SOUTHERN CALIFORNIA EDISON
TRANSMISSION AND DISTRIBUTION

Distribution Underground Construction Standards (DUG)

2023 SECOND QUARTER ISSUE
April 28, 2023

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SOUTHERN CALIFORNIA EDISON
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Distribution Underground Construction Standards (DUG)

Revision Summary

2023 Second Quarter Issue

Effective Date: April 28, 2023

Overview

The main purpose of this revision summary is to describe new revisions to this manual. (Some or all of the information may have been previously communicated to field personnel by other means.)

Table 1 lists the revisions. Click-able standard and page/sheet numbers link directly to individual revisions or the first of a series of revisions.

Table 2 defines four types of revisions: (1) Admin (Administrative), (2) Technical, (3) New, and (4) Pilot.

Note: **Admin** *and* **Technical** *revisions to existing standards or existing* **Pilot** *projects are identified with change bars* **|** *in the left margin.* **New** *standards (as well as new pilot projects) do not receive change bars. Editorial revisions, such as corrections to spelling, do not receive change bars.*

A Getting Help section provides contact information.

Table 1: Revisions

Standard	Sheet	Description	Type
TX 190		**Single-Phase Pad-Mounted Transformers (All Primary Voltages)**	
	6	Removed and corrected call out to footnote 2/; changed to footnote 1/.	Technical

Table 2: Revision Types

Type	Definition
Admin	Administrative revisions do not significantly affect design, construction, maintenance or operation of the electrical distribution, substation, and transmission systems. They do not require Standards Review Team (SRT) or management approval; however, they have been approved by other organizations, as appropriate. They may include updates to material codes, updates to references, updates to standards for clarity, or deletions of outdated information.
Technical	Technical revisions are engineering changes to existing standards. They affect the design, construction, maintenance or operation of the electrical distribution, substation, and transmission systems. They require SRT and management approval.
New	Refers to a new standard. New technical standards require SRT and management approval.
Pilot	A *Pilot* is an in-field evaluation of a piece of equipment or work method, with the intention of approving for standardized use. Pilot standards will have a PILOT watermark so that they are easily identified throughout this manual.

Getting Help

Technical Issues

If you have any comments, corrections, questions, or suggestions concerning manual revisions, please contact one of the following individuals at the numbers provided, or click on the name to send an email:

- Alaira Bilek (Manager) — PAX: 54156 Outside: (714) 895-0156
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Brian S. Chen

Director | Asset Management Program

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AP 100 Fuse Splice Box to Nonmetered Cellular Service

Scope AP 100.1 Typical Connection to Nonmetered Cellular Fuse Splice Box in 17" x 30" x 15" Handhole

1.0 General Information

1.1 The 17" x 30" x 15" handhole provides as an alternate method for installing fuse splice boxes for Nonmetered Cellular Service (refer to Section 2.1 for proper application details).

For 17" x 30" x 15" handhole structure, wiring diagram, and construction details refer to Figure AP 100–1 (Sheet 2).

2.0 Application

2.1 Handhole Structure (17" x 30" x 15")

The customer shall first request a pedestal installation from the government agency. If that request is denied, then the 17" x 30" x 15" handhole installation will be allowed. The customer must provide SCE planning with a copy of the request letter and the denial letter from the government agency. Information on the denial should include the reason for the denial and the person making the denial. The approved 17" x 30" x 15" handhole structure shall be provided by customer and is referenced in UGS, Table HP 200-2, Item Number HH9.

2.2 Labeling Requirements

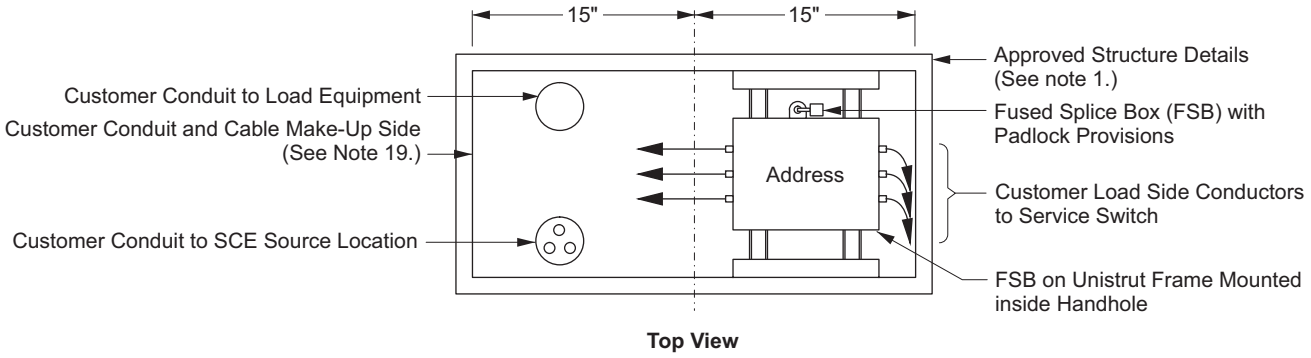
A. Permanently labeled with machine-engraved, laminated-phenolic (or equivalent) labels shall be provided by the customer. Quarter-inch high white letters and numbers on red-colored material, which is readily visible and mechanically attached to the top side of the handhole lid or face of the pedestal enclosure; and shall be worded as follows:

- Address of handhole/pedestal location
- Name of carrier
- Site identifier

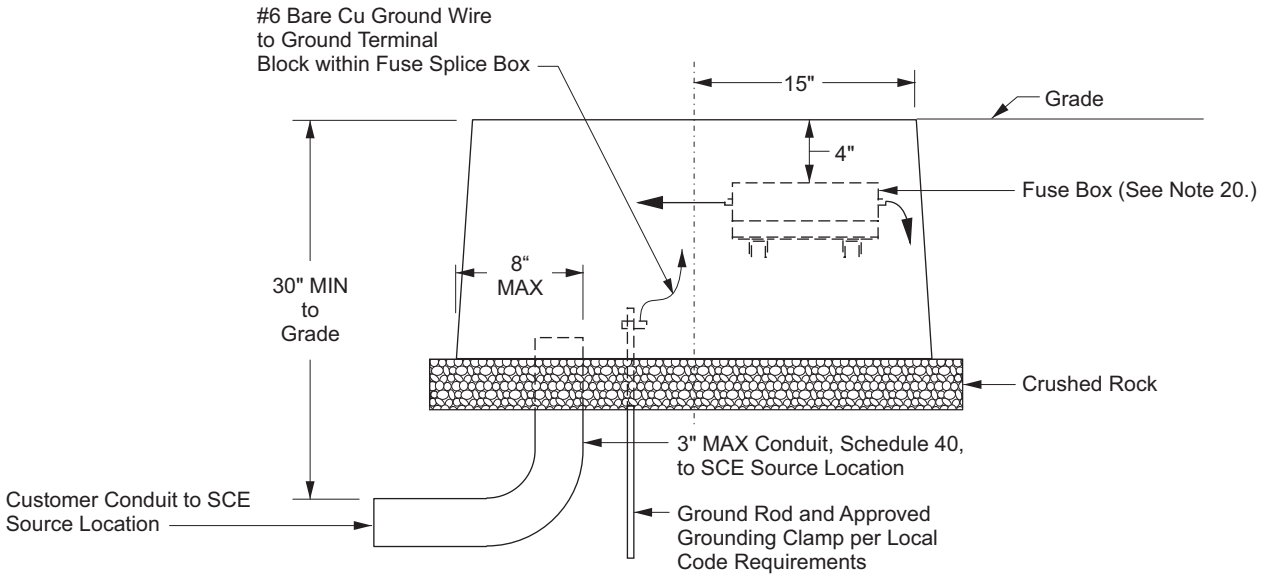
B. Labeling for the inside of the handhole/pedestal shall be as follows:

- Handhole: RF/Power Shut-Off Switch, and Fuse/Breaker Ampacity (that is being used) — placed on the top cover lid for the fuse splice box (FSB)
- Pedestal: RF/Power Shut-Off Switch, and Fuse/Breaker Ampacity (that is being used) — placed by the location of the switch

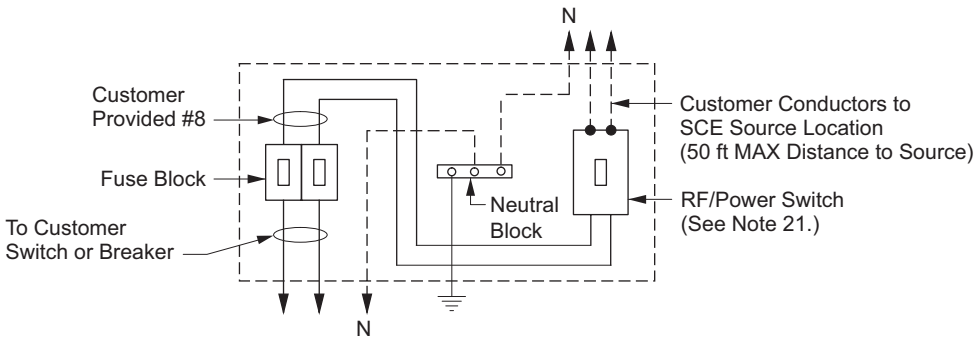
Figure AP 100–1: Typical Connection to Nonmetered Cellular Fuse Splice Box in 17" x 30" x 15" Handhole



Top View



Side View



Wiring Diagram
inside Fuse Splice Box

Note(s):
1. Handhole to be minimum size 17" × 30" × 15".
2. Fuse splice box (FSB) to be 12" (W) x 14" (L) x 6" (D), type 4X watertight.
3. Customer to supply type 4X, FSB with lockable hinged cover with locking clip facing center of handhole.

4. Customer to supply #8 str Cu line side conductors out of FSB.
5. All conductors exiting FSB shall maintain watertight rating of fuse splice box.
6. Ground rod and clamp per local code requirements.
7. All conduits and ground rod to be placed in cable make-up side of handhole.
8. Handhole to be placed on crushed rock bed.
9. Supplied voltage 120/240 volt, 3-wire, single phase.
10. Grounding conductor to terminate on ground terminal block.
11. Subject to local codes/ordinances where applicable.
12. FSB to be pre-wired and devices labeled by customer.
13. Customer to supply fuses with ratings per SCE approval.
14. One additional set of fuses to be supplied in FSB.
15. Customer to make-up all cable terminations within this structure.
16. SCE to padlock FSB with #203 lock after service is energized. Customer installs and replaces fuses, if needed, once unlocked by SCE.
17. SCE personnel to notify SCE IMS group if fuses are replaced.
18. Customer conduit to feed to SCE Emergency RF/Power Shut-Off Switch 50 feet maximum from the SCE structure with an antenna affixed to it within line of site.
19. Customer Emergency RF/Power Shut-Off Switch with dual locking device as close to the Antenna structure as possible.
20. Rotate Fuse Box 90 degrees counter clockwise to allow placement and access of lock or meter seal.
21. RF/Power Switch to have Customer's and SCE locks.
22. Where vegetation or landscaping could conceal the handhole, optional unmetered service enclosure can be used. Refer to Electrical Service Requirements (ESR), Section ESR-3, Page 3-46.

Scope AP 100.2 Typical Connection to Nonmetered Cellular Fuse Splice Box in 24" x 36" x 24" Handhole

1.0 General Information

The 24" x 36" x 24" handhole provides as an alternate method for installing fuse splice boxes for Nonmetered Cellular Service (refer to Scope AP 100.2, Section 2.1 for proper application details).

For 24" x 30" x 15" handhole structure, wiring diagram, and construction details, refer to Figure AP 100-2.

2.0 Application

2.1 Handhole Structure (24" x 36" x 24")

The customer shall first request a pedestal installation from the government agency. If that request is denied, then the 24" x 36" x 24" handhole installation will be allowed. The customer must provide SCE planning with a copy of the request letter and the denial letter from the government agency.

Information on the denial should include the reason for the denial and the person making the denial. The approved 24" x 36" x 24" handhole structure shall be provided by customer.

2.2 Labeling Requirements

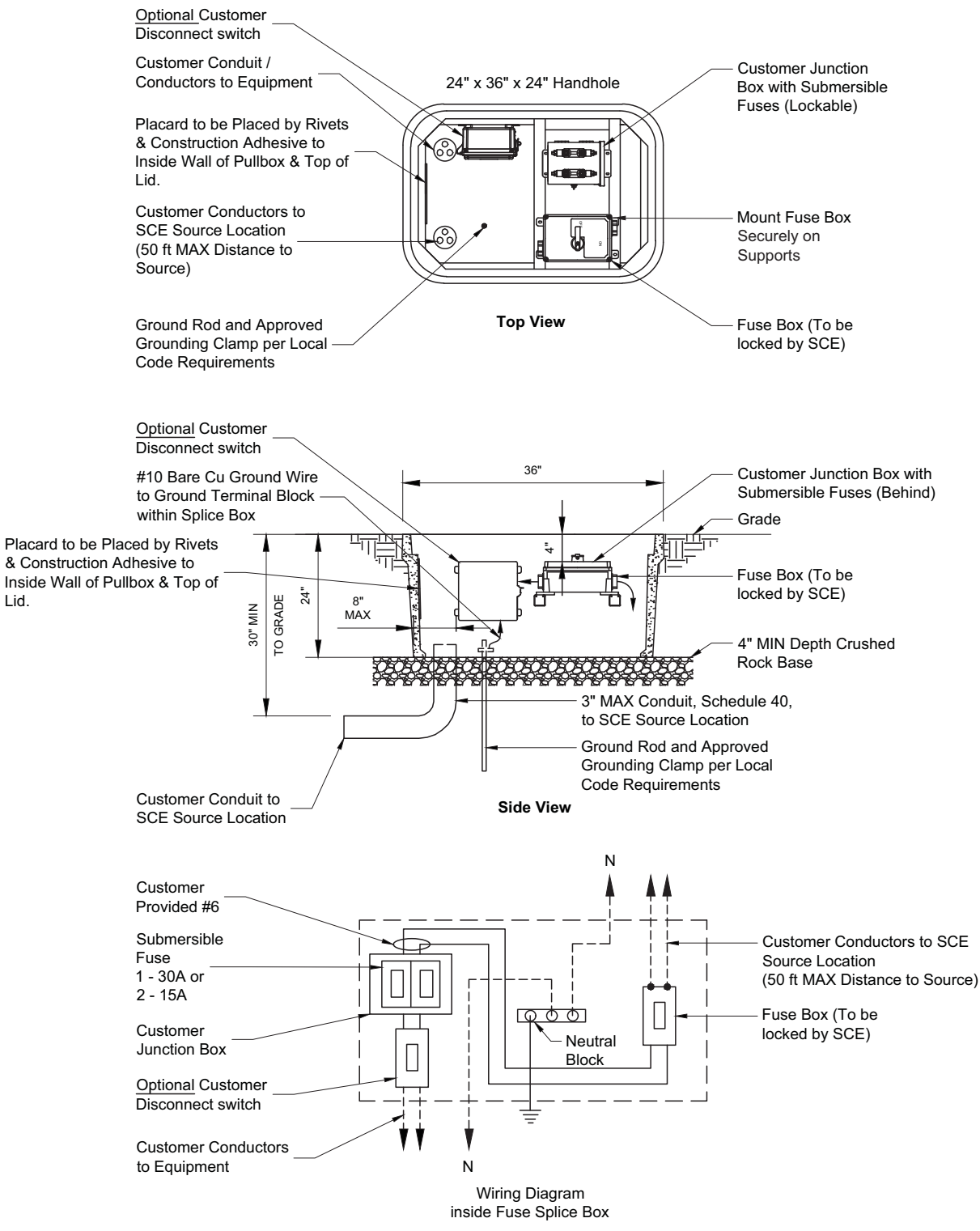
A. Permanently labeled with machine-engraved, laminated-phenolic (or equivalent) labels shall be provided by the customer. Quarter-inch high white letters and numbers on red-colored material, which is readily visible and mechanically attached to the top side of the handhole lid or face of the pedestal enclosure; and shall be worded as follows:

- Address of handhole/pedestal location
- Name of carrier
- Site identifier

B. Labeling for the inside of the handhole/pedestal shall be as follows:

- Handhole: RF/Power Shut-Off Switch, and Fuse/Breaker Ampacity (that is being used) - placed on the top cover lid for the fuse splice box (FSB)
- Pedestal: RF/Power Shut-Off Switch, and Fuse/Breaker Ampacity (that is being used) - placed by the location of the switch

Figure AP 100–2: Typical Connection to Non-metered Cellular Fuse Splice Box in 24" x 36" x24" Handhole



Note(s):

1. Handhole to be minimum size 24" x 36" x 24".
2. Fuse splice box (FSB) to be 12" (W) x 14" (L) x 6" (D), type 4X watertight.
3. Customer to supply type 4X, FSB with lockable hinged cover with locking clip facing center of handhole.
4. Customer to supply #8 str Cu line side conductors out of FSB.
5. All conductors exiting FSB shall maintain watertight rating of fuse splice box.
6. Ground rod and clamp per local code requirements.
7. All conduits and ground rod to be placed in cable make-up side of handhole.
8. Handhole to be placed on crushed rock bed.
9. Supplied voltage 120/240 volt, 3-wire, single phase.
10. Grounding conductor to terminate on ground terminal block.
11. Subject to local codes/ordinances where applicable.
12. FSB to be pre-wired and devices labeled by customer.
13. Customer to supply fuses with ratings per SCE approval.
14. One additional set of fuses to be supplied in FSB.
15. Customer to make-up all cable terminations within this structure.
16. SCE to padlock FSB with #203 lock after service is energized. Customer installs and replaces fuses, if needed, once unlocked by SCE.
17. SCE personnel to notify SCE IMS group if fuses are replaced.
18. Customer conduit to feed to SCE Emergency RF/Power Shut-Off Switch 50 feet maximum from the SCE structure with an antenna affixed to it within line of site.
19. Customer Emergency RF/Power Shut-Off Switch with dual locking device as close to the Antenna structure as possible.
20. Rotate Fuse Box 90 degrees counterclockwise to allow placement and access of lock or meter seal.
21. RF/Power Switch to have Customer's and SCE locks.
22. Where vegetation or landscaping could conceal the handhole, optional unmetered service enclosure can be used. Refer to Electrical Service Requirements (ESR), Section ESR-3, Page 3-46.

AP 105 Underground Communication Devices

Scope AP 105.1 Underground Communication Devices - General

1.0 General Information

The Underground Communication assembly is used to support Socket Based Cell Relay (SBCR), NetComm Packet Router, and Range Extender (RRE) installations from an underground 120, 208, or 240 V source feed. For background information regarding the SmartConnect Range Extender, refer to the Distribution Apparatus Construction Standards (DAP), AP 710.

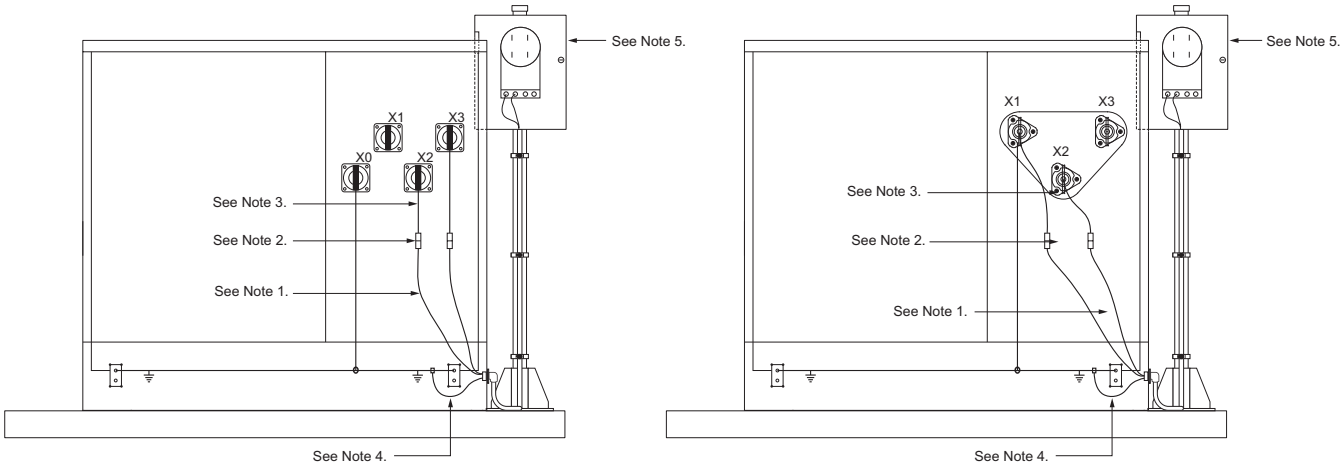
2.0 Application

The pad-mount post shall be installed and anchored on a transformer concrete pad or concrete slab box. If the transformer is on a polymer pad, contact Distribution Civil/Structural group for guidance with the installation of the post.

SmartConnect Semi-Buried Pedestal base shall be buried at 12 inches below grade.

Scope AP 105.2 Underground Communication Pad-mount Post Assembly Configuration

Figure AP 105–1: Connection to Serve Pad-mount Post Assembly Installed on Transformer Concrete Pad (Front View)

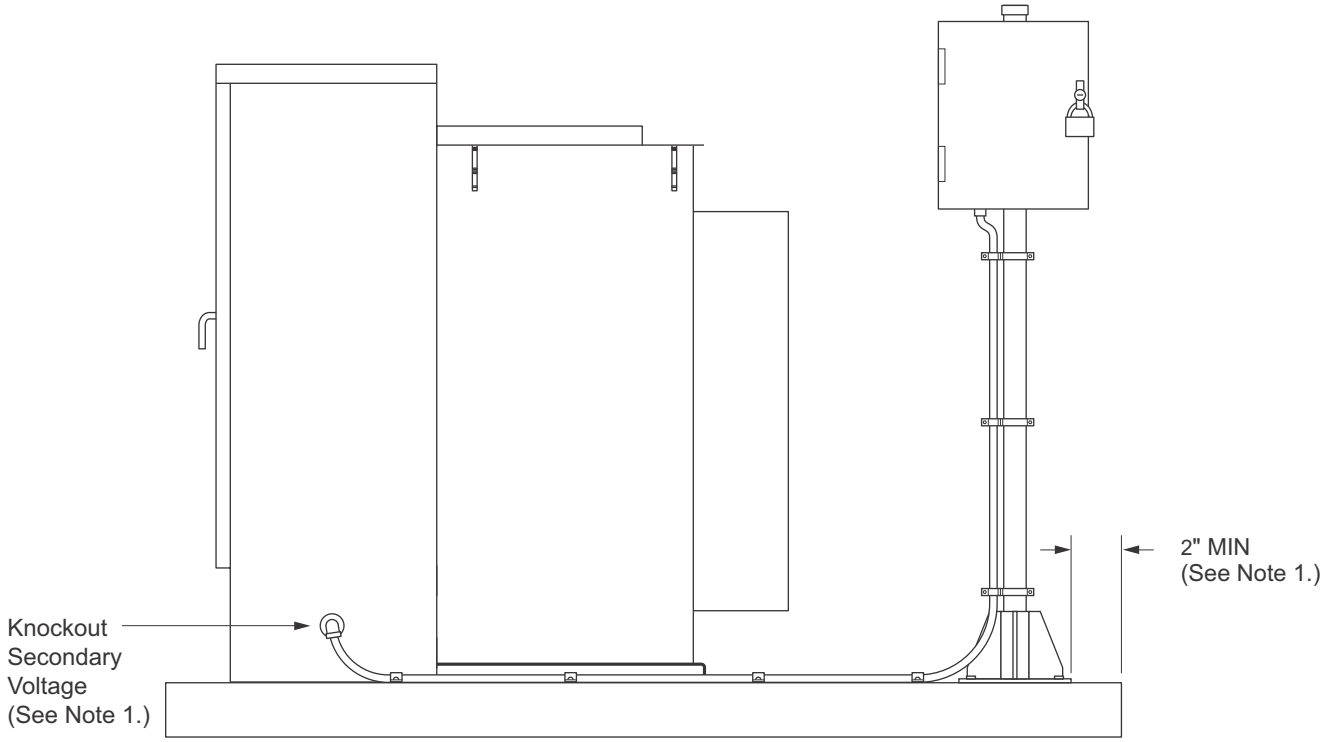


208Y/120 4-Wire **240V 3-Wire**

Note(s):

1. Run three #8 AWG TW-insulated wires and one #8 AWG bare solid copper wire from transformer to SmartConnect communication device enclosure
   a. For the 120 V Range Extender, connect phase and neutral, (one black, SAP 10109744 and one white, SAP 10109763).
   b. For Socket Base Cell Relay in A-Base Adapter (SAP 10106018), connect both phase wires to the A-base terminal (two black wires).
   c. The remaining #8 AWG insulated wire is for future use and should be safe-ended in the device (plastic) enclosure. Connect bare solid copper wire to case ground in pad-mount transformer and to bonding lug in the cabinet.
   d. For the 120 V NetComm Post Mount Packet Router, connect two phases and neutral, (two black, SAP 10109744 and one white, SAP 10109763). Connect bare solid copper wire to case ground in pad-mount transformer and to bonding lug in the cabinet.
2. For 240 or 277 V, connect two in-line fuse-holders, SAP 10107492. For 120 V, connect one in-line fuse-holder in hot (black) wire. Use 10-amp fuses, SAP 10107730.
3. Connect #8 AWG wires with ring terminals, SAP 10111079, to threaded ‘everdur’ bolts.
4. Run #6 AWG bare solid copper wire (SAP 10109324) from conduit grounding bushing to transformer ground bus inside transformer.
5. Orientation of the Socket Based Cell Relay or Range Extender shall be determined by Grid Services Advanced Metering Operations (AMO) and provided in their installation request.
6. If the source transformer is 277/480 V, see DUG TX 250 for step-down transformer.
7. When connecting a SmartConnect 240V Range Extender (HW 2.0) or 240V Cell Relay to an existing 3-Phase, 3-Wire 240 delta padmount transformer, a 2-wire power cable shall be connected phase-to-phase in which one phase is the grounded leg of the 240V delta.

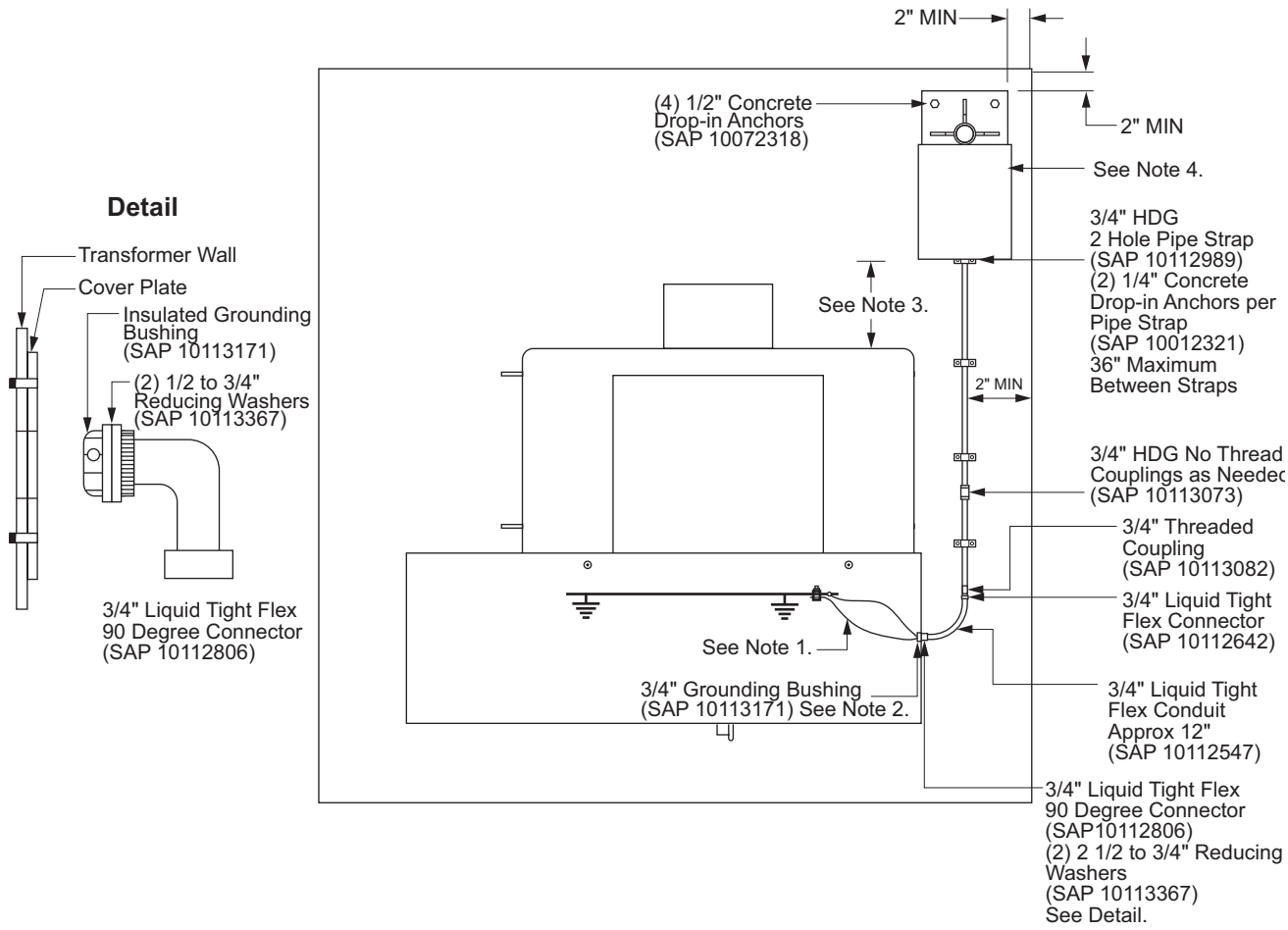
Figure AP 105–2: Pad-Mount Post Assembly Installed on Transformer Concrete Pad (Side View)



Note(s):

1. The mounting post shall be as close as possible to the low voltage knockout. However, the post may be installed on either side or back of the concrete pad, maintaining a 2-inch minimum clearance from post flange to edge of pad. Avoid placement on front of pad.
2. Orientation of the Socket Based Cell Relay or Range Extender shall be determined by Grid Services Advanced Metering Operations (AMO) and provided in their installation request.
3. Orientation of Netcomm Post Mount Packet Router enclosure shall have the door paralleled to either side or rear edge of transformer pad if possible. The door cannot face toward the transformer.

Figure AP 105–3: Pad-Mount Post Assembly Installed on Transformer Concrete Pad (Top View)



Note(s):
1. Run #6 AWG bare solid copper wire (SAP 10109324) from conduit ground bushing to ground bus inside transformer.
2. Use 3/4" grounding bushing on conduit fitting inside transformer, SAP 10113171.
3. Allow minimum door width clearance for device (plastic) enclosure, including clearance for single phase pad mounted transformers to open.
4. Orientation of the Socket Based Cell Relay or Range Extender shall be determined by Grid Services Advanced Metering Operations (AMO) and provided in their installation request.
5. Orientation of Netcomm Post Mount Packet Router enclosure shall have the door paralleled to either side or rear edge of transformer pad if possible. The door cannot face toward the transformer.
6. The post shall be as close as possible to the low voltage knockout. However, the post may be installed on either side or back of concrete pad, maintaining a 2-inch minimum clearance from post flange to edge of pad. Avoid placement on front of pad.

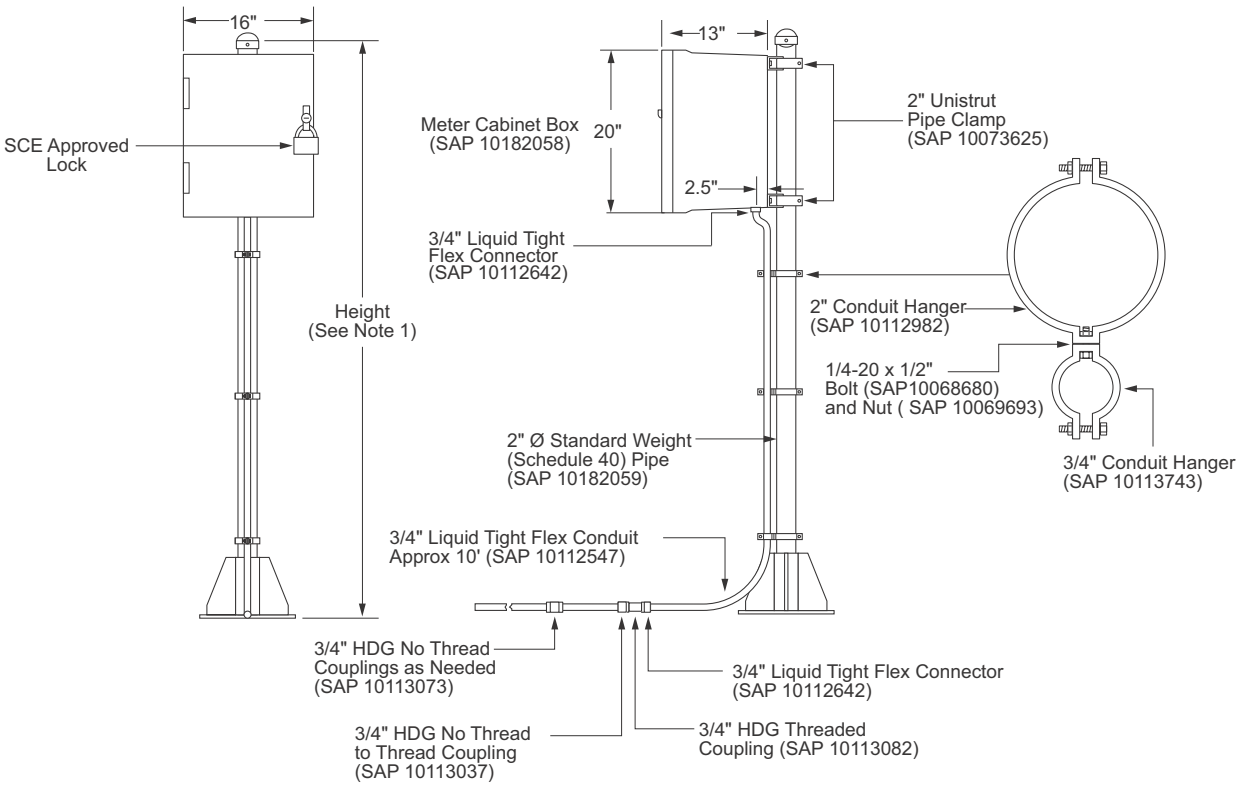
Figure AP 105–4: Pad-Mount Post Assembly Installed on Transformer Flange (Side View) — BEAM CLAMP OPTION

Note(s):

1. This option can be applied when there is insufficient space on the pad to allow the conduit to be anchored to it. The Pad-Mount transformer flange shall be used to attach 2 Beam Clamps with Conduit Hangers to support the 3/4” HDG conduit.
   The material needed for the attachment are:

Beam Clamp	SAP 10112968
3/4" Conduit Hanger	SAP 10113743
1/4-20 x 3/4" Round Head Screw, Steel	SAP 10073443
1/4" ID, Split Lock Washer, Cadmium Plated Steel	SAP 10072310

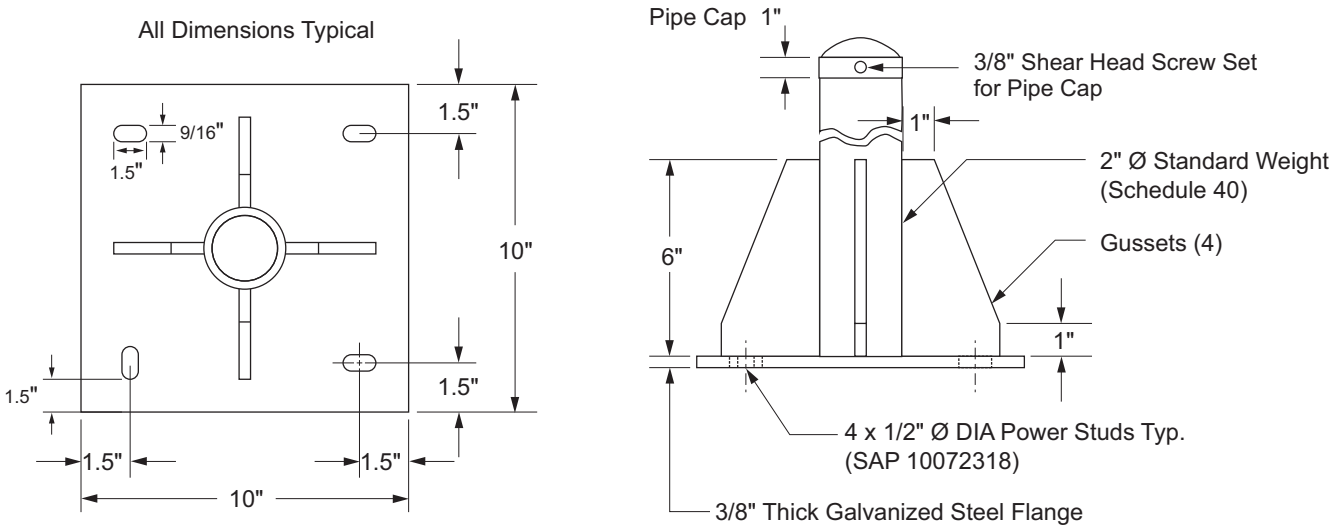
Figure AP 105–5: Pad-Mount Post Assembly Detail



Note(s):

1. Cabinet height shall have the lowest visibility while maintaining RF signal path above the transformer, as deteremined by Grid Services Advanced Metering Operations (AMO) and provided in their installation request.

Figure AP 105–6: Post Flange (SAP 10182059)



Note(s):

1. The underground communication post shall only be installed and anchored onto a transformer concrete pad using 1/2" concrete anchor bolts.

