Prepared by: MZGD

REQUIREMENTS FOR BUS DUCT ENTRANCE TERMINATION UNIT FOR USE WITH PAD-MOUNTED TRANSFORMERS

063929

Asset Type: Electric Distribution **Function:** Design and Construction

Issued By: Lisseth Villareal (LDV2) **Date:** 06/30/2023

Rev. #13: This document replaces PG&E Document 063929, Rev. #12. For a description of the changes, see Page 12.

This document is also included in the following manual:

- *Electric and Gas Service Requirements Manual* (Greenbook)

Purpose and Scope

This document provides the tools, ordering instructions, and the necessary manufacturing specifications and details for the fabrication and assembly of bus duct entrance terminations.

The function of the entrance box is to:

- Provide a means for connecting the customer's bus duct to a pad-mounted transformer.
- Permit a future, larger transformer to be installed without disturbing the existing bus duct installation.
- Reduce the shutdown time for transformer replacement. The entrance box is furnished with two removable sections to permit access to the bus duct extension connections. PG&E will supply and install the entrance box.

General Information

1. The "Bus Duct Entrance Termination Unit" is used to provide transition from a customer-provided service entrance bus duct to the low-voltage service compartment of a PG&E, pad-mounted transformer, for services of 3,000 to 4,000 amps.
2. Construction
   A. The unit's construction design shown in this document must comply with the Western Underground Committee's Guide 2.13, latest revision, for tamper-resistant, pad-mounted, equipment enclosures.
   B. Each top and side cover must latch and securely self-lock at a minimum of three points, when the unit is assembled. All sharp external corners, edges, and joints must be smoothed to prevent injury or damage to clothing.
   C. The edges, seams, and joints must be made and formed to provide a close-fitting mating surface. Exposed welding on the outside surface of the unit(s) must be a continuous bead, machined and ground flush.
   D. All metal work must be cleaned free of dirt, oils, and rust, and immediately painted, both inside and outside, with one coat of suitable, rust-inhibiting primer, approximately 1.5 mils thick when dry.
   E. The interior and exterior of the housing must be finished with one or more coats of Green Munsel, No. 7gy, 3.29/1.5 paint. The total dry film thickness must not be less than 2 mils (the total paint thickness, including primer, not less than 3.5 mils when dry).
   F. Approximately a half pint of "touch-up" paint (preferably in an aerosol spray can) must be included and shipped with each unit (attached inside the unit to the cable support block).
3. Methods of Serving Large Commercial Customers
   A. Main Service Rating 201 Through 2,500 Amps: The approved method is by underground cable in customer-installed conduit for cable distance 50 feet or less (refer to Document 063928 for details).
   B. Main Service Rating 3,000 Through 4,000 Amps: The approved method is a PG&E-owned and installed bus duct entrance box attaching to customer-owned and installed bus duct that is a minimum of 36" long.
4. Note: Bus ducts must only be connected to pad-mounted transformers with a minimum 30-inch deep cabinet and a secondary terminal height of 46 inches from the bottom of the cabinet (Style IIE-LB and IIF, 300 kVA and larger).

5. It is recommended to install pad-mounted transformer, bus duct entrance termination box, and customer bus duct entrance box on the same monolithic pad to avoid soil settlement issues. See Document 043818 or Document 045292 for transformer pad dimensions.
6. Service Connection

   The customer must provide a minimum of 36 inches of straight (unbent) bus duct from the bus duct entrance terminating end at the side of the pad-mounted transformer (top entry is not permitted). The customer must also supply tie straps for collecting like phases, all necessary bus extensions, and bracing for bus extensions, as required. The bus duct must enter the transformer entrance box in a “horizontal” configuration. PG&E will make the connections from the bus extensions to the transformer secondary terminals, using insulated, flexible, copper conductor provided by PG&E.
7. A termination enclosure is allowed if its installation meets the following requirements:
   A. Has the same capacity and short circuit rating as the customer’s switchboard.
   B. Installed at a distance no closer than 60” from the edge of the transformer pad.
   C. Meets Greenbook specifications as listed below:
   - 5.2.1. Approved Metering and Service Termination Equipment.
   - 5.2.2. Drawing Submittal Requirements for Metering and Service Termination Equipment.
   - 9.10. Underground Service Cable–Termination Section or Pull Box.
   - Table 9 – 4 Minimum Pad–Mounted (Floor–Standing) Switchboard Pull–Section Dimensions: Residential and Nonresidential, Single–Phase and Three–Phase.
   - Figure 9 – 15, Detail of Aluminum, Termination Bus Stubs.
   - 10.3.12. Service Terminations for Underground Services.
   - 10.3.14. Underground, Cable–Terminating Facilities in Pull Boxes or Pull Sections.
8. To provide a water tight transition between the components, the bus duct (flanged ends provided by the customer) must match the dimensions of the transition box assembly and flange plate (Detail B on Page 10).
   A. An alternative bus duct termination design for 4000 A bus duct installation has been approved. See Figure 8 and its Side View on Page 11. In addition to meeting the dimension shown in the referred figures, this design must meet the minimum horizontal clearance of one–inch at both ends of the energized bus duct and the grounded metal cabinet.
9. Transformer Bus Duct Cover Plate

   A cover used to close off the bus duct entrance hole left in a transformer when it is removed or replaced. This plate bolts into the same bolt holes used for the bus duct entrance termination box and can be installed locally so that the transformer can be reused without sending it to Emeryville to have the opening covered (**Code M180203**).

References	Location	Document
Connectors for Insulated Cables Underground Distribution Systems	UG-1: Connectors/Greenbook	015251
Concrete Pads for Radial-Style, Three-Phase Pad-Mounted Transformers	UG-1: Transformers	043818
Installation of Loop-Style, Three-Phase, Pad-Mounted Transformers	UG-1: Transformers	045291
Concrete Pad for Three-Phase, Loop-Style, Pad-Mounted Transformers	UG-1: Transformers/Greenbook	045292
Terminating Underground Electric Services 0–600 Volts in Customer-Owned Facilities	UG-1: Services/Greenbook	058817
Methods and Requirements for Installing Commercial Underground Electric Services 0-600 Volts to Customer-Owned Facilities	UG–1: Services/Greenbook	063928

Installation

Notes

1. Method of installation (see Figure 1 on Page 4) - The location of the edge of the pad must first be established by consultation between PG&E and the building architect or contractor. The bus duct termination end flange and flange plate must be located such as to permit its connection to the bus duct entrance termination box at a point 23 inches to 24 inches from the edge of the pad. The vertical centerline of the bus duct entrance termination box must be located 23 inches from the front edge of the transformer pad (see Figure 1, Section A-A and Figure 2, Section B-B on Page 4). Additionally, there must be a minimum of 60 inches straight length between the edge of the pad and any obstruction (bend, support, apparatus, wall or building, etc) in the bus duct to accommodate the 48” long bus duct entrance termination box provided by PG&E.

