rated service. To meet the demands of a service rated at 100%, PG&E may require applicants to install multiple sets of utility service cables. Additionally, PG&E may require applicants to supply stacking lugs for terminating its cables in any installation that is rated nonresidential, three phase, 1,200 amperes or greater.

For nonresidential services, additional space (i.e., depth, width, and termination height) may be required in any section of switchboard, panelboard, or other enclosure used to terminate PG&E service cables. This additional space may be necessary to provide proper clearances between phases and grounded surfaces, as well as to accommodate the installation of service cable. Applicants should review Document 063928, "Methods and Requirements for Installing Commercial Underground Electric Services 0–600 Volts to Customer-Owned Facilities," for the appropriate conduit and

cable requirements for nonresidential service installations. This document is included in Appendix B, "Electric and Gas Service Documents."

PG&E does ***not*** allow applicants to install wall-mounted cable termination and pull enclosures for nonresidential, three-phase installations rated at 401 amperes through 2,500 amperes. For those installations, PG&E requires a switchboard pull section or enclosure meeting the requirements shown in Table 9-4, "Minimum Switchboard Pull-Section Dimensions Over 600 Amperes, Single-Phase Service, 100% Rated, and Commercial/Industrial, Three-Phase Service," on Page 9-18, and Table 10-1, "Minimum, Bottom-Fed, Pull-Section Dimensions," on Page 10-23, for bottom entry. Also, see Table 10-2, "Pull Section Dimensions (Minimums) Below Ground Level," on Page 10-25, for side or back entry.

When installing an approved alternative to switchboard pull sections or free-standing enclosures, the alternative includes separate, cable-splicing boxes and other specially fabricated enclosures (e.g., underground splice enclosure or primary box). Also, applicants may install their own conduits and cables to those enclosures; however, the enclosures must be acceptable to PG&E (e.g., underground splice enclosure or primary box), and be located in areas acceptable to PG&E.

PG&E will install and terminate its cables to the applicant's cables in that enclosure.

NOTE: The utility point of service (i.e., service point) is defined as the approved enclosure and the terminated or spliced connections.