Scope AP 105.3 SmartConnect Communication Devices

Figure AP 105–7: Cell Relay Connection to A-Base Adapter

Figure AP 105–8: Range Extender

Figure AP 105–8.1 HW 2.0

Figure AP 105–8.2 HW 3.1

Note(s):

1. The Socket Based Cell Relay is energized by using two phase conductors connected to the line side of the A-Base Socket Adapter (no load side wiring). No neutral connection is required.
2. The RFLAN Range Extender (RRE) is energized by using the phase and neutral conductors.
3. The underground communication post shall only be installed and anchored onto a transformer concrete pad using 1/2" concrete anchor bolts. The communication device enclosure shall be rotated in the appropriate direction to receive optimal signal.
4. Run three #8 AWG TW-insulated wires and one #8 AWG bare solid copper wire from transformer to SmartConnect communication device enclosure.
   a. For Range Extender, connect the phase and neutral wires, [120V (one black, SAP 10109744 and one white, SAP 10109763)].
   b. For Socket Base Cell Relay in A-Base Adapter (SAP 10106018), connect using the phase wires (two black wires).
   c. The remaining #8 AWG insulated wire is for future use and should be safe-ended in the device (plastic) enclosure.
   d. Connect #8 AWG bare solid copper wire to case ground in padmount transformer and to the bonding lug in the cabinet.
5. Call Grid Services Advanced Metering Operations (AMO) at (626) 543-6393 upon completion of the installation to validate activation of device on the grid. AMO will require identifying the SmartConnect Cell Relay or Range Extender Unit serial number and SCE structure number. RRE will come with AMO contact decal installed on device. For cell relay, install decal with AMO contact information on back of Meter Cabinet door.
6. When connecting a SmartConnect 240V Range Extender or 240V Cell Relay to an existing 3-Phase, 3-Wire 240 delta padmount transformer, a 2-wire power cable shall be connected phase-to-phase in which one phase is the grounded leg of the 240V delta.

Scope AP 105.4 NetComm Post Mount Packet Router

Figure AP 105–9: NetComm Post Mount Packet Router

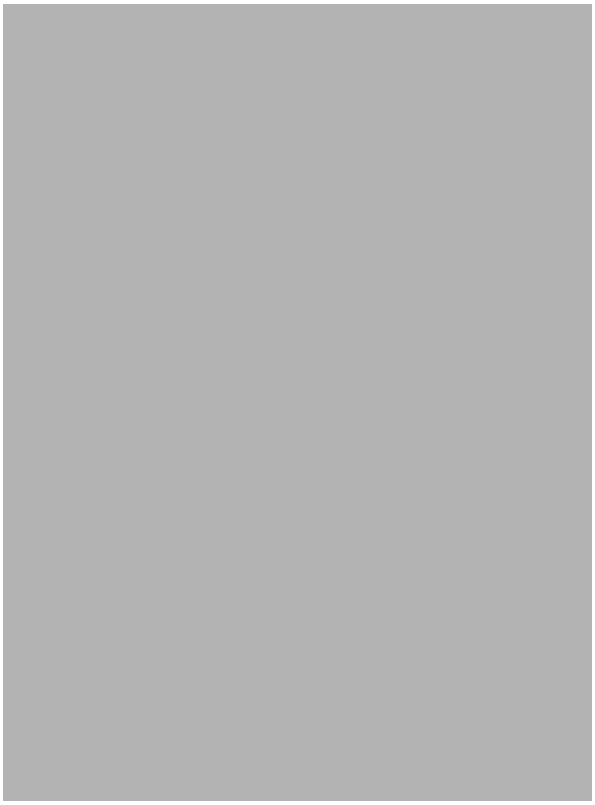


Figure AP 105–9.1 NetComm Packet Router with Battery

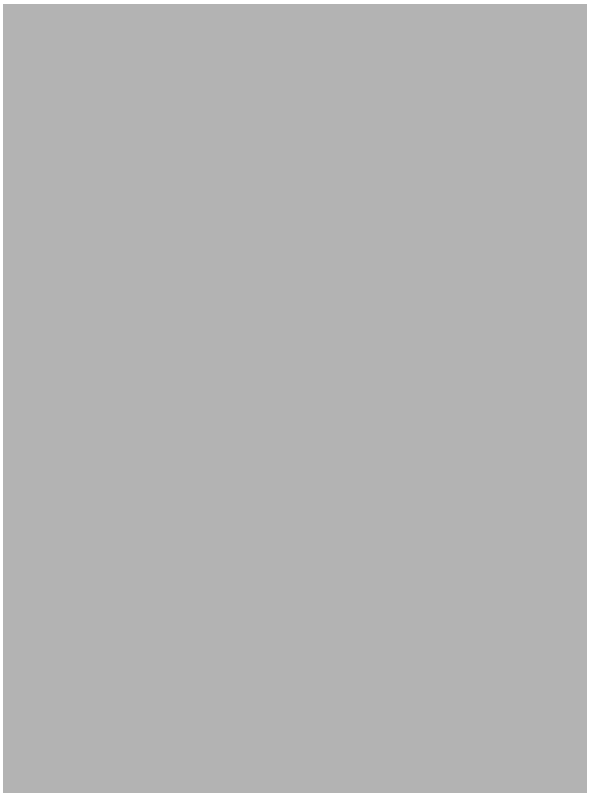


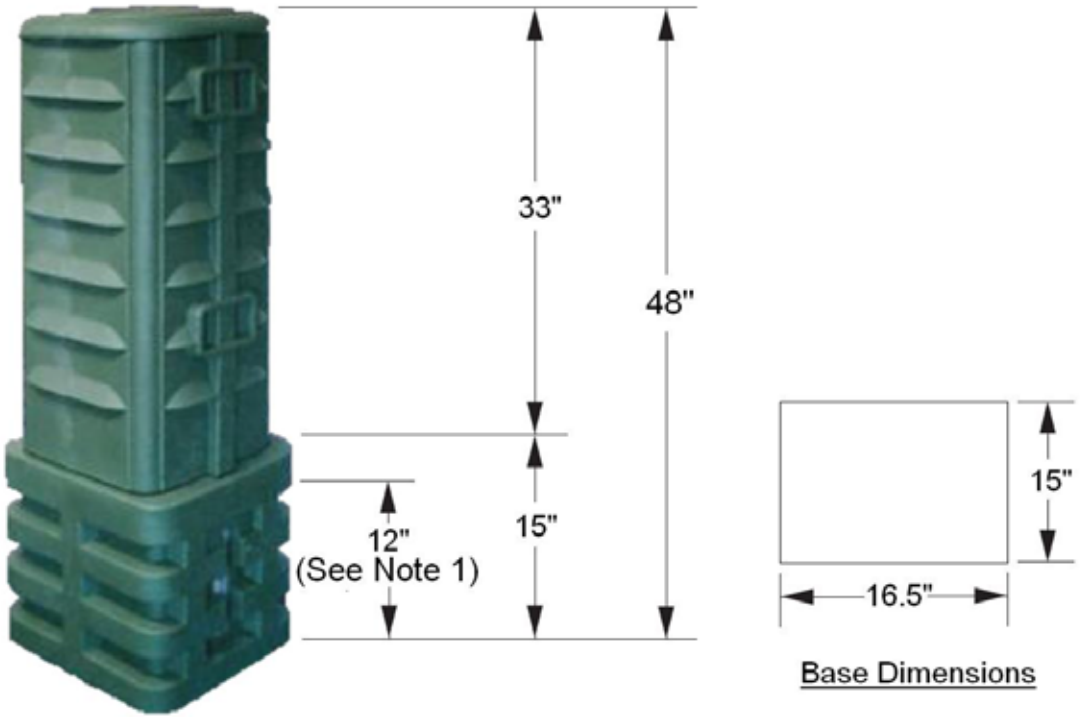
Figure AP 105–9.2 NetComm Packet Router without Battery

Note(s):

1. Run three #8 AWG TW-insulated wires and one #8 AWG bare solid copper wire from transformer to the terminal blocks and circuit breakers of Packet Router enclosure. Post mount packet router can only be installed in 4 wire scenarios.
   a. The NetCom Packet Router is energized by using the phase and neutral conductors.
   b. The remaining #8 AWG insulated wire is for the AC outlet and should be connected to the circuit breaker connected to the AC outlet.
   c. Connect #8 AWG bare solid copper wire to case ground in padmount transformer and to the bonding lug in the cabinet.
2. Call GSOC (Grid Service Operation Center) at (626)-588-4598 upon completion of the installation to validate activation of device on the Network. GSOC will require identifying the NetComm Packet Router by radio serial number (on top of radio, LT-80######) and SCE structure number. Install decal with NetComm contact information on back of enclosure door.

Scope AP 105.5 SmartConnect Underground Communication Pedestal Assembly Configuration

Figure AP 105–10: SmartConnect Semi-Buried Pedestal (SAP 10182060)



Note(s):
1. The semi-buried pedestal base shall be buried 12-inches below grade.

Figure AP 105–11: Lockable Pedestal Cover

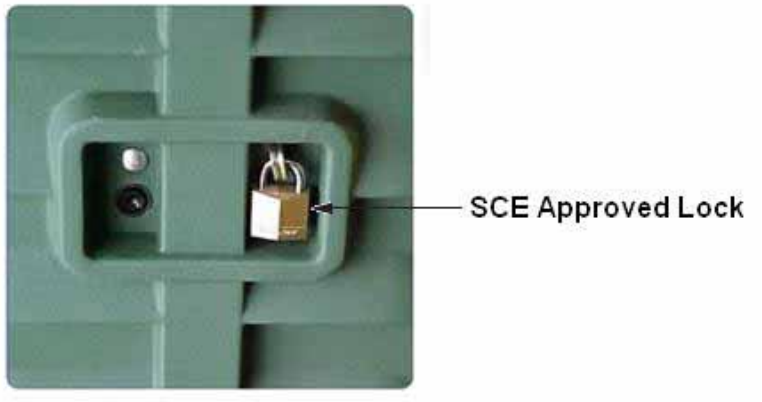


Figure AP 105–12: Cell Relay Mounted in Pedestal

Note(s):

1. For SBCR installation, install two short #8 leads in the line side connection of the A-base adaptor. Connect both phase wires of the service to the two # 8 leads, and safe end the neutral. (Neutral will be needed for replacement device.)
2. One ground rod is required for this pedestal installation.
3. Orientation of the Socket Based Cell Relay or Range Extender and its pedestal shall be determined by Grid Services Advanced Metering Operations (AMO) and provided in their installation request.

Figure AP 105–13: Pedestal Grounding

Attach bond wire for A-Base adaptor to ground bus.

Note(s):

1. The Socket Based Cell Relay is energized by using two phase conductors connected to the line side of the “A”-Base Socket Adapter (no load side wiring). No neutral connection is required.
2. The RFLAN Range Extender (RRE) is energized by connection of the service’s phase and neutral conductors. Safe-end the unused cable.
3. The Pedestal shall be installed so that the SCE name-plate faces the street.
4. Run two 1/0 and one #2 AWG aluminum service wires from source to SmartConnect communication enclosure.
   a. For Range Extender, connect phase to neutral (120V). Remaining phase wire is for future use and should be safe-ended.
   b. For Socket Base Cell Relay in A-Base Adapter (SAP 10106018), connect phase to phase (208 or 240 V). Remaining neutral wire is for future use and should be safe-ended.
5. Run #6 AWG bare solid copper wire from pedestal ground buss to pedestal grounding rod.
6. Call Grid Services Advanced Metering Operations (AMO) at (626) 543-6393 upon completion of the installation to validate activation of device on the grid. AMO will require identifying the SmartConnect Cell Relay or Range Extender Unit serial number and SCE structure number. RRE will come with AMO contact decal installed on device. For cell relay, install decal with AMO contact information on back panel of pedestal.
7. If the source transformer is 277/480 V, see DUG TX 250 for step-down transformer.
8. When connecting a SmartConnect 240V Range Extender or 240V Cell Relay to an existing 3-Phase, 3-Wire 240 delta padmount transformer, a 2-wire power cable shall be connected phase-to-phase in which one phase is the grounded leg of the 240V delta.

Figure AP 105–14: 120 V RRE (HW 3.1) Mounted in a Pedestal Range Extender

External Antenna Alignment

Install the RRE with the power cord and connector port oriented straight down, and the external antenna with the elbow adapter on the left side of the unit as illustrated in Figure AP 105-13. Ensure that the external antenna is aligned straight up towards the sky, unless otherwise stated within the instructions. The external antenna has an attached elbow adapter which allows the antenna to be rotated up, down, or 360 degrees around its axis.

Antenna Orentation

In some rare cases, the pedestal with the RRE installed, may be situated at a higher elevation than one or more of the target endpoint meters, requiring the RRE's external antenna to be aligned vertically straight down towards the ground for optimum signal propagation. See Figure AP 105-14. This scenario will be the exception so unless specified in the job instructions, place the antenna in the upward posistion. Hand tighten the antenna elbow connector snugly, to secure the vertical angle.

Figure AP 105–15: 120V RRE (HW 3.1) Mounted in Pedestal (Downward Facing Antenna)

Underground Communication Devices – Materials

Table AP 105–1: Socket Base Cell Relay (SBCR), NetComm Packet Router, or RFLAN Range Extender (RRE) Options

Item	SAP Number	Unit	Quantity	Description[a/]
1	10171529	EA	1	CDMA (Verizon) Cell Relay (UG-HW2.0)
2	10171539	EA	1	GSM (AT&T) Cell Relay (UG-HW2.0)
3	10182194	EA	1	SmartConnect Range Extender Unit, 120 V (HW 2.0)
4	10209413	EA	1	SmartConnect Range Extender Unit, 240 V (HW 2.0)
5	10209422	EA	1	SmartConnect Range Extender Unit 120 V (HW 3.1)
6	10212979	EA	1	NetComm Post Mount Cabinet without Battery
7	10212980	EA	1	NetComm Post Mount Cabinty with Battery
8	10175268	EA	1	NetComm IWR Radio

[a/] Only one SBCR or RRE is required for each installation.

Table AP 105–2: Materials for SBCR, NetComm Packet Router, or RRE in Pad-Mount Post Installations

Item	SAP Number	Unit	Quantity	Description
1	10109744	FT	40	#8 AWG TW black insulated wire
2	10109763	FT	20	#8 AWG TW white insulated wire
3	10109323	FT	20	#8 AWG bare solid copper ground wire
4	10182058	EA	1	Meter Cabinet Box (for SBCR and RRE only)
5	10182059	EA	1	SmartConnect 2” Post w/ Flange
6	10112989	EA	4	3/4” HDG 2-hole Pipe Straps
7	10072320	EA	8	1/4” concrete anchors, stud type
8	10113073	FT	10	3/4” HDG Conduit
9	10112642	EA	3	3/4” Liquid Tight Flex Connectors
10	10112547	FT	12	3/4” Liquid Tight Flex Conduit
11	10072318	EA	4	1/2” concrete anchors, stud type
12	10112806	EA	1	90-degree connector
13	10113367	EA	2	2 1/2” to 3/4” reducing washers
14	10073625	EA	2	2” Unistrut pipe clamps
15	10112982	EA	3	2” Conduit Hangers
16	10113743	EA	3	3/4” Conduit Hangers
17	10068680	EA	6	1/4-20 x 1/2” bolts
18	10089193	EA	6	1/4-20 nuts
19	10113082	EA	2	3/4” threaded couplings
20	10113171	EA	1	3/4” grounding bushing
21	10113037	EA	1	3/4” No thread to thread coupling

Table AP 105–2: Materials for SBCR, NetComm Packet Router, or RRE in Pad-Mount Post Installations *(Continued)*

Item	SAP Number	Unit	Quantity	Description
22	10106018	EA	1	A-Base Adapter (for SBCR)
23	10171833	EA	1	Cable, Electric 2 Conductor. 12', 2 Pin Female to Un-terminated End (for RRE)
24	10207968	EA	1	Mounting Kit (for RRE)
25	10208918	EA	1	Cable Electric 3 Conductor, 12', 3 Pin Female to Unterminated End (For HW 3.1 RRE)
26	10127348	EA	1	Connector Adapter, Right Angle, N-Male to N-Female

Table AP 105–3: SAP Numbers for Socket Base Cell Relay (SBCR) or RFLAN Range Extender (RRE) for Pedestal Installation (Alternate)

Item	SAP Number	Unit	Quantity	Description
1	10110161	FT	20	Conductor, UG, 2-1/0 and 1-#2 CLP
2	10109315	FT	20	#6 AWG bare solid copper ground wire
3	10182060	EA	1	Metering Pedestal
4	10068435	EA	1	5/8" x 8' Ground Rod
5	10111635	EA	1	Grounding Clamp
6	10106018	EA	1	A-Base Adapter (for SBCR)
7	10171833	EA	1	Cable, Electric 2 Conductor, 12', 2 Pin Female to Un-terminated End (for HW 2.0 RRE)
8	10207968	EA	1	Mounting Kit (for RRE)
9	10208918	EA	1	Cable, Electric 3 Conductor, 12', 3-Pin Female to Unterminated End (For HW 3.1 RRE)
10	10127348	EA	1	Connector Adapter, Right Angle, N-Male to N-Female

Table AP 105–4: Additional Materials Required for 120V RRE or NetComm Packet Router Served from 120/208V or 120/240V Transformers

Item	SAP Number	Unit	Quantity	Description
1	10107492	EA	1	Fuse Holder, In Line, 20 Amps
2	10107730	EA	1	Fuse, 10 Amp, Cartridge Type

Table AP 105–5: Additional Materials Required for 240V SBCR, NetComm Packet Router, Served from 120/208V or 120/240V Transformers

Item	SAP Number	Unit	Quantity	Description
1	10107492	EA	2	Fuse Holders, In Line, 20 Amps
2	10107730	EA	2	Fuses, 10 Amp, Cartridge Type

Table AP 105–6: Additional Materials Required for Communication Device Served from 277/480V Transformers

Item	SAP Number	Unit	Quantity	Description
1	10105073	EA	1	Transformer 1 kVA, 277V – 120/240V

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AP 108 Underground Communication Devices - Socket Based Router

Scope AP 108.1 Underground Communication Devices - Socket Based Router - General

1.0 General Information

The Underground Communication assembly is used to support Socket Based Router (SBR), from an underground 208, or 240 V source feed.

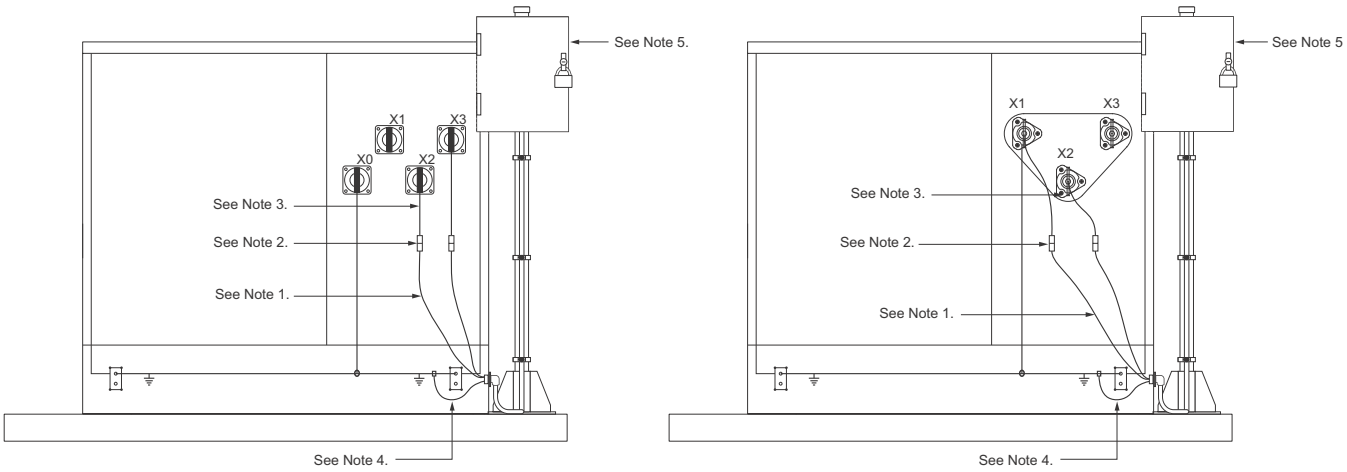
2.0 Application

The pad-mount post shall be installed and anchored on a transformer concrete pad or concrete slab box. If the transformer is on a polymer pad, contact Distribution Civil/Structural group for guidance with the installation of the post.

SmartConnect Semi-Buried Pedestal base shall be buried at 12 inches below grade.

Scope AP 108.2 Underground Communication - Socket Based Router - Pad-mount Post Assembly Configuration

Figure AP 108–1: Connection to Serve Pad-mount Post Assembly Installed on Transformer Concrete Pad (Front View)

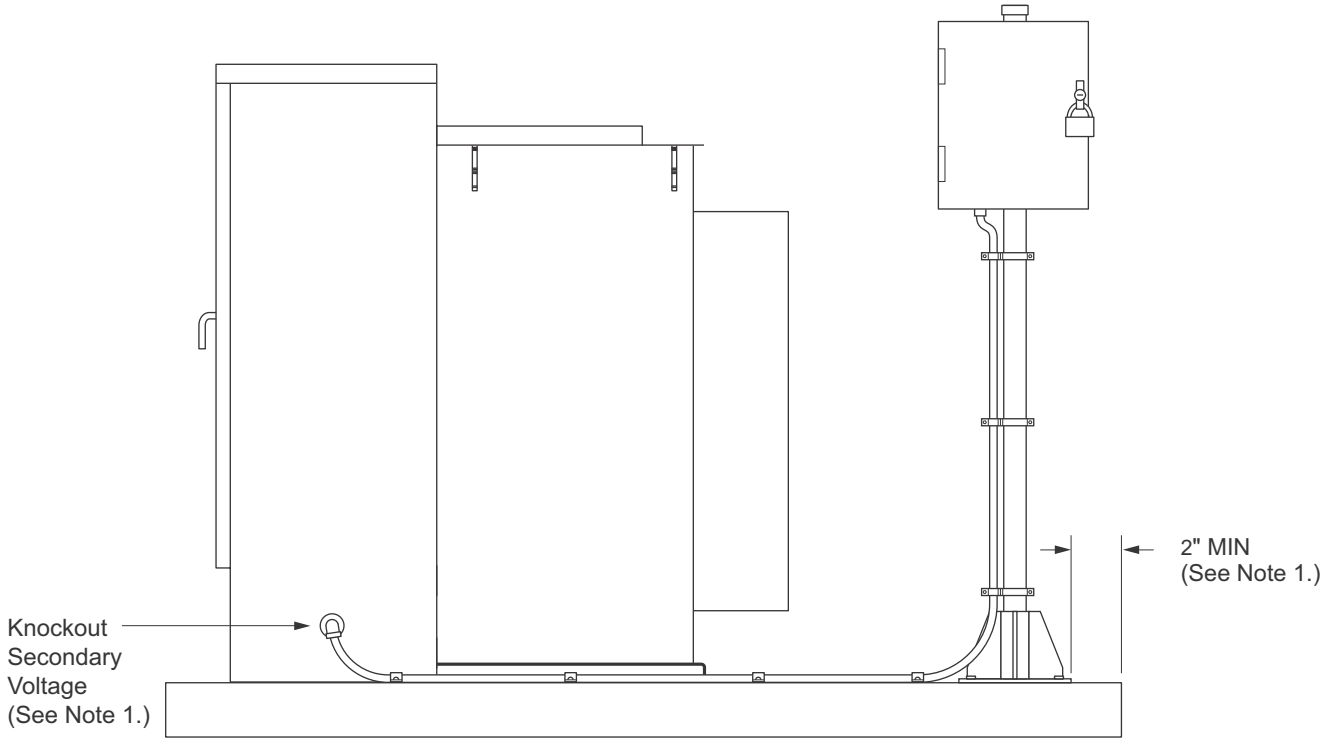


208Y/120 4-Wire **240V 3-Wire**

Note(s):

1. Run three #8 AWG TW-insulated wires and one #8 AWG bare solid copper wire from transformer to SmartConnect communication device enclosure
   a. For 240 V SBR in A-Base Adapter (SAP 10106018), connect both phase wires to the A-base terminal (two black wires).
   b. The remaining #8 AWG insulated wire is for future use and should be safe-ended in the device (plastic) enclosure. Connect bare solid copper wire to case ground in pad-mount transformer and to bonding lug in the cabinet.
2. Connect two in-line fuse-holders, SAP 10107492. Use 10-amp fuses, SAP 10107730.
3. Connect #8 AWG wires with ring terminals, SAP 10111079, to threaded ‘everdur’ bolts.
4. Run #6 AWG bare solid copper wire (SAP 10109324) from conduit grounding bushing to transformer ground bus inside transformer.
5. If the source transformer is 277/480 V, see DUG TX 250 for step-down transformer.
6. When connecting a Socket Based Relay to an existing 3-Phase, 3-Wire 240 delta padmount transformer, a 2-wire power cable shall be connected phase-to-phase in which one phase is the grounded leg of the 240V delta.

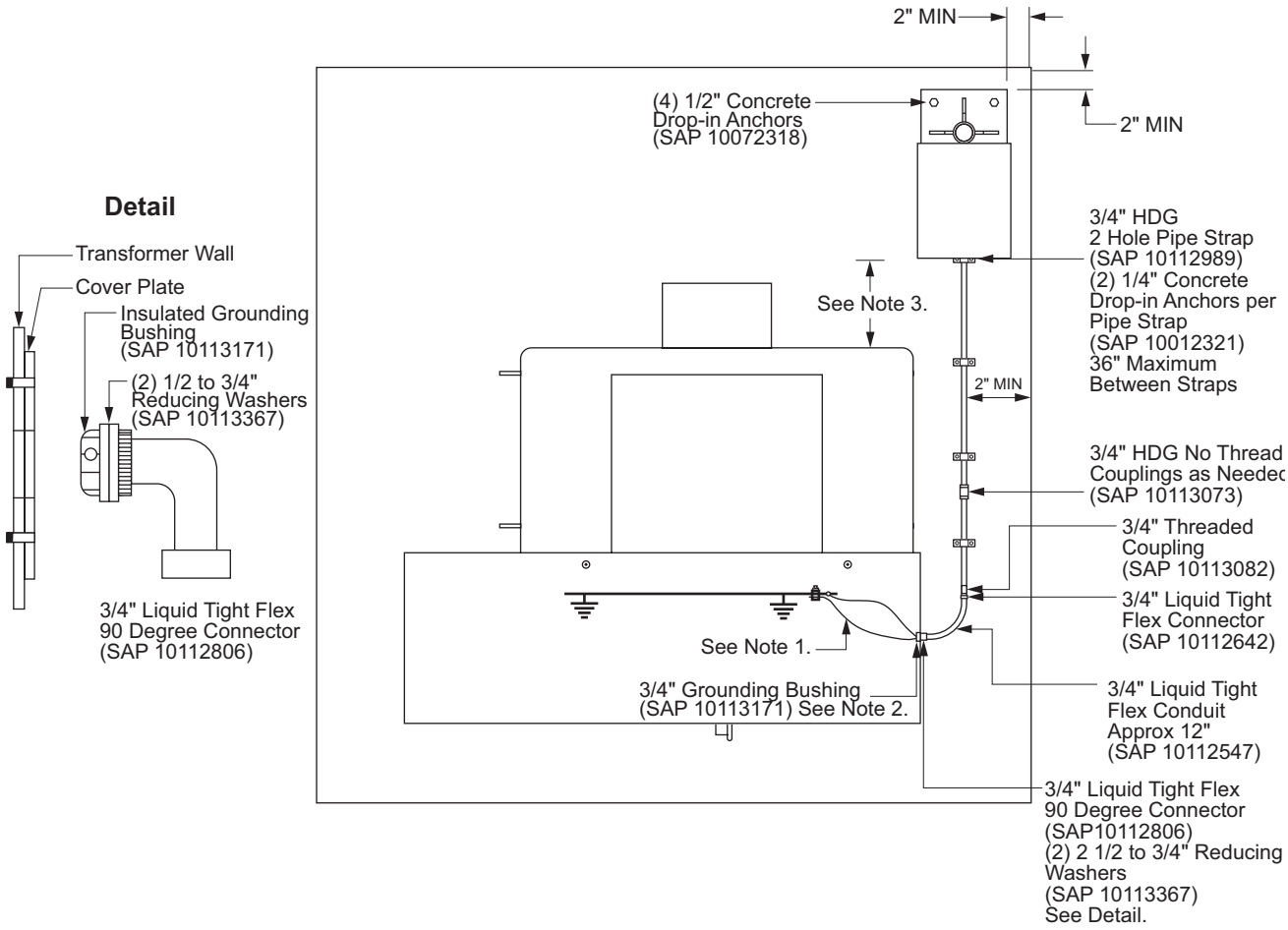
Figure AP 108–2: Pad-Mount Post Assembly Installed on Transformer Concrete Pad (Side View)



Note(s):

1. The mounting post shall be as close as possible to the low voltage knockout. However, the post may be installed on either side or back of the concrete pad, maintaining a 2-inch minimum clearance from post flange to edge of pad. Avoid placement on front of pad.

Figure AP 108–3: Pad-Mount Post Assembly Installed on Transformer Concrete Pad (Top View)



Note(s):

1. Run #6 AWG bare solid copper wire (SAP 10109324) from conduit ground bushing to ground bus inside transformer.
2. Use 3/4” grounding bushing on conduit fitting inside transformer, SAP 10113171.
3. Allow minimum door width clearance for device (plastic) enclosure, including clearance for single phase pad mounted transformers to open.
4. The post shall be as close as possible to the low voltage knockout. However, the post may be installed on either side or back of concrete pad, maintaining a 2-inch minimum clearance from post flange to edge of pad. Avoid placement on front of pad.

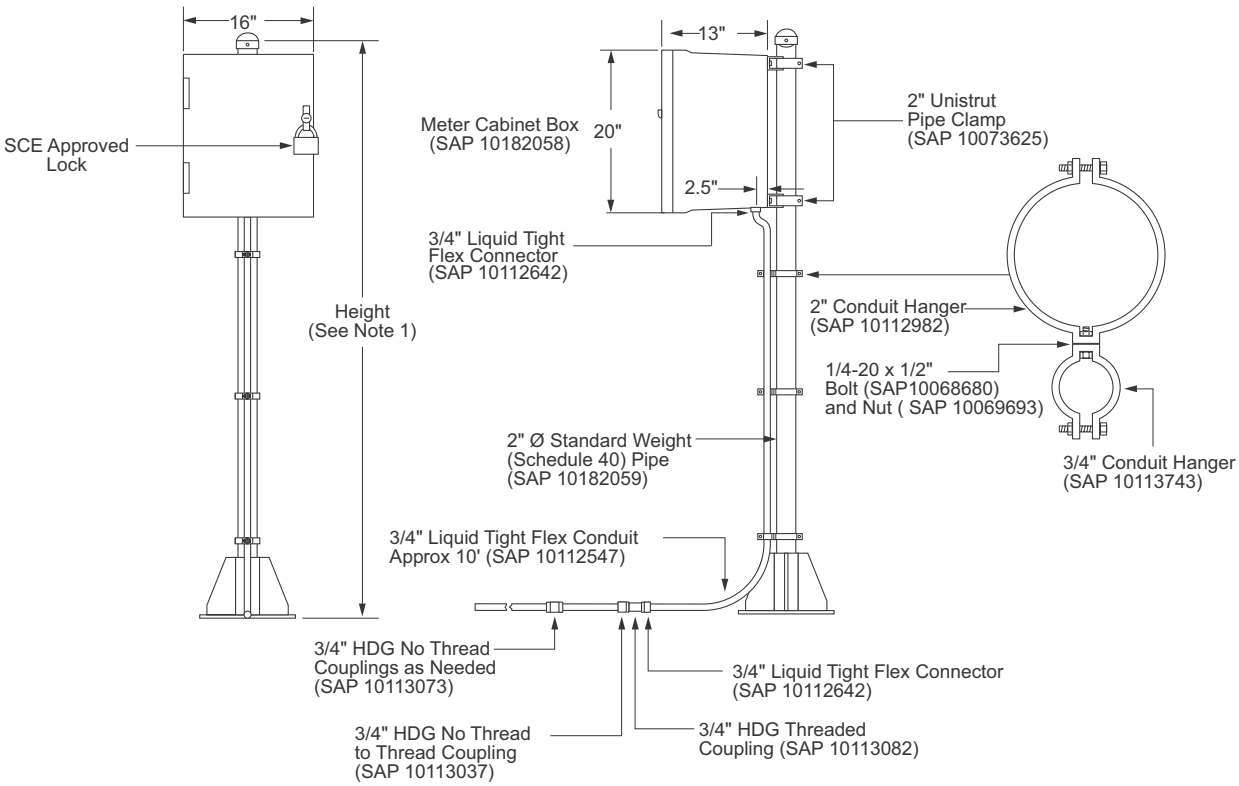
Figure AP 108–4: Pad-Mount Post Assembly Installed on Transformer Flange (Side View) — BEAM CLAMP OPTION

Note(s):

1. This option can be applied when there is insufficient space on the pad to allow the conduit to be anchored to it. The Pad-Mount transformer flange shall be used to attach 2 Beam Clamps with Conduit Hangers to support the 3/4" HDG conduit.
   The material needed for the attachment are:

Beam Clamp	SAP 10112968
3/4" Conduit Hanger	SAP 10113743
1/4-20 x 3/4" Round Head Screw, Steel	SAP 10073443
1/4" ID, Split Lock Washer, Cadmium Plated Steel	SAP 10072310

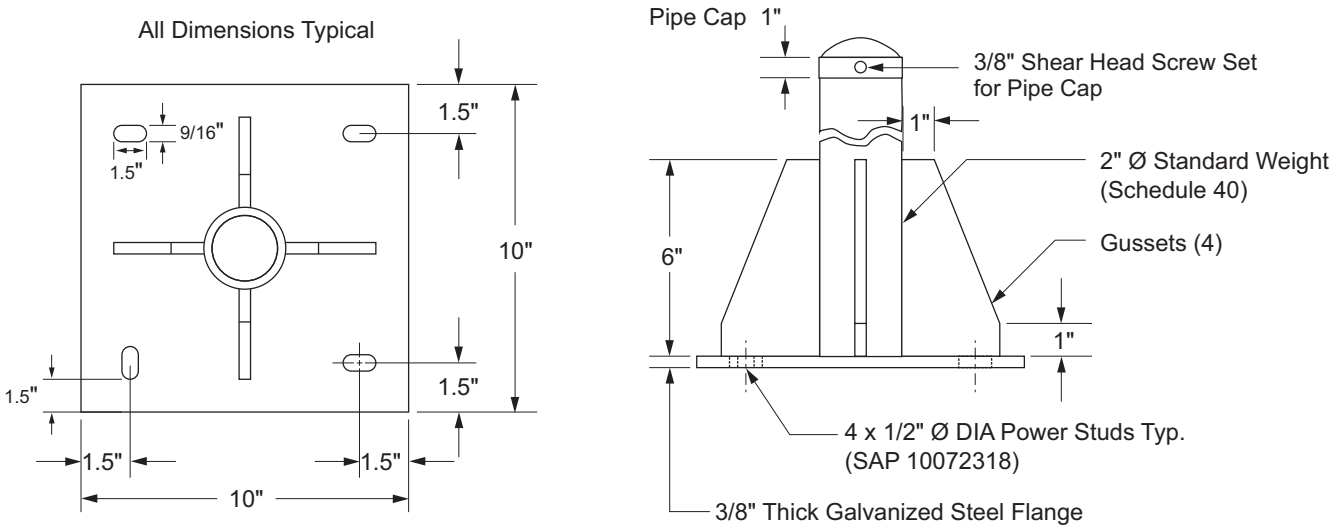
Figure AP 108–5: Pad-Mount Post Assembly Detail



Note(s):

1. Cabinet height shall have the lowest visibility while maintaining RF signal path above the transformer.

Figure AP 108–6: Post Flange (SAP 10182059)



Note(s):

1. The underground communication post shall only be installed and anchored onto a transformer concrete pad using 1/2" concrete anchor bolts.