   These dimensions will accommodate all style IIB, IIC, IIE, IIF, IIG, and IIH transformers used in bus applications.

2. Bus duct flange plate (see Detail B on Page 10) - A removable bus duct end flange plate must be provided by the customer at the transformer end of the bus duct. This plate must not be drilled. PG&E will locate and drill 1/2-inch diameter holes in the flange plate to match the square holes in the adjustable end flange of the entrance box.

   A. For the 4000A alternate bus duct design, this note does not apply as this design incorporates the bus duct end flange at the transformer end of the bus duct as part of the design, and it comes with the holes already drilled. Refer to Figure 8 and its Side View on Page 11.

3. Transformer cabinet bus duct cutout - The horizontal centerline of the bus duct termination box in the side of the transformer must be approximately 24 inches above the top of the pad. The cutout dimensions and drilling for bolt holes must match the dimensions and drilling of the entrance box, as determined in the field. A template is provided in the kit to help in positioning the flanged end and locating the mounting holes.

4. Bus duct connections in transformer (see Figure 3 on Page 5)

   A. For two and three bars per phase, the customer must provide tie straps bolted across like phases where they enter the transformer entrance box.

   B. PG&E will provide the flexible copper conductor and spade connectors necessary to make the connection between the secondary spades of the transformer and the customer’s bus duct.

   C. The customer must furnish the tie bars (Section F-F on Page 10) and spacers (Detail E on Page 10) with the bus duct. The bus duct must be in a horizontal configuration when entering the entrance box.

   D. PG&E will provide the necessary spade supports for the protection of the transformer. See Document 045291 for further information on the secondary cable support kit (**Code M019644**).

5. Feeder bus duct and entrance box supports - Feeder bus duct supports (where necessary) are required to be installed by the customer. The entrance box must not be used as a bus duct support. PG&E will provide and install a support (supports are not part of a kit) for the bus duct entrance termination box, as shown in Figure 1 and Figure 2 on Page 4, and Detail G on Page 11.

Requirements for Bus Duct Entrance Termination Unit for Use With Pad-Mounted Transformers

Installation (continued)