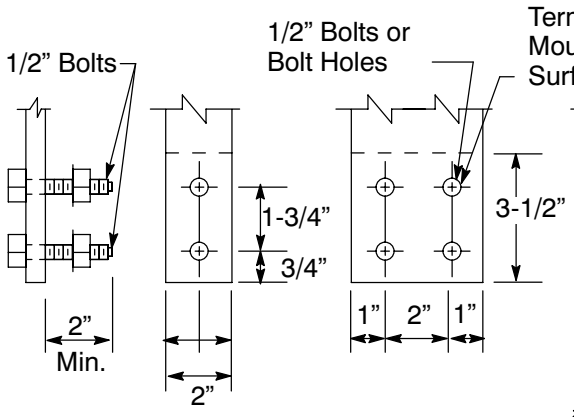


Figure 10-17
Landing Terminal Detail

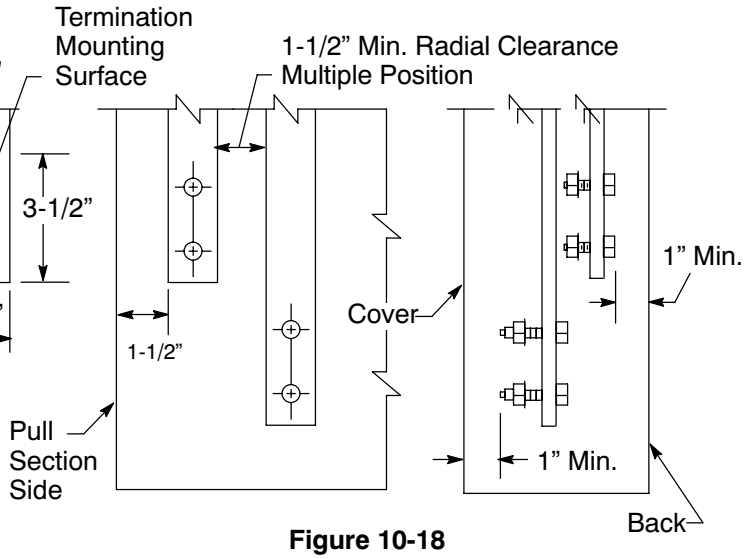


Figure 10-18
Spacing Requirements

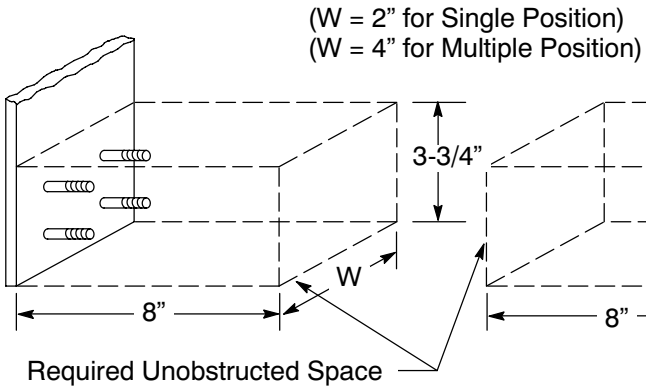


Figure 10-19
Buses Accessible From Only One Side
(Bolts Must Be Secured in Place)

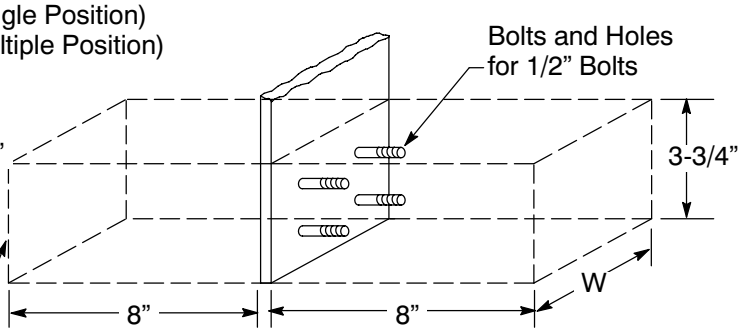


Figure 10-20
Buses Accessible From Either Side
(Mounting Surfaces on Both Sides of Bus)

10.4. Meter and Switch Sequence Requirements

PG&E will locate meters and metering equipment ahead of (i.e., on the supply side) the applicant's main switch and fuse or circuit breaker. Exceptions to this normal sequence are permitted only when required by electric codes and as allowed by PG&E.

10.5. Metering Transformer Compartments

The following requirements apply to applicants who are installing metering transformer compartments.

A. Bus the CT compartments using a rectangular bus bar. See Figure 10-1 through Figure 10-6 on Pages 10-6 through 10-14 for more information.

B. Ensure that the covers for metering transformer compartments are:

- Constructed of 12-gauge steel (minimum).
- Provided with lifting handles.
- Attached with sealable studs and wing nuts or using other approved means.

C. Use a copper or aluminum bus bar on both the line sides and load sides of all CTs. When links and supports are required for through-type CTs, ensure that the bus and removable links are constructed of a compatible material.

D. Do ***not*** use PG&E's CTs for any purpose but metering.

E. Do ***not*** use the metering transformer compartment as a splicing or tap-making chamber.

F. Do ***not*** use the bolts required for connecting a CT to attach other conductors.

10.6. Meter Panels

The following requirements apply to applicants who are installing meter panels.

A. Use ***only*** hinged meter panels in front of a metering transformer compartment.

B. Ensure that the dual-socket metering panel is provided in switchboards supplying a demand load of 400 kilovolt amperes (kVA) or more. See Table 10-3 below and Figure 10-24 on Page 10-33 for more details.

C. Ensure that meter panels are constructed of 12-gauge steel (minimum) and are sealable, hinged, and reversible. Because the meter panels are reversible, the hinges can be used on either the right side or the left side of the panels.

D. Note that the width of meter panels may sometimes require the service section to be wider than the minimum-allowable width of the transformer compartment.