Scope AP 108.3 Socket Based Router Cabinet Assembly Configuration

Figure AP 108–7: SBR Connection to A-base Adapter

Figure AP 108–7.1

Figure AP 108–7.2

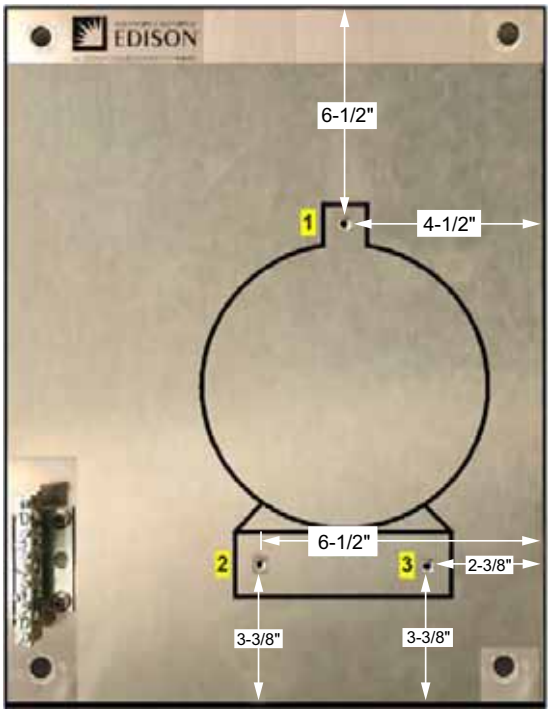


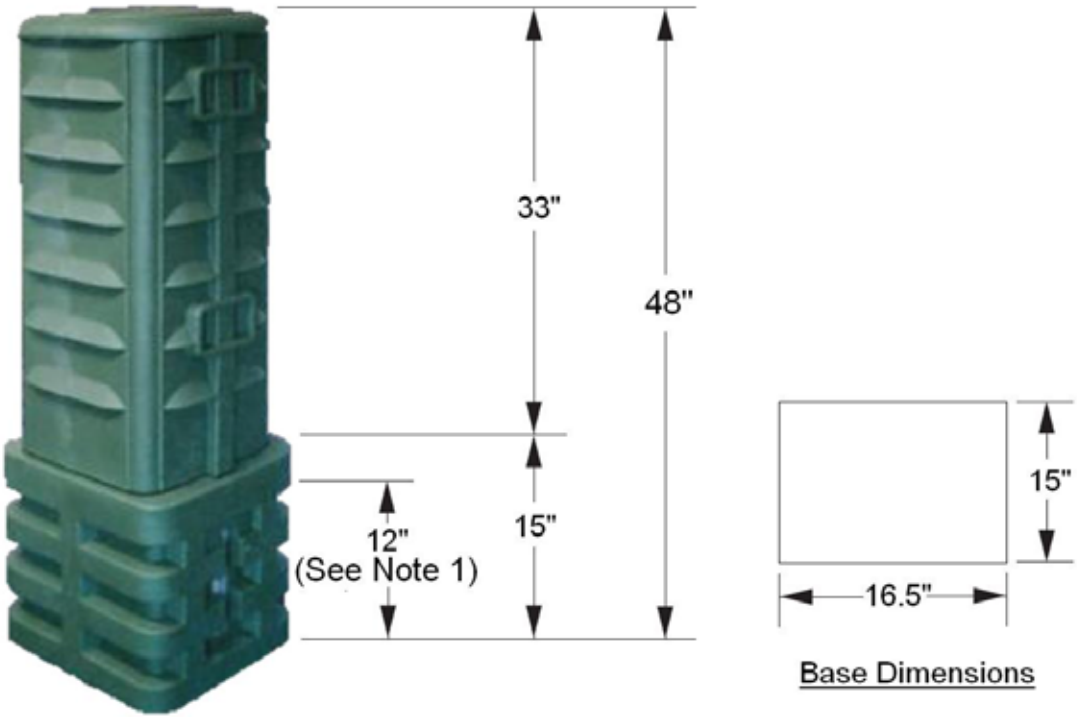
Figure AP 108–7.3

Note(s):

1. The SBR is energized by using two phase conductors connected to the line side of the A-Base Socket Adapter installed on the newly-stenciled template to the right and down from center (no load side wiring). No neutral connection is required. Refer to Figure AP-108-7.3 for location of socket adapter.
2. The A-Base socket adapter to be energized, plated off and sealed. The SBR is to be installed later by a Meter Technician.
3. The underground communication post shall only be installed and anchored onto a transformer concrete pad using 1/2” concrete anchor bolts.
4. Run three #8 AWG TW-insulated wires and one #8 AWG bare solid copper wire from transformer to SmartConnect communication device enclosure.
   a. For SBR in A-Base Adapter (SAP 10106018), connect using the phase wires (two black wires).
   b. The remaining #8 AWG insulated wire is for future use and should be safe-ended in the device (plastic) enclosure.
   c. Connect #8 AWG bare solid copper wire to case ground in padmount transformer and to the bonding lug in the cabinet.
5. Install decal with AMO contact information on back of SBR Cabinet door.
6. When connecting a SmartConnect 240V SBR to an existing 3-Phase, 3-Wire 240 delta padmount transformer, a 2-wire power cable shall be connected phase-to-phase in which one phase is the grounded leg of the 240V delta.

Scope AP 108.4 SmartConnect Underground Communication Pedestal Assembly Configuration

Figure AP 108–8: SmartConnect Semi-Buried Pedestal (SAP 10182060)



Note(s):
1. The semi-buried pedestal base shall be buried 12-inches below grade.

Figure AP 108–9: Lockable Pedestal Cover

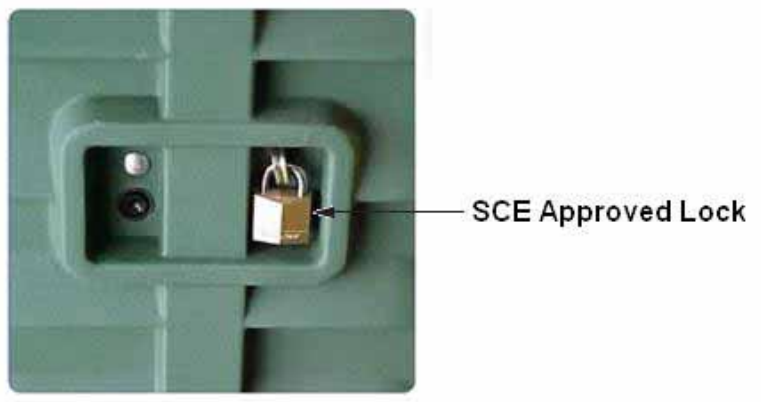


Figure AP 108–10: Socket-Based Router Mounted Pedestal

Figure AP 108–10.1

Figure AP 108–10.2

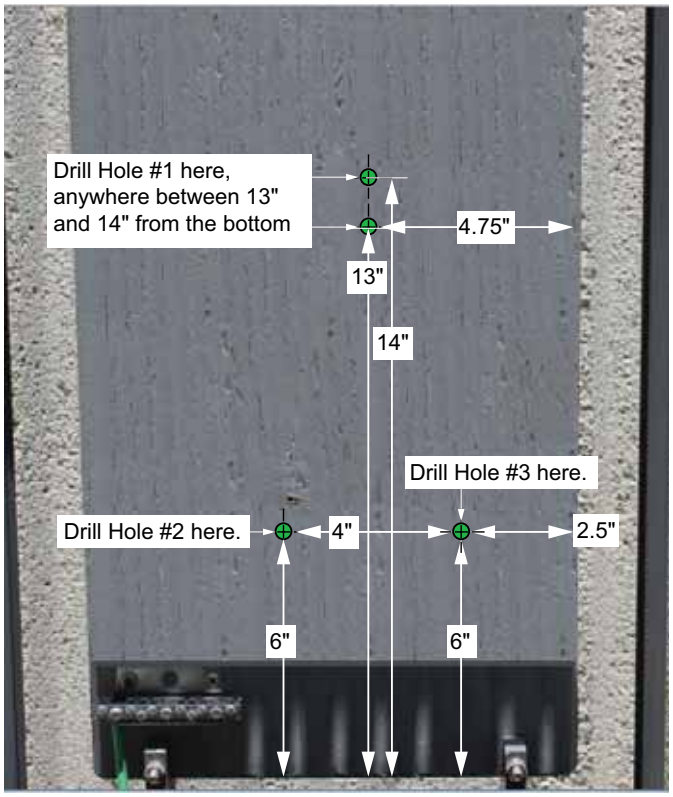


Figure AP 108–10.3

Note(s):

1. For SBR installation, install A-base adapter in the new location. Use Figure AP 108-10.3 as a guide if the new location is not stenciled on the backplate of the pedestal. Install two short #8 leads in the line side connection of the A-base adapter. Connect both phase wires of the service to the two # 8 leads, and safe end the neutral.
2. One (1) ground rod is required for this pedestal installation.

Figure AP 108–11: Pedestal Grounding

Attach bond wire for A-Base adapter to ground bus.

Note(s):

1. The SBR is energized by using two phase conductors connected to the line side of the “A”-Base Socket Adapter installed the right and down from center (no load side wiring). No neutral connection is required.
2. The A-Base socket adapter to be energized, plated off and sealed. The SBR is to be installed later by a Meter Technician.
3. The Pedestal shall be installed so that the SCE name-plate faces the street.
4. Run two 1/0 and one #2 AWG aluminum service wires from source to SmartConnect communication enclosure. For SBR in A-Base Adapter (SAP 10106018), connect phase to phase (208 or 240 V). Remaining neutral wire is for future use and should be safe-ended.
5. Run #6 AWG bare solid copper wire from pedestal ground buss to pedestal grounding rod.
6. Install decal with AMO contact information on back panel of pedestal.
7. If the source transformer is 277/480 V, see DUG TX 250 for step-down transformer.
8. When connecting a SmartConnect 240V SBR to an existing 3-Phase, 3-Wire 240 delta padmount transformer, a 2-wire power cable shall be connected phase-to-phase in which one phase is the grounded leg of the 240V delta.

Socket Based Router – Materials

Table AP 108–1: SBR (Socket-Based Router)

Item	SAP Number	Unit	Quantity	Description
1	10212250	EA	1	(Verizon) Socket Based Router (SBR)
1	10212262	EA	1	(AT&T) Socket Based Router (SBR)
2	10212261	EA	1	Base Meter (required for both Verizon and AT&T SBR)

NOTE

Only one SBR and Base Meter is required per installation.

Table AP 108–2: Materials for SBR in Pad-Mount Post Installations

Item	SAP Number	Unit	Quantity	Description
1	10109744	FT	40	#8 AWG TW black insulated wire
2	10109763	FT	20	#8 AWG TW white insulated wire
3	10109323	FT	20	#8 AWG bare solid copper ground wire
4	10182058	EA	1	Meter Cabinet Box (for SBR)
5	10182059	EA	1	SmartConnect 2” Post w/ Flange
6	10112989	EA	4	3/4” HDG 2-hole Pipe Straps
7	10072320	EA	8	1/4” concrete anchors, stud type
8	10113073	FT	10	3/4” HDG Conduit
9	10112642	EA	3	3/4” Liquid Tight Flex Connectors
10	10112547	FT	12	3/4” Liquid Tight Flex Conduit
11	10072318	EA	4	1/2” concrete anchors, stud type
12	10112806	EA	1	90-degree connector
13	10113367	EA	2	2 1/2” to 3/4” reducing washers
14	10073625	EA	2	2” Unistrut pipe clamps
15	10112982	EA	3	2” Conduit Hangers
16	10113743	EA	3	3/4” Conduit Hangers
17	10068680	EA	6	1/4 - 20 x 1/2” bolts
18	10089193	EA	6	1/4 - 20 nuts
19	10113082	EA	2	3/4” threaded couplings
20	10113171	EA	1	3/4” grounding bushing
21	10113037	EA	1	3/4” No thread to thread coupling
22	10106018	EA	1	A-Base Adapter (for SBR)
23	10115546	EA	1	Meter Lock Ring

Table AP 108–3: SAP Numbers for Socket Based Router (SBR) for Pedestal Installation

Item	SAP Number	Unit	Quantity	Description
1	10110161	FT	20	Conductor, UG, 2-1/0 and 1-#2 CLP
2	10109315	FT	20	#6 AWG bare solid copper ground wire
3	10182060	EA	1	Metering Pedestal
4	10068435	EA	1	5/8” x 8’ Ground Rod
5	10111635	EA	1	Grounding Clamp
6	10106018	EA	1	A-Base Adapter (for SBR)
7	10171833	EA	1	Cable, Electric 2 Conductor, 12’, 2 Pin Female to Un-terminated End (for HW 2.0 RRE)
8	10115546	EA	1	Meter Lock Ring

Table AP 108–4: Additional Materials Required for 240V SBR Served from 120/208V or 120/240V Transformers

Item	SAP Number	Unit	Quantity	Description
1	10107492	EA	1	Fuse Holder, In Line, 20 Amps
2	10107730	EA	1	Fuse, 10 Amp, Cartridge Type

Table AP 108–5: Additional Materials Required for Communication Devices Served from 277/480V Transformers

Item	SAP Number	Unit	Quantity	Description
1	10105073	EA	1	Transformer 1 kVA, 277V – 120/240V

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AP 110 Live-Front Primary Metering Cabinets for 12 kV and 16 kV System Applications

Scope AP 110.1 Live-Front Primary Metering Cabinets for 12 kV and 16 kV System Applications

1.0 General Information

Primary metering cabinets (live front) are purchased by Edison for use on Added Facility Projects. Approved SAP numbers and descriptions are listed in Table AP 110–1 (Sheet 1).

2.0 SAP Numbers

Table AP 110–1: SAP Numbers for 3-Wire Metering[1/]

SAP Number	Brief Description
10107308	One switch and 2 fuse positions
10107309	Three switches (no fuse positions)
10107336	One switch and one fuse position
10107357	No switch and no fusing
10107331	One switch position (no fuse position)
10107330	Two switches and one fuse position

3-Wire Metering — Detailed Description

SAP 10107308: Pad-mounted with one 600 A gang-operated switch position and two fuse positions with three single-phase fuses; 15 kV Class, 17 kV maximum, 95 kV BIL; supplied with SML-20 fuseholders (200 A maximum), with Unirupter load-break capability

SAP 10107309: Pad-mounted, with three 600 A gang-operated switch positions, 15 kV Class, 17 kV maximum, 95 kV BIL; no fuse positions

SAP 10107336: Pad-mounted, with one 600 A gang-operated switch position, one primary fuse position, 15 kV Class, 17 kV maximum, 95 kV BIL; supplied with SM-20 fuseholders (200 A maximum)

SAP 10107357: Pad-mounted, without switch or fuses, 600 A Bus, 15 kV Class, 17 kV maximum, 95 kV BIL; In-and-out, metering only

SAP 10107331: Pad-mounted with one 600 A gang-operated switch position; 15 kV Class, 17 kV maximum, 95 kV BIL

SAP 10107330: Pad-mounted with two 600 A gang-operated switch positions and one fuse position with three single-phase fuses; 15 kV Class, 17 kV maximum, 95 kV BIL; supplied with SML-20 fuseholders (200 A maximum) with Unirupter load-break capability.

Note(s):

1. All metering cabinets are provided with 15-clip meter sockets for either 3-wire or 4-wire metering, and with a center phase CT bus link bolted in place by the manufacturer. When a 4-wire cabinet is required, it will be almost identical to one of the material coded cabinets in Table AP 110–1 (Sheet 1) above, except that additional internal barriers will be provided internally to accommodate an extra VT and CT. Therefore, when ordering, specify: “similar to SAP 101XXXXX except for 4-wire metering”; the XXXXX will be the SAP number for a cabinet selected from Table AP 110–1 (Sheet 1).
2. Refer to Assembly Kit ZMTR section for information on meters, CTs and PTs.
3. All metering cabinets are supplied with GPO-3 (fiberglass) moisture/animal barrier flooring with 2-1/2 inch and 4 inch holes for cable access.
4. Cabinets with fuse positions are supplied with end fittings for SMU-20 fuses. (Fuses must be ordered separately.)

[1/] See Note 1 below for 4-wire metering.

3.0 References

See UGS SS 590 (Precast Tub-type PMH Structure).

Figure AP 110–1: 15 kV Primary Metering Cabinets for 12/16 System Applications — Outline Drawings

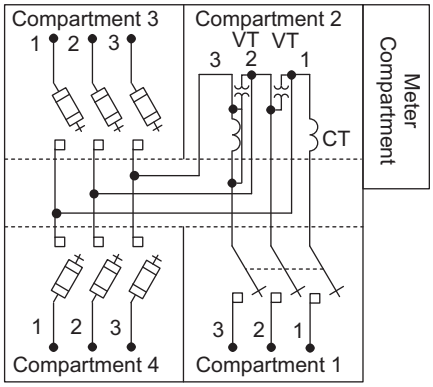

Figure AP 110–1.1: SAP 10107308
(72" x 70" Base)

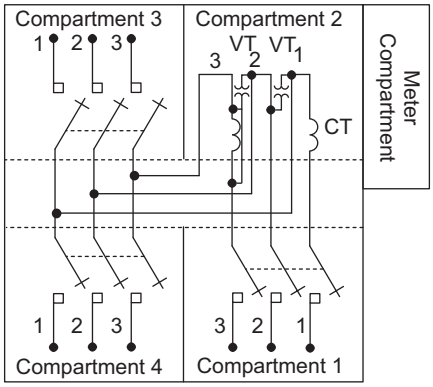

Figure AP 110–1.2: SAP 10107309
(72" x 70" Base)

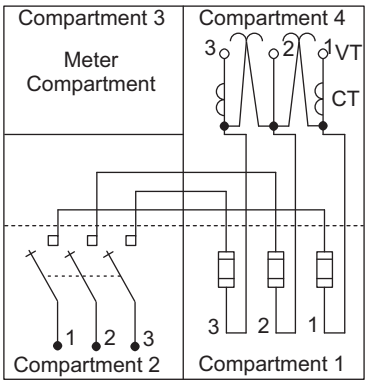

Figure AP 110–1.3: SAP 10107336
(72" x 70" Base)

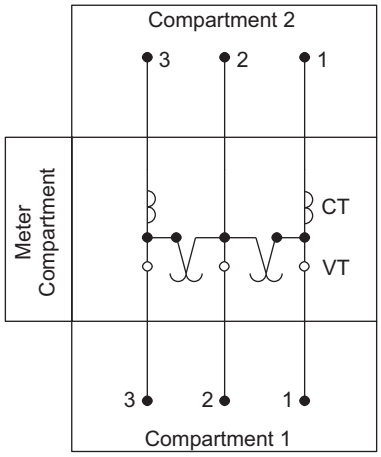

Figure AP 110–1.4: SAP 10107357
(78" x 54" Base)

Figure AP 110–1: 15 kV Primary Metering Cabinets for 12/16 System Applications — Outline Drawings

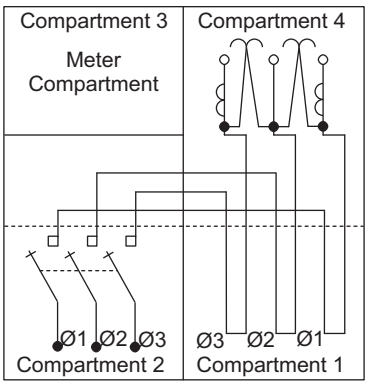

Figure AP 110–1.5: SAP 10107331 (72" x 70" Base)

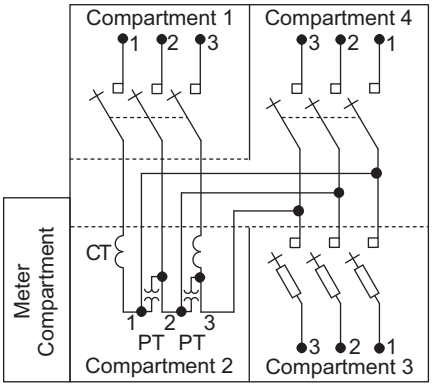

Figure AP 110–1.6: SAP 10107330 (72" x 70" Base)

Figure AP 110–2: 15 kV Primary Metering Cabinets for 12/16 System Applications — One-Line Diagrams

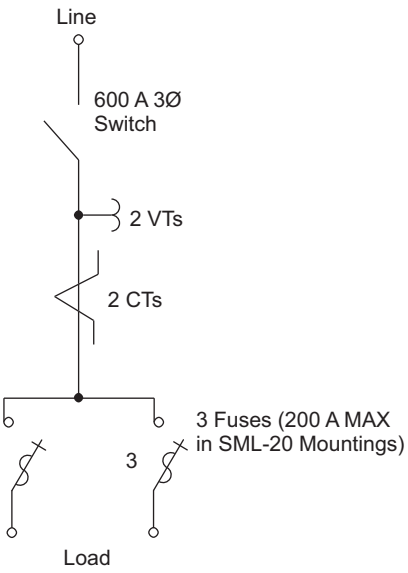

Figure AP 110–2.1: SAP 10107308

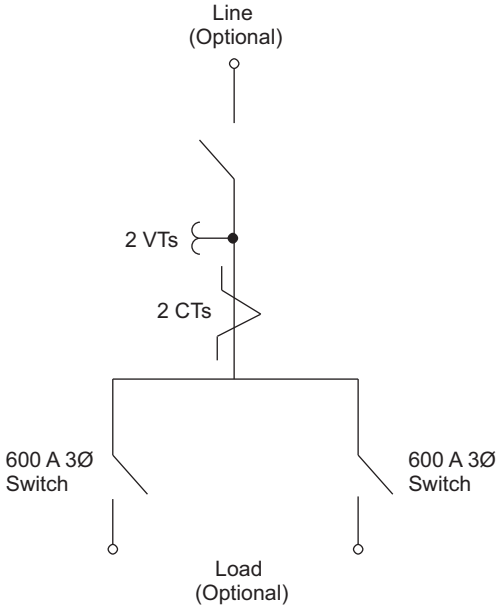

Figure AP 110–2.2: SAP 10107309

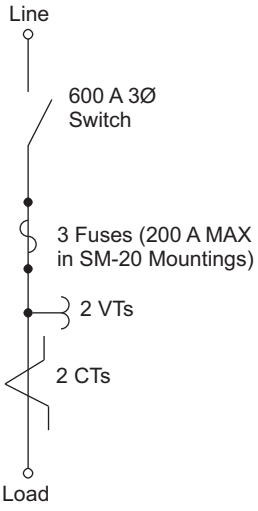

Figure AP 110–2.3: SAP 10107336

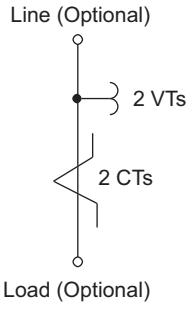

Figure AP 110–2.4: SAP 10107357

Note(s): If the CPT is connected to the SCE system on the supply side of the customer's main service disconnect (or customer's main breaker) within the primary switchboard, the Company shall install a three-phase load-break gang-operated switch ahead of the primary switchboard to avoid any potential ferroresonant condition that may occur while energizing/de-energizing the primary switchboard.

Figure AP 110–2: 15 kV Primary Metering Cabinets for 12/16 System Applications — One-Line Diagrams

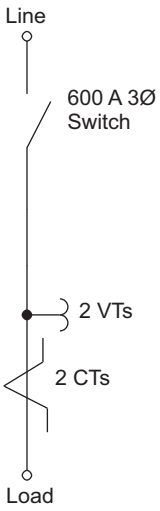

Figure AP 110–2.5: SAP 10107331

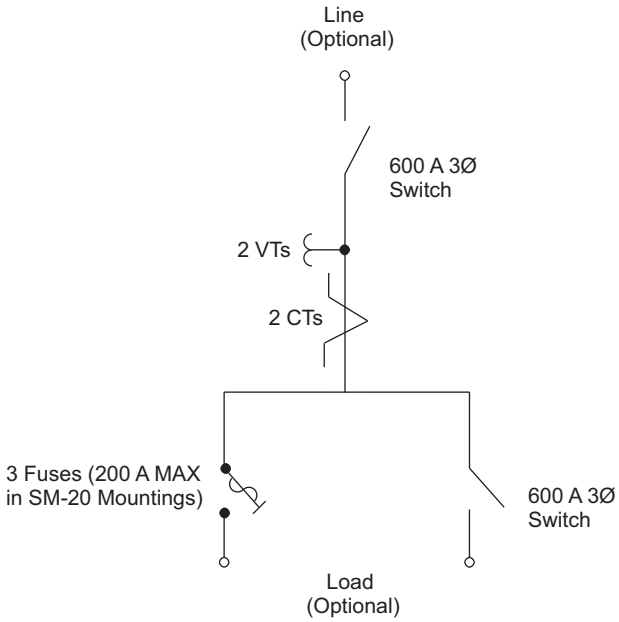

Figure AP 110–2.6: SAP 10107330

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AP 115 Dead-Front Primary Metering Cabinet for 33 kV System Applications

Scope AP 115.1 Dead-Front Primary Metering Cabinet for 33 kV System Applications

1.0 General Information

1.1 The Dead-Front Primary Metering Cabinet (SAP 10179147) for 33 kV applications is purchased by Edison for use on Added Facility Projects. The pad-mounted cabinet does not have switches or fuses, is a 600 A Buss, 600 A bushings, 33 kV Class, 150 kV BIL; In-and-out, metering only. CT's and VT's are not provided with the cabinet and must be ordered separately. Refer to DOH T 62 for CT and VT information.

NOTE Use only solid dielectric CT & VT type.

1.2 Cabinets are provided with 15-clip meter sockets.

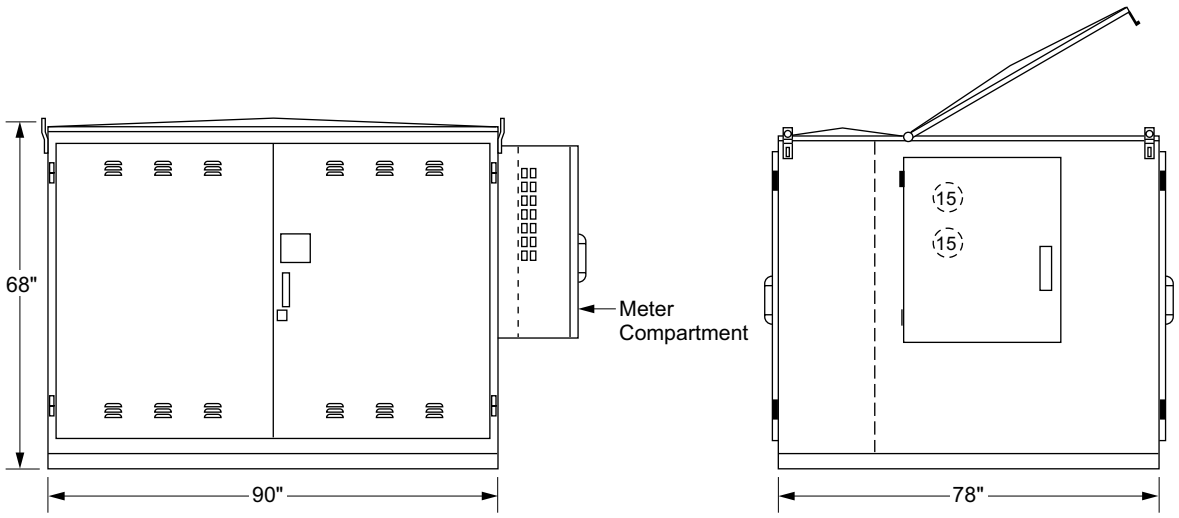
1.3 Line and Load Elbows are connected on the front side. Back side is for CT and VT connections.

1.4 Use swing-up roof to provide easy access for CT and VT installation and connection.

1.5 For general requirements of anchoring, stenciling, and sealing of Pad-Mounted equipment refer to DUG TX 160.

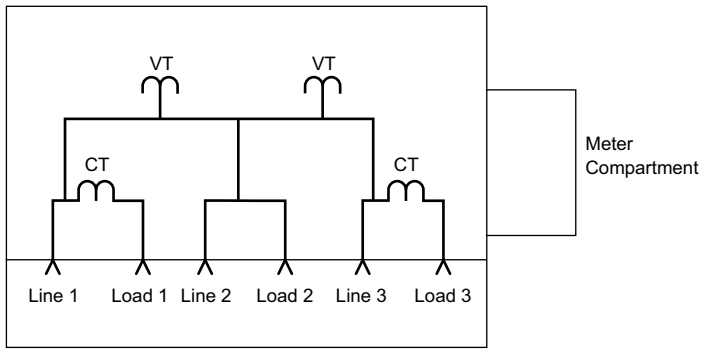
1.6 An 8-foot minimum working clearance is required directly in front and back of the Pad-Mounted Primary Meter Cabinet, 3 feet in non-meter side compartment, and 3 feet from the edge meter compartment door.

Figure AP 115–1: Primary Meter Cabinet Dimensions

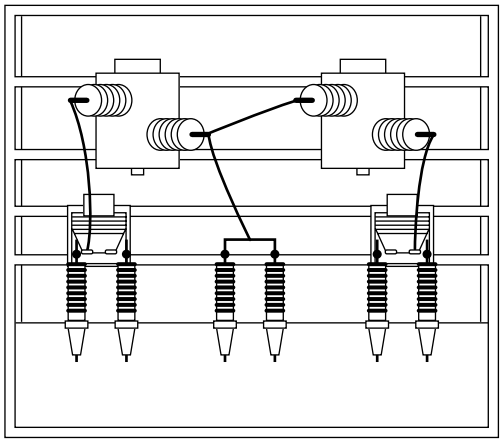


Front View **Right Side View**

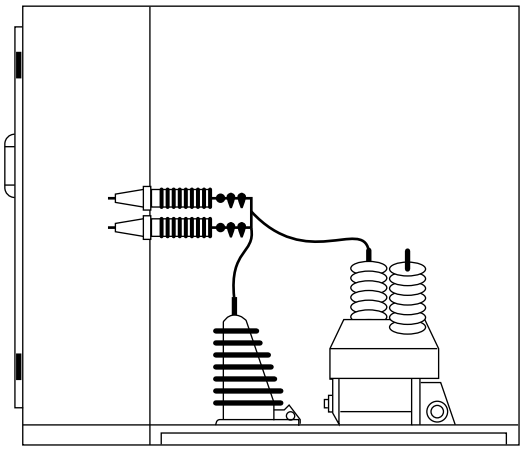
Figure AP 115–2: Primary Metering – Schematic Diagram, CT and VT Lay-Out



Schematic Diagram



Top View



Side View

Note(s):
1. Attach all cable concentric wires and the switch enclosure to the structure 4/0 ground/neutral bus per the material and installation requirements for GR 100.
2. See JJ Section for 33kV 600A dead-break termination information.
3. Refer to UGS SS 538 (Precast Concrete Equipment Slab Box – 8’ x 10' x 8" pad with 4' x 7' x 3'-6” box).

2.0 Recommended structure

2.1 Use Precast Concrete Equipment Slab Box – 8’ x 10' x 8" pad with 4' x 7' x 3’-6” box. Refer to UGS SS 538 for details.

AP 120P Current Monitor with Voltage (CM-V) Secondary Network Monitoring System

Scope AP 120P.1 CM-V Secondary Network Monitoring System

1.0 General Description

The purpose of the Cleaveland/Price (CPI) Current Monitor with Voltage (CM-V) Secondary Network Monitoring System is to remotely monitor the status of the Long Beach Secondary Network. The CM-V is capable of remotely monitoring up to 10 three-phase runs of secondary cable at each installation location. Three-phase telemetry is supplied to SCADA though a CPI RTU 3200 that is connected via coaxial cable to an antenna located in an adjacent vault vent.

The 3-phase telemetry data allows field personnel, operations and engineering to recognize and respond to secondary network over-load conditions, equipment and cable failures, and primary backfeed conditions.

Currently, the CM-V deployment scope is limited to locations specified by Advanced Technology and Apparatus Strategies.

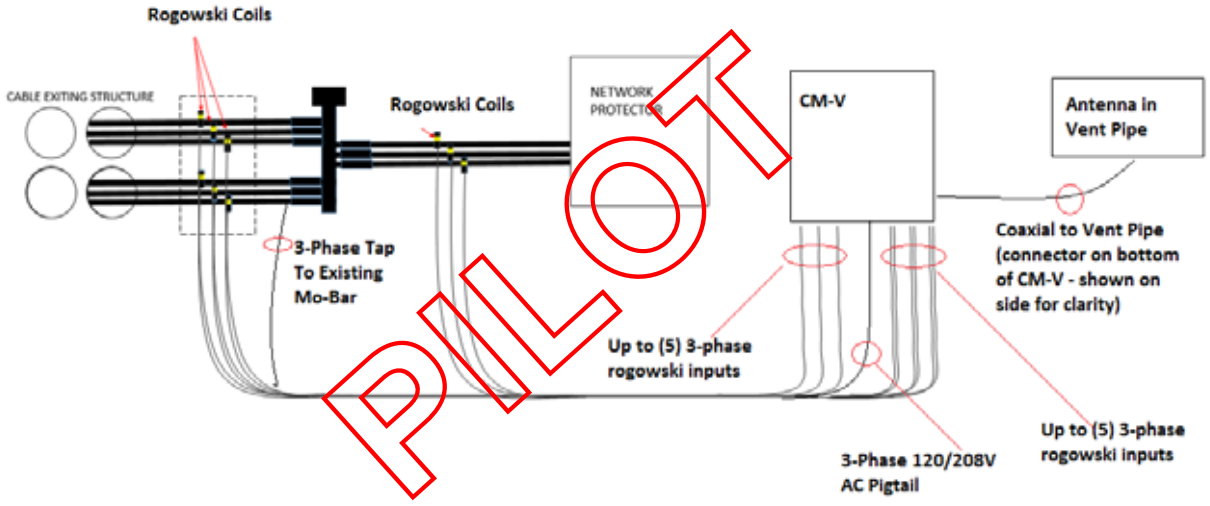
The CPI CM-V Secondary Network Monitoring System detects and transmits the following data:

- Ten 3-Phase Current Magnitudes
- One 3-Phase Voltage Magnitude
- Ten 3-Phase Phase Angles

1.1 CM-V Secondary Network

The CM-V monitors current with up to ten sets of three Rogowski coils. Each set of three Rogowski coils is connected to a three-phase integrator unit internal to the CM-V cabinet. Power to the unit and voltage telemetry are supplied via a tap to an existing mo-bar. A CPI RTU 3200 communicates via Netcomm radio to provide the data to DMS.

Figure AP 120P–1: Typical CM-V Installation



Figures 2 through 7 depict all included equipment in the CM-V.

Figure AP 120P–2: Front of Cabinet with Door Attached

Figure AP 120P–3: Front of Cabinet with Door Removed

PILOT

Figure AP 120P–4: Bottom of Cabinet

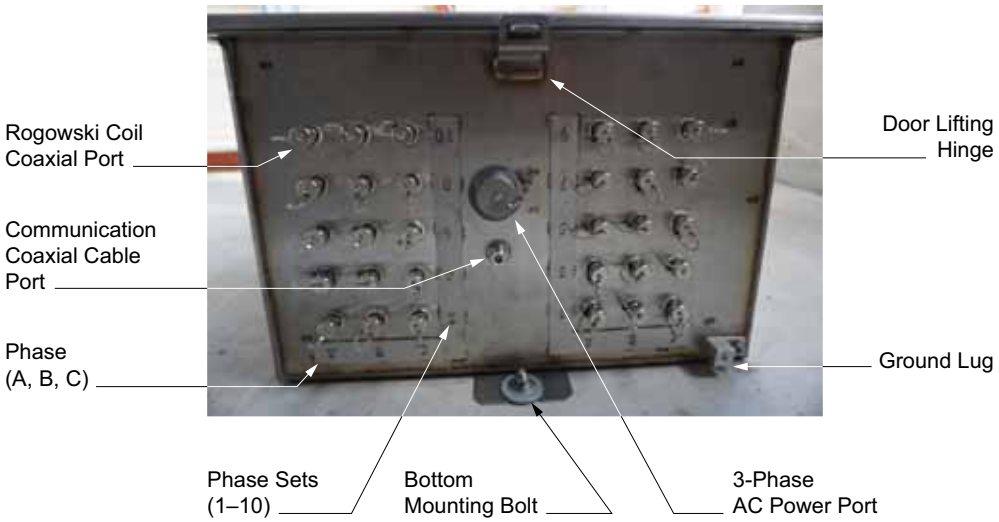


Figure AP 120P–5: 3-Phase Rogowski Coil Set

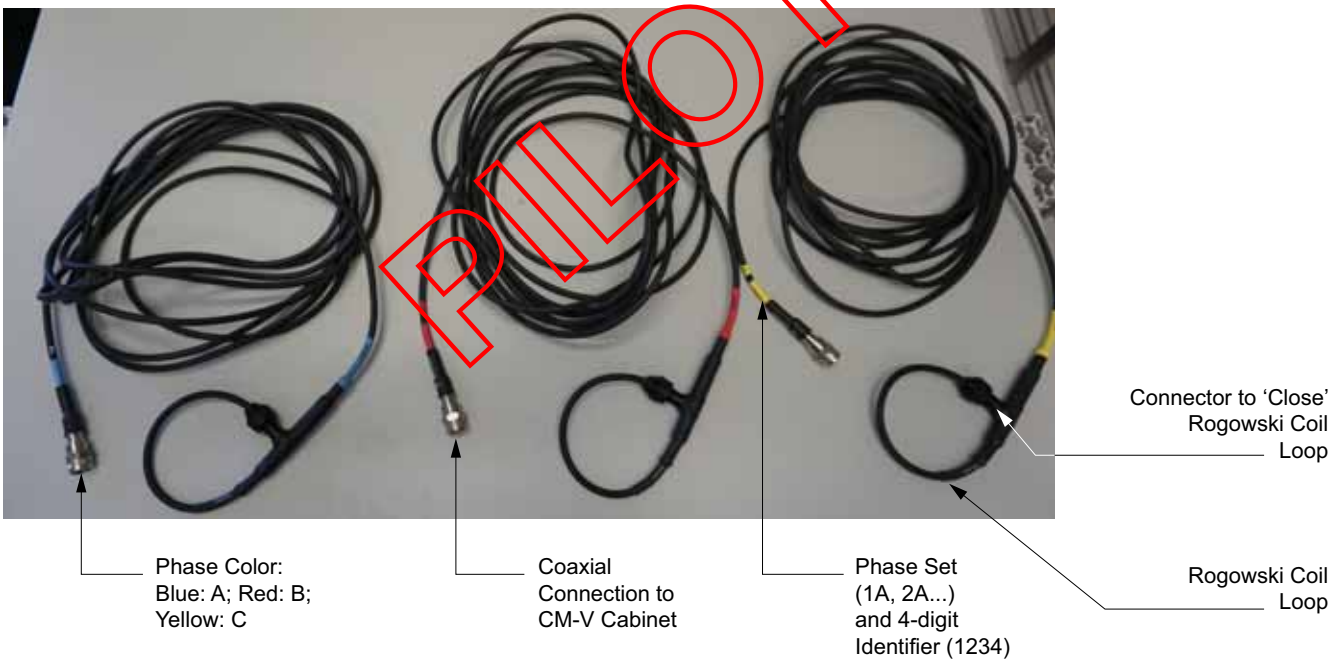


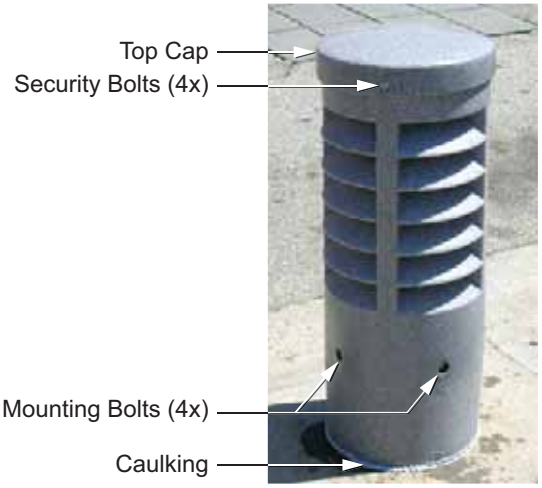
Figure AP 120P–6: 3-Phase AC Power Pigtail

Figure AP 120P–7: Coaxial Cable, Antenna and Connector

2.0 Pre-Installation Instructions for CM-V

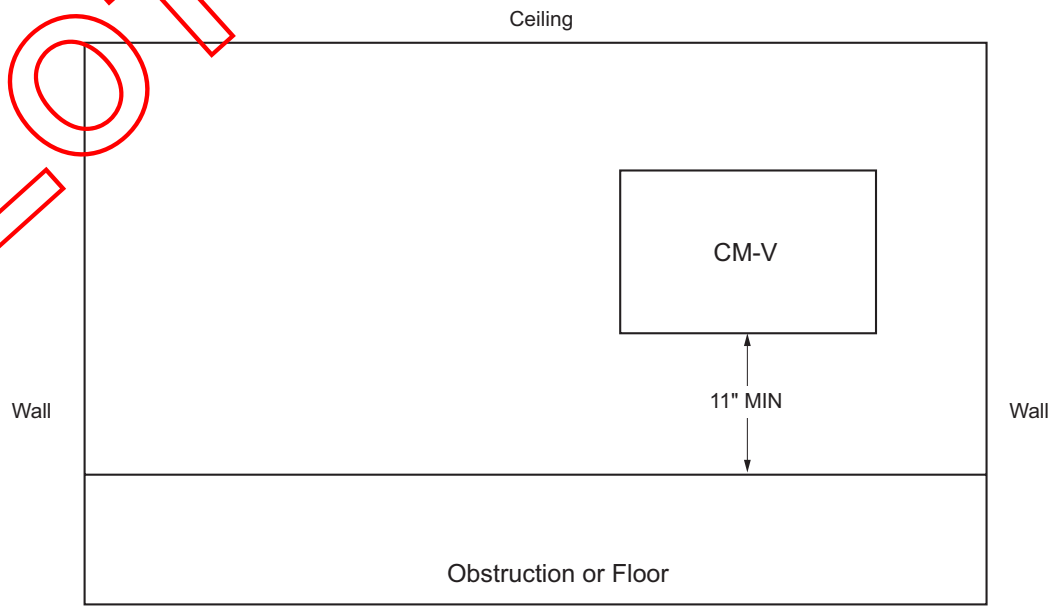
STEP 1. Verify the vault targeted for installation has a polyethylene vent pipe. The vent pipe must have space for an additional antenna to be installed inside.