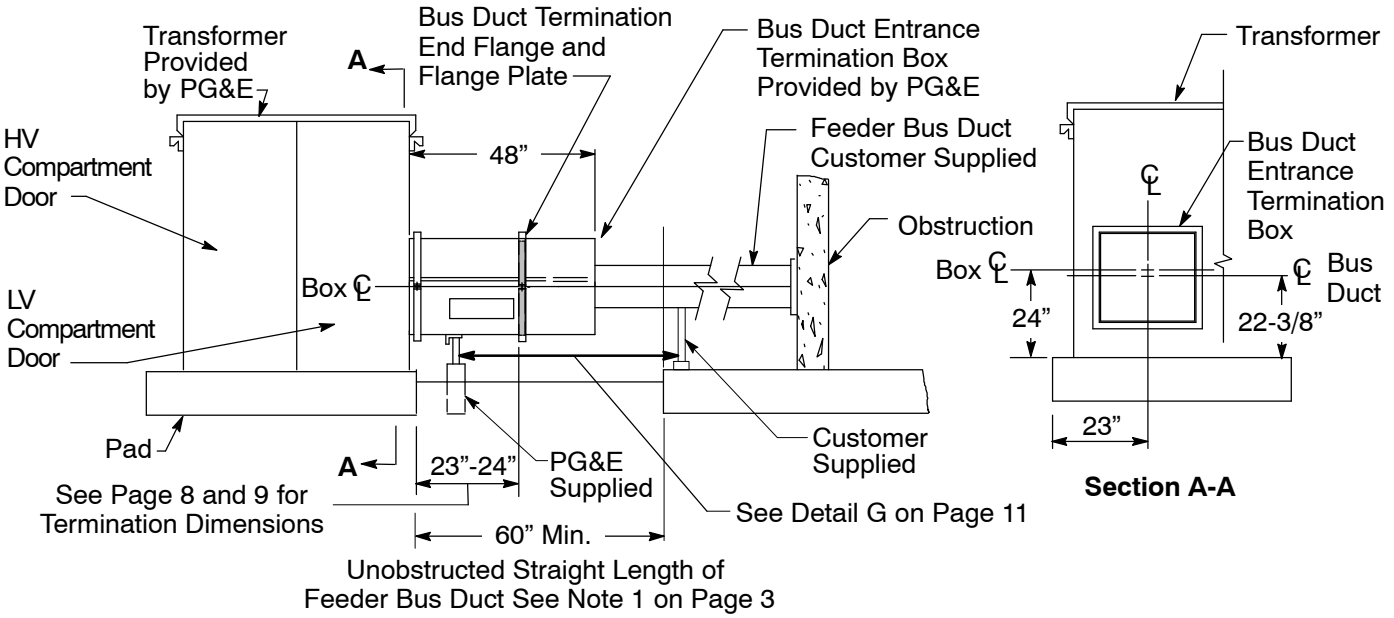


Figure 1
Typical Bus Duct Assembly for Largest Pad-Mounted Transformer

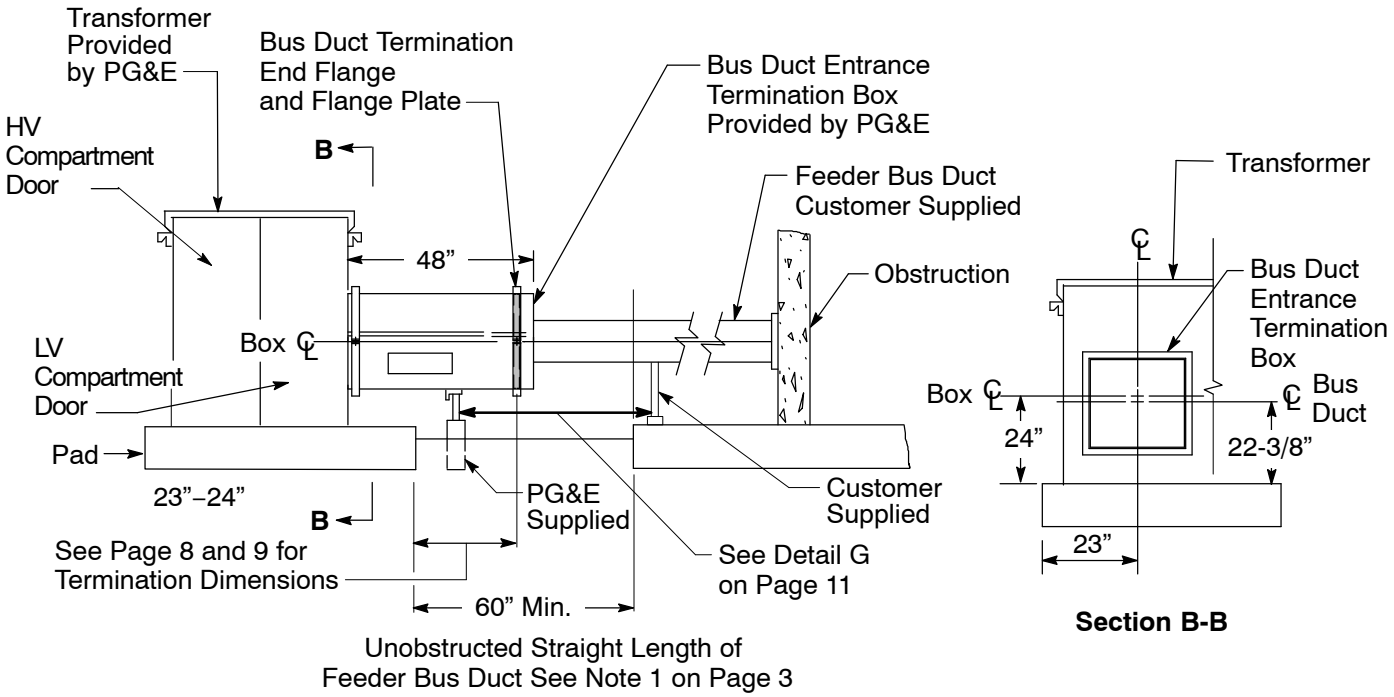


Figure 2
Typical Bus Assembly for Smallest Pad-Mounted Transformer

Note: Dimensions in all Figures are not to scale.

Requirements for Bus Duct Entrance Termination Unit for Use With Pad-Mounted Transformers

Bus Duct Entrance Termination Box Assembly

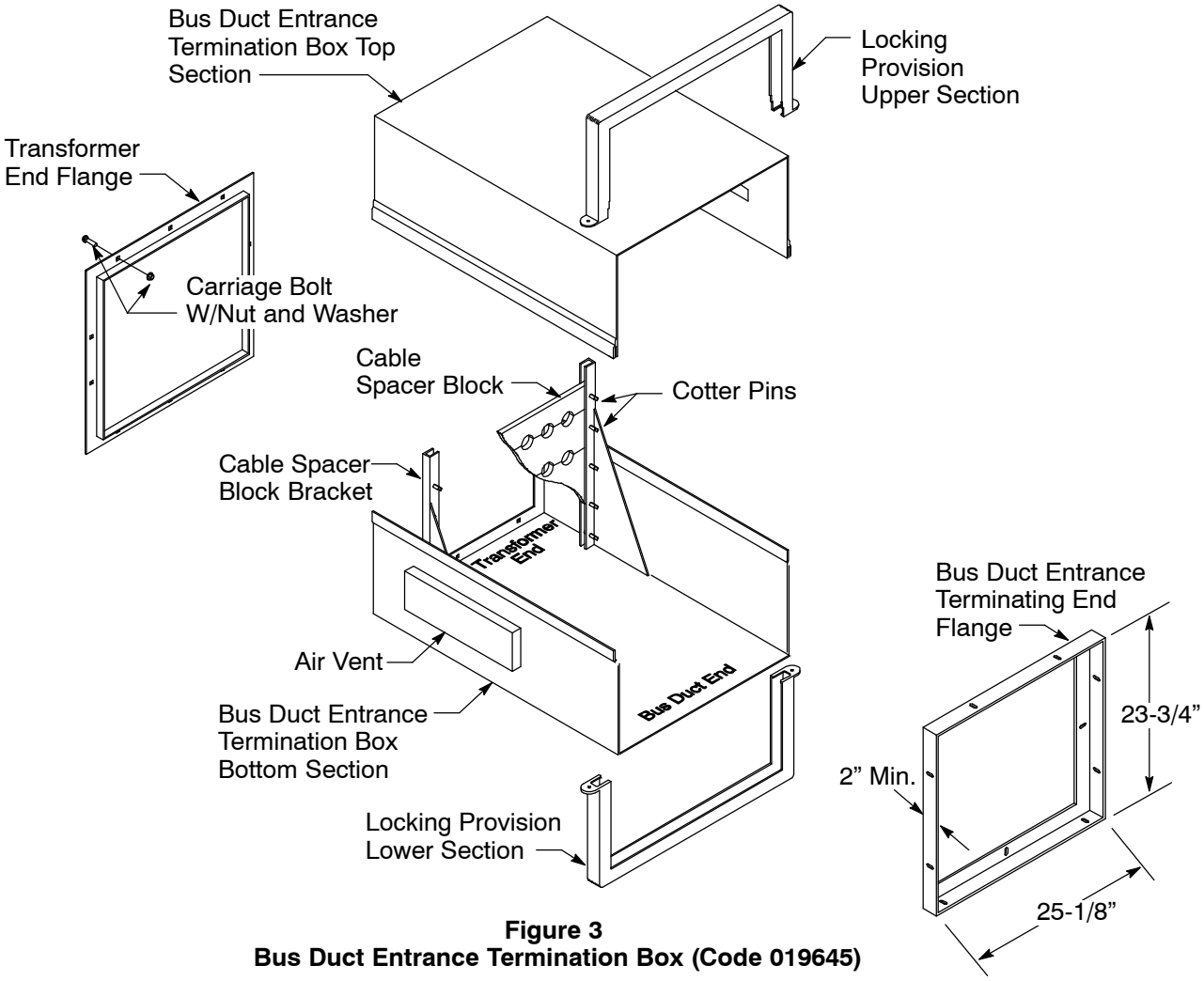


Figure 3
Bus Duct Entrance Termination Box (Code 019645)