E. Mount self-contained meters on nonhinged panels, as shown in Figure 10-11 on Page 10-21.

Table 10-3 Hinged Meter Panel Requirement

Service Voltage	Switch Rating	Panel Required
277/480V 3∅, 4-Wire	401 Amperes and Above	Yes
120/240V 3∅, 4-Wire	801 Amperes and Above	Yes
120/208V 3∅, 4-Wire	1,001 Amperes and Above	Yes

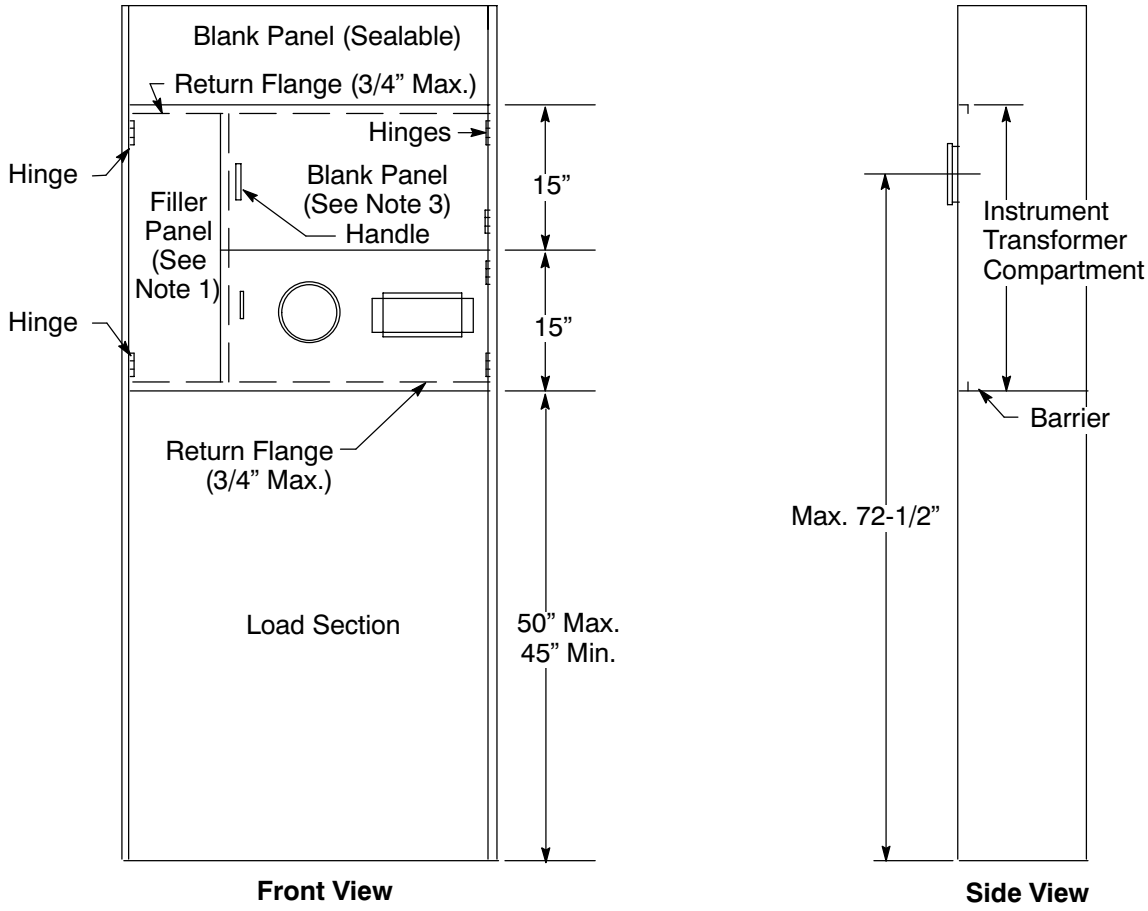


Figure 10-21
Standard Switchboard Service Section With CT Compartment and Filler Panel, 0 Through 600 Volts

Notes in reference to Figure 10-21.

1. Use filler panels where the switchboard width exceeds the allowable meter panel width. Do ***not*** hinge meter panels on filler or pull-section panels.
2. Make the grounding connection in the main switch or breaker compartment.
3. In a split-panel arrangement, mount the kilowatt-hour (kWh) meter panel in the lower position.
4. Equip meter panels and filler panels with stops to prevent the panels from swinging inward beyond the front surface of the switchboard.
5. Ensure that all panels and covers are sealable.