Figure AP 120P–8: Polyethylene Vent Pipe



STEP 2. Verify the selected mounting location inside of the vault has a minimum vertical clearance of 11" from bottom-of-cabinet to the nearest obstruction.

Figure AP 120P–9: Minimum Vertical Clearance



PILOT

STEP 3. Verify the vault has available space for a 3-Phase, 120/208VAC voltage tap.

3.0 Installation Instructions for CM-V

STEP 1. Drill holes on vault wall corresponding to Cleaveland/Price provided chipboard drill template. The CM-V mounts using two bolts on top and one on bottom.

Figure AP 120P–10: Drilling Template

PILOT

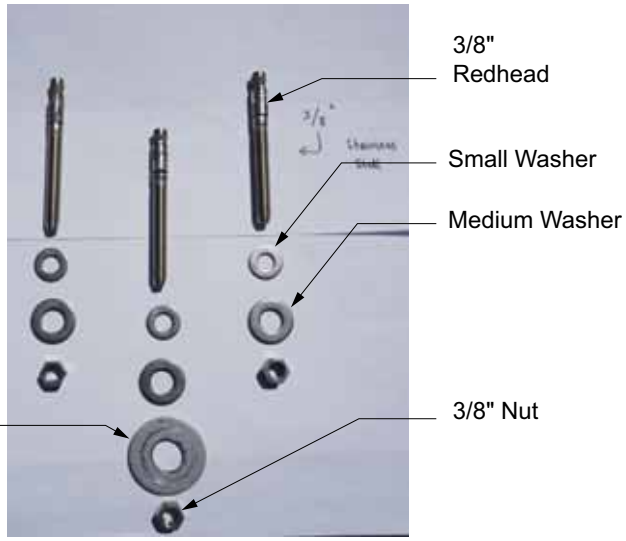
STEP 2. Install a 3/8" redhead into each hole.

NOTE

DO NOT install the CM-V cabinet without sufficient clearance as noted in Step 2 of the Pre-Installation Instructions. This clearance is required for proper routing of leads into the bottom of the cabinet.

STEP 3. Mount the CM-V cabinet onto the anchors and tighten the hardware securely. Leave the bagged bolts taped to the front of the cabinet in place. They will be used to seal the cabinet after installation is completed.

Figure AP 120P–11: Cabinet Mounting Hardware



STEP 4. Attach cabinet ground to structure ground halo using #2 soft-drawn bare CU and Kearney grounding connector.

STEP 5. Attach coaxial cable to connector located on the bottom of the cabinet.

STEP 6. Use Phase ID Tool to establish phasing at the network protector secondary and mo-limiters.

STEP 7. Connect Rogowski coils to CM-V cabinet. Ensure phasing & phase set on the Rogowski coil coaxial termination matches the phasing & phase set stenciled on the bottom of the cabinet. Begin at Phase Set 1 (rear right of cabinet) and sequentially connect up to Phase Set 10.

STEP 8. Once connected to the cabinet, install Rogowski coils onto conductors. For service or grid tie monitoring, point the polarity arrow away from the mole bar. Refer to Figure AP 120P-15. For network protector monitoring, point the polarity arrow towards the mole bar. Refer to Figure AP 120P-16. If necessary, use a zip tie to secure the coil to the conductor.
NOTE: The CM-V phasing nomenclature is A = Blue, B = Red, C = Yellow

Figure AP 120P–12: Rogowski Coil (Open & Closed)

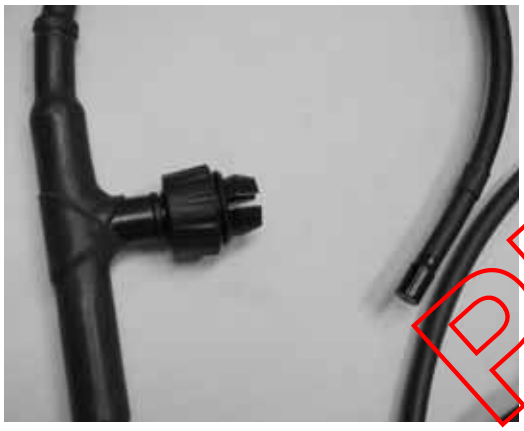


Figure AP 120P–12.1 Rogowski Coil (Open Coil)

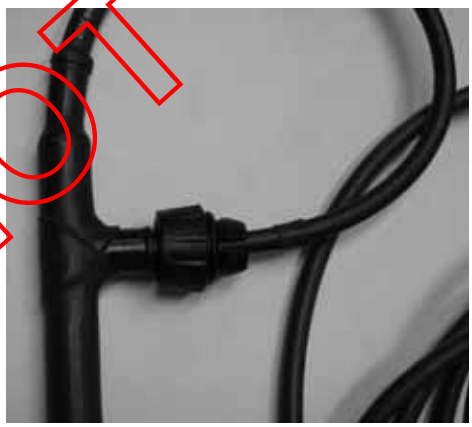


Figure AP 120P–12.2 Rogowski Coil (Closed Coil)

PILOT

Figure AP 120P–13: Polarity Arrow on Coil

NOTE

NOTE: It is critical that the polarity is correctly identified when installing the Rogowski Coils. All arrows should point **AWAY** from the mole bar (for service/grid tie monitoring) or **AWAY** from the network protector (for network protector monitoring).

Figure AP 120P–14: Service/Grid Tie Monitoring: Polarity Arrow Away from Mole Bar

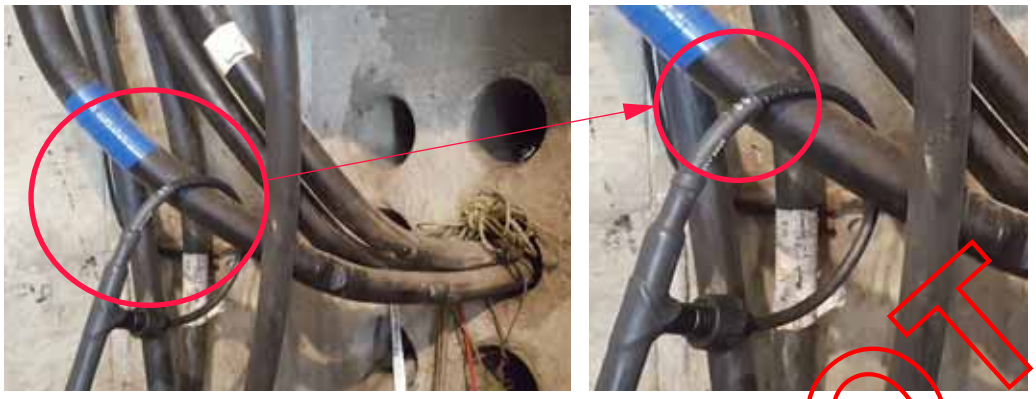


Figure AP 120P–15: Network Protector Monitoring: Polarity Arrow Towards Mole Bar (Away from Network Protector)

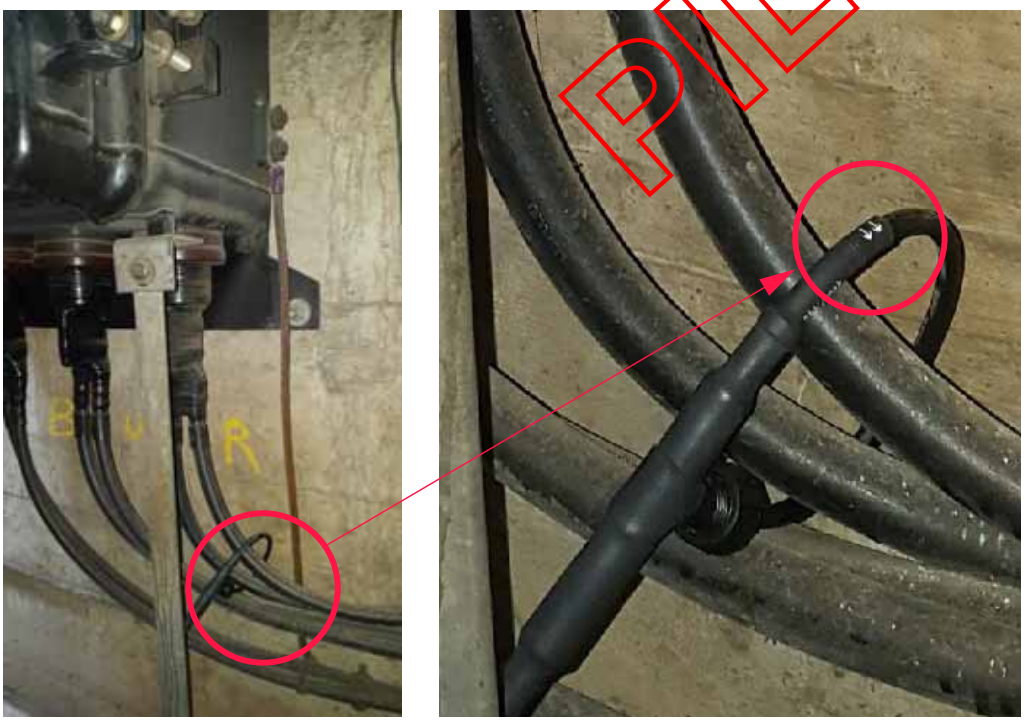


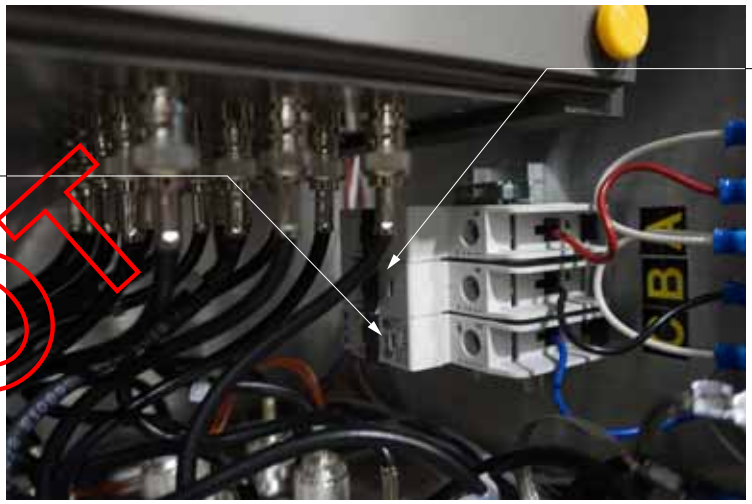
Figure AP 120P–16: Rogowski Coil Zip Tied to Cable

PILOT

Figure AP 120P–17: Rogowski Coil Connection to Cabinet

STEP 9. Remove CM-V cabinet door and verify the AC circuit breaker is in the OFF position.

Figure AP 120P–18: AC Breaker in OFF Position (Switch Towards Front of Cabinet, Green Light OFF)



PILOT

STEP 10. Establish 3-phase AC power connection in vault and splice to CPI supplied pigtail.

STEP 11. Attach A/C power cable to connector located on the bottom of the cabinet.
NOTE: Ensure phasing of splice matches phasing established in Step 9. Correct phasing is required to correctly calculate the power angle.

STEP 12. Insert CPI supplied DC fuses (bagged inside the cabinet) into fuseholders.

Figure AP 120P–19: DC Fuseholder

STEP 13. Move the AC circuit breaker to the ON position.

Figure AP 120P–20: AC Breaker ON (switch towards back of cabinet, green light ON)

PILOT

STEP 14. Verify the green power LED on the cabinet is ON. It may take up to 30 seconds for the RTU to 'boot up' and the green power LED turn on.

Figure AP 120P–21: Power Light Location

STEP 15. Attach the door to the cabinet. Remove extra bolts attached to the door handle. Insert and tighten all bolts to 5 ft-lbs using a “star pattern.”
When completed, re-tighten all bolts again to 10 ft-lbs.

STEP 16. When the cabinet door has been sealed, a pressure test must be completed to verify a water-tight seal.

NOTE Ensure the o-ring on the pressure tester is lubricated.

STEP 17. Using the fill port, pressurize the cabinet to 3 PSI (max). Wait 5 minutes for the cabinet to stabilize. Record the pressure. Wait 10 more minutes. The unit has passed the pressurization test when the previously noted pressure does not drop over a 10 minute period. If the unit fails the pressurization test, contact Apparatus Strategies.

STEP 18. Using the gore valve on the top of the cabinet, bleed the pressure from the cabinet then close the gore valve.

STEP 19. Install ground plane, salt shaker antenna and coaxial cable into polyethylene standpipe vent per DUG VE 240. If a vault blower is present, install offset bracket per DUG VE 245P. Rout coaxial cable through vault to vent pipe.

STEP 20. Verify all cables are securely tightened to the CM-V cabinet and the Rogowski coils. Verify all Rogowski coil arrows are correctly oriented as specified in Step 8.

STEP 21. Verify that a single point ground connection has been established.

STEP 22. Contact the Distribution Automation Hotline to conduct end point test at (714) 285-4325.
Hours: Mon-Fri 7 a.m. – 4 p.m. Available after hours/weekend upon request.

PILOT

AP 200 Installation Procedure for 27 kV and 38 kV Pad-Mounted and Submeble RAM Bypass Switches

Scope AP 200.1 27 KV and 38 KV Bypass Switch for AR and VFI Installations

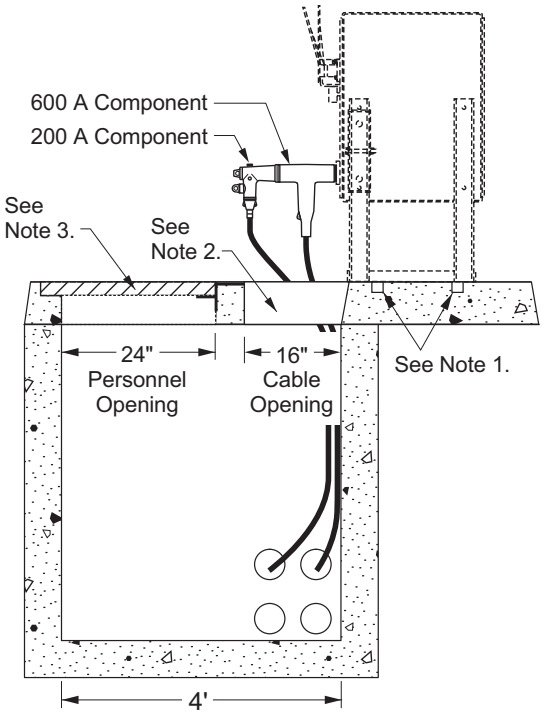
1.0 Installation Details

1.1 Installation Details for Pad-Mounted Bypass Switches (Refer to UGS SS 538)

For placement of the SF_6-insulated pad-mounted bypass switch, align the face of the switch tank to the tapered back edge of the cable opening. Center the switch tank to the center of the cable opening to allow enough clearance to shape and terminate cable. The switch tank legs will line up over the four rear unistrut embedments. Secure the switch tank to the unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). It is suggested that all necessary cable shaping, make up, and terminating be completed before setting the switch cabinet. Place the switch cabinet enclosure over the switch tank and secure it to the four unistruts with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP 10117403). See Figure AP 200–1:.

Attach a 4/0 bare copper neutral/ground bus to the furnished 1/2-inch threaded “J” bolts at the top of both ends of the structure or enclosure. Install the bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of the structure. Interconnect the neutral/ground bus to the split bolt connector with #2 str copper wire at both end locations. Attach all cable concentric wires to the 4/0 copper bus. Ground the switch tank to the 4/0 copper neutral/ground bus with #2 str copper. Ground the cabinet enclosure to the switch tank by attaching #2 str copper wire from ground lug on the switch face to ground lug on inside front of cabinet enclosure. See GR Section for additional grounding requirements.

Figure AP 200–1: Typical Installation of Pad-Mounted Gas Switch on a Pad with 4' x 7' x 5' Pull Box Preferred Cable Layout



Note(s):

1. Unistrut embedments in six locations of the pad for separately securing gas switch tank and cabinet.
2. Cable opening with 16" x 72" clear opening to allow stacking one 200A tap on each 600A component.
3. Enclosure is furnished with two 24" x 36" polymer concrete covers, and a removable steel beam to provide a 24" x 72" personnel access.
4. When using a 4-way gas switch, the primary cable should be limited to four runs of 350, 750, or 1,000 kcmil cable.
5. Cable racks, support hooks, and tie-wraps. (See RS 110)
6. Attach 4/0 Cu neutral/ground bus to furnished 1/2-inch threaded "J" bolts at top of both ends of the enclosure.

1.2 Installation Details for Submeble Bypass Switches

This section outlines the minimum installation requirements for placement of topconnected, submeble gas-filled bypass switches in vaults.

NOTE

Since the bypass switch can float when exposed to water within the structure, it must always be secured to the structure. It is essential that the following installation procedures be followed to provide for the operation and maintenance of the switch, and cable terminations.

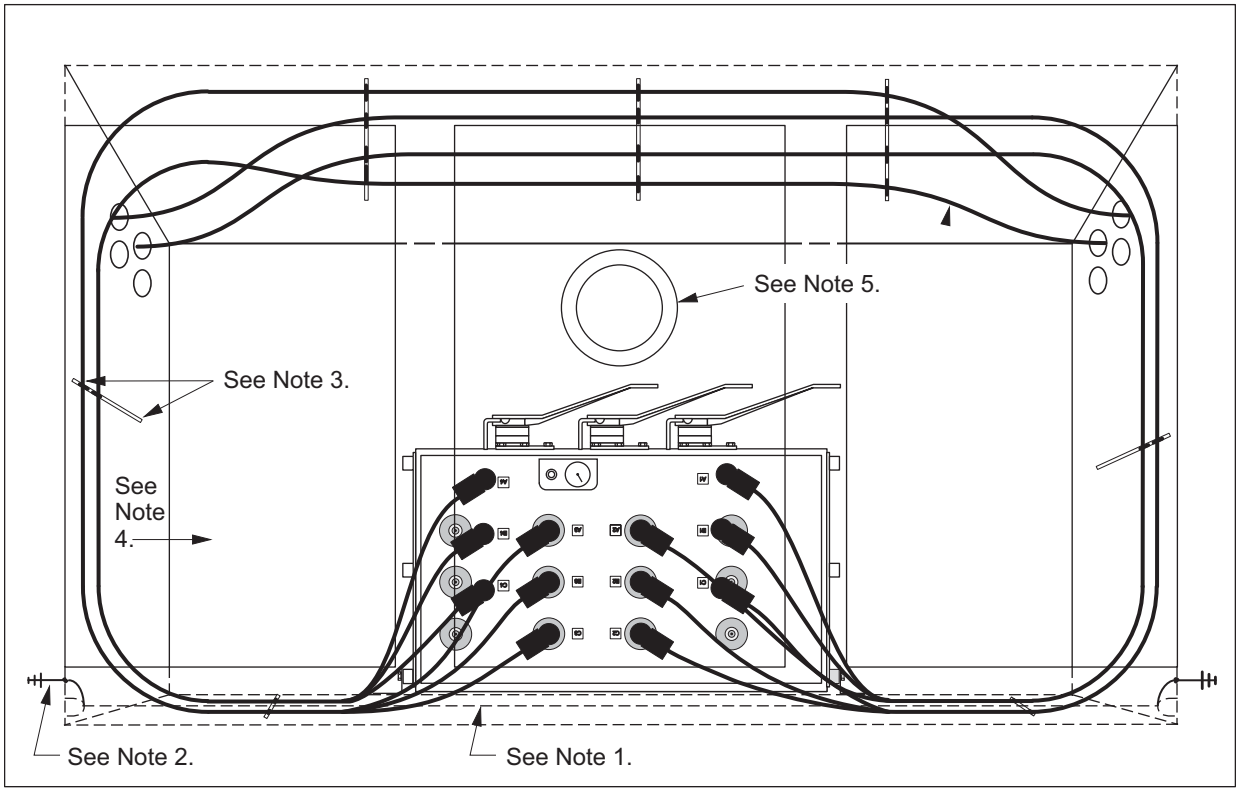
A. Vaults

The preferred placement of the submeble bypass gas switch in a new or existing vault shall be on the structure wall, or secured to the structure floor when wall mounting is not feasible. The switch may have to be offset from the center line of the vault access opening, to obtain sufficient clearance from the switch operating handles to the vault ladder. Switches are supplied with four wall mounting brackets. Secure the switch to the wall using all four brackets employing four 1/2-inch stainless steel wedge style concrete stud anchors (SAP 10072180). When the switch is to be floor mounted, it must be secured to the structure floor to prevent the switch from floating.

The submeble bypass switch is supplied with two bottom mounted support channels with 9/16-inch holes for floor mounting. The front hole of one channel and (1) the rear hole of the opposite channel, or (2) the corresponding wall bracket should be used to secure the switch with 1/2-inch stainless steel wedge style concrete stud anchors, as a minimum. Switches have support channels which extend outside the tank bottom. Each switch shall be secured at all four locations. Since structure floors are not always flat or level, care must be taken not to place any undue stress on the switch. Stainless steel washers should be used as shims under the bottom support channels to provide a flat surface for securing the switch. See RS 100 for additional anchor material information and installation instructions.

Ground the cable concentric wires, and the switch tank to the vault 4/0 copper ground/neutral per the material and installation requirements of GR 100.

Figure AP 200–2: Typical Installation of Submeble Bypass Gas Switch in Enclosure

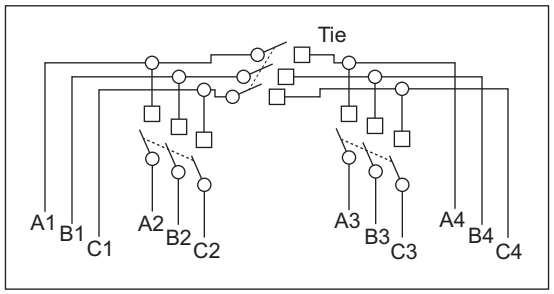


Note(s):

1. Attach 4/0 bare copper ground/neutral bus to furnished 1/2-inch threaded “J” bolts at top of both ends of enclosure.
2. Attach a bronze 1/2-inch threaded split bolt grounding connector (SAP 10111624) to the bronze grounding inserts at top of both ends of the enclosure. Connect the 4/0 Cu ground bus to the grounding connector with #2 str Cu wire.
3. Cable support hooks and racks (See RS 110).
4. Enclosure furnished with 30" x 48" polymer concrete covers.
5. Deep sump, 13" x 13”.

2.0 Equipment Configuration.

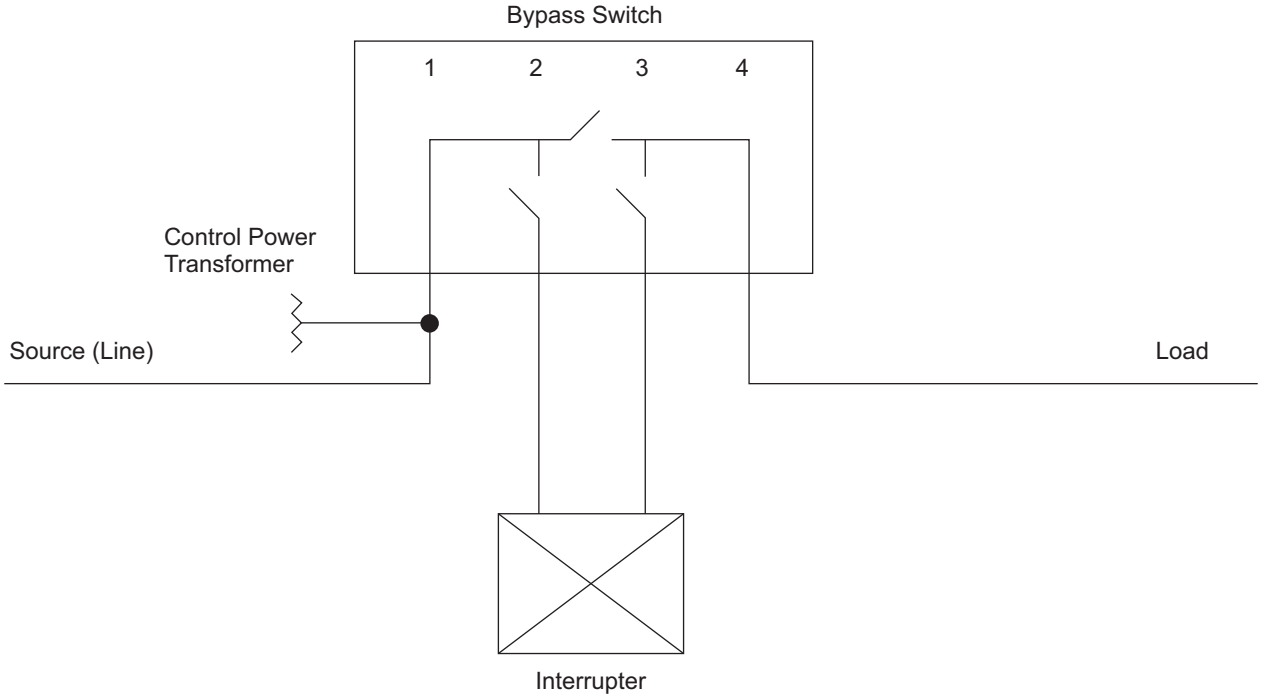
Figure AP 200–3: Pad-Mounted Bypass Switch Equipment Configuration



NOTE

The bypass switch shall be used to provide isolation, testing, and maintenance of interrupter equipment.

Figure AP 200–4: Typical One-Line Installation Details



The interrupter or apparatus that is intended to be bypassed shall be connected to Positions 2 and 3. Depending on field conditions, Position 1 or Position 4 may be used as the source (line), with the other position for the load. Typical installations will have the interrupter apparatus in the closed position. The isolation switch Positions 2 and 3 shall be normally closed, and the TIE switch shall be normally open.

3.0 Equipment Outline and Ordering Information

3.1 27kV and 38kV Pad-Mounted Bypass Switch Equipment

Figure AP 200–5: Pad-Mounted Bypass Switch Overall View

Figure AP 200–6: Pad-Mounted Bypass Switch Equipment Outline Dimensions (Refer to Table AP 200-1 27 kV and 38 kV G&W Pad-Mounted SF6 Bypass Switches, 4-Way, 600A, 25 kA RMS Momentary):

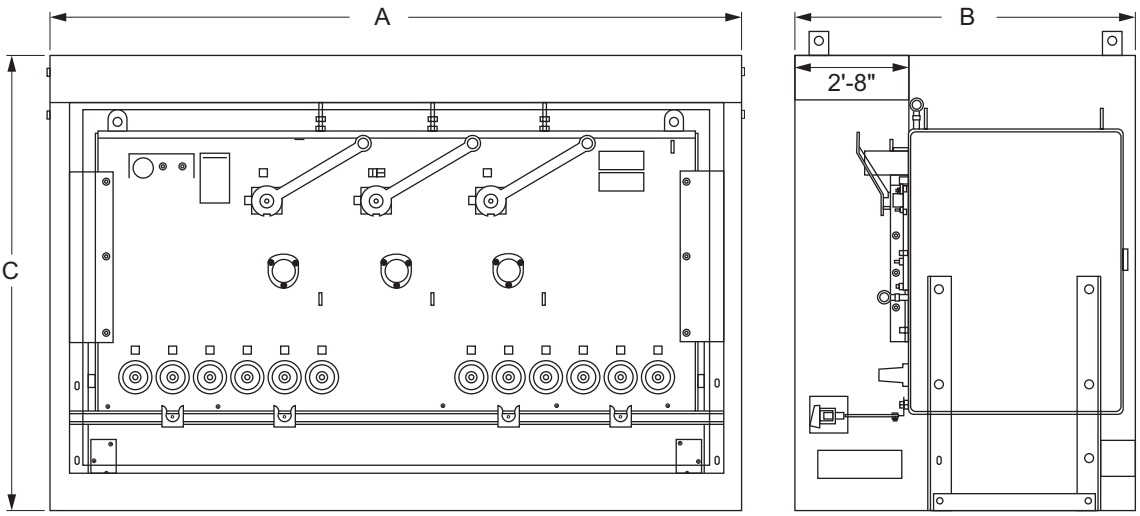


Table AP 200–1: 27kV and 38kV G&W Pad-Mounted SF6 Bypass Switches, 4-Way, 600A, 25 kA RMS Momentary

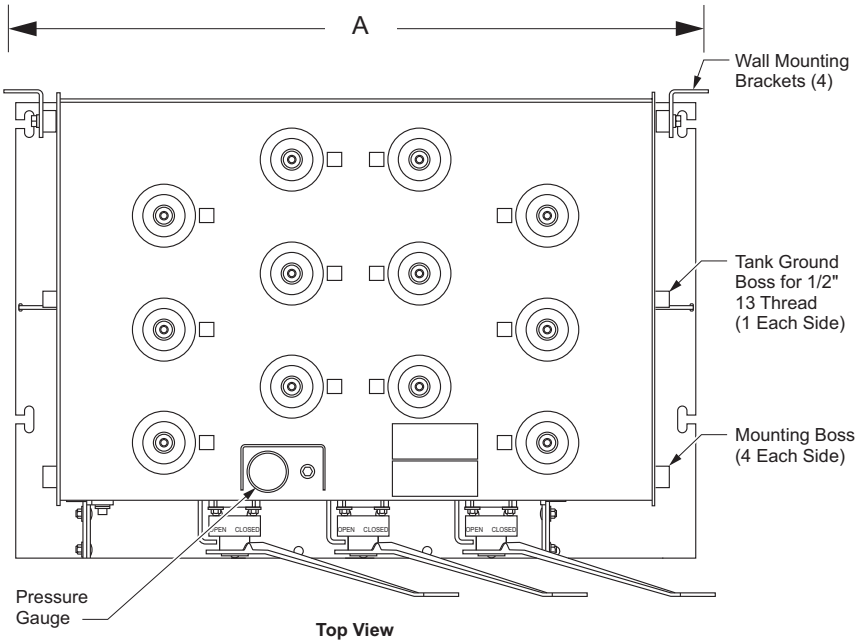
Type	Voltage	Current	Dimensions			Approximate Weight (lbs)	Recommended Structure	SAP Number
			A (in)	B (in)	C (in)			
4-Way Pad-Mounted	27 kV	600 A	87	51	54	2650	UGS SS 538	10106477
4-Way Pad-Mounted	38 kV	600 A	93	51	61	2650	UGS SS 538	10106478

Note(s):

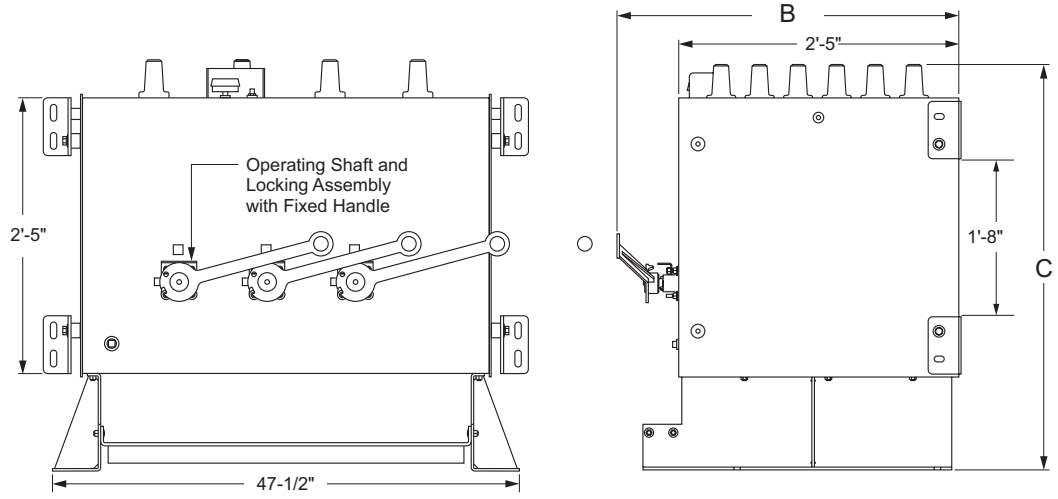
1. The switches come with 600A bushings and are rated at 600A continuous duty.
2. Bypass switches are rated 25 kA momentary RMS symmetrical, 25kA fault close and latch rating. The 27kV Pad-Mounted bypass switch has a 125kV BIL rating. The 38kV Pad-Mounted bypass switch has a 150 BIL rating.
3. Switches are provided with a color-coded gauge to indicate correct gas pressure.
4. The 27-kV rated bypass switch shall be applied to the Edison 4 kV, 12 kV, and 16 kV systems. The 38 kV-rated bypass switches shall be applied to the Edison 25kV and 34.5 kV systems.
5. Refer to DOM manual, Section SW-5, for inspection requirements of switches prior to installation.

3.2 27kV and 38kV Submeble Bypass Switch Equipment

Figure AP 200–7: Submeble, Staggered Bushing RAM Type SF6 Bypass Switch



Top View



Front View **End View**

Note(s):

1. The switches come with 600A bushings and are rated at 600A continuous duty.
2. Bypass switches are rated 25 kA momentary RMS symmetrical, 25kA fault close and latch rating. The 27kV submeble switch has a 125kV BIL rating. The 38kV submeble bypass switch has a 150 BIL rating.
3. Switches are provided with a color-coded gauge to indicate correct gas pressure.
4. The 27-kV rated bypass switch shall be applied to the Edison 4 kV, 12 kV, and 16 kV systems. The 38 kV-rated bypass switches shall be applied to the Edison 25kV and 34.5 kV systems.
5. Staggered bushing configuration provides practical access for grounding.
6. Refer to DOM manual, Section SW-5, for inspection requirements of gas switches prior to installation.

Table AP 200–2: 27 kV and 38 kV G&W Submeble SF6 Bypass Switches, 4-Way, 600A

Type	Voltage	Current	Dimensions			Weight (lbs)	Structure Information	SAP Number
			A (in)	B (in)	C (in)			
4-Way Submeble	27 kV	600 A	54	36	47	1100	DDS-6	10183849
4-Way Submeble	38 kV	600 A	54	36	47	1100	DDS-6	10183850

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AP 210 Pad-Mounted Electronic Remote-Controlled Automatic Circuit Reclosers

Scope AP 210.1 Pad-Mounted Electronic Remote-Controlled Automatic Circuit Recloser Installation Instructions and General Information

1.0 General Information

1.1 Pad-mounted remote-controlled automatic circuit reclosers (RARs) are primarily installed for circuit protection in pad-mounted substation designs. However, they may be installed for protection for high fire risk areas (HFRAs), increased reliability, and end-of-line protection.

1.2 All new RAR installations shall be automated with the incorporation of a NetComm Integrated WanGate Radio (IWR) packet radio for interface with the Distribution Control and Monitoring System (DCMS) network.

1.3 Pad-mounted RARs have dead-front designs with 600 A apparatus bushings, and are rated for 600 A continuous current.

1.4 The bypass switch shall be used in order to provide isolation and allow for testing and maintenance of the RAR. The preferred and alternate bypass switch equipment approved for AR installation are as follows:

- Preferred – Pad-Mounted Bypass Switch
- Alternate 1 – Submeble Bypass Switch
- Alternate 2 – Two 3-Way or Two 4-Way SF6 RAM Switches

See AP 200 for installation details for the bypass switch. See SE 258 and SE 260 for SF_6 RAM switch installation details.

2.0 Protection Information

2.1 Pad-mounted RAR apparatus are supplied with an electronic control. The control shall be programmed with the settings stated on an OD-43, and with the automation settings for DCMS monitoring. The controller may be used to electrically operate the recloser. Field Engineering shall obtain an OD-43 from Protection Engineering. OD-43 settings shall be programmed and changed by qualified Distribution Apparatus Technicians or Foreman.

2.2 External CT protection may be applied in applications such as pole tops or ground banks in conjunction with AR installations. The indoor only 1000/500:1 CT (SAP 10184003) is available as the preferred option for these applications. For alternate option, use the indoor/outdoor 1000/500:1 CT (SAP 10184002). See Section 8.0 for details.