Table 1 List of Material for Bus Duct Entrance Termination Box Kit [1]

Quantity	Description
1	Stainless Steel Bus Duct Entrance Termination Box
1	Cable Spacer
4	Copper Bus Bar Extensions [2] (see Detail F on Page 11)
24	1” x 3/8” Carriage Bolts With Nuts and Washers
2	3/8” x 3-1/2” Bolt, With Nut and 3/16” Diameter Hole for Safety Lock
2	Safety Locks, Utilco Catalog Number PEL-1, Code 170115
10-Foot Length	Weather Stripping
1	Template

[1] When needed, use and order secondary cable support kit M019644 (see Document 045291). This kit is not included in the bus duct termination box kit.
[2] See Page 6 for additional information on copper bus bar extensions.

Bus Duct Entrance Termination Box Assembly (continued)

Copper bus bar extensions are available as a component of the bus duct entrance termination box kit (**Code M019645**), and can also be ordered separately. (**Code M310028**).

The copper bus bar extensions are used when additional secondary cable is added to the transformer and the terminal spades do not have enough room to accommodate the additional cable.

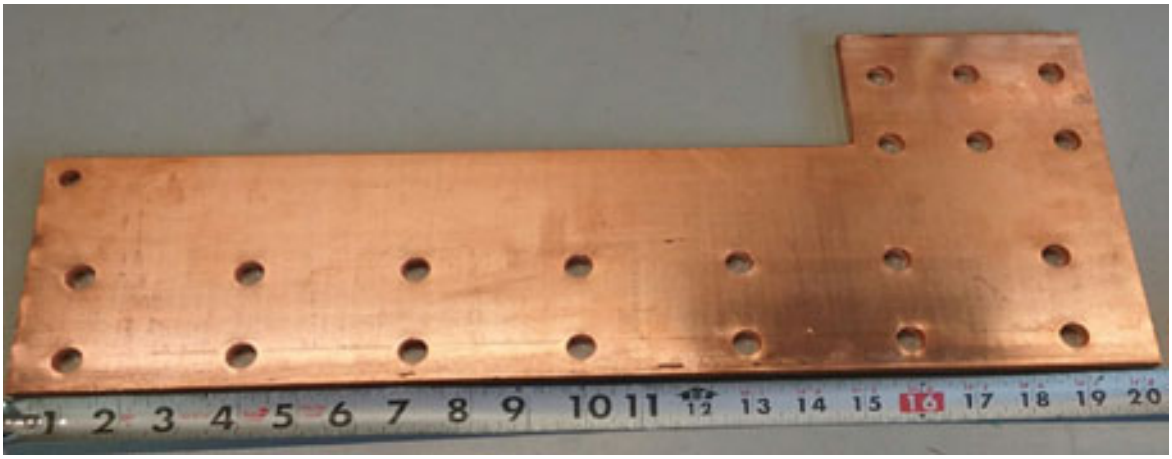
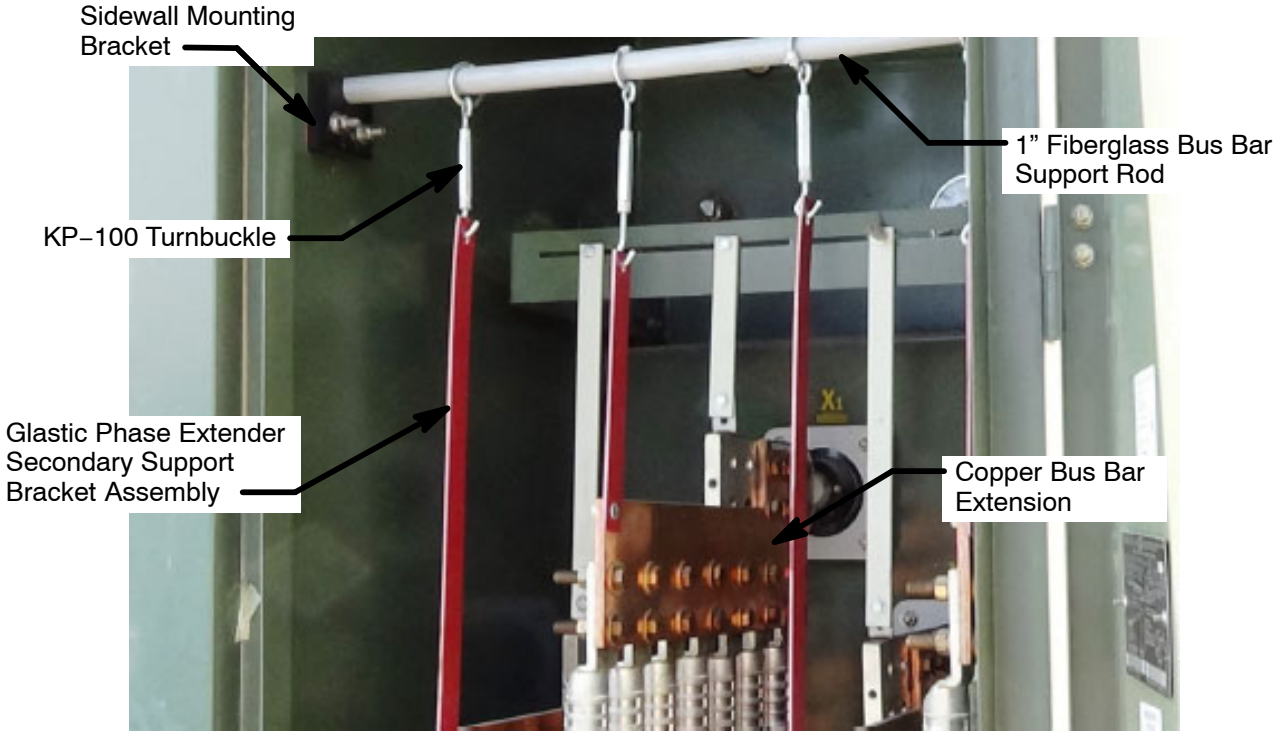


Figure 4
Copper Bus Bar Extension



Detail A
Secondary Cable Installation using the Copper Bus Bar Extension and Secondary Cable Support Kit.