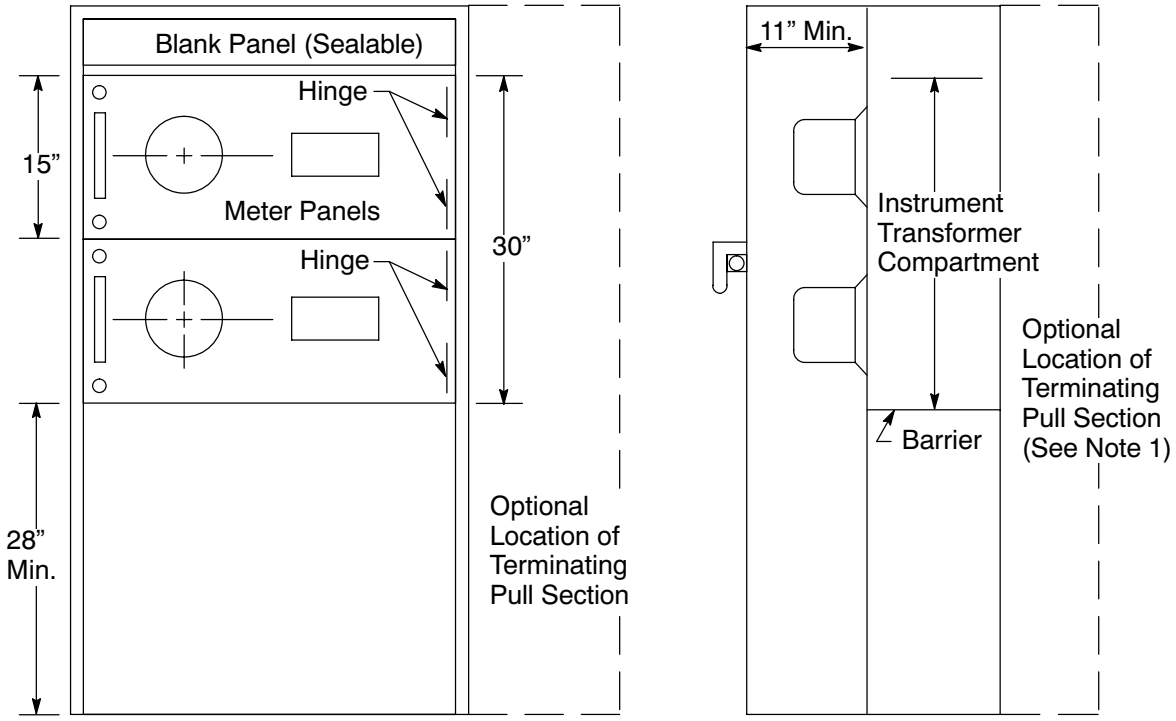


Figure 10-22
Low-Profile Switchboard Service Section With CT Compartment for Underground, Outdoor Application, 0 Through 600 Volts

Notes in reference to Figure 10-22.

1. Locate the terminating pull section beside or behind the instrument compartment.
2. Use filler panels where the switchboard width exceeds the maximum-allowable meter panel width. Do ***not*** hinge meter panels on filler or pull-section panels.
3. Make the grounding connection in the main switch or breaker compartment.
4. Equip meter panels and filler panels with stops to prevent the panels from swinging inward beyond the front surface of the switchboard.
5. Ensure that all panels and covers are sealable.