3.0 Equipment Installations Details

3.1 Pad-mounted remote-controlled automatic reclosers shall have dedicated control power transformers for field installations. For 12/16 kV applications, see TX 300 for installation details of the submeble 1 kVA ABB control power transformer. Use SAP 10105053 for the transformer, and SAP 10104932 for the low-profile stainless steel transformer mounting frame.

3.2 The control power transformer shall be connected to the line side of the remote-controlled automatic recloser. The transformer should be tapped off of the line position of the bypass switch, either position 1 or 4 respectively. The transformer and mounting frame shall be mounted in the slab box of the remote-controlled automatic circuit recloser.

3.3 Refer to Section JJ for 600 A elbow terminations, as well as Section GR for grounding requirements.

3.4 Contact Distribution Field Engineering and Apparatus Strategies for 4 kV, 25 kV, or 33 kV applications for control power requirements.

4.0 Automatic Recloser prior to Commissioning after Construction

Distribution construction shall contact the Distribution Automation Hotline at 714-285-4325 when installing, relocating, or removing automated equipment .

After the installation of the recloser, the equipment needs to be commissioned by Distribution Apparatus Test. The construction crew shall configure the equipment for Distribution Apparatus Test as follows:

- Line and Load disconnects connected to both the source and the recloser
- Line and Load disconnects in the OPEN position
- AR breaker in the OPEN position
- Bypass switch in CLOSED position, unless otherwise indicated on the Work Order
- PT tapped to the primary circuit
    - If the circuit is energized, check for 120 V at the controller and connect the controller battery
    - If the circuit is not energized, controller battery shall not be connected
- Release to substation jurisdiction that recloser has been installed and is NOT READY FOR SERVICE; Follow the procedure stated in System Operating Bulletin #25

5.0 Equipment Ratings

Table AP 210–1: G&W Viper Ratings for 4/12/16 kV Applications SCE Systems

Rating	27 kV Apparatus
Maximum Voltage (kV)	27
Continuous Current (A)	600
Interrupting Current (kA, symmetrical)	12.5
Fault Close (kA, symmetrical)	20

Table AP 210–2: G&W Viper Ratings for 25 and 33 kV Applications SCE Systems

Rating	38 kV Apparatus
Maximum Voltage (kV)	38
Continuous Current (A)	600
Interrupting Current (kA, symmetrical)	12.5
Fault Close (kA, symmetrical)	20

Table AP 210–3: Material Numbers

Description	SAP Number
27 kV Pad-Mounted Viper AR	10106587
Pad-Mounted Controller Veon of SEL 351R[a/]	10106590
27 kV Pad-Mounted Viper AR with SS Enclosure	10173977
38 kV Pad-Mounted Viper AR	10173375
38 kV Pad-Mounted Viper AR with SS Enclosure	10173974
Replacement SS Enclosure	10174720
Neutral Sensing CT (1000/500:1) (Indoor Only) – Preferred Option	10184003
Neutral Sensing CT (1000/500:1) (Indoor/Outdoor) – Alternate Option	10184002

[a/] Controller must be ordered in conjuction with pad-mounted Viper AR. Refer to DOM SW-13 for replacement controllers and parts.

6.0 Recommended Structures and Working Clearances

6.1 For structure requirements reference:

- UGS SS 530, use 6' x 8'-6" slab box
- Contact Apparatus Strategies for alternate options.

6.2 Front and Rear High Voltage compartment doors require 8' clearance, 4' of the equipment clearances are measured from the edge of the concrete pad outward.

Note(s):

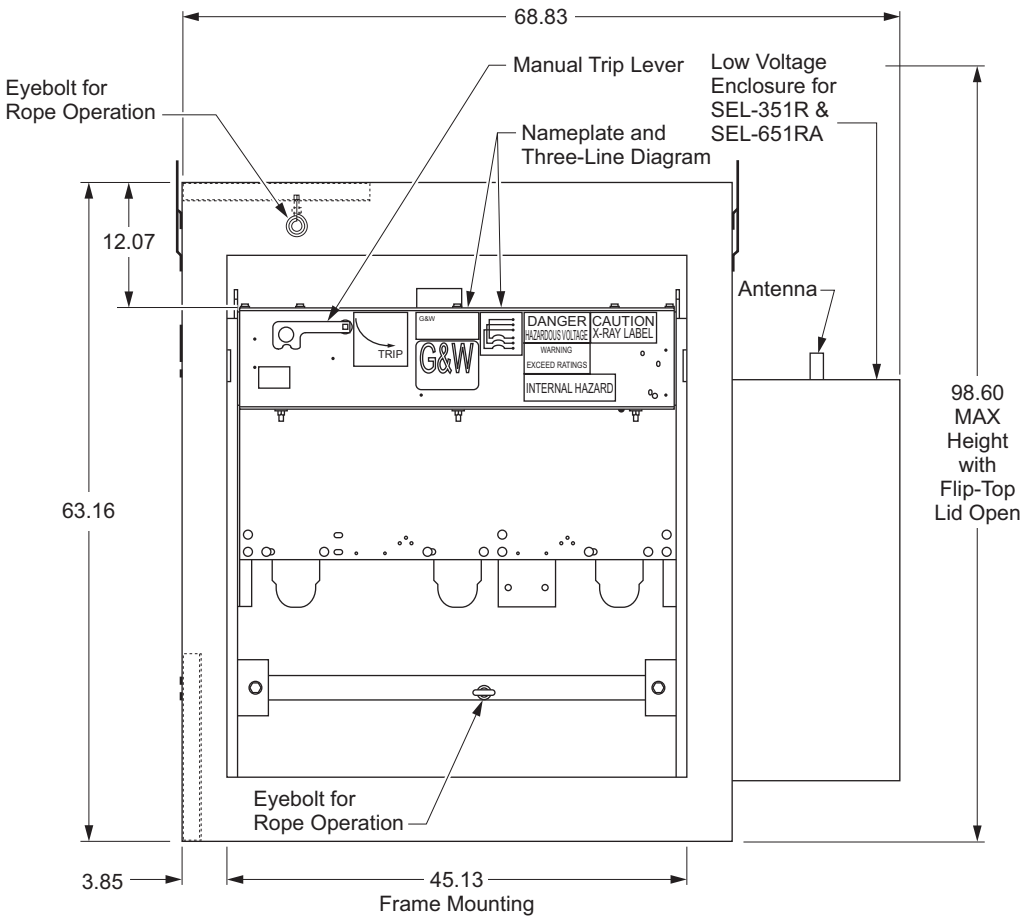
1. See TX 160 for general anchoring, stenciling, and sealing requirements for pad-mounted equipment.

7.0 Equipment Outline

Figure AP 210–1: Manual Trip Lever View of Pad-Mounted Viper RAR

Figure AP 210–2: Cable Connections View of Pad-Mounted Viper RAR

Figure AP 210–3: Cabinet Dimensions (in Inches)



Note(s):
1. Recloser weight=1,750 lb.

Figure AP 210–4: Cabinet Dimensions — Bird's Eye View (in Inches)

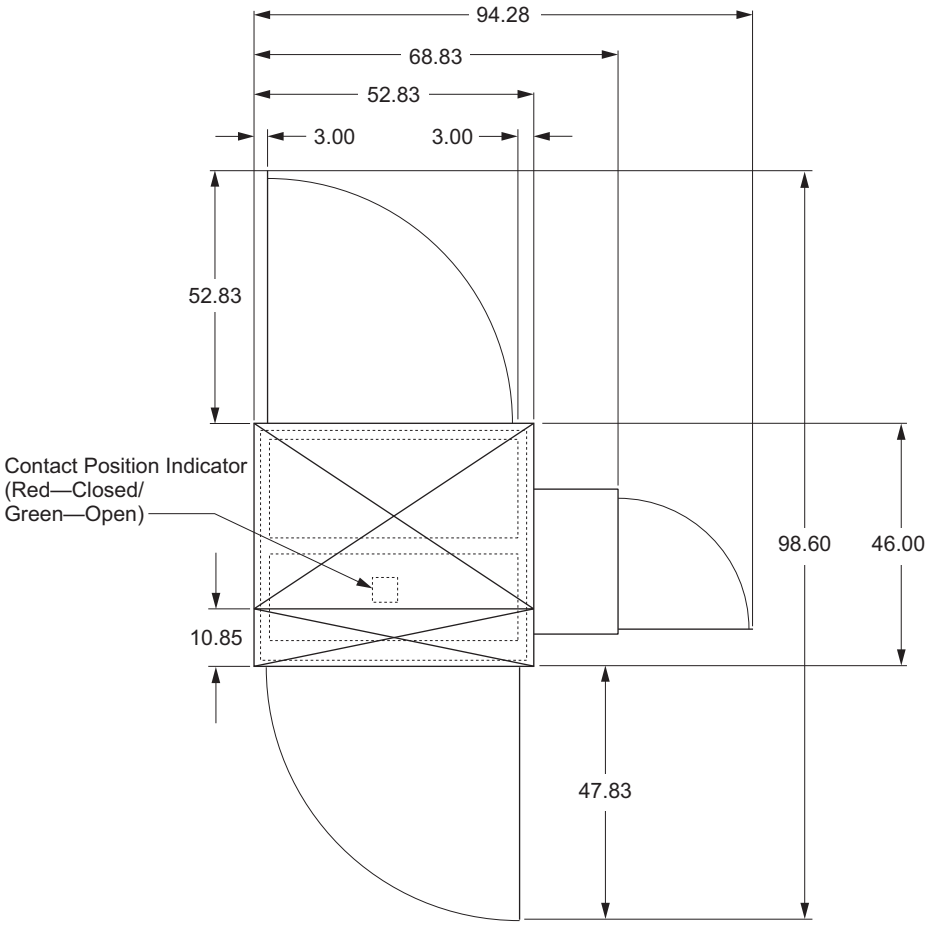
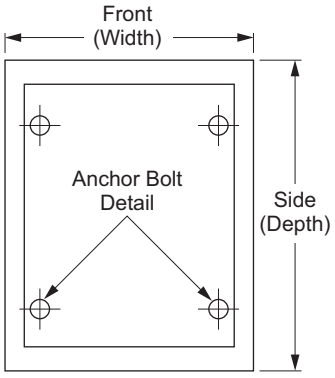
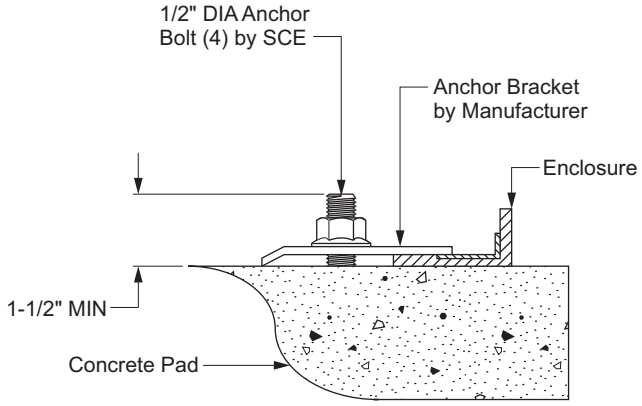


Figure AP 210–5: Cabinet Anchor Details



Cabinet Plan



8.0 External Neutral Sensing CT Detail Application

Figure AP 210–6: Single Line Diagram for Pole Top Application of Neutral CT

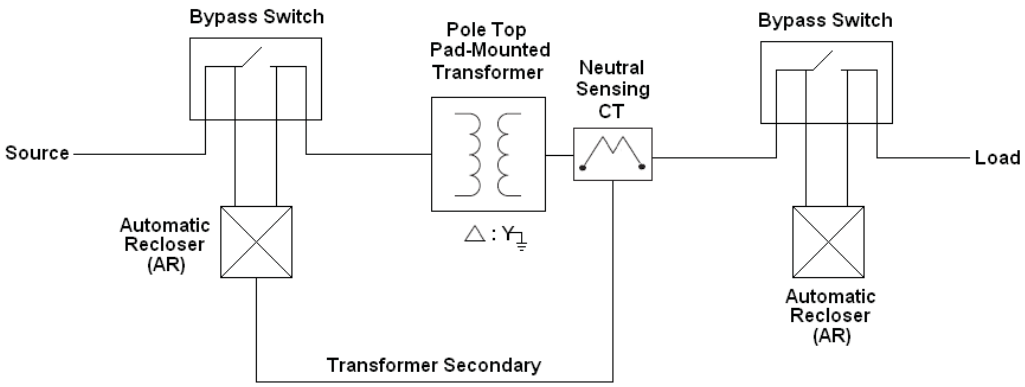


Figure AP 210–7: External Neutral Sensing CT (1000/500:1) (Indoor Only) Dimensions – Preferred Option

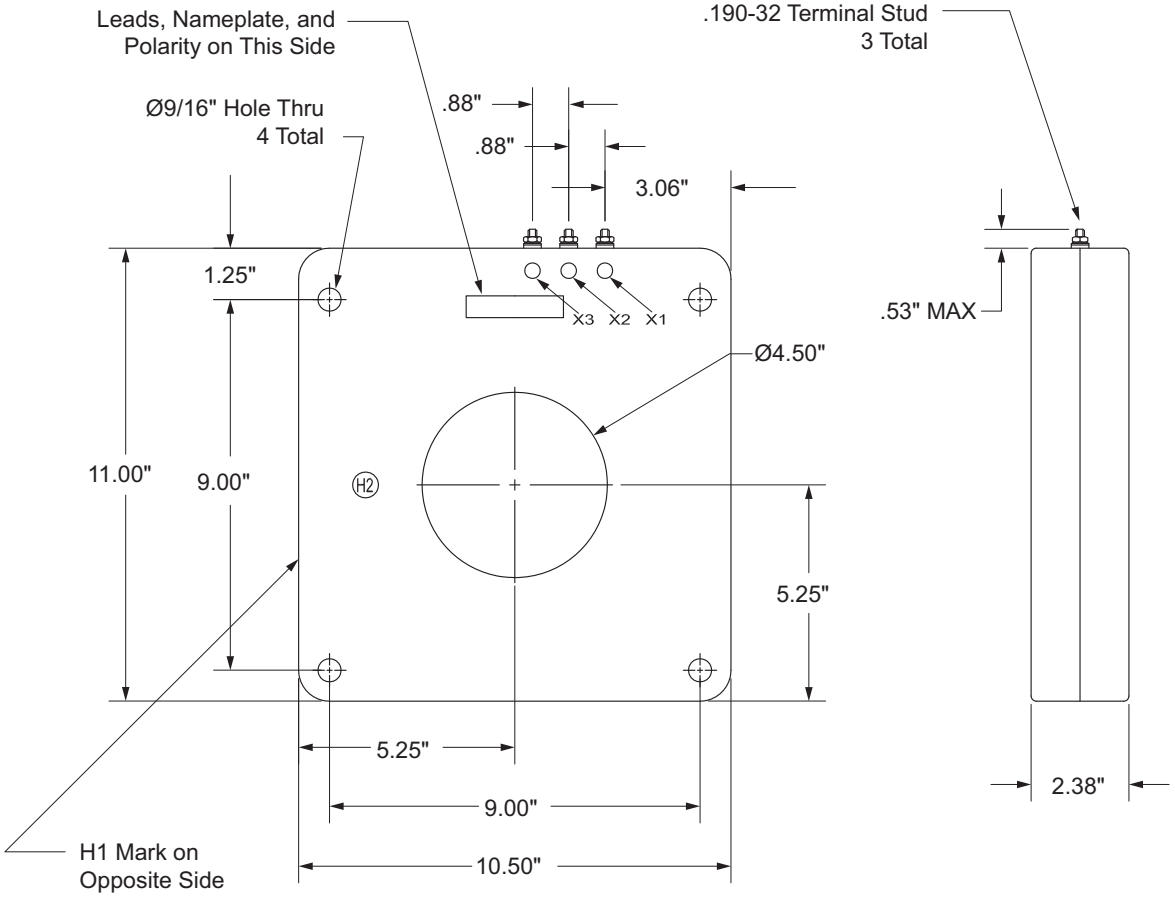
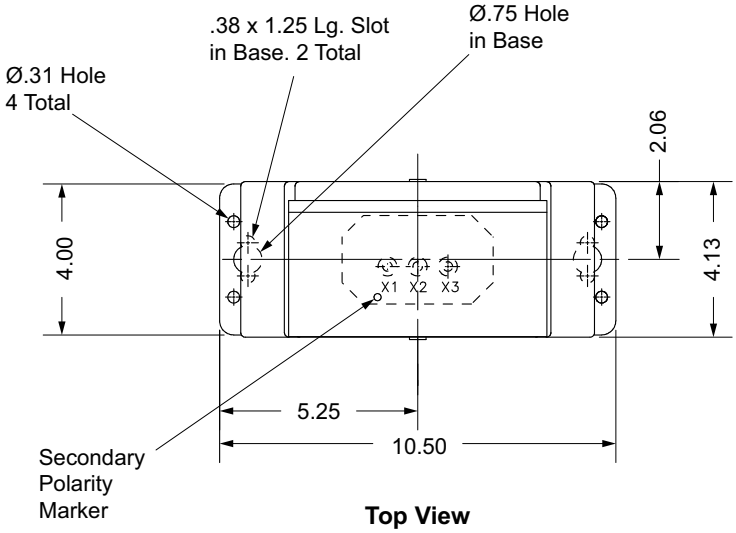
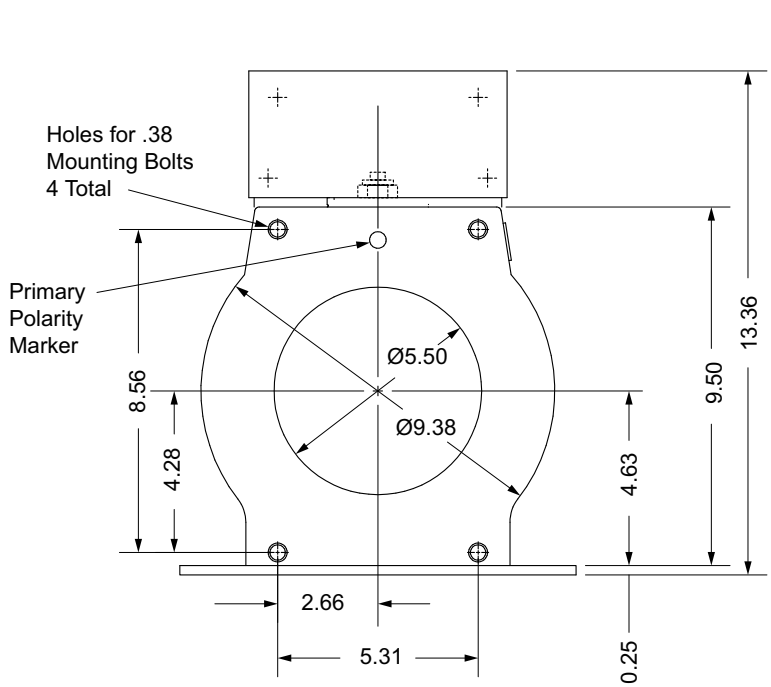


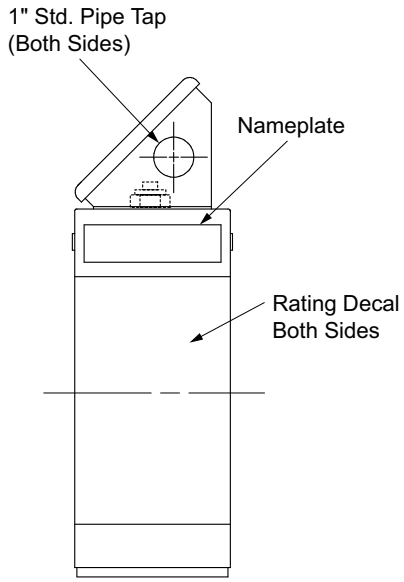
Figure AP 210–8: External Neutral Sensing CT (1000/500:1) Dimensions (Indoor/Outdoor) – Alternate Option



Top View



Front View



Side View

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AP 220P Inductor Cabinet for 12 kV and 16 kV REFCL Systems

Scope AP 220P.1 Inductor Cabinet for 12 kV and 16 kV REFCL Systems

1.0 General Information

Pad-mounted inductor cabinets are applied to facilitate resonant grounded systems. These systems generally applied as part of Isolation Bank and Pole Top installations. Distribution Apparatus Test are responsible for configuration of the secondary breakers for commissioning the inductors. The inductor cabinet is part of the protection and grounding scheme, and will typically be configured along with field reclosers during construction.

2.0 SAP Numbers

Figure AP 220P–1: Inductor Cabinet Dimensions

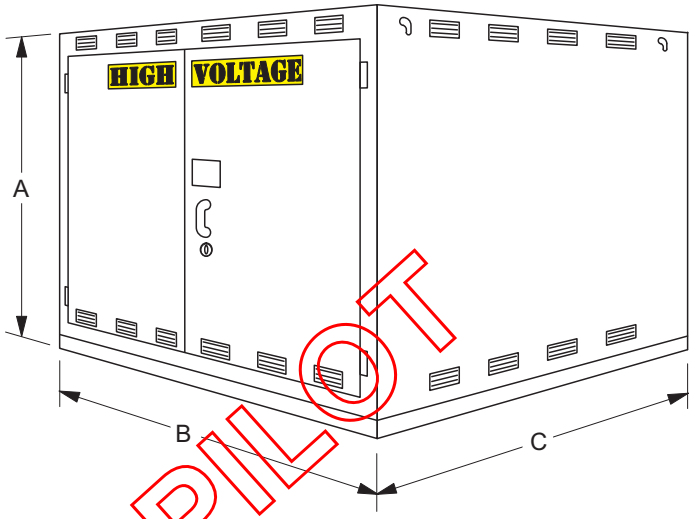

Table AP 220P–1: SAP Numbers for Inductor Cabinet

Dimensions			SAP Number	Approx. Weight (lb)
A (in)	B (in)	C (in)	12/16 kV	
56	58	58	10216712	1700

Table AP 220P–2: SAP Numbers for Replacement Parts

Description	SAP	Value
Strip Heater 240 VAC	10114644	1 kW
Inductor 120/240 VAC	TBD	50 mH

Note(s):
1. Pad-mount inductor cabinets are supplied with inductors, individual circuit breakers for each inductor, and a main breaker.
2. See UGS SS 520 for Inductor Cabinet Mounting Pad Instruction Details.
3. Connect the strip heater to the vacant mounting position. See Figure AP 220P–2.

Figure AP 220P–2: Inductor Cabinet Dimensions

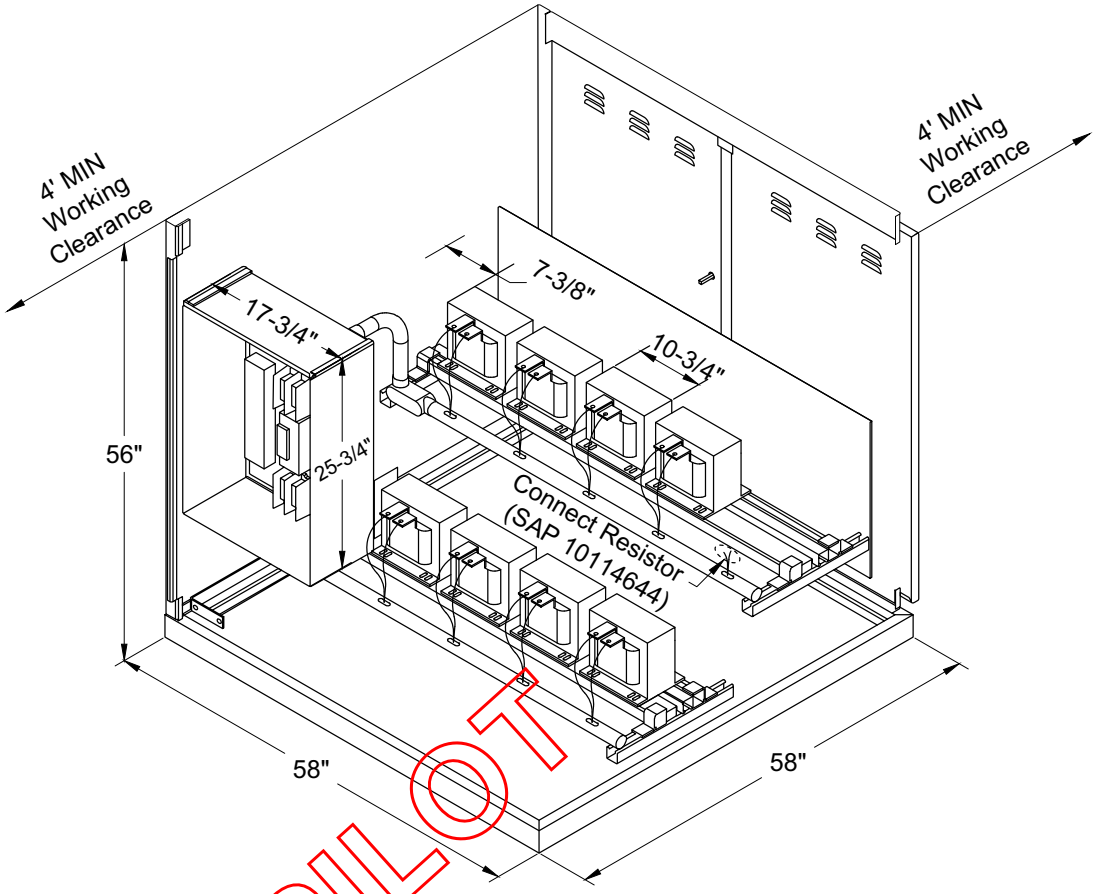

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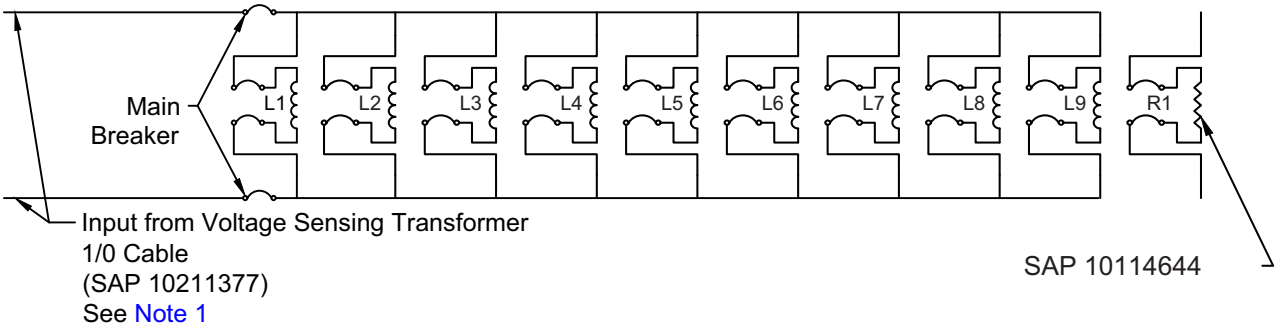
Figure AP 220P–3: Inductor Cabinet Internal Wiring Diagram



Note(s):
1. See DUG TX 230 for the 12/16 kV system application of the Inductor Cabinet.

Figure AP 220P–4: Inductor Cabinet Control Panel

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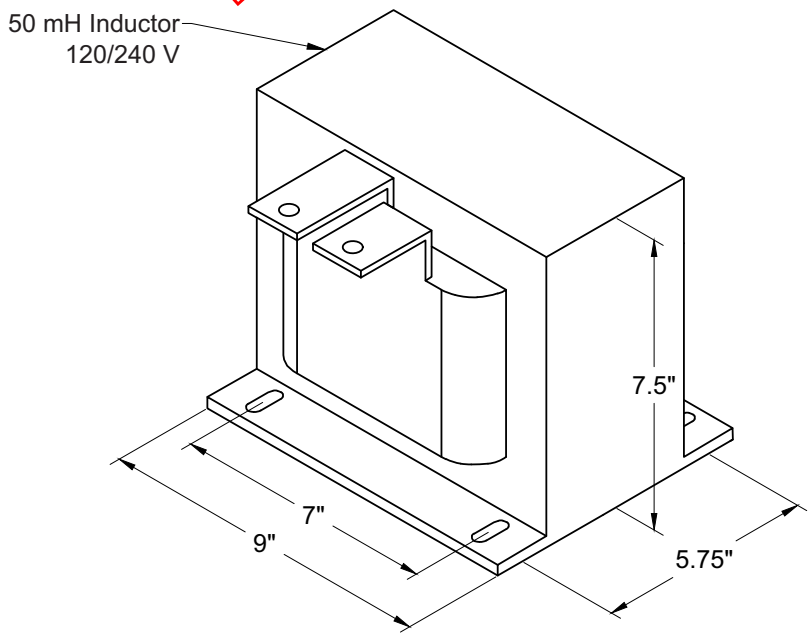
Figure AP 220P–5: Inductor Dimensions



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AP 230P Pad-mounted Capacitive Balancing Unit (CBU) for REFCL Systems

Scope AP 230P.1 Installation Procedure for Pad-Mount Remote Controlled Capacitive Balancing Unit

1.0 General Information

Pad-mounted Capacitive Balancing Units (CBU) are applied to facilitate resonant grounded systems.The purpose of the CBU is to add capacitance to ground to create balanced amounts of capacitance to ground between phases. The more balanced the stray capacitance, the more sensitive the REFCL system is in detection of high impedance faults. The REFCL system is designed to reduce phase to ground fault current to less than 0.5 A. The neutral imbalance at the substation or REFCL Isolation Bank will reveal any failure of the CBU.

2.0 Material Information

2.1 The Cleaveland/Price Pad-Mount CBU kit provides the CBU controller equipped with capacitors.

Refer to Table AP 230P-1 for SAP numbers.

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Table AP 230P–1: CBU Cabinet Materials

Material Description	SAP
Pad-mount Automated CBU Enclosure	10217297
Replacement Capacitor, 100 uF	10217298
Replacement Capacitor, 300 uF	10217299

2.2 A 120 VAC source is required to power the CBU cabinet.

A. Control power shall be provided for Pad-Mount Remote Controlled CBUs using one of the following options:

1. 25 kVA, 12 kV, Pad-Mounted Bay-O-Net Fused Transformer. See Scope TX 300.2.
2. 1 kVA, 12/16 kV, Solid Dielectric Transformer for submersible applications. See Scope TX 300.3.
3. 25 kVA, 12 kV, BURD Transformer for ferroresonance mitigation. See Scope TX 300.4.
4. 0.5 kVA, 12/16 kV, Dry Type Overhead VT on FuseSaver/Riser Pole.

B. Use #12 AWG white and #12 AWG black copper wire for control power to CBU cabinet.

C. For Dual Pad-Mount applications a single control power transformer can be used for both CBU cabinets.

2.3 A Single-Phase, Switched, Fused Transformer is required to connect the phase being balanced tothe CBU.

A. One 50 kVA single-phase transformer (SAP 10104093) shall be used per phase being balanced.

B. The H1A bushing shall be connected to the phase being balanced using 1/0 JCN cable.

C. The X1 and X3 bushings shall be connected to the 240 VAC terminal block in the CBU enclosure using 4/0 cable.

D. See Section 3.0 for grounding requirements for the single phase transformer.

E. See Scope TX 190.2 for construction details.

3.0 Grounding

3.1 At the source structure tie the concentric neutrals for all three phases together.

3.2 Single Phase Transformer Grounding

A. Tie the concentric neutral of the H1A bushing to the equipment ground.

B. The H2A Bushing shall be connected directly to the equipment ground.

C. The X2 bushing shall be connected directly to the equipment ground

D. See Scope TX 190.2 and GR 110 for grounding materials and installation details.

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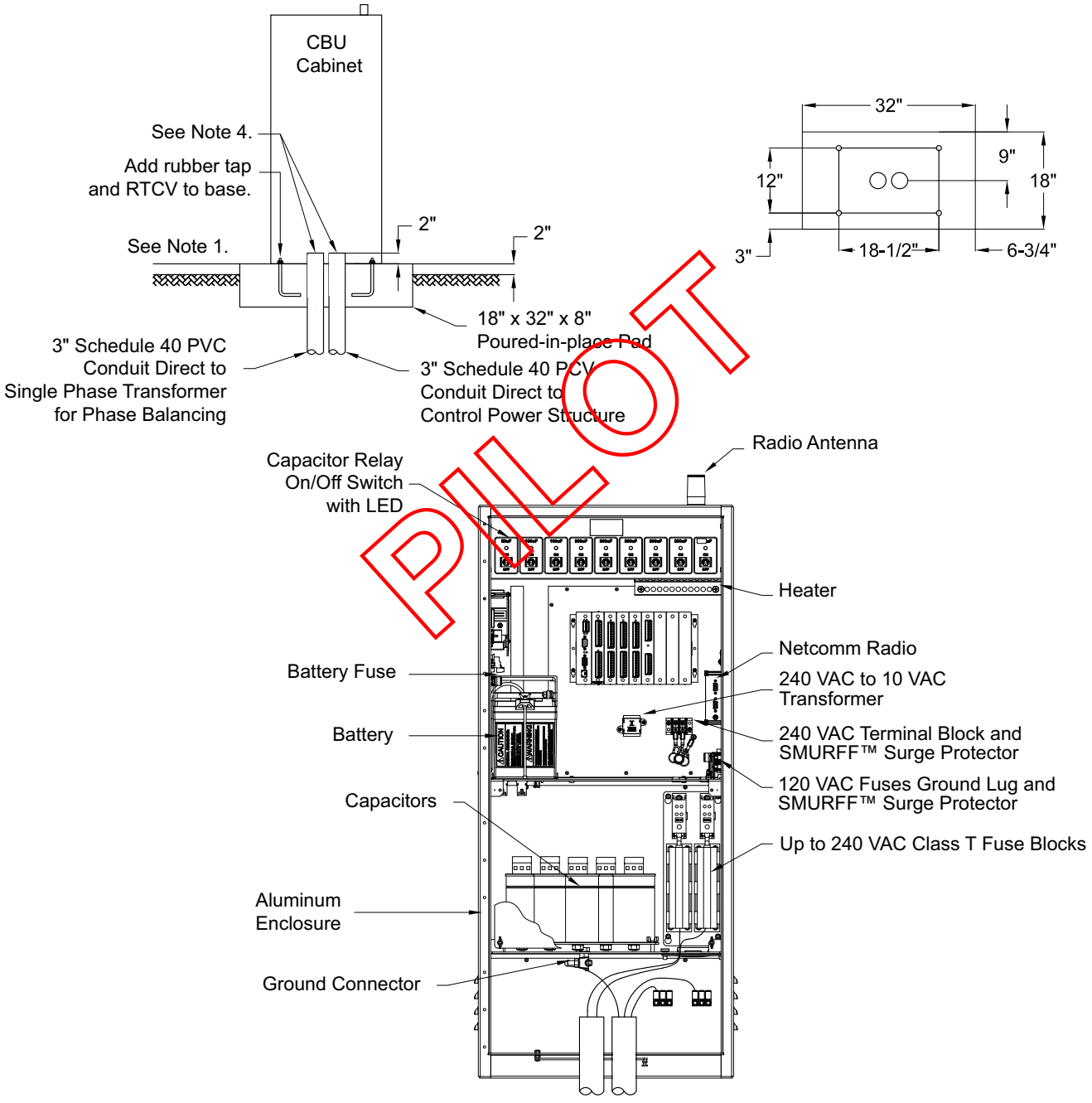
Figure AP 230P–1: Pad-mount Remote Controlled CBU Installation



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Note(s):

1. The CBU cabinet door should NOT face the street traffic lane.
2. 120 VAC to be provided to CBU with one of the methods detailed in Section 2.2.
3. Ground CBU cabinet at the grounding lug with minimum #6 bare copper wire (SAP 10109324).
4. Use submersible 3 way connectors (SAP 10181504) for 120 VAC connections.
5. Apply duct seal to close conduit openings in CBU cabinet, See CW 105.