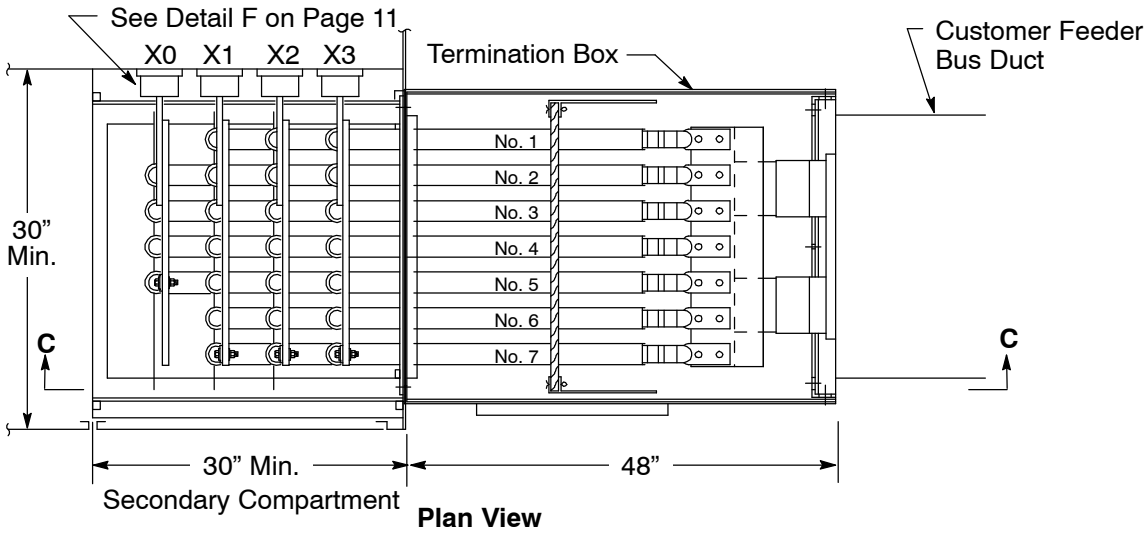
Requirements for Bus Duct Entrance Termination Unit for Use With Pad-Mounted Transformers

Table 2 Recommended Tools for Assembly and Installation of Bus Duct Entrance Termination Box

Description	Code
Sawzall, Heavy Duty, Milwaukee #6511-W/Case	210075
Blades, Sawzall, Milwaukee #48-00-1171 – Package of 10	207674
Drill, Skil #6550, 1/2” Variable Speed Reversible	210026
Drill Bit Set, 1/16” to 1/2”, W/Case	203026
Punch, Center, 3/8”	201305

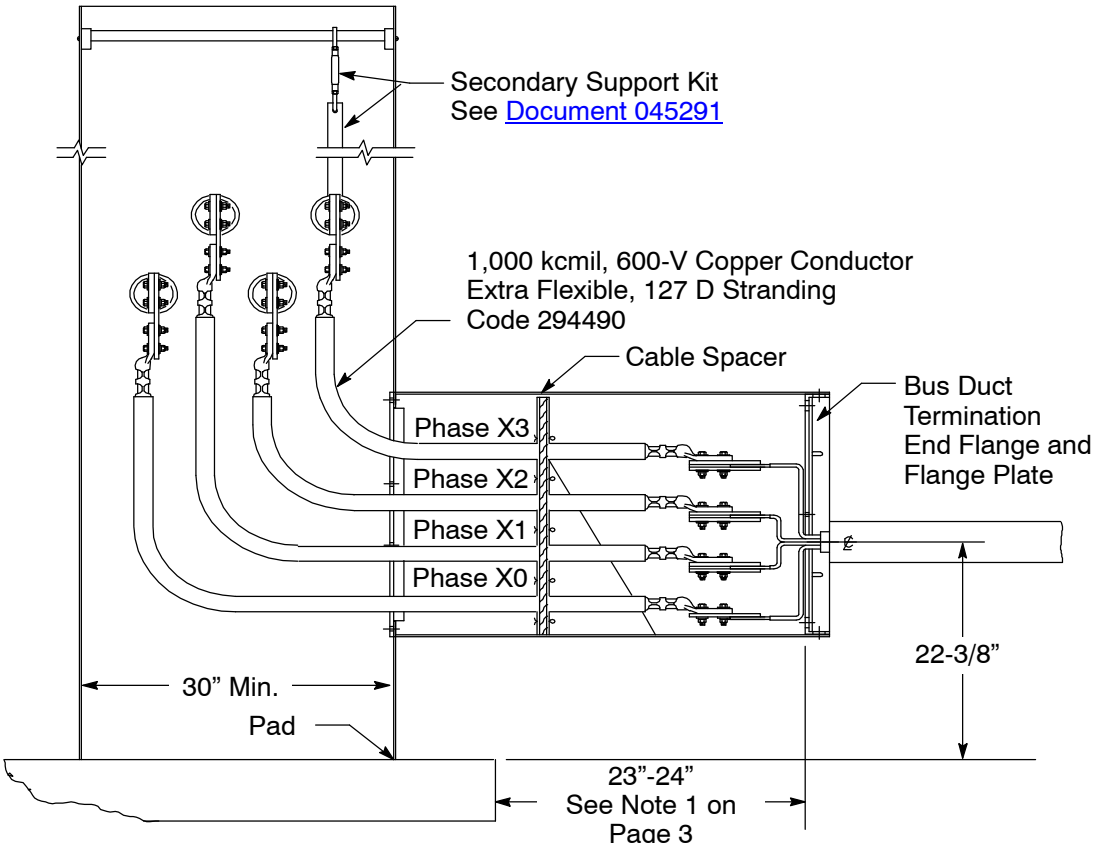
Requirements for Bus Duct Entrance Termination Unit for Use With Pad-Mounted Transformers