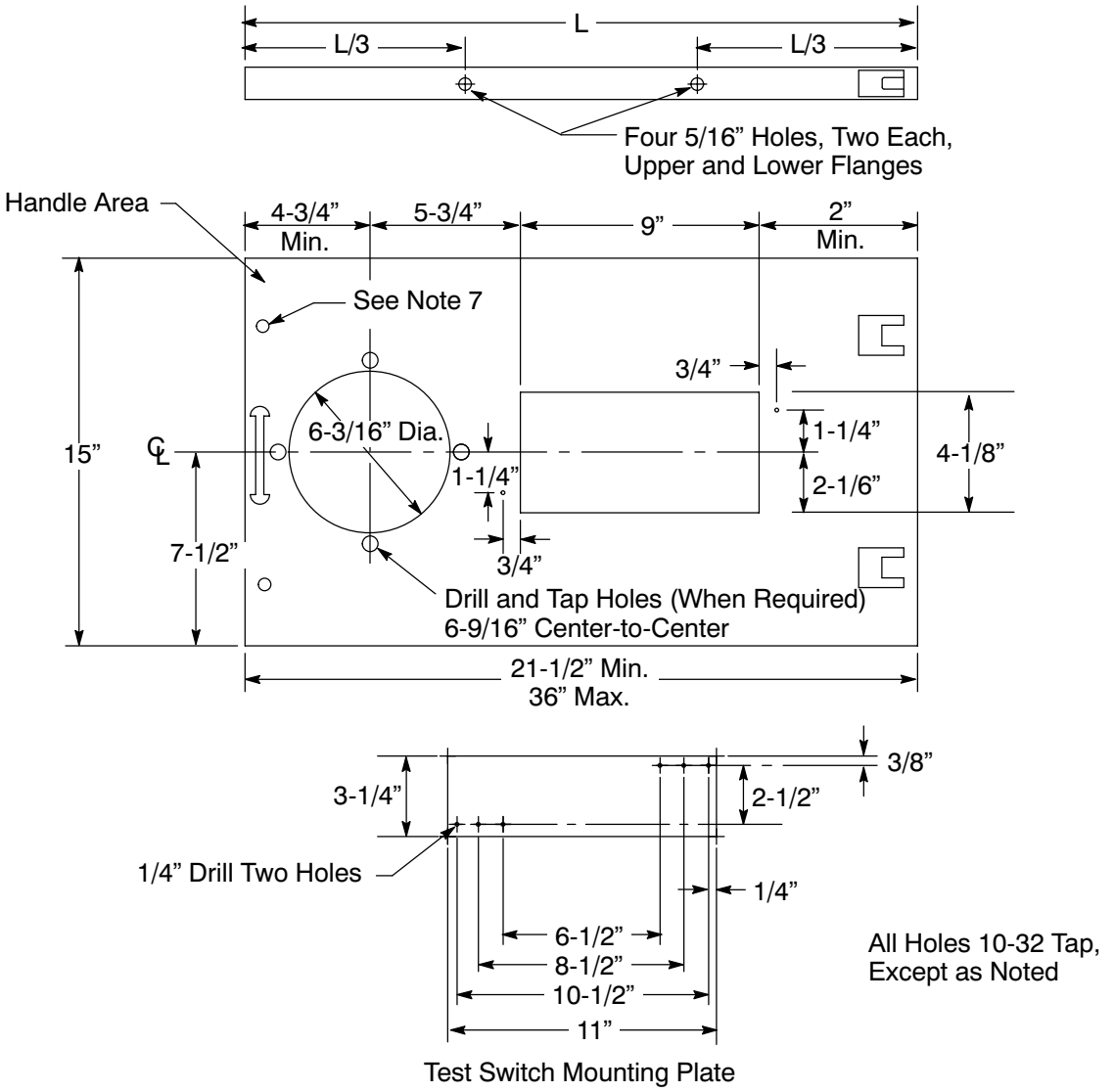


Figure 10-23
Standard Switchboard Service Section, 15-Inch Hinged Panel for Socket Meter

Notes in reference to Figure 10-23.

1. Ensure that the switchboard manufacturer drills, taps, and slots the panel for the secondary test switch, as shown. Also, ensure that the switchboard manufacturer furnishes and installs the socket with a sealing ring.
2. Design the meter sockets to be installed on hinged panels for back (rear) connection.
3. Use the outdoor or rain-tight enclosures shown in Figure 10-25 through Figure 10-27 on Page 10-34.
4. Attach a handle at the unsupported end of the meter panel. Leave a minimum clearance of 1 inch from the handle to the meter socket.
5. Ensure that hinges can support a 25-pound load applied at the unsupported end with a maximum 1/8-inch sag when the panel is open.
6. Secure removable plates to the rear of the panel using screws that do ***not*** protrude through the face of panel.
7. Ensure that the meter panels can open 90° with the meter and test facilities in place.
8. Ensure that all securing screws and sealing screws on the panels are captive. Studs and wing nuts must be sealable, when they are used.