Scope AP 230P.2 Applications for Pad-Mount Remote Controlled CBU

Figure AP 230P–2: Schematic of Single Remote Controlled Capacitive Balancing Unit

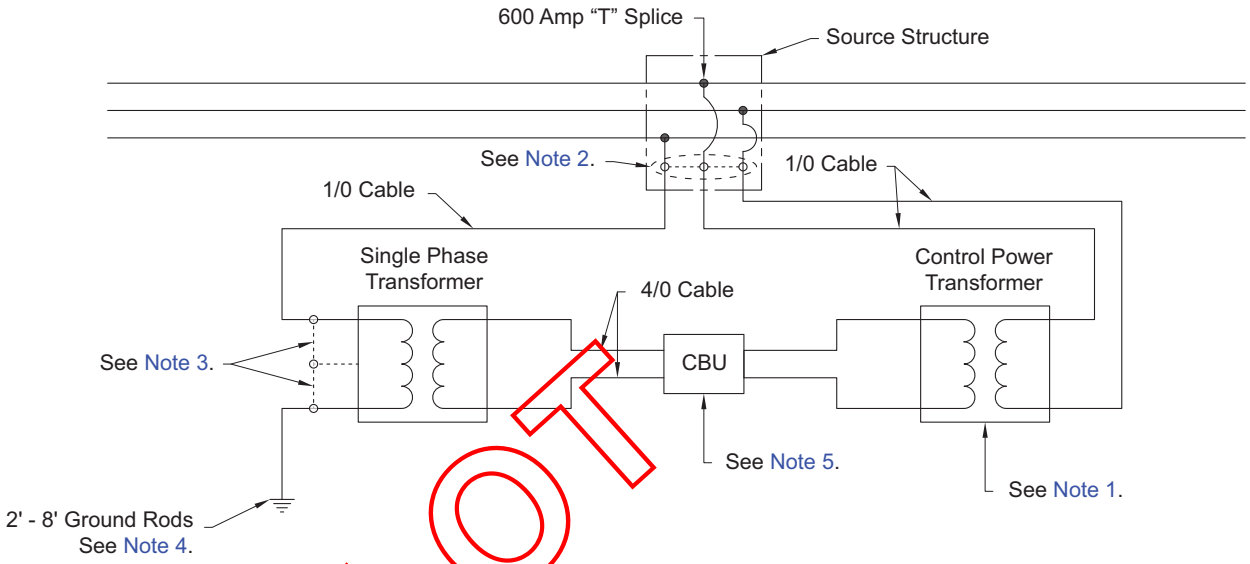

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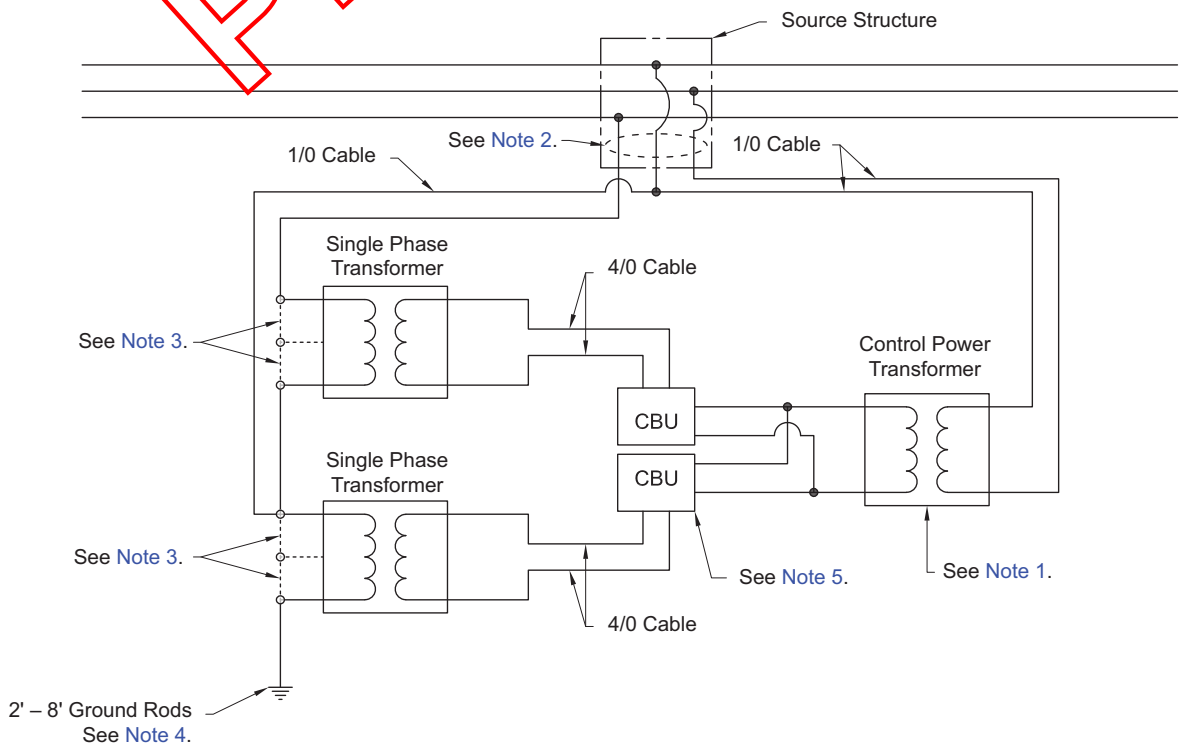
Figure AP 230P–3: Schematic of Dual Remote Controlled Capacitive Balancing Unit



Note(s):
1. See Scope AP 230P.1 Section 2.0 for transformer and CBU material requirements.
2. See Scope AP 230P.1 Section 3.1 for grounding requirements at the source structure.
3. See Scope AP 230P.1 Section 3.2 for grounding requirements at the single phase transformer.
4. Grounding electrode, per DOH GR 400, is not required for padmount CBU installations.
5. See Figure AP 230P–1 for installation details on the CBU enclosure

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AP 250 Installation Procedure for Remote Sectionalizing Interrupter (RSI)

Scope AP 250.1 Installation Procedure for RSI

1.0 General Information

1.1 The Remote Sectionalizing Interrupter (RSI) utilizes the Elastimold Molded Vacuum Interrupter (MVI) which is a three-phase, gang-operated, 2-way interrupter used for reliability purposes. It is rated 27 kV maximum, 125 kV Basic (Impulse) Insulation Level (BIL), 600 A continuous current, and 12.5 kA sym. withstand current rating and fault interruption. It weighs approximately 145 pounds and can be mounted in any position.

1.2 The RSI includes a 24 VDC submeble motor operator that is connected by a control cable to a remote surface-mounted cabinet supplied by Cleveland Price Inc.

1.3 A 10-pin yellow cable connects the interrupter to the pedestal mounted control box. This cable is used for current transformer signals, trip signals, and trip indication status. Two 30 ft. cables are provided, along with a threaded stainless steel coupling. The connections on this cable shall be protected against water intrusion. See Figure AP 250–3.

1.4 Two dedicated control power transformers shall be applied for control power. One CPT shall be applied to the line side and one CPT shall be applied to the load side of the RSI. Both control power transformers shall be connected to the same phases, with the same high-side and low-side connections to enable correct operation of phantom voltage telemetry (See Figure AP 250–8 and Figure AP 250–9 for 12 and 16 kV applications, respectively). A transfer switch in the UAD control cabinet will select power from the CPTs.

A. See TX 300 for dedicated control power transformer installation procedure, Figure AP 250–8 and Figure AP 250–9 for transformer secondary power connections.

B. The secondary neutral shall be grounded to the structure ground system at the control transformer.

C. A voltage source sign is required to be placed at the location where the control transformer is swtiched and at the location of the control transformer itself.

D. For installations that involve a ferroresonance condition, an alternate transformer is to be used. (See Table AP 250–2: SAP Numbers - Alternate Phase to Ground Transformers)

2.0 Material Information

For new installations, both SAP 10106479 and SAP 10107154 are required. These two codes must be ordered together to alert the supplier to ship a complete unit with the motor operator attached and calibrated as shown in Figure AP 250–1 (Sheet 3).

Table AP 250–1: SAP Numbers – New Installations

Description	SAP Number
Interrupter and Motor Operator	10106479
UAD Controller	10107154
Control Power Transformer	10105053
Mounting Frame for Control Transformer	10104924
Voltage Source Sign	10135323

Table AP 250–2: Alternate Phase to Ground Transformers

Description	SAP Number
25 kVA, 6.9 kV Fused/Switch BURD Transformer	10103917
25 kVA, 9.4 kV Fused/Switch BURD Transformer	10103918

3.0 Dimensions

Figure AP 250–1: Elastimold Molded Vacuum Interrupter (MVI) – Top View

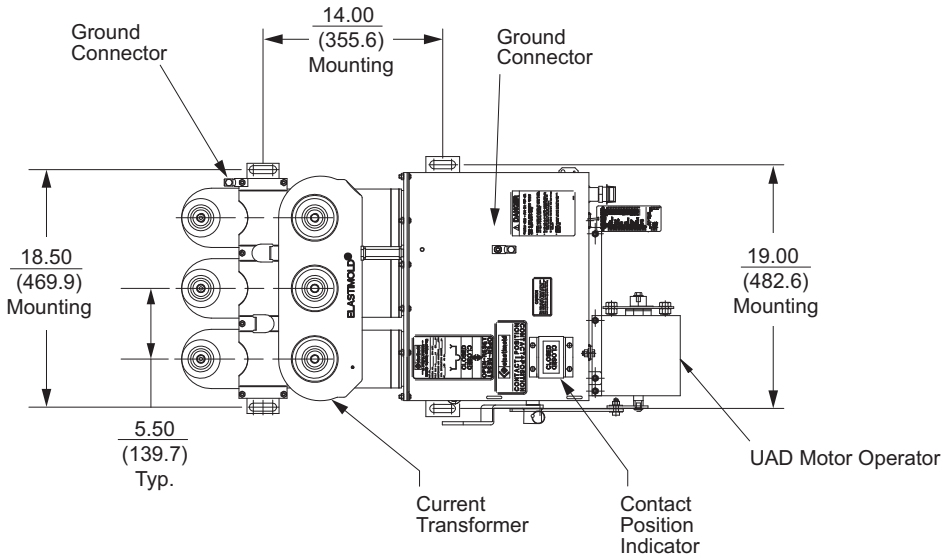


Figure AP 250–2: Elastimold MVI – Side View

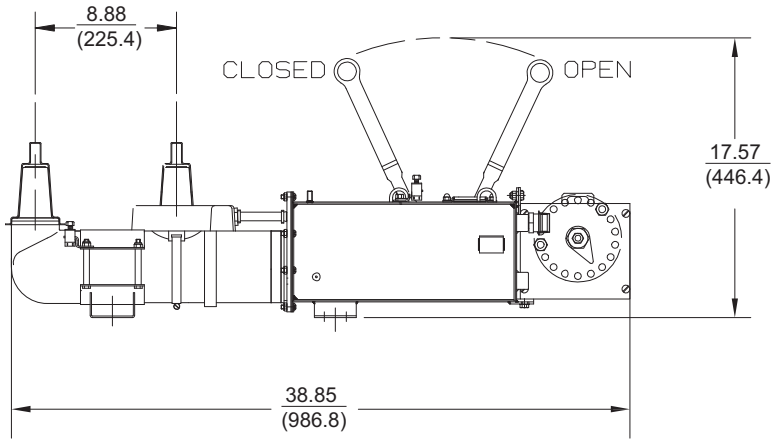
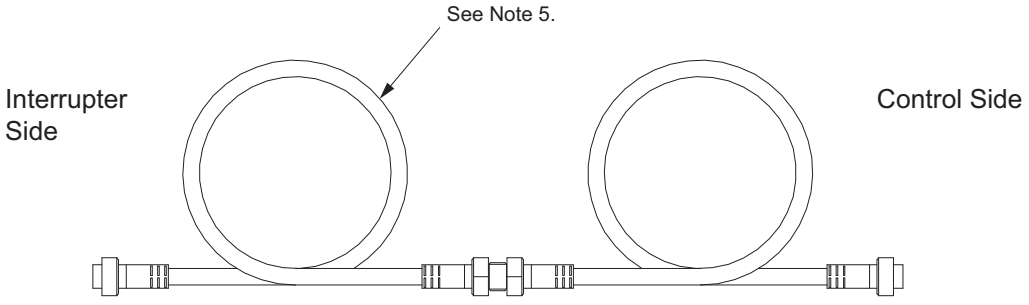


Figure AP 250–3: CT Cable Connections



Note(s):
1. Install no more than two bushing extensions, See JJ 660
2. See Figure AP 250–4 and AP 250–5 for mounting bracket, or alternate mounting bracket AP 250–6.
3. Install rigging hogeyes/anchors as required for manual operation of the interrupter.
4. Two 30-foot cables are provided for connection between the interrupter and control box.
5. The cables may be joined using the supplied stainless steel union. Rubber tape the union coupling and connection at the interrupter for protection against water intrusion with 3M Scotch 23 and 33 tape.

4.0 Bracket Installation and Dimensions for RSI

Figure AP 250–4: Elastimold Bracket Installation for RSI

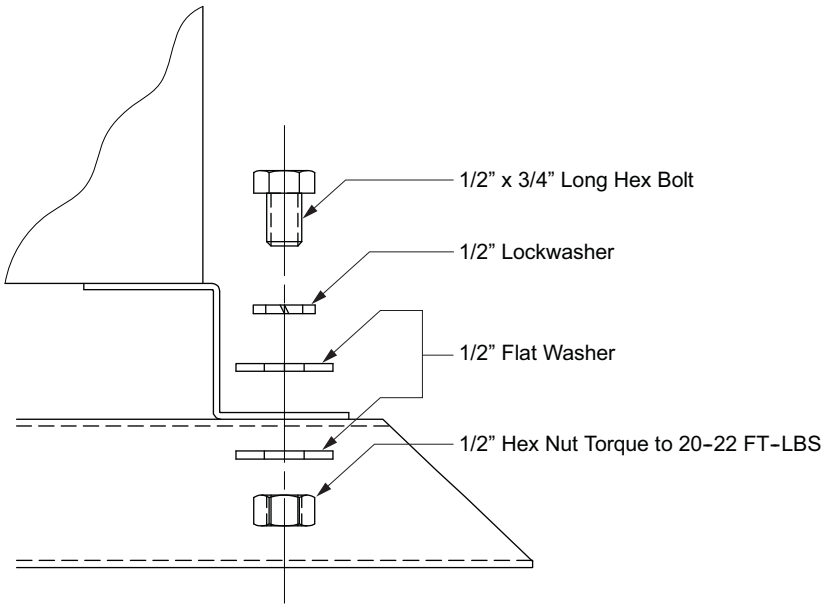


Figure AP 250–5: Elastimold Bracket Dimensions for RSI

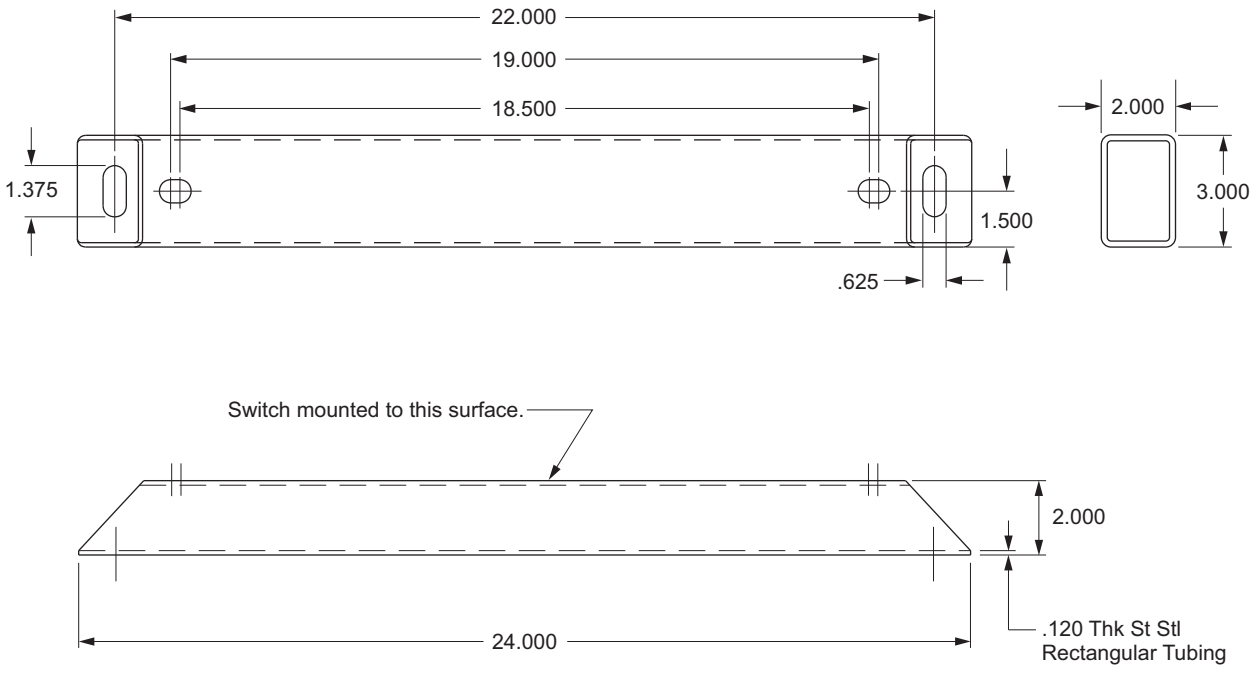
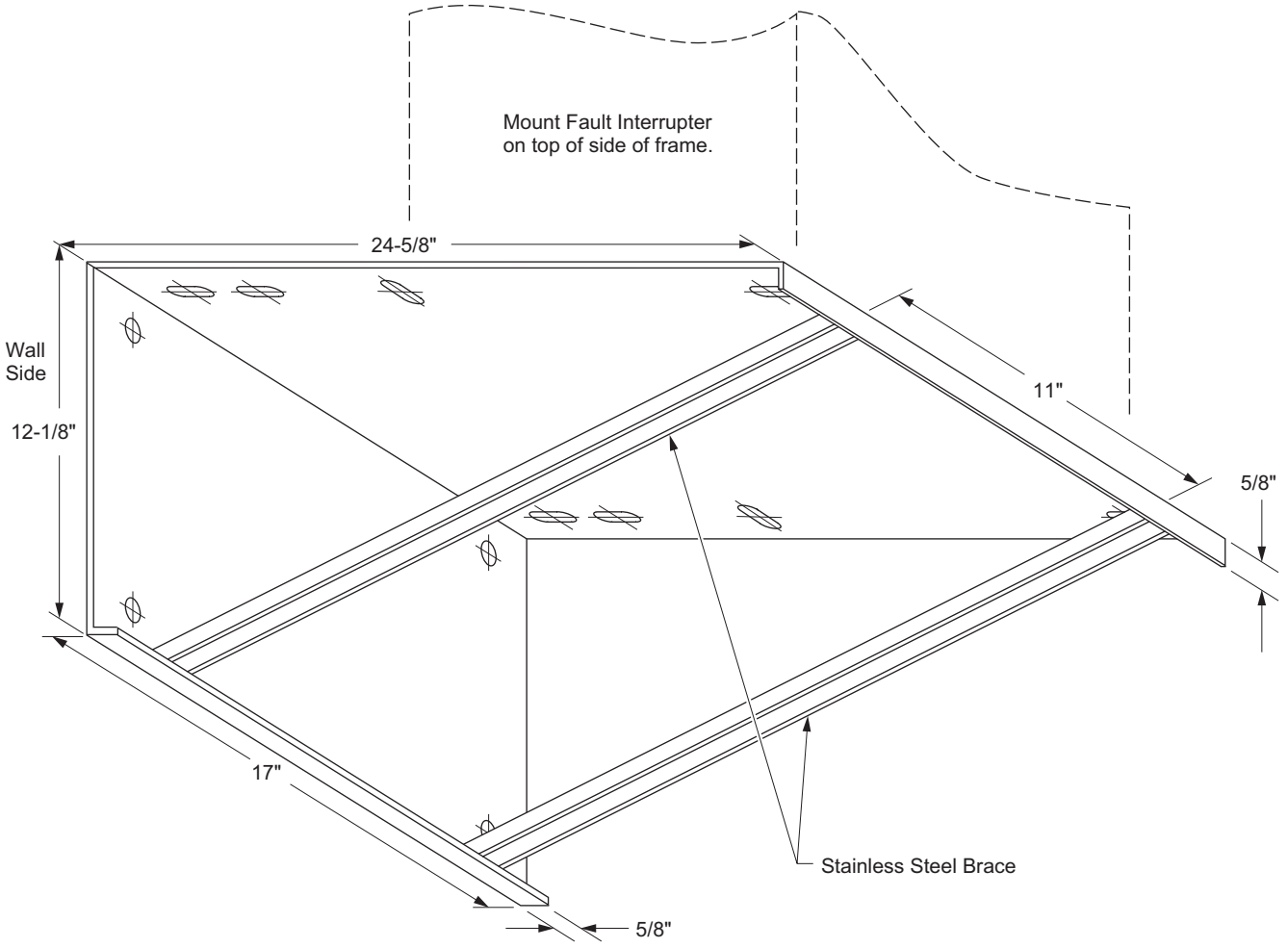


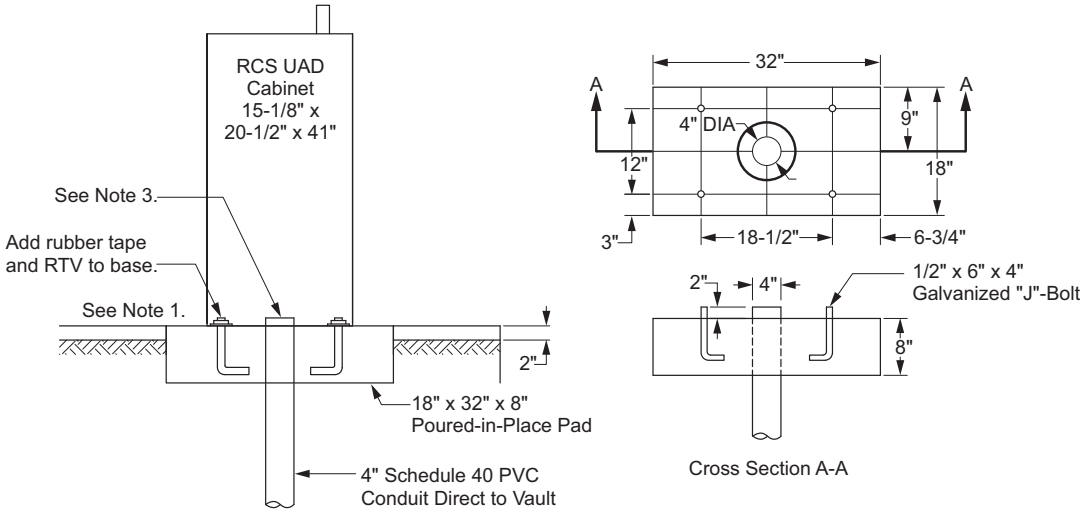
Figure AP 250–6: Scott Engineering ES-287 Stainless Steel Optional Mounting Frame

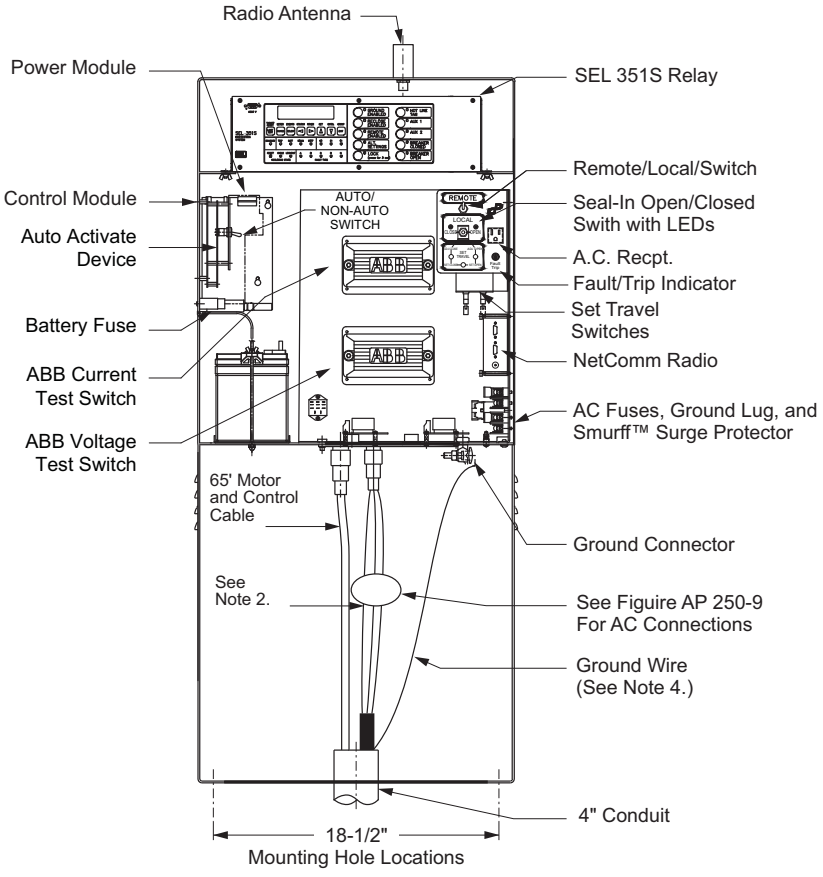


Bottom View

Scope AP 250.2 Installation of Underground Automated Distribution (UAD) Cabinet

Figure AP 250–7: UAD RSI Cabinet Installation – Dimensions and Corrections

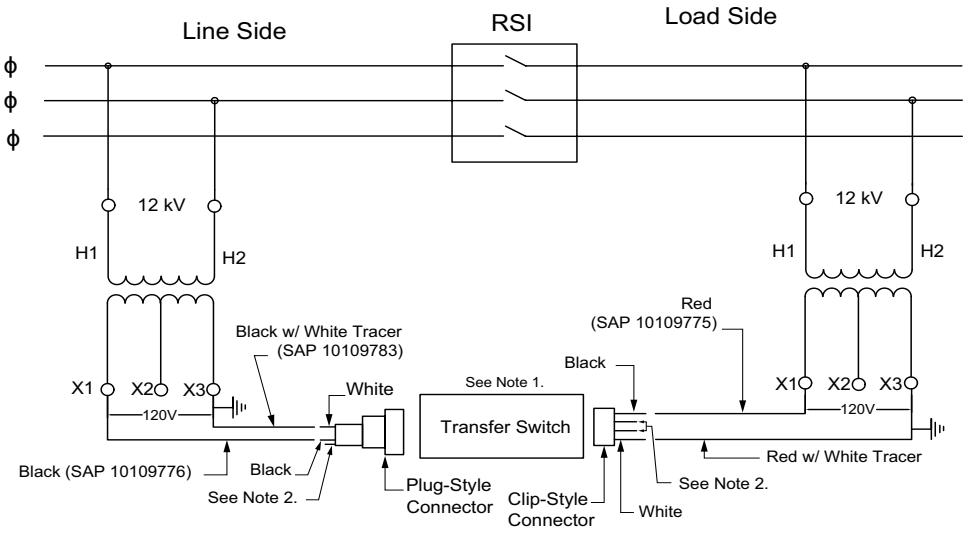




Note(s):

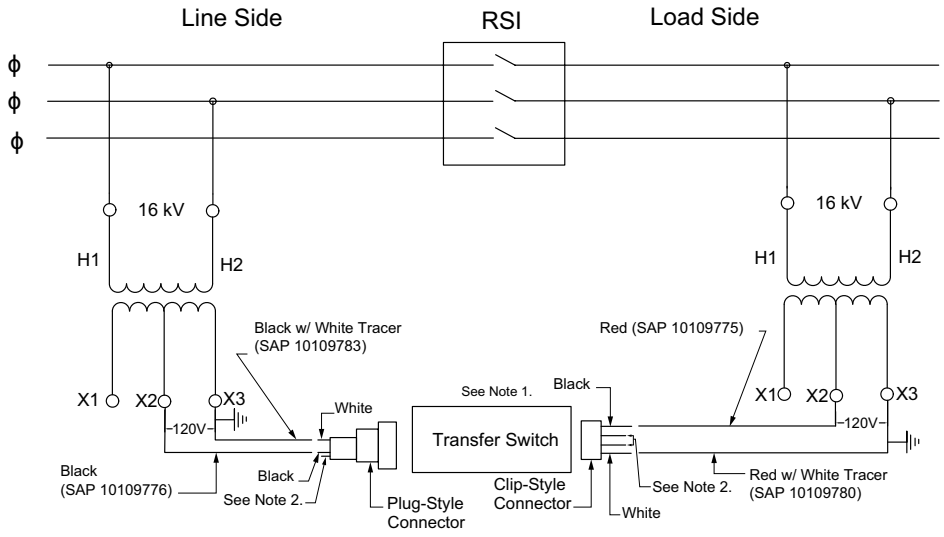
1. Distance between vent and UAD control cabinet may vary. UAD cabinet door should not face ventpipe or street traffic lane.
2. 120 VAC to be provided to RSI from available AC on source side of switch. Use #8 copper, jacketed 2-conductor (SAP 10109555) or 3-conductor (SAP 10109562) depending on transformer configuration.
3. Apply duct seal to close conduit openings in UAD cabinet, see CW105.
4. Ground interrupter and UAD cabinet with minimum #6 bare copper from vault ground using ground lugs provided.
5. Ground the control power transformer mounting bracket per DUG TX 300.
6. Use underground connector (SAP 10118144) for 120 VAC connections in lower portion of UAD cabinet.
7. Use 4-way bar-type connector (SAP 10118162) to provide for neutral ground at control transformer.;

Figure AP 250–8: CPT Primary and Secondary Connections for Phantom Voltage for 12 kV Application



Note(s):
1. Transfer switch is pre-wired in UAD control cabinet. During installation, field personnel shall terminate secondaries to the plug-style and clip-style connectors as shown, and mate to the corresponding bulkhead connectors of the UAD cabinet. See Figure AP 250–7.
2. Safe-end unused wires on plug-style and clip-style connectors

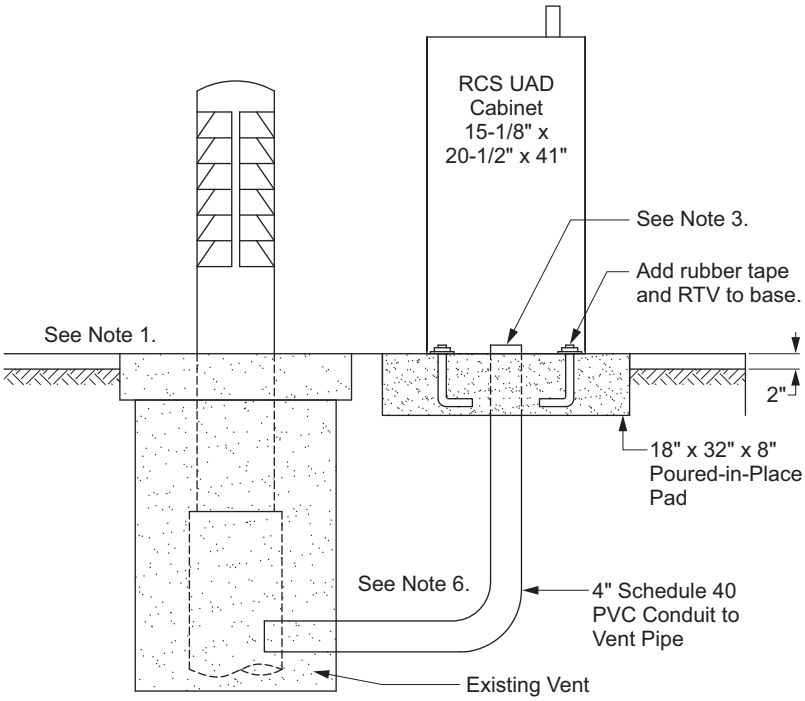
Figure AP 250–9: CPT Primary and Secondary Connections for Phantom Voltage for 16 kV



Note(s):
1. Transfer switch is pre-wired in UAD control cabinet. During installation, field personnel shall terminate secondaries to the plug-style and clip-style connectors as shown, and mate to the corresponding bulkhead connectors of the UAD cabinet. See Figure AP 250–7.
2. Safe-end unused wires on plug-style and clip-style connectors

Scope AP 250.3 Alternate Installation of Underground Automated Distribution (UAD) Cabinet

Figure AP 250–10: Alternate RSI UAD Cabinet Installation – Dimensions and Connections



Note(s):

1. Confirm that the vent pipe chosen is not equipped with a vault blower. Feed pull rope down the other vent pipe if this is found to be the situation.
2. Ensure that pull rope goes all the way from UAD to vault.
3. Apply duct seal to close conduit openings in UAD cabinet. See CW 105.
4. If the vent pipe present is made of steel, and the lid is welded shut, replace vent pipe. See VE 225.
5. Distance between vent and UAD control cabinet may vary. UAD cabinet door should not face vent pipe or street traffic lane.
6. 120 VAC to be provided to RCI from available AC on source side of switch. Use #8 copper, jacketed 2-conductor (SAP 10109555) or 3-conductor (SAP 10109562) depending on transformer configuration.
7. Ground interrupter and UAD cabinet with minimum #6 bare copper from vault ground using ground lugs provided.
8. Use underground connector SAP 10118144 for 120 VAC connections in lower portion of UAD control cabinet.
9. Ensure that the end of the 4" PVC conduit is flush with the PVC duct to prevent cable binding during installation.
10. Use 4-way bar-type connector SAP 10118162 to provide for neutral ground at the control transformer.

AP 300 Equipment Clearances in Walk-In Vaults (Transformer Rooms)

Scope AP 300.1 Equipment Clearances in Customer – Owned Transformer Rooms

1.0 General Information

1.1 This standard provides the working clearances requirements for equipment installed in customer-owned transformer rooms.

1.2 A clearance of at least eight feet must be maintained on the door side of the pad-mounted equipment or in front of the three-phase subway transformer. The eight feet clearance shall be measured from the edge of the BART pad or subway transformer.

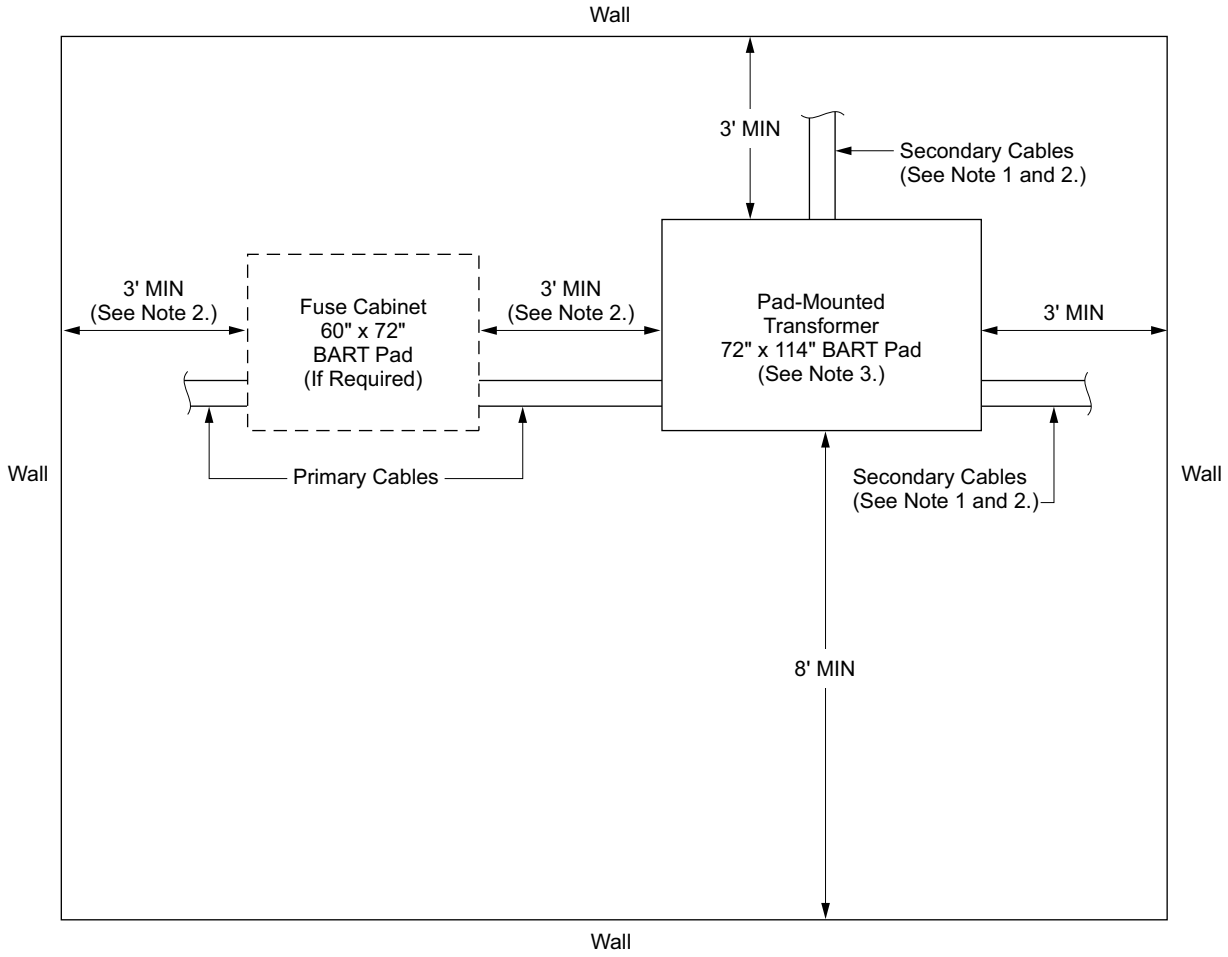
1.3 A clearance of at least three feet must be maintained on the non-door side of the pad-mounted equipment or in the back and sides of the three-phase subway transformer. The three feet clearance shall be measured from the edge of the BART pad or subway transformer.

1.4 For multiple pad-mounted/subway equipment installations, a clearance of at least three feet must be maintained between apparatus to allow for access and access and air ventilation/circulation.

1.5 Refer to DDS-15 for approved equipment and structures required for a transformer room.

1.6 Refer to ESR-4 for wall, ceiling and floor requirements, transformer room equipment and personnel access, grounding requirements, and equipment lifting requirements.

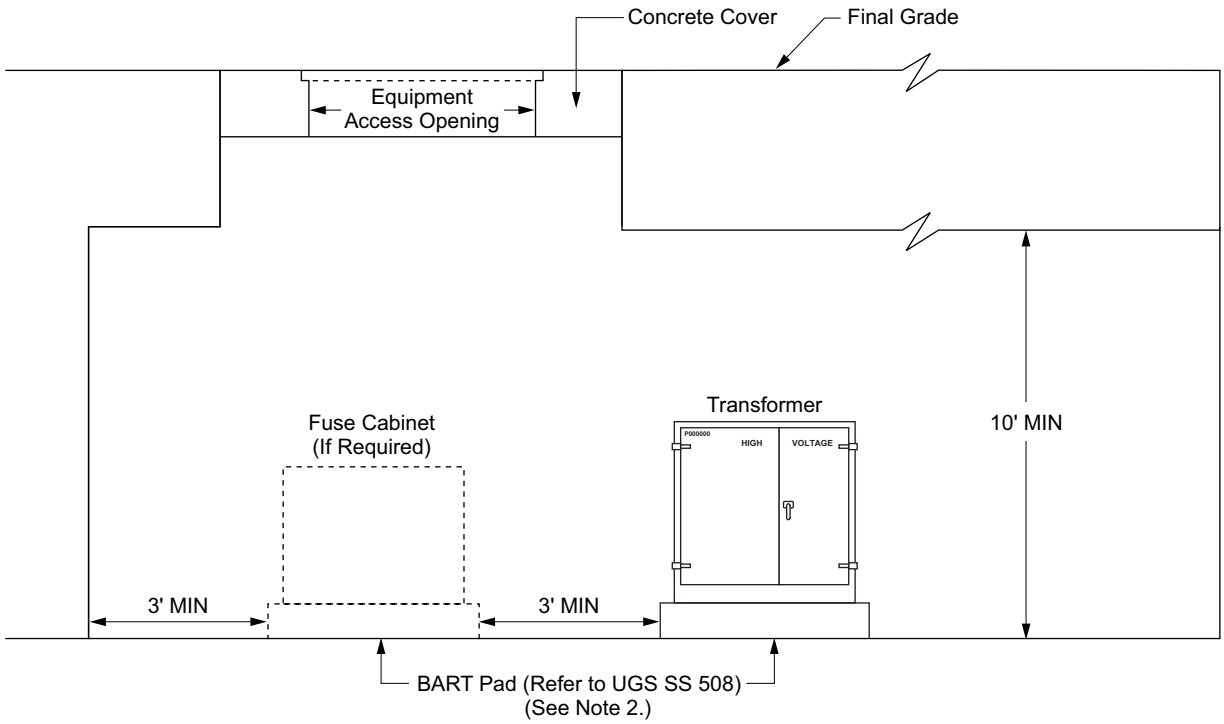
Figure AP 300–1: Transformer Room Plan View (Typical) at Grade Level – Equipment Clearances



Note(s):

1. Size and number of secondary cables are based on the panel size.
2. If primary/secondary service cable exceeds 3 feet from the pad to wall and lying on the ground, 5-inch PVC conduit shall be required for each run of cables for mechanical protection.
3. BART Pads are not allowed for new construction within a customer-owned transformer room (COTR).