Bus Duct Termination Assembly – Fully Extended



Plan View

Typical Outdoor Bus Termination Fully Extended

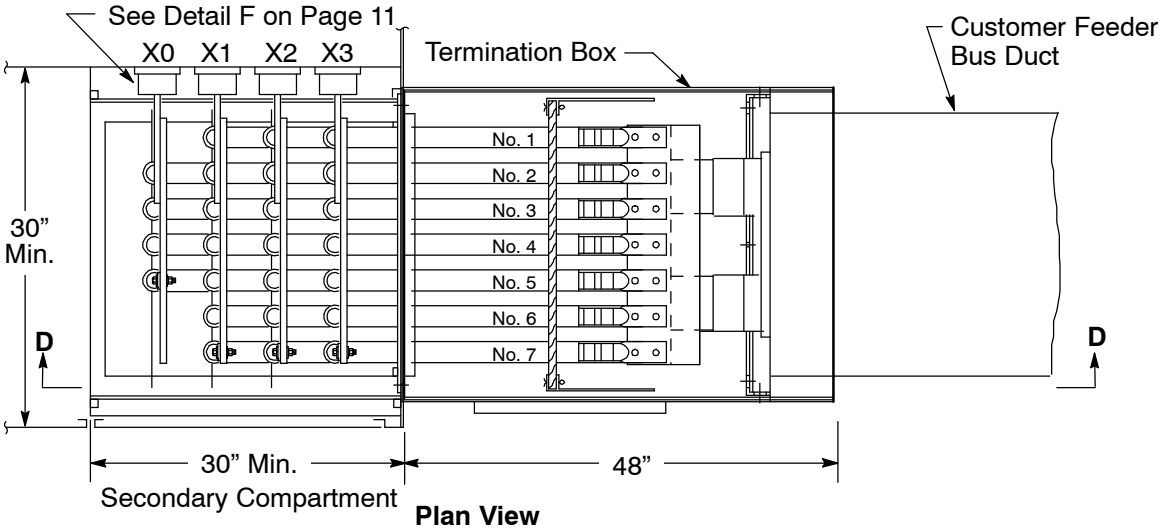


Section C-C
Fully Extended

Figure 5
Bus Duct Termination Assembly Fully Extended

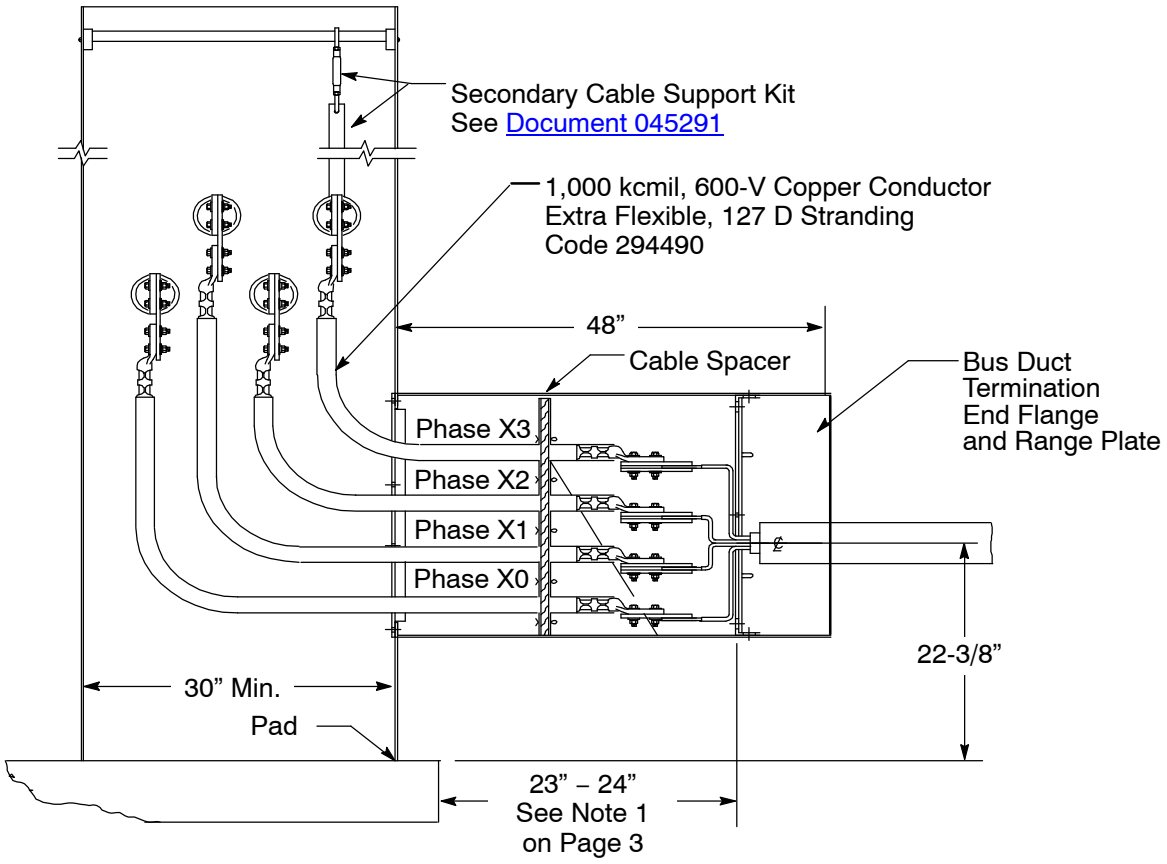
Requirements for Bus Duct Entrance Termination Unit for Use With Pad-Mounted Transformers

Bus Duct Termination Assembly – Fully Compressed



Plan View

Typical Outdoor Bus Termination Fully Compressed



Section D-D
Fully Compressed

Figure 6
Bus Duct Termination Assembly Fully Compressed

Requirements for Bus Duct Entrance Termination Unit for Use With Pad-Mounted Transformers