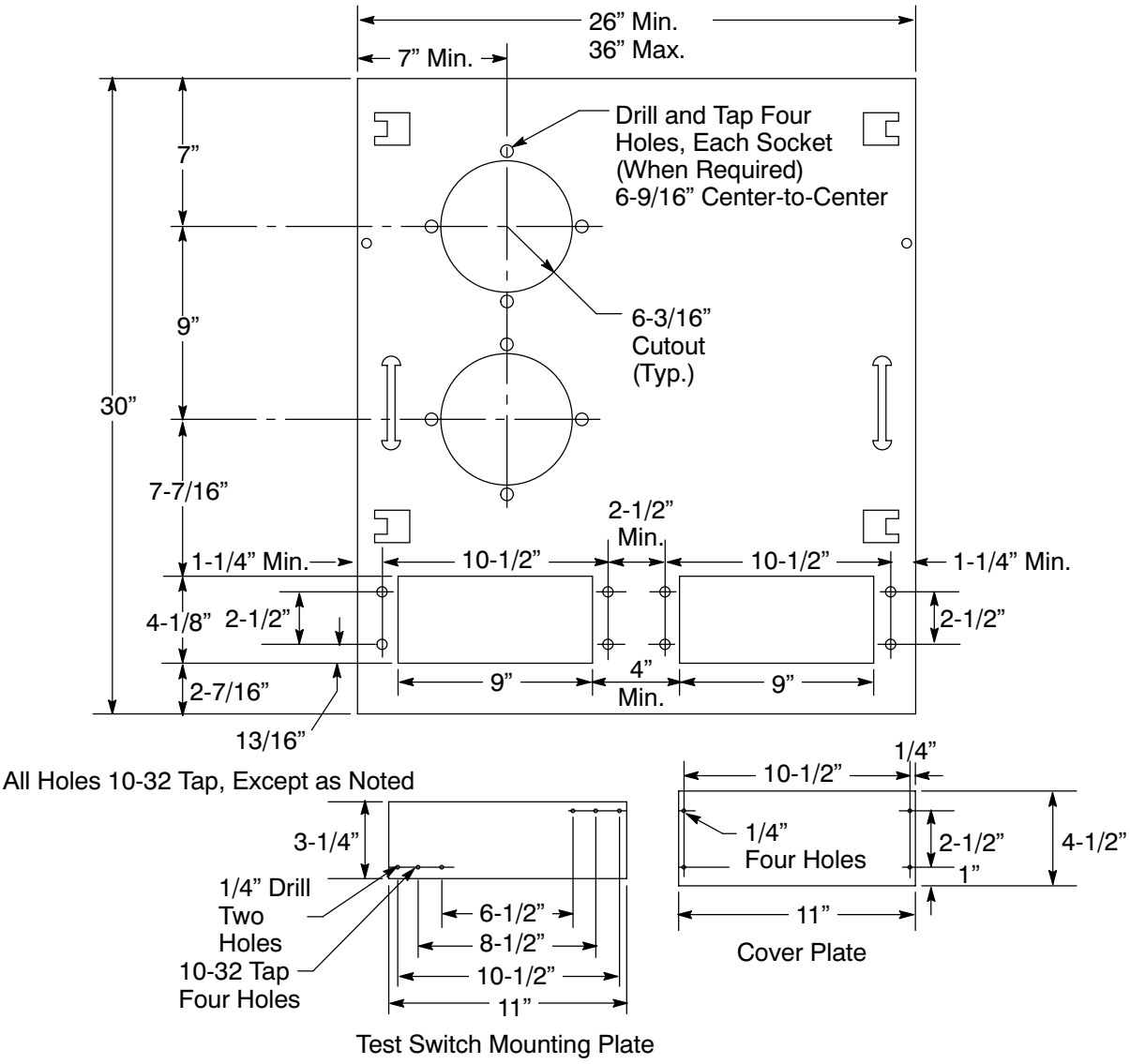


Figure 10-24
Standard Switchboard Service Section, 30-Inch Panel for Socket Meters and Recorder

Notes in reference to Figure 10-24.

1. Meter openings may be on either the right or the left side of the panel.
2. Ensure that the switchboard manufacturer drills, taps, and slots the panel for the secondary test switch, as shown. Also, ensure that the switchboard manufacturer furnishes and installs the socket with a sealing ring.
3. Paint the removable plates and attached them to the panel.
4. Construct meter panels of 12-gauge steel (minimum). Ensure they are hinged and sealable.
5. Ensure that hinges are interchangeable and can be used on either the right side or the left side of the meter panels. When using clevis-type or removable pin-type hinges, ensure that the pin can be removed from the top of the meter panel.
6. Ensure that hinges can support a 25-pound load applied at the unsupported end with a maximum 1/8-inch sag when the panel is open.
7. Do ***not*** use a hinge to connect a hinged meter panel to a filler panel.