Figure AP 300–2: Transformer Room Side View (Typical) Below Grade Level – Equipment Clearances



Note(s):

1. See Section 1.2 (Sheet 1) for minimum working clearance in front of the equipment.
2. BART Pads are not allowed for new construction within a customer-owned transformer room (COTR).

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Conduits and Risers
Table of Contents

Standard	Title
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CR 110.1	Conventional Riser Conduit Installation
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CR 110.3	Riser Installation Using Power Strut (Alternate Method)
CR 110.4	Riser Installation Using Unistrut (Alternate Method)
CR 110.5	Riser Installation Using Kicker Block
CR 120	12/16-kV Riser Installation #2 and 1/0 Cable
CR 120.1	12/16-kV CIC Riser Conduit Installation
CR 130	Streetlight Riser Installation
CR 130.1	Streetlight Riser Installation
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CR 135.1	Installation of 12/16-kV “U” Shaped Riser
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CR 140	BC Neutral — Riser Installation
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CR 141	BC Neutral — Riser Installation on Subtransmission Lightweight Steel (LWS) Pole
CR 141.1	BC Neutral - Riser Installation on Subtransmission LWS Pole
CR 150	Riser Conduit Labeling
CR 150.1	Riser Conduit Labeling

CR 100 Minimum Cable Depths

Scope CR 100.1 Minimum Cable Depths

Underground cable systems shall be installed at the following minimum depths (measured to top of upper most conduit or cable, or to top of concrete on encased banks). Local ordinances or joint construction with other utilities may require greater depths.

1.0 Maintenance of Minimum Cable Depths

Underground systems may be damaged and safety hazards created by changes in surface grade after electrical facilities have been installed. These changes may be caused by the homeowner's activity, a change in the developer's plans, failure of the developer to complete grading as scheduled, or by washouts, slides, or earth settlement. To minimize the possibility of this type of damage, the following procedure shall be followed:

1.1 Initial Installation. Before cables are installed in any section of trench (Conductor in Conduit [CIC] system) or conduit (conventional underground, tunneling, boring, jacking, plowing), determine as accurately as possible the proposed final grade; and make sure that this grade provides sufficient cover over the cables.

1.2 Grade Changes. Grade Changes are most likely to occur prior to final completion of the tract development but in many cases, after our facilities have been installed. All District personnel must be made aware of the importance of immediately reporting any construction activity in the vicinity of our facilities.

1.3 Corrective Action. The Claims Department will be notified immediately and pictures will be taken whenever an inspection reveals that underground facilities have been damaged by outside parties or that changes in grade have reduced the cover over underground facilities below the allowable minimum. In such cases, immediate action shall be taken to prevent further damage to underground facilities and to provide safety precautions as necessary. Permanent repairs or replacement as specified herein shall then be initiated.

Table CR 100–1: Conduit or Cable System

Circuit Voltage (Phase-to-Phase)	Conventional (See Note 1)	CIC	Direct Buried Cables
Streetlights (All Voltages)			
Commercial	30 in	45 in[3]	NA
Residential	30 in	45 in	NA
0–750			
Commercial	30 in	45 in	NA
Residential	30 in	45 in[2]	45 in
750–30,000			
Commercial	30 in	45 in	NA
Residential	30 in	45 in	NA
30,000–35,000			
Commercial	30 in	NA	NA
Residential	30 in	NA	NA

= For Reference Only

Note(s):

1. For encasement criteria, refer to UGS CD 120. Conduit depths listed meet or exceed General Order 128 requirements for conventional or trenchless technology construction.
2. Approved only for apartment complexes, condominiums and mobile homes where it is known that the cables will be installed under concrete or asphalt and known rocky areas, gophers, and so forth.
3. May be installed at lesser depth when in conjunction with conventional conduit.
   N.A. not approved

When cable depths are reduced below the specified minimum as a result of grade changes after installation, the following corrective action shall be taken.

4. For all conventional systems in commercial areas:
   a. Where cover is 18 inches or more but less than the specified minimum: If conduit is already encased, no action required. If conduit is direct buried, pour a three-inch thick concrete cap three inches above the uppermost conduit and extend this cap six inches laterally beyond each side.
   b. Where cover is less than 18 inches: Reinstall conduit at proper depth.
5. In all cases, depths and clearances must comply with PUC General Order #128.

CR 110 Conventional Riser Installation

Scope CR 110.1 Conventional Riser Conduit Installation

Figure CR 110–1: Conventional Riser Conduit Installation

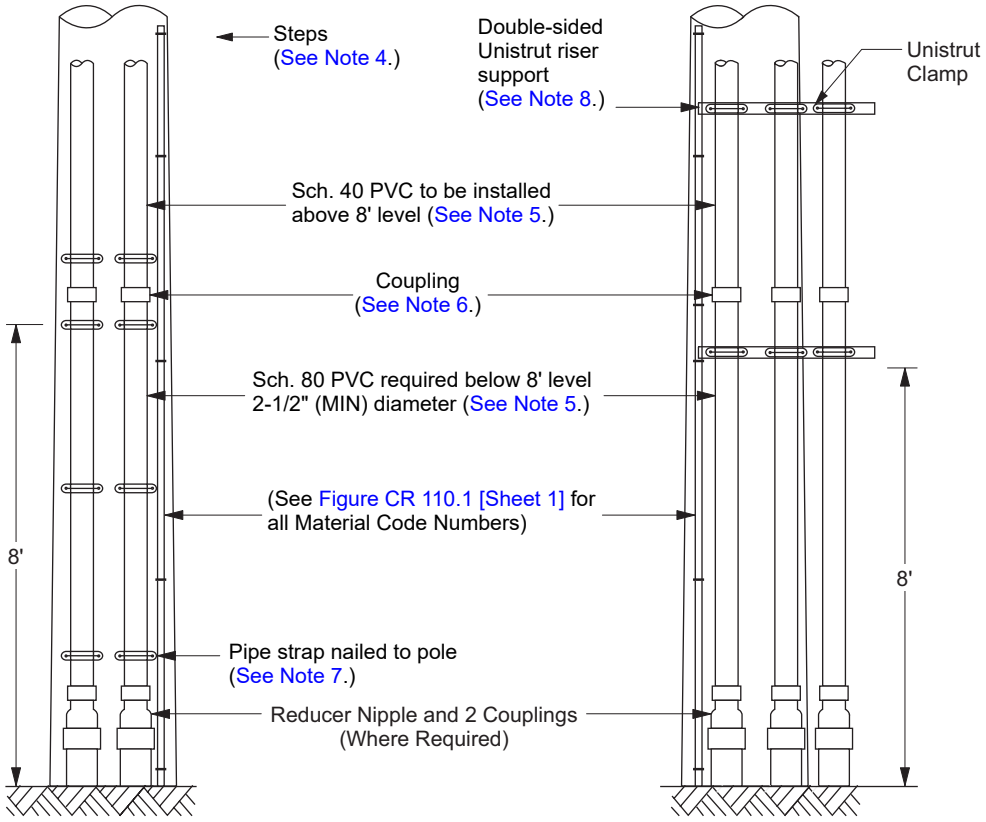


Figure CR 110–1.1 **Figure CR 110–1.2**

Note(s):

1. Figure CR 110–1.1 (Sheet 1) construction is restricted to a maximum of two Edison risers with a maximum size of 4 inches each or one riser with no size limitation. If a need for future (more than two) risers is anticipated or either riser is 5 inches or greater in size, use Figure CR 110–5 (Sheet 3) construction. **NOTE:** A riser conduit for bare copper neutrals (CR 140) shall not be considered a riser under the interpretation of Figure CR 110–1.1 (Sheet 1) construction when installed in conjunction with one riser of any size.
2. Normally, not more than two circuits should be brought up a pole on substation getaways.
3. Risers should be placed on the side of the pole away from vehicular traffic. See Scope CR 110.3 (Sheet 4) if the riser obstructs vehicular traffic, alley ways, and/or curb side.
4. See DOH PO 100.4 for pole step requirements. No step or kicker block should be placed below the 9 foot level.
5. The lower 8 feet of riser must be 2-1/2 inches in diameter or larger (Schedule (Sch.) 80 PVC); the diameter may be reduced above the 8-foot level. All risers installed above the 8-foot level shall be Sch. 40 PVC.
6. Cement PVC couplings at top sockets only (except cement top and bottom sockets of couplings at reducer nipples and at Fiberglass riser bends). Leave lower sockets loose to allow for expansion and contraction.
7. Install three pipe straps 10 feet in length for Figure CR 110–1.2 (Sheet 1) construction.
8. Each 10-foot length of conduit above the 8-foot level, for Figure CR 110–1.1 (Sheet 1) construction, should have a minimum of two double-sided unistrut riser supports.
9. The uppermost riser support (kicker block or pipe strap) shall be 6 inches (minimum) to 12 inches (maximum) from the top of the riser.
10. Hot-dipped galvanized (HDG) shall be used below 8-foot level when risers are smaller than 2-1/2 inches in diameter. Riser bend shall also be HDG for this installation only. HDG must be effectively grounded. (Refer to UGS AC 702.)
11. See DUG CR 150 for placement of riser conduit warning labels.

Table CR 110–1: Conventional Riser Installation SAP Numbers

Size (in)	Sch. 40 PVC Conduit	Sch. 80 PVC Conduit	PVC Female Slip Coupling	PVC 90° Elbows	Steel Strap	Hook Bolt
1	10112582	—	10113957	10114092 1/	10112990	—
2	10112585	—	10113960	10113840 1/	10112993	—
2.5	10112586	10112597	10113961	10114004 2/	10112994	—
3	10112587	10112598	10113962	10113997 1/	10112995	10068922
4	10112588	10112600	10113963	10114006 2/	10112996	10068923
5	10112589	10112601	10113964	—	10112997	10068924
6	10112590	10112602	10113965	—	10112999	—

Size (in)	HDG Conduit 3/	HDG Coupling 3/	HDG to PVC Adapter
1	10112464	10113083	10113909
2	10112480	10113086	10113917
2.5	10112485	10113087	—
3	10112494	10113088	—
4	10112508	10113090	10113925
5	10112521	10113091	10113926
6	—	—	10113927

Size (in)	PVC Reducer Nipple	HDG Reducer Nipple 3/
2 to 1	—	—
2.5 to 2	10114070	—
3 to 2	10114069	—
4 to 2.5	—	—
4 to 3	10114072	—
5 to 4	10114073	10077900
6 to 5	10113751	—

1/ Schedule 40
2/ Schedule 80
3/ See Note 10 in Figure CR 110–1.2 for the use of HDG.

Figure CR 110–2: Reducer Nipple Installation

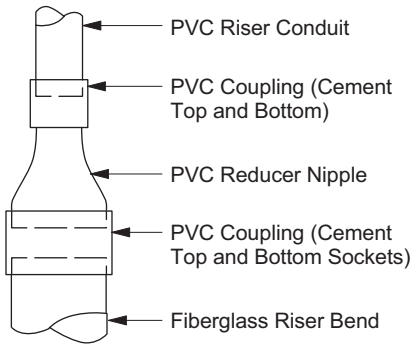


Figure CR 110–3: PVC Coupling Installation

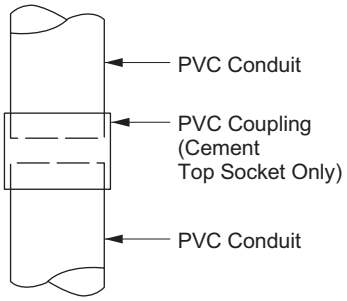
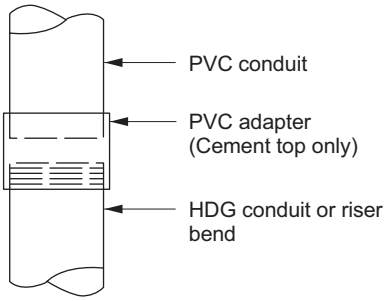


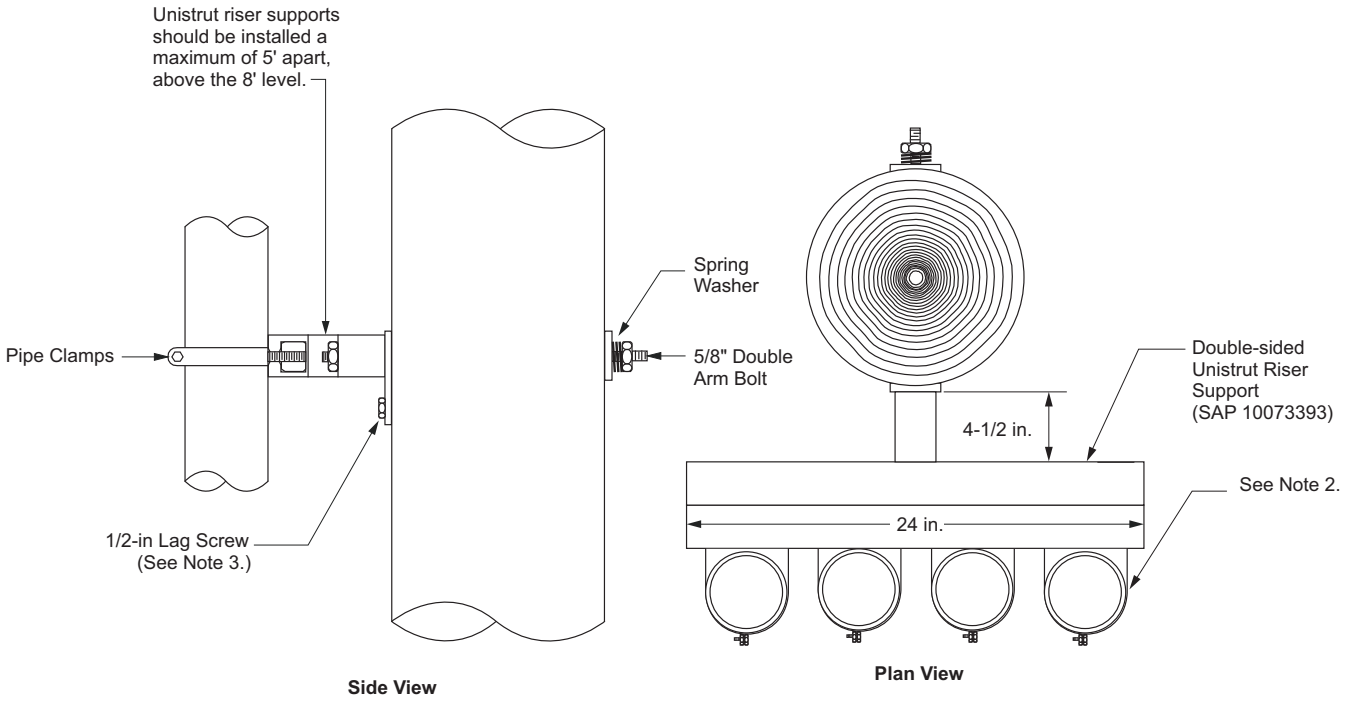
Figure CR 110–4: HDG-to-PVC Adapter Installation



Note(s):
1. PVC cement, SAP 10064289 (1/4 pint with brush), should be used as shown in the figures above.

Scope CR 110.2 Riser Installation Using Double-sided Unistrut Riser Support (Preferred Method)

Figure CR 110–5: Preferred Method for Using Unistrut Riser Support in Riser Installation



Note(s):

1. All notes pertaining to Figure CR 110–1.1 (Sheet 1) construction on Scope CR 110.1 (Sheet 1) also apply to risers supported by a unistrut.
2. The double-sided unistrut riser support can hold four 5-inch risers. If needed, risers can also be placed on the inner side of the double-sided unistrut.
3. As per DOH PO 112 Section 3.5, lag screw-type hardware is not approved for use on sectional composite poles.

1.0 Application

The unistrut shown in Figure CR 110–5 (Sheet 3) is the preferred method where multiple risers are required.

2.0 Material

Table CR 110–2: Unistrut Pipe Clamps

Conduit Size (in)	SAP Number
1	10113004
2	10073625
2.5	10073623
3	10073467
4	10073466
5	10073619
6	10073620
24" Double-sided Unistrut Riser Support	10073393

Scope CR 110.3 Riser Installation Using Power Strut (Alternate Method)

Figure CR 110–6: Alternate Method for Using Power Strut in Riser Installation

1.0 Application

For use in areas where the preferred method may obstruct traffic, alley way, and/or curb side.

2.0 Material

Table CR 110–3: Power Strut

Power Strut Size (in)	SAP Number
12	10073372
18	10073373
24	10073374

Table CR 110–4: 5/8" Double-Arm Bolts

Length (in)	SAP Number
12	10068865
14	10068866
16	10068867
18	10068868
20	10068869
22	10068870
24	10068871
26	10068872
28	10068873
30	10068874
32	10068875
34	10068876

3.0 Installation

Use unistrut pipe clamps per Table CR 110–1 (Sheet 2). Mount power strut to pole using one 5/8" double-arm bolt, in top hole of power strut, (See Figure CR 110–7 [Sheet 5] and Figure CR 110–8 [Sheet 5]) through pole and three 1/2" x 6" lag bolts (SAP 10071080).

Figure CR 110–7: Power Strut Mounted to Pole

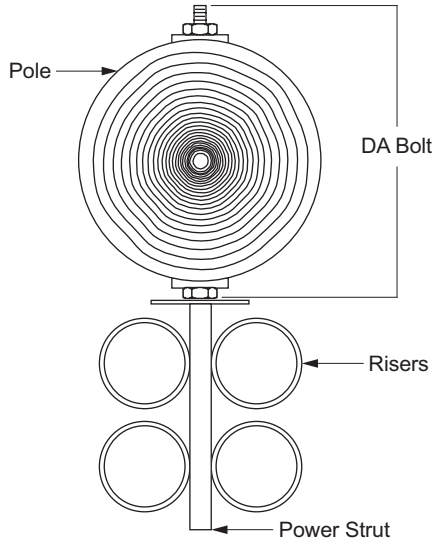
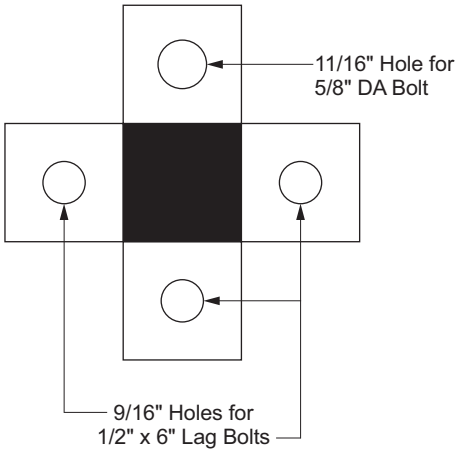


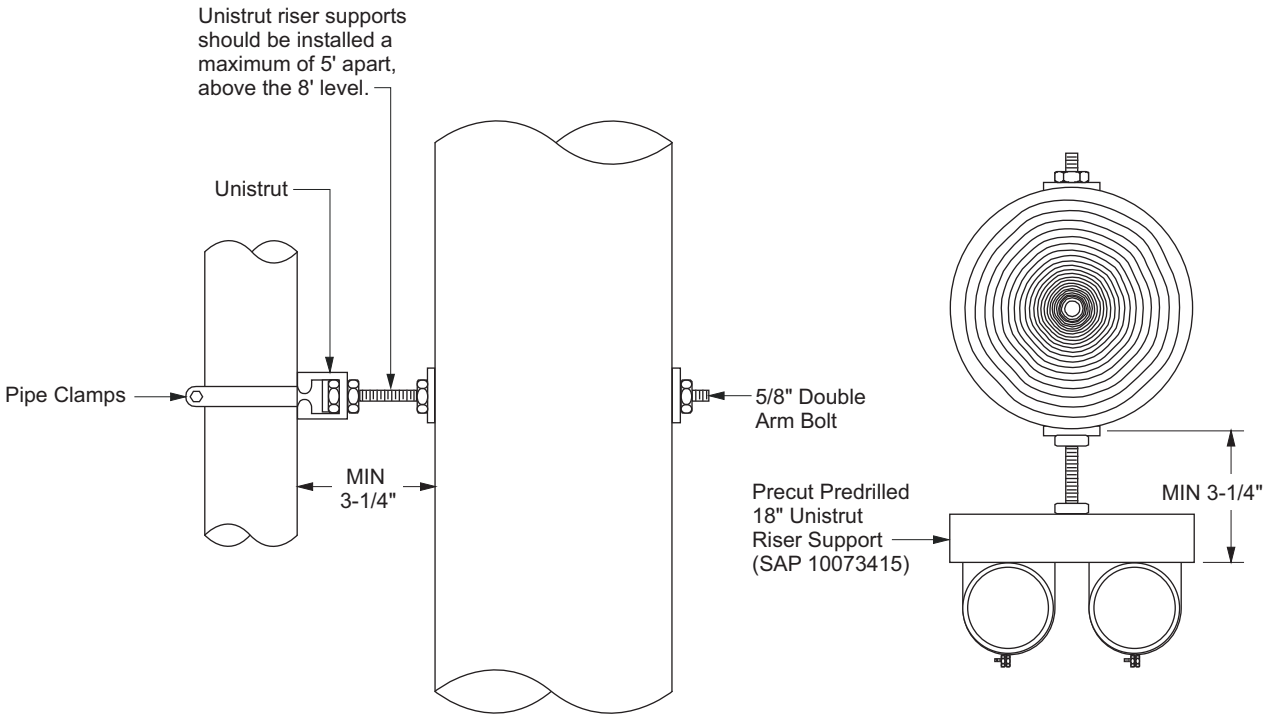
Figure CR 110–8: Power Strut Mounting Holes



Note(s):
1. Install bolt in top hole of power strut.

Scope CR 110.4 Riser Installation Using Unistrut (Alternate Method)

Figure CR 110–9: Alternate Method for Using Unistrut in Riser Installation

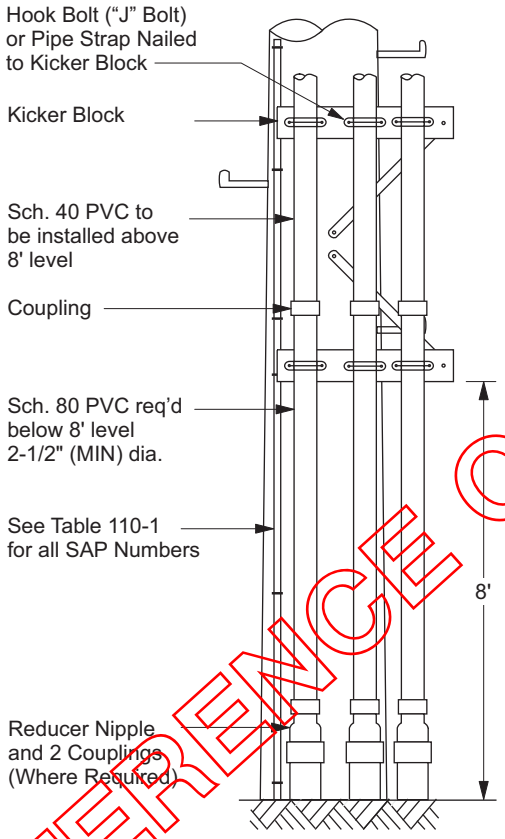


Note(s):

1. All notes pertaining to Figure CR 110–1.1 (Sheet 1) construction on Scope CR 110.1 (Sheet 1) also apply to risers supported by a unistrut.
2. 3-1/4" minimum required to accommodate kick blocks, guard arms, or cross arms if required.

Scope CR 110.5 Riser Installation Using Kicker Block

Figure CR 110–10: Typical Riser Conduit Installation Using Kicker Block



FOR REFERENCE ONLY

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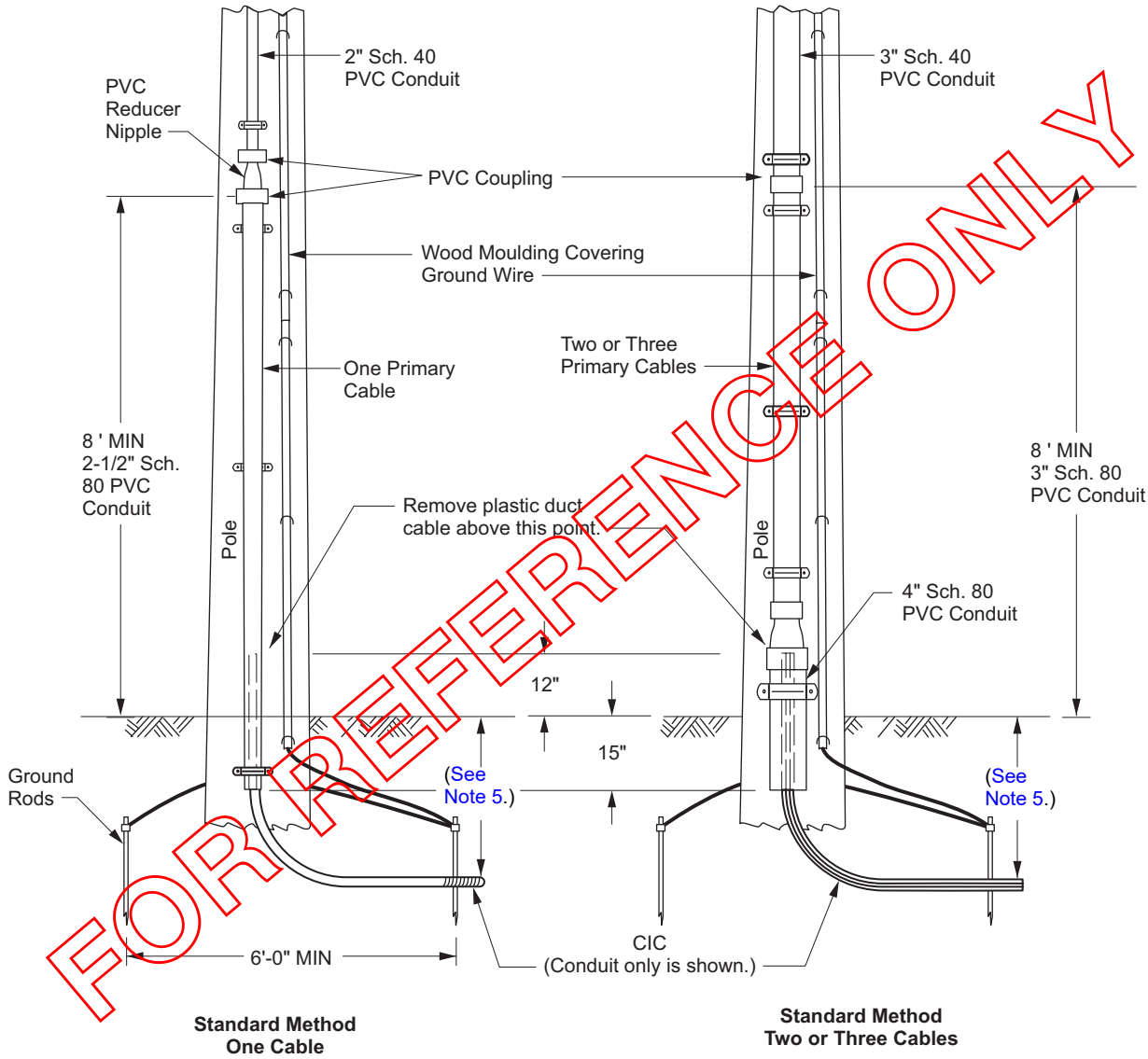
CR 120 12/16-kV Riser Installation #2 and 1/0 Cable

Scope CR 120.1 12/16-kV CIC Riser Conduit Installation

Figure CR 120–1: 12/16-kV CIC Riser Conduit Installation



FOR REFERENCE ONLY

Note(s):

1. See DOH PO 100.4 for pole site requirements.
   EXCEPTION: Solely-owned Edison poles with one low voltage riser (3 inches or less).
2. For details of ground rod arrangement refer to the *Distribution Overhead Construction Standards* Book.
3. Cement all couplings at top sockets only. Leave lower sockets of couplings loose to allow for expansion and contraction.
4. Two and one-half inch Sch. 80 is the minimum size PVC that may be used **below** the 8 foot level. Conduit installed **above** the 8 foot level shall be Sch. 40 PVC. See CR 110 for riser material.
5. CIC shall be installed with a minimum cover of 45 inches in commercial and residential areas.
6. See CR 110 for conventional riser conduit installation.

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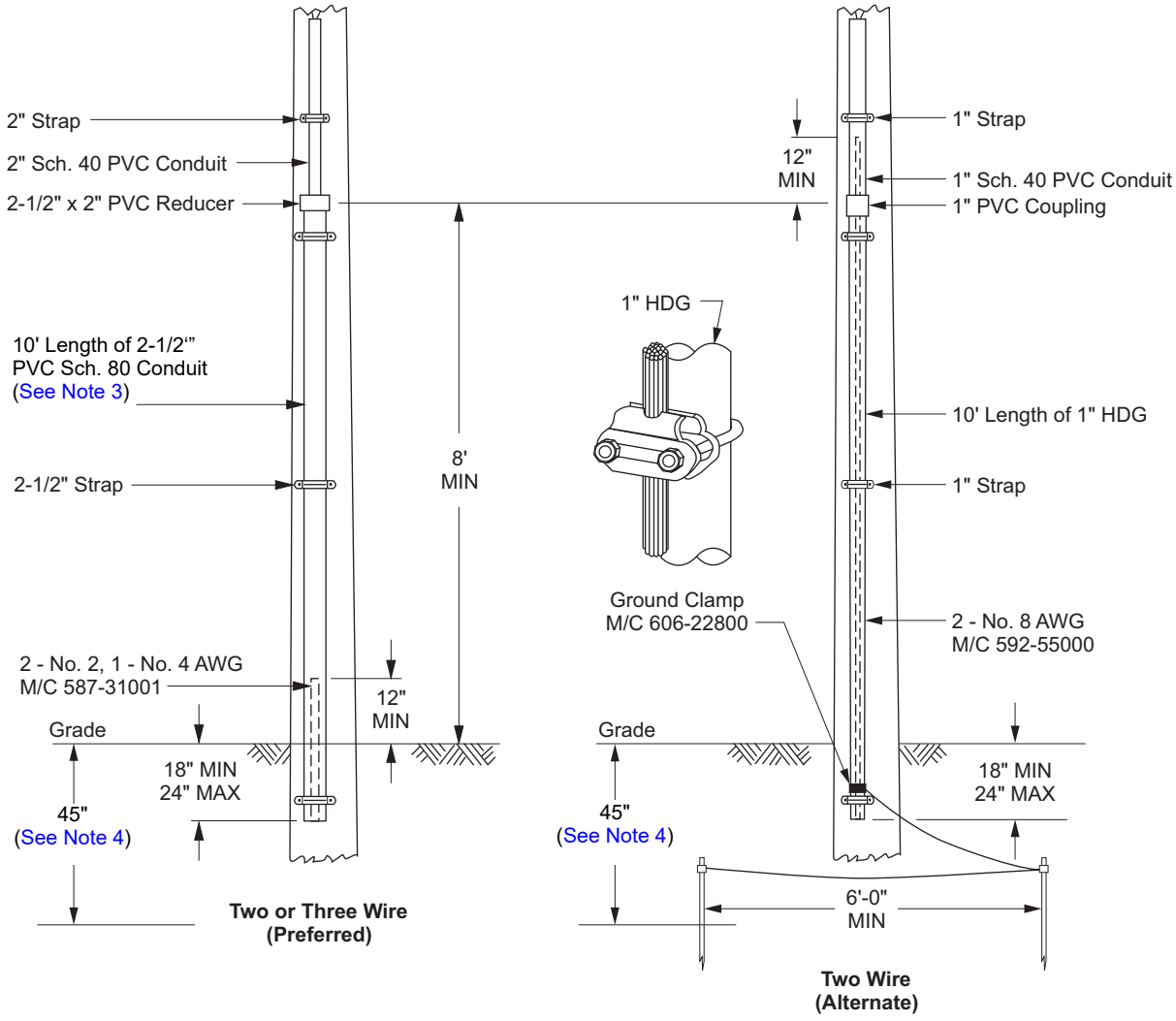
CR 130 Streetlight Riser Installation

Scope CR 130.1 Streetlight Riser Installation

Figure CR 130–1: Streetlight Riser Installation



Note(s):

1. See DOH PO 100.4 for pole step requirements.
2. PVC couplings are to be cemented to PVC at top socket of couplings. Do not cement the lower socket of any coupling. This allows for expansion and contraction of conduit.
3. Two and one half inch (2-1/2") Sch. 80 is the minimum size PVC that may be used below the 8 foot level. Conduit installed above the 8 foot level shall be Sch. 40 PVC. See CR 110 for riser material.
4. Ground cover may be 30 inches when conventional conduit is used.
5. See DUG CR 150 for placement of riser conduit warning labels.

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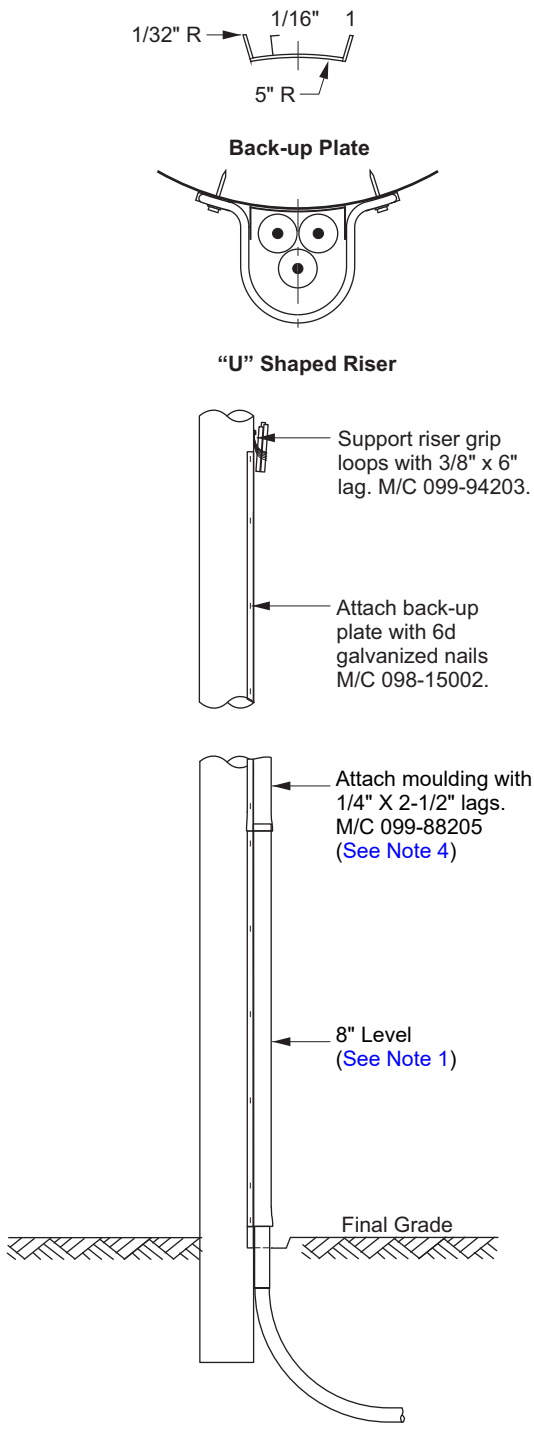
CR 135 12/16-kV "U" Shaped Riser Installation

Scope CR 135.1 Installation of 12/16-kV "U" Shaped Riser

Figure CR 135–1: Installation of 12/16-kV "U" Shaped Riser



1.0 Applications

For use when installation of this riser will save the expense of locating a structure closer to the riser pole (to increase cable pulling length).

Note(s):

1. Install safety backup plate to the top of the riser and below final grade at the same depth as the reducer.
2. Do not install pole ground(s) under PVC cable guard, pole ground(s) shall be installed under wood molding.
3. Install PVC cable guard on quadrant of pole opposite oncoming traffic wherever possible and provide space for communication attachment.
4. When concrete-encased conduit system is encountered, the ventilation boot shall sit flush on concrete.
5. Only one "U" riser per pole. Where additional risers are anticipated, use conventional riser.
6. Do not install "U" shaped riser where it extends above additional class "H" circuits on the same pole.
7. "U" shaped riser should be used where it is not economical to locate a structure closer to the riser pole for cable pulling purposes.
8. Attach molding with 1/4 inch X 2-1/2 inch galvanized lag screw M/C 099-08205 with 1/4 inch washer installed in each slotted hole of the flanges at 18 inch intervals below the 8 foot level and at 36 inch intervals above the 8 foot level.
9. Install the washer and lag screw snug against the flanges but do not drive tight in order to permit expansion of the molding because of temperature changes.
10. When joining the belled end of the molding, line up the edge of the belled end with a mark inscribed 1 inch from the plain end of the adjacent molding to insure that sufficient spacing is provided between sections for thermal expansion.
11. Schedule 40, 4- and 5-inch "U" molding shall be installed below the 8 foot level. Schedule 30, 4- and 5-inch molding shall be installed above the 8 foot level of the pole. See Table CR 135–1 (Sheet 2).
12. See DUG CR 150 for placement of riser conduit warning labels.

Scope CR 135.2 Material for U-Shaped Risers

Table CR 135–1: U-Shaped Riser Molding and Associated Hardware

"U" Molding (10 ft)		Back-Up Plate (10 ft)	
Size	Material Code	Size (in)	Material Code
4" Schedule 30	620-01276	4	627-03574
5" Schedule 30	620-01284	5	627-03582
4" Schedule 40	620-01292	4	627-03574
5" Schedule 40	620-01268	5	627-03582

Table CR 135–2: Cable Grips for Supporting 12/16 kV 220 mil with U-Shaped Riser

Cable Size (kcmil)	Grip Range	Grip Material Code	Kellems Catalog Number	Economy Catalog Number
350 Al	1.25–1.50	655-00514	022-03-018	SPC125-SU
750 Al	1.75–2.00	655-00506	022-03-020	SPC175-SU
1,000 Al	2.00–2.50	655-00498	022-03-021	SPC200-SU

Table CR 135–3: Cable Sizes in U-Shaped Riser

Cable Size (kcmil)	Riser Size
350 Al	4" Molding
750 Al	5" Molding
1,000 Al	

CR 140 BC Neutral — Riser Installation

Scope CR 140.1 Riser Conduit for Bare Copper Neutral (4-Wire Circuits Only)

Figure CR 140–1: Riser Conduit for Bare Copper Neutral (4-Wire Circuits Only)

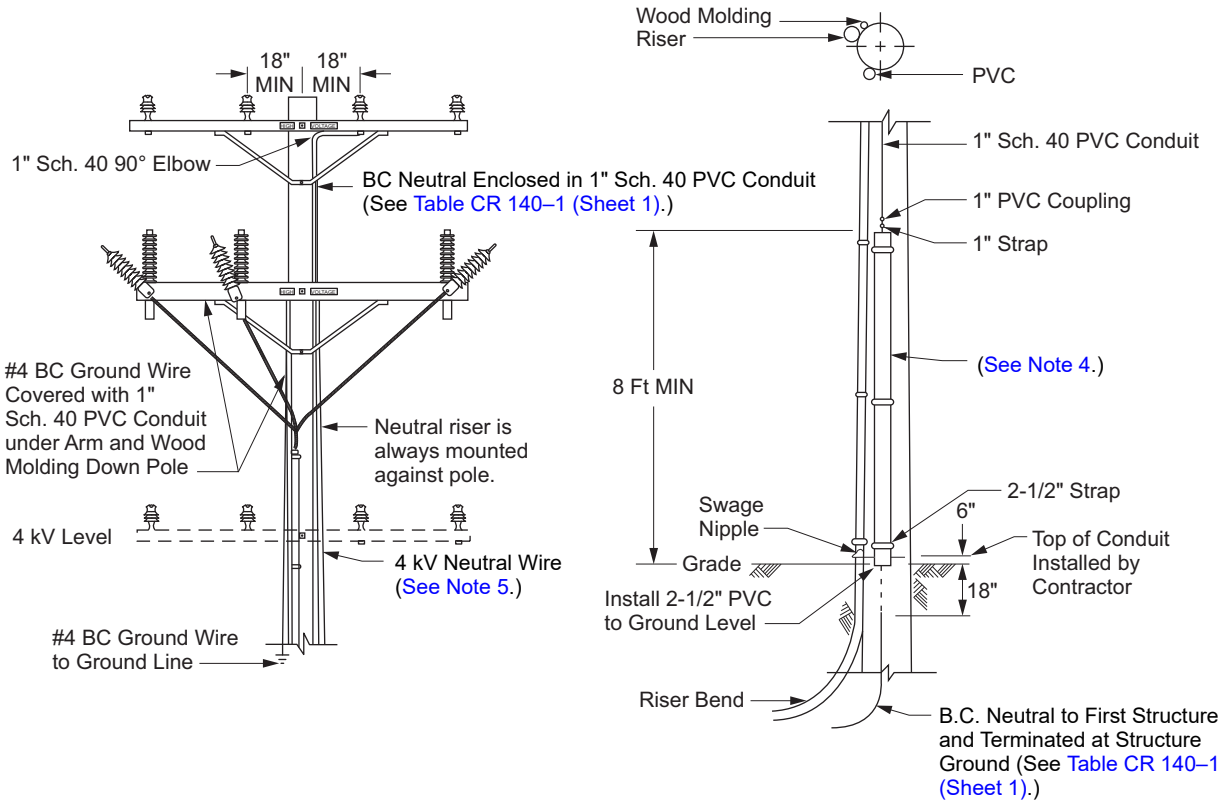


Table CR 140–1: Bare Copper Neutral Sizing

Conductor Size	Bare Copper Neutral Size
1/0	#2
350 and Larger	4/0

Note(s):

1. 2-1/2 inch Sch. 80 PVC is the minimum size that may be used **below** the 8 foot level. Conduit installed **above** the 8 foot level shall be Sch. 40 PVC.
2. See DOH PO 100.4 for pole step requirements.
3. PVC couplings are to be cemented to PVC conduit at top socket of coupling. Do not cement the lower socket of any coupling. This allows for expansion and contraction of the conduit.
4. Install 10 foot length of 2-1/2 inch PVC conduit over 1 inch PVC conduit (previously installed by contractor) at base of pole. 1 inch PVC conduits must butt against each other inside 2-1/2 inch conduit. 2-1/2 inch conduit must extend to ground level completely covering 1 inch PVC below 8 foot level. Secure all conduits with straps, (3 per 10 foot length). See CR 110 for Riser Material.
5. When 4 kV is present on pole, its neutral wire must be in a separate riser conduit mounted against the pole. Construct similar to that shown for 12- or 16-kV. Extend wire to first structure.
6. See DUG CR 150 for placement of riser conduit warning labels.

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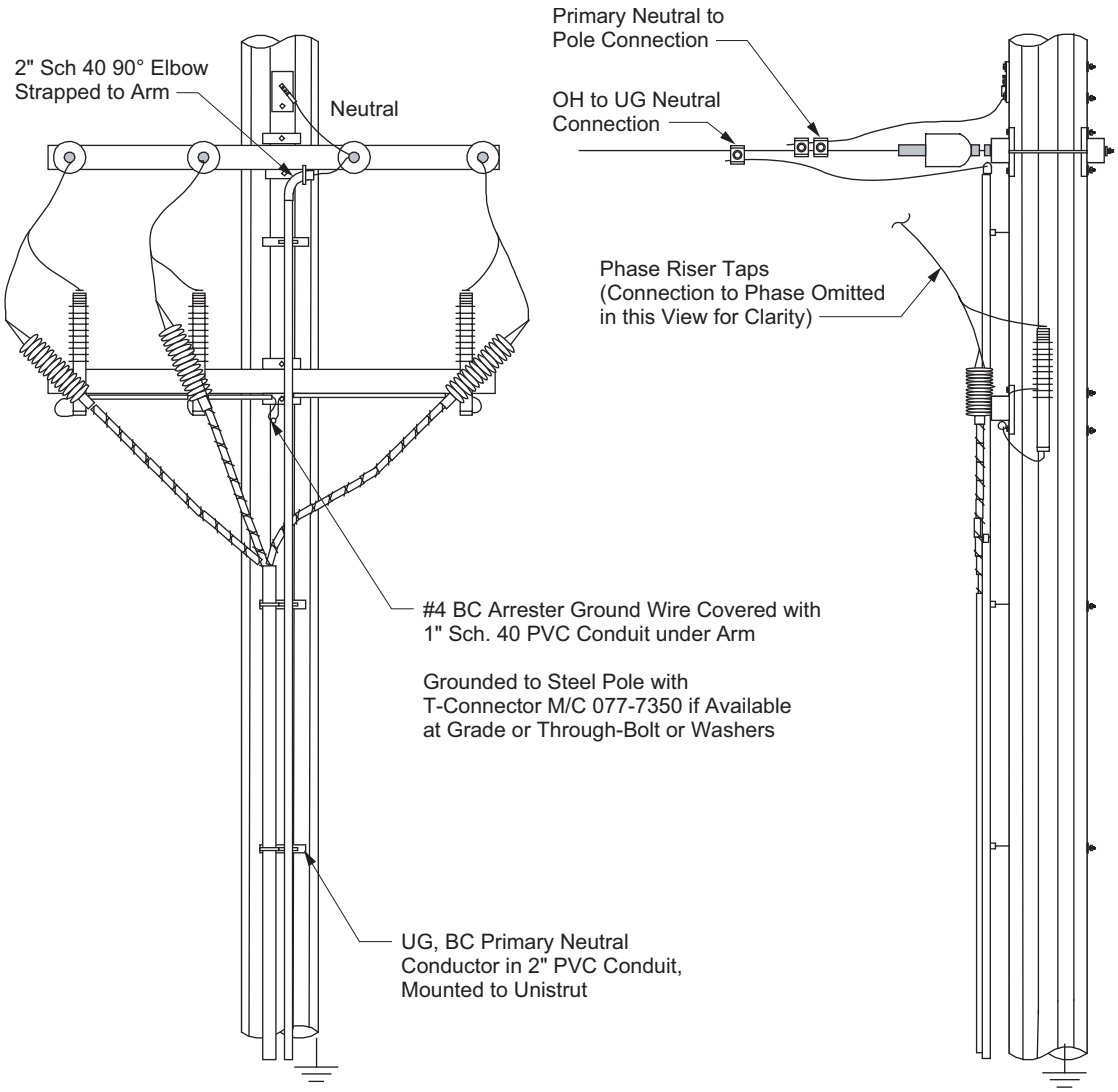
CR 141 BC Neutral — Riser Installation on Subtransmission Lightweight Steel (LWS) Pole

Scope CR 141.1 BC Neutral - Riser Installation on Subtransmission LWS Pole

Figure CR 141–1: BC Neutral-Riser Installation on LWS Poles



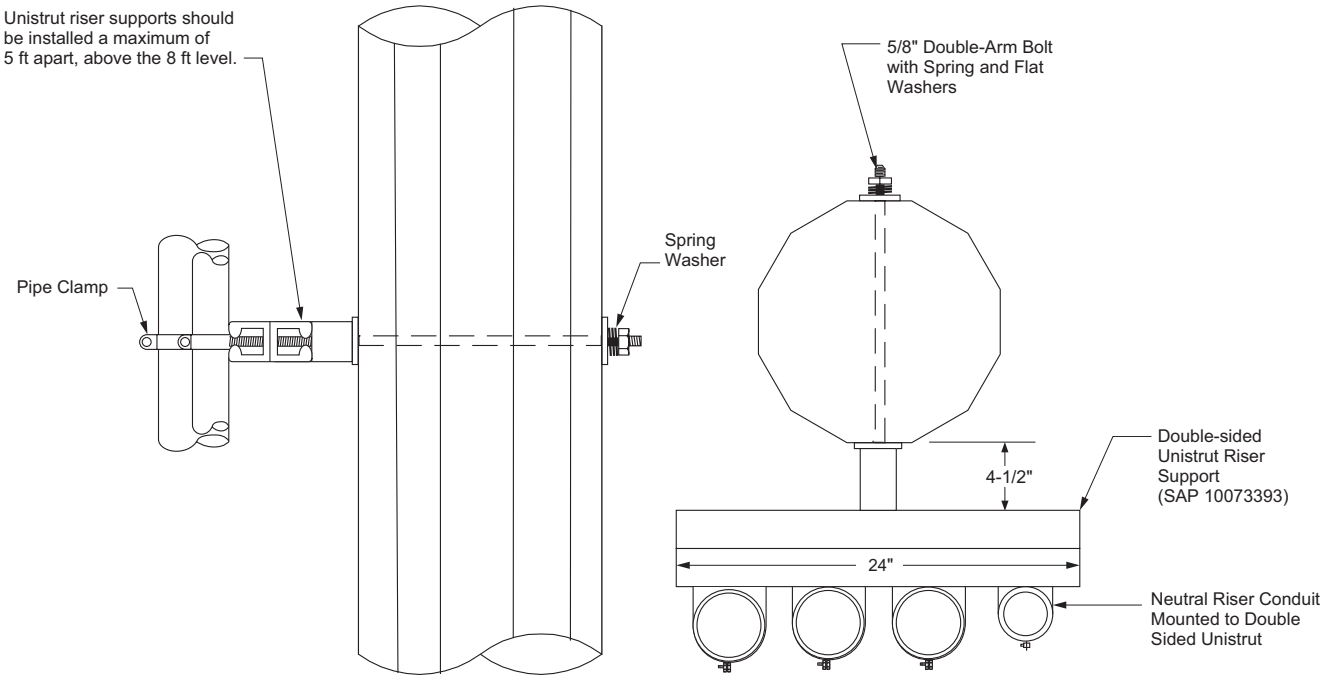
Grounded Steel Pole

Grounded Steel Pole with Pole-Bond Wire Attached

Note(s):

1. Bare Copper (BC) primary neutral risers from underground circuits shall be installed on LWS Poles on the same unistrut riser support used for the circuit cables.
2. When the neutral riser is transitioned so that the neutral connection can be made, the conductor must be covered with 1" PVC to at least 18" from the center line of the pole.
3. Use heavy-duty dead-end composite crossarms with mounting brackets if the circuit dead-ends on the rise structure.
4. See DUG CR 150 for placement of riser conduit warning labels.

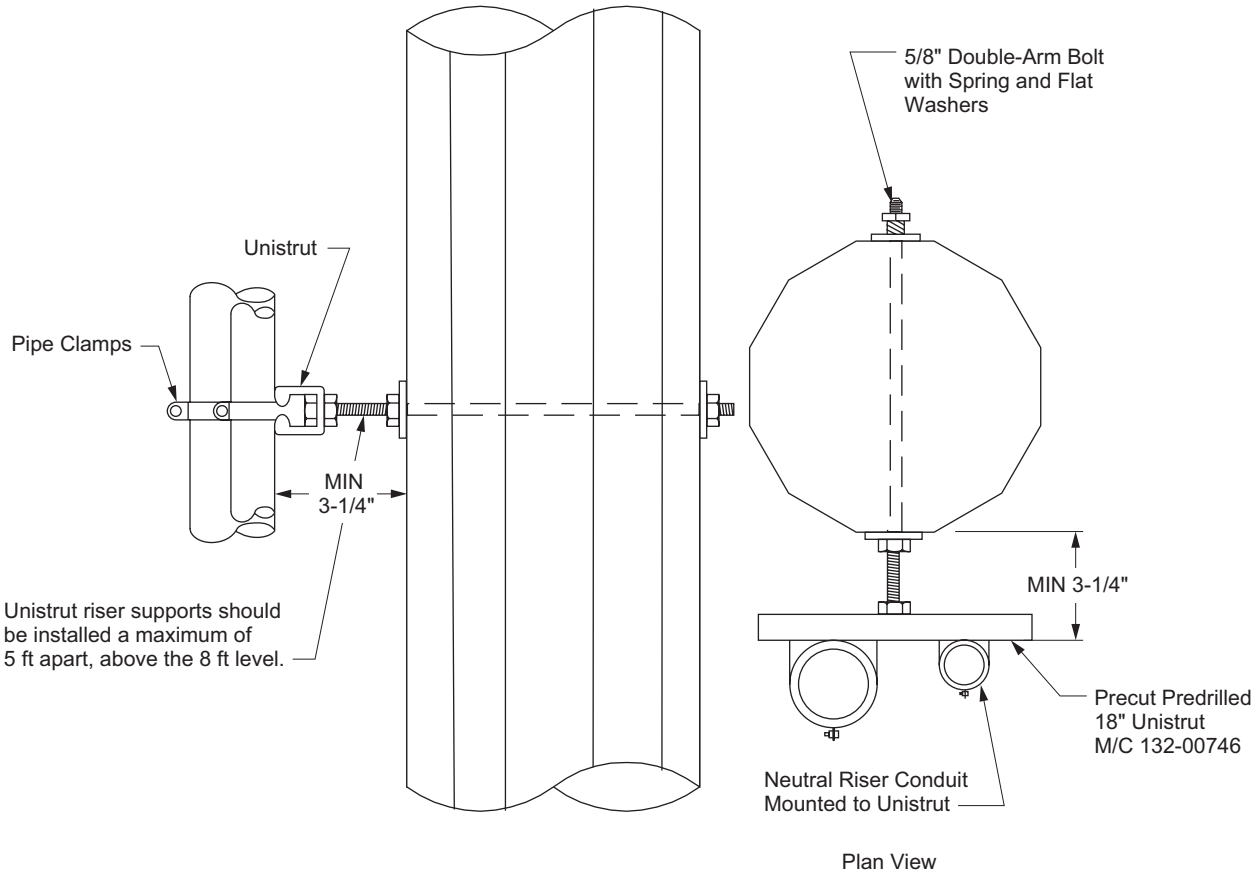
Figure CR 141–2: Details of Riser Installation on Lightweight Steel Poles (Preferred Method)



Note(s):

1. Mount neutral riser conduit to the circuit cable riser unistrut with unistrut pipe clamps shown in CR 110.
2. Telecommunications risers and third party joint pole risers will also be mounted to unistrut riser support.
3. Use straps and #8 machine screws to mount the neutral riser to the pole when it extends above the circuit cable riser or in situations where there is no unistrut.
4. 4-1/2" minimum required to accommodate double-sided unistrut riser support.

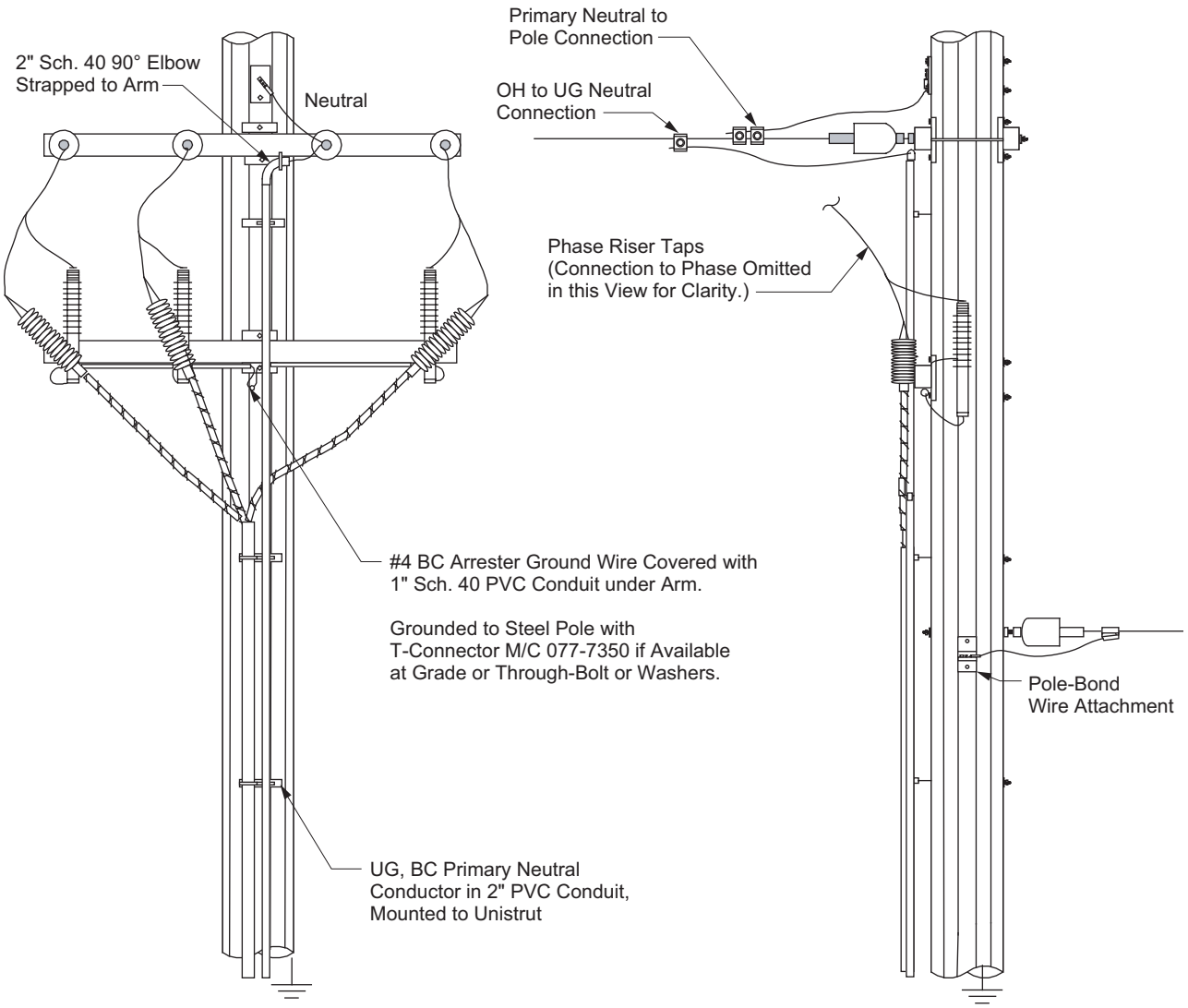
Figure CR 141–3: Details of Riser Installation on Lightweight Steel Poles (Alternate Method)



Note(s):

1. Mount neutral riser conduit to the circuit cable riser unistrut with unistrut pipe clamps shown in CR 110.
2. Telecommunications risers and third party joint pole risers will also be mounted to unistrut riser support.
3. Use straps and #8 machine screws to mount the neutral riser to the pole when it extends above the circuit cable riser or in situations where there is no unistrut.
4. 3-1/4" minimum required to accommodate kick block, guard arms, or cross arms if required.

Figure CR 141–4: Riser Installation on Lightweight Steel (LWS) Poles with both Pole-Bond Wire and Primary Neutral Attached as Part of the Fault Return Conductor (FRC) Path



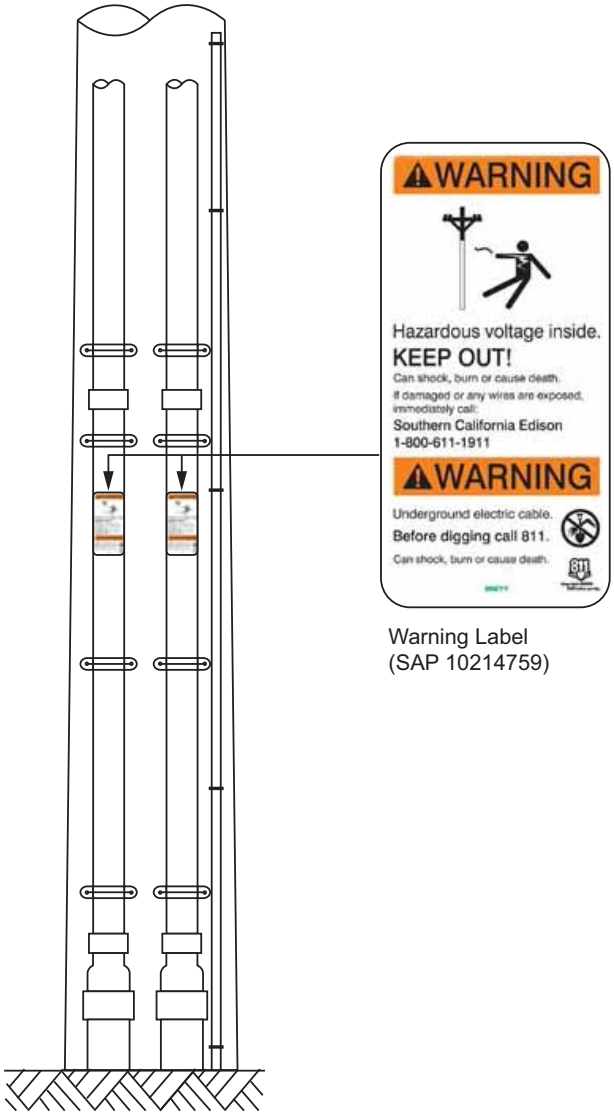
CR 150 Riser Conduit Labeling

Scope CR 150.1 Riser Conduit Labeling

1.0 Application

All riser conduit installations containing primary or secondary voltage cables shall be labeled with the appropriate "WARNING" reflective label (SAP 10214759). One label shall be placed on each riser conduit as shown in Figure CR 150-1 during new construction, rebuilds, or during maintenance type activities. The label should be placed near public eye level (for example, between 4-6 feet from ground level).

Figure CR 150–1: Example of Warning Label on Riser Conduit



Warning Label
(SAP 10214759)

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Corrosion and Waterproofing
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CW 105.2	Sealing Conduits Containing Cables
CW 200	Sump Pump Installation
CW 200.1	Sump Pump Electrical Installation
CW 200.2	Installation Instructions for Oil Smart Water Pump Switch
CW 200.3	Sump Pump Installation Notes and Material Listing
CW 300	Cathodic Protection Anode Installation for BURD Enclosures
CW 300.1	Cathodic Protection Anode Installation for BURD Enclosures
CW 400	Wall Bracket — BURD Transformers and Switches
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CW 100 Corrosion Prevention — General Guidelines

Scope CW 100.1 Corrosion Prevention — General Guidelines

Underground structures suffer from water intrusion through the lid, vents, ducts, and concrete that leads to rapid corrosion of equipment. Applying the following measures will minimize water intrusion and reduce the rate of corrosion.

1.0 All structure lids designed to be sealed shall be inspected to ensure that the following conditions exist when the lid is in place:

1.1 Lid gasket/felt is properly installed

1.2 Lifting holes are properly plugged

1.3 All lid bolts are in place and tight

2.0 The following steps should be taken to minimize water intrusion into structures:

2.1 Where PVC standpipe vents are subjected to spray from water sprinklers, install vent guards, see VE 230.

2.2 If water is entering through the ducts, install duct plugs, see CW 105.

2.3 Where water seeps through joints or small cracks in the concrete, plug leaks with concrete sealant.

3.0 Where water cannot be kept out of the structure, the following actions will reduce the rate of corrosion:

3.1 Raise the equipment off the ground if it is subject to partial submersion before the pump switch is activated (CW 400 or US 155).

3.2 Use TW or weatherproofing wire to make grounding connections between the ground bus and the equipment when rapid corrosion is taking place at the ground connection on the piece of equipment, see GR 100.

3.3 Consult field engineering regarding the application of jacketed cable in areas with concentric corrosion problems.

3.4 If equipment corrodes in an enclosure (BURD or S.O.E.), then magnesium anodes should be installed for cathodic protection, see CW 300. In severely corrosive areas, the rate of corrosion and anode use can be reduced by covering (with an insulation, but not necessarily waterproof covering) all exposed copper surfaces.

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CW 102 Vault Waterproofing

Scope CW 102.1 Vault Waterproofing

Sealing a vault can best be done by finding out where the water comes from and then stopping it one step at a time. The first step should be to pump out a vault and see if the water appears to be entering through the conduits from another part of the system. If this is the case, the conduits must be sealed, see CW 105.

After the conduits have been sealed, the vault should be checked again to determine if it still has standing water, then an investigation should be made to determine where the water is entering. If the vault is still under warranty, the Underground Inspector should be notified to have the contractor repair/seal any areas of water intrusion.

If a vault shows severe signs of water intrusion through the walls and concrete damage, then the vault can be sealed by the grout injection method. A contract crew with the proper equipment injects the sealant into the outside of the vault by drilling through the walls. The contractor will provide a warranty period, so if the vault should leak at a later date, there will be no additional charge to the Company for any resealing. The vaults that are sealed using this process must be checked periodically during the warranty period to see if any new leaks develop. To utilize this procedure contact the Underground Planning Supervisor.

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CW 105 Sealing Conduits

Scope CW 105.1 Sealing Conduits

1.0 Sealing Conduits

Corrective action shall be taken to eliminate water intrusion (that is, more than two inches of water) in wet vaults during the inspection/maintenance cycle of all structures that contain apparatus and/or equipment.

2.0 Blank Conduits

All new conduits terminated at vaults, manholes, and PHM structures are to be sealed by using a blank duct plug to prevent water from entering the conduit system. Contractors who install these structures are to include a blank duct plug for each new conduit termination.

All existing blank conduits exhibiting signs of water intrusion are to be sealed with a blank duct plug to prevent water from entering the structure.

Blank duct plugs are available in 2-, 3-, 4-, 5-, and 6-inch duct sizes. In cases where 4- and 5-inch duct plugs (M/C 656-14703 and M/C 656-14802, respectively) do not fit various types of terminators (Encased Burial, Direct Burial, Schedule 40, and Schedule 80), use the duct plugs shown in bold.

- M/C 656-00181 – 2" duct
- M/C 656-14604 – 3" duct
- M/C 656-14703 – 4" duct
- **M/C 656-00579 – 4" duct**
- M/C 656-14802 – 5" duct
- **M/C 656-00520 – 5" duct**
- M/C 656-00157 – 6" duct

Figure CW 105–1: Blank Duct Plug

3.0 Installation

Each plug has a place at the back to secure the pull rope. Attach the pull rope or pull tape securely to the eye, slip into the blank duct and tighten.

NOTE Jackmoon plugs (Figure CW 105–1 [Sheet 1]) are designed for hand tightening only.

Figure CW 105–2: Jackmoon Plug

Bottom Compression Plate w/Bolt

Casket

Top Compression Plate

Eye Nut

Scope CW 105.2 Sealing Conduits Containing Cables

1.0 Conduits with Cable

1.1 The make-up, cable pulling, or maintenance crews should install duct plugs in all cable conduit terminations if the structure is known to be wet (*that is,* more than two inches of water). Mechanical duct plugs should only be installed when cables are de-energized during new installations or planned outages. Chemical duct plugs can be installed when cables are energized.

1.2 All cable applications are to be used with General Electric (Silglaze 2801) RTV silicone to seal between the duct plug, concentric neutral wires and center of triplexed cables.

- M/C 656-00397 – RTV silicone sealant, 10.3 ounce tube
- M/C 839-52739 – Caulking gun for injecting sealant

CAUTION DO NOT substitute this silicone product. Other types of sealant might contain acids that could damage the concentric neutral conductor and/or the semiconducting layer around the insulation.

2.0 Round Duct Plugs

2.1 The single-conductor round duct plug (Figure CW 105–3 [Sheet 3]) comes with a universal cable size (one inch) round hole.

2.2 The round duct plugs are available in 2-, 3-, 4-, and 5-inch duct sizes for use with single-conductor per duct or three-conductor lead cables.

- M/C 656-00173 – 2" duct
- M/C 656-00124 – 3" duct
- M/C 656-00058 – 4" duct
- M/C 656-00066 – 5" duct

Figure CW 105–3: Round Duct Plug

2.3 Installation (Nonenergized)

A. Clean inside of conduit and remove any debris.

B. If cable size is larger than one inch, cut the foam rubber dam to a size slightly smaller than the outside diameter of the cable.

C. Apply a bead of sealant to the inner and outer space in the center of the dam.

D. Place the plug around the cable and slide into place at least 1/2 inch beyond the end of the duct.

E. Tighten the compression bolts until slight resistance, approximately one foot-pound. If water drips, use the caulking gun to inject additional sealant inside the dam and retighten the compression bolts. Be careful not to over tighten bolts. Approximately three ounces of sealant is required for this installation.

3.0 Triplex Duct Plugs

3.1 Standard Triplex Duct Plugs

The standard triplex cable duct plugs (Figure CW 105–4 [Sheet 4]) are available in 4-, 5-, and 6-inch duct sizes with cable sizes 4/0 to 1,500 kcmil.

- M/C 656-00074 – 4" duct, 4/0 AWG–350 kcmil cable
- M/C 656-00082 – 5" duct, 4/0 AWG–350 kcmil cable
- M/C 656-00090 – 5" duct, 500–750 kcmil cable
- M/C 656-00108 – 5" duct, 1,000 kcmil cable
- M/C 656-00199 – 6" duct, 1,000–1,500 kcmil cable

Figure CW 105–4: Triplex Duct Plug

3.2 Installation (Nonenergized)

Clean the inside of the conduit and remove any debris. Separate the cable inside the duct and inject sealant between the cables especially around the concentrics. Place plug sections around the cable and slide into place. Tighten compression bolts until a slight resistance is felt, approximately one foot-pound. Inject sealant in the center of the plug. If water drips, inject additional sealant and retighten compression bolts. Be careful not to over tighten bolts.

3.3 Jackmoon Triplex Duct Plugs

Under continually wet conditions and/or relatively high-water head pressure, a more durable duct plug should be used. These triplex cable duct plugs (Figure CW 105–5 [Sheet 5]) are available in 4- and 5-inch duct sizes with cable sizes #2 AWG to 1,000 kcmil.

- M/C 656-00751 – 4" duct, #2 AWG cable
- M/C 656-00769 – 4" duct, 1/0 AWG cable
- M/C 656-00561 – 4" duct, 4/0 AWG–350 kcmil cable
- M/C 656-00777 – 5" duct, #2 AWG cable
- M/C 656-00785 – 5" duct, 1/0 AWG cable
- M/C 656-00553 – 5" duct, 4/0 AWG–350 kcmil cable
- M/C 656-00546 – 5" duct, 500–750 kcmil cable
- M/C 656-00538 – 5" duct, 1,000 kcmil cable

Figure CW 105–5: Jackmoon Triplex Duct Plugs

3.4 Installation (Nonenergized)

Clean inside of conduit and remove debris. These plugs have internal cavities that need to be filled with sealant. Take each section of the plug and fill the holes with approximately 1 to 2 ounces of sealant per hole. Approximately 8 ounces of sealant is required for this operation. Install each section of the plug around the cable and tighten compression bolts, approximately 2- to 3 foot-pounds. Inject a small amount of sealant around the concentric wires in the center of the plug.

4.0 Chemical Duct Plugs

4.1 In an existing Cable-in-Conduit (CIC) energized installation, the recommended method for sealing the duct is with a Semkit (M/C 645-00366 – Semkit [one kit for all size ducts])

4.2 In an existing CIC energized installation, when running water and a relatively high head pressure is encountered, the recommended method for sealing the duct is with an IPlug Kit.

- M/C 645-00275 – IPlug for 2 inch duct
- M/C 645-00309 – IPlug for 4–6-inch duct

4.3 Installation (Energized)

A. All chemical duct plugs must be installed in a dry environment. In order to stop water flow, the Water Stop Kit (WSK) should be used.
- M/C 645-00283 – 2 inch duct
- M/C 645-00291 – 4–6-inch duct

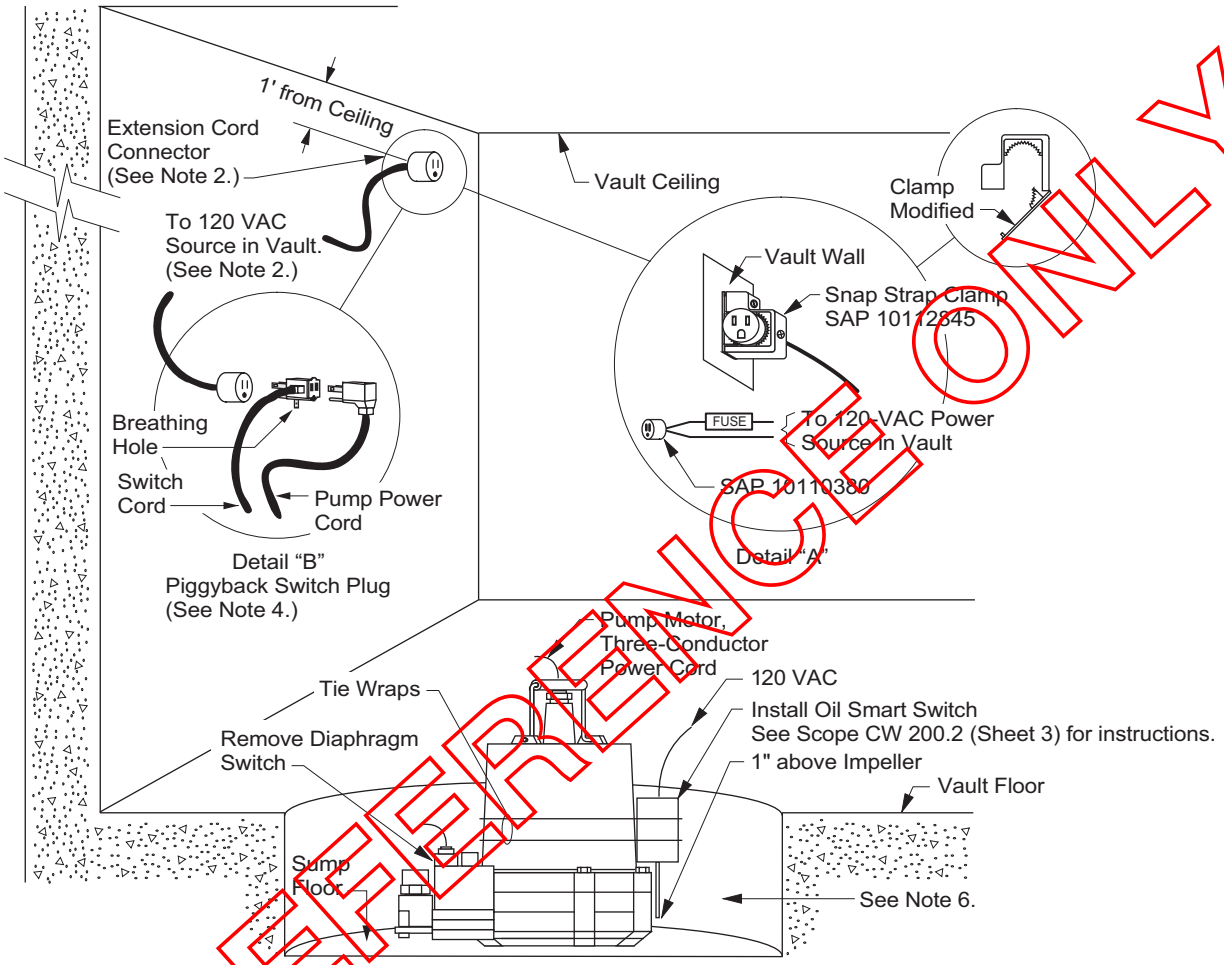
B. See the manufacturer's package for installation, mixing instructions, and pictures/sketches of proper installation sequence for the chemical duct plugs and Water Stop Kit.

NOTE Do not use Water Stop Kit