Bus Duct Termination Assembly – Details

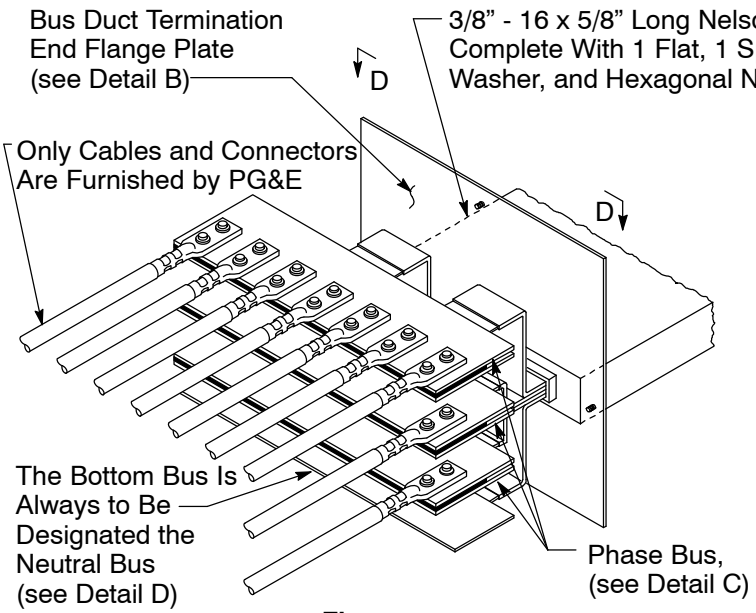
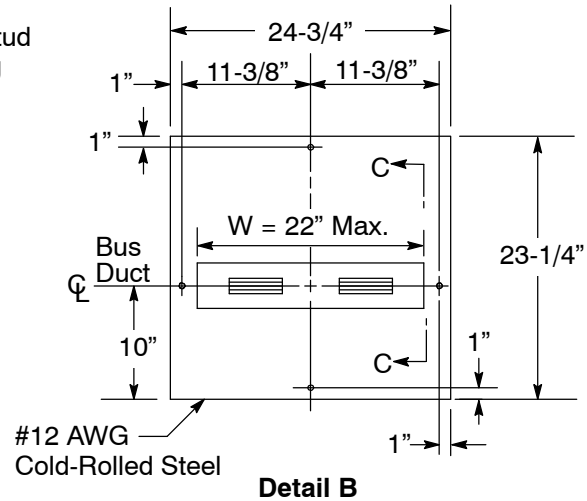
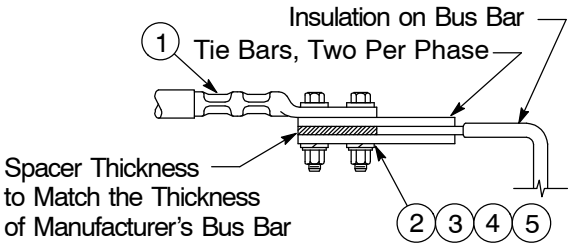


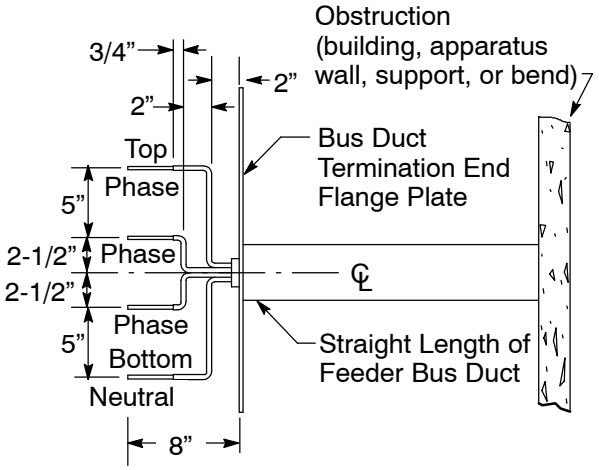
Figure 7
Termination Detail With
Bus Duct End and Tie Bars



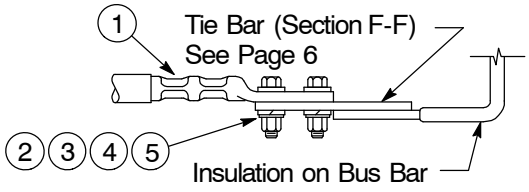
Detail B
End Flange Plate
(customer supplied)



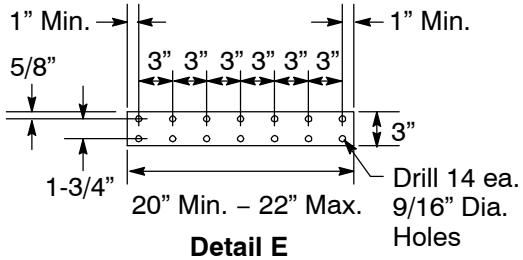
Detail C
Typical Phase Bus Termination Assembly



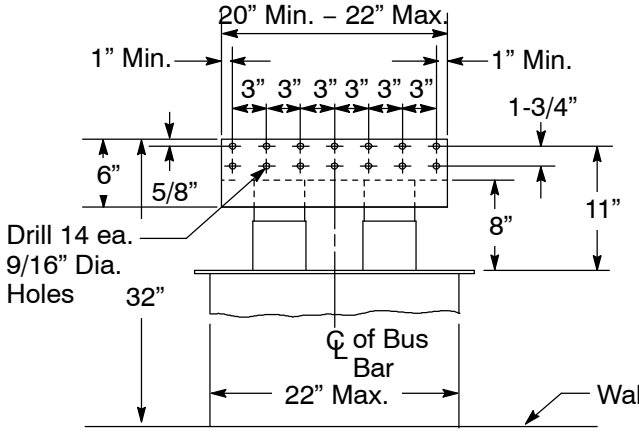
Section E-E
Bus Bar
(customer supplied)



Detail D
Typical Neutral Bus Termination Assembly



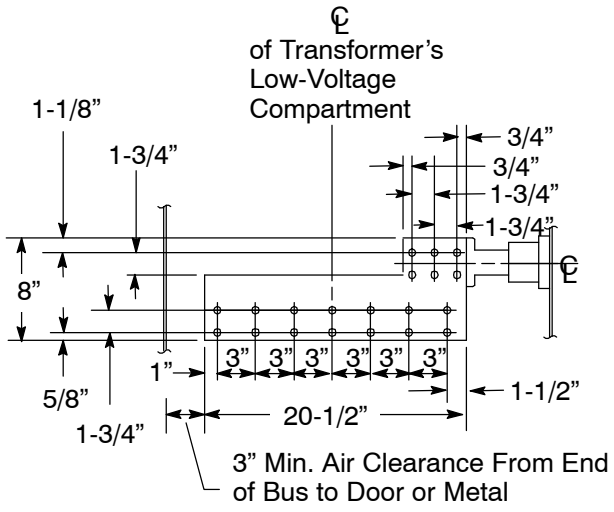
Detail E
Spacer 3" x 20" Long Copper
(thickness to suit)
(customer supplied)