Notes in reference to Figure 10-24, continued.

8. Ensure that a hinged meter panel can be opened 90° with the meter and test facilities in place. When working with either recessed or enclosed meter panels, see Figure 10-25 below.
9. Ensure that the panel has a handle attached on both sides.
10. All securing screws and sealing screws on the panel must be captive. Stud and wing nuts must be sealable, when they are used.
11. Design the meter sockets to be installed on hinged panels for back (i.e., rear) connection.
12. For panel widths of less than 26 inches, consult your local PG&E service planner.

10.7. Multimetering for Self-Contained, Nonresidential Services to 225 Amperes

Applicants may use switchboards consisting of a main disconnect (if required), individual meter sockets, and associated circuit breakers or switches for individually metered, multiple occupancies supplied from one service. Figure 10-25 through Figure 10-28 below, all show standard switchboard service-section details for self-contained meter sockets rated from 0 through 200 amperes.

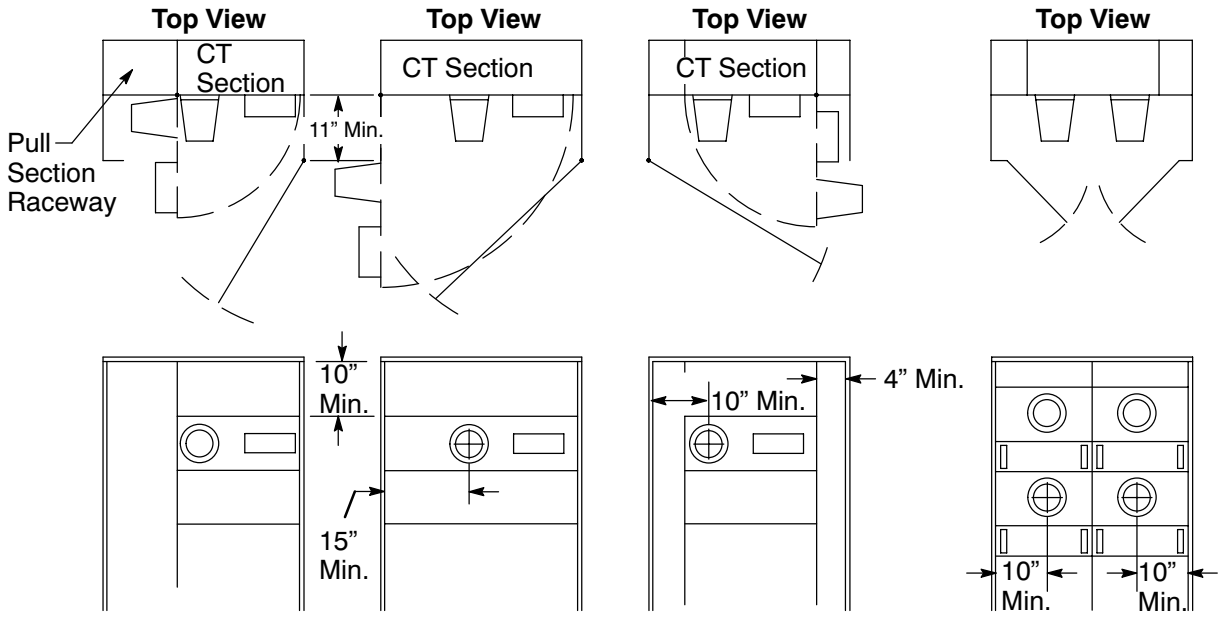


Figure 10-25 **Figure 10-26** **Figure 10-27** **Figure 10-28**

Outdoor or Rain-Tight Enclosures for Switchboards

Notes in reference to Figure 10-25, Figure 10-26, Figure 10-27, and Figure 10-28.

1. Ensure that hinged meter panels and enclosure doors can be opened at least 90° with meter and test facilities in place.
2. For hinged meter panel designs, see Figure 10-21 on Page 10-30 and Figure 10-22 on Page 10-31.
3. Ensure that enclosure doors can be secured in the 90° open position.
4. For approved enclosure-locking provisions, see Section 5, "Electric Metering: General," Subsection 5.3.4., "Meter Rooms," on Page 5-4.