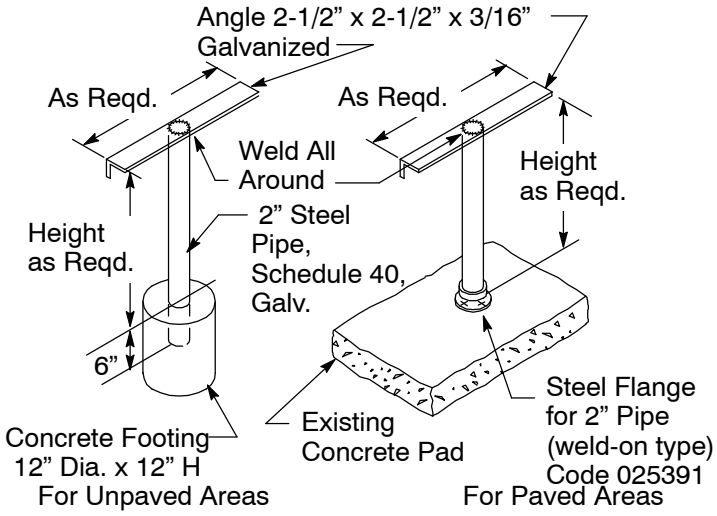
Section F-F
Tie Bar Connection 1/4" x 6" x 20" Long Copper
(two per phase and one per neutral required)
(customer supplied)

Requirements for Bus Duct Entrance Termination Unit for Use With Pad-Mounted Transformers

Bus Duct Termination Assembly – Details (continued)



Detail F
Copper Bus Bar Extension
(see Table 1 on Page 5)



Detail G
Termination Unit Supports
(PG&E supplies one under the bus duct termination box. Customer supplies remainder as required.)

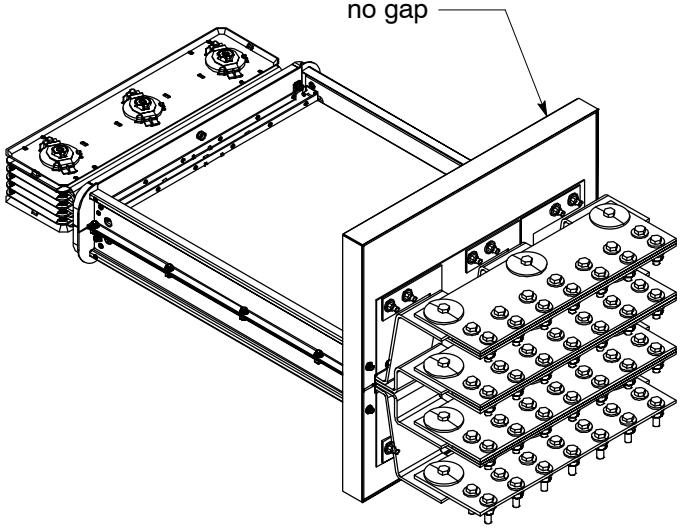
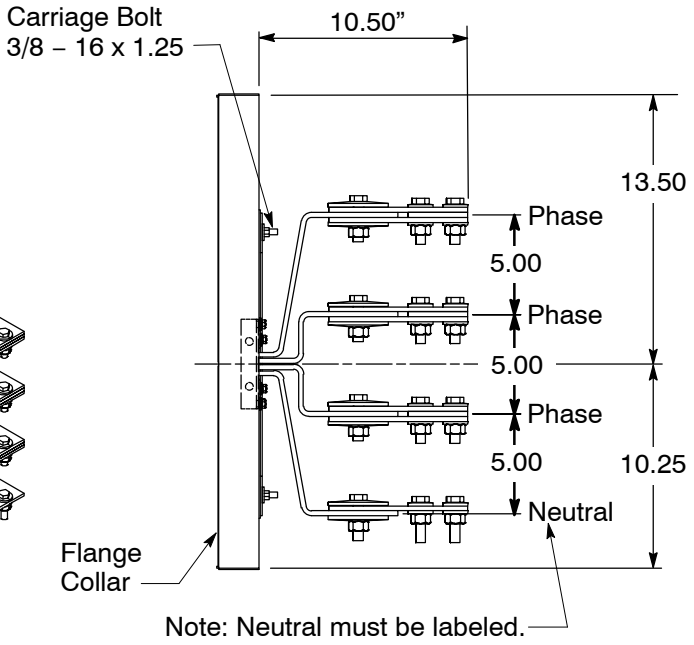


Figure 8
Alternative Design for Termination Detail for 4000A Bus Duct Installations



Side View of Figure 8
Alternative Design for Bus Bar for 4000A Bus Duct Installations (Customer Supplied)

Requirements for Bus Duct Entrance Termination Unit for Use With Pad-Mounted Transformers

Bus Duct Termination Assembly – Details (continued)

Table 3 Copper Conductor Requirements [3]

Main Switch Rating (Amps)	Number of Conductors Per Phase	Number of Neutral Cables	Approximate Footage of Conductor
2,500	4	2	140
3,000	5	3	180
3,500	6	3	210
4,000	7	4	250

[3] Use only 1,000 kcmil copper cable (Code 294490).

Table 4 List of Materials for Bus Termination Assemblies (see Detail C and Detail D on Page 10)

Item	Description	Code	Document
1	Terminal Connector, Compression-Type, Cable-to-Flat, for 1,000 kcmil Cable	303461	015251
2	Screw, Cap (bolt), Hex. Head, 1/2” x 2-1/2”, Everdur or Equivalent	193177	–
3	Nut, Bolt, Hex., 1/2”, Everdur or Equivalent	195013	–
4	Washer, Round, 1/2”, Everdur or Equivalent	195252	–
5	Washer, Lock, 1/2”, Everdur or Equivalent	195193	–

Revision Notes

Revision 13 has the following changes:

1. Added Note 8A on Page 2.
2. Added Note 2A under Installation Section on Page 3.
3. Modified Figure 1 and Figure 2 on Page 4
4. Revised width dimension of Bus Duct Termination Entrance End Flange on Page 5.
5. Added Detail A for Figure 4 on Page 6.
6. Added Figure 8 and its Side View on Page 11. For the newly approved alternate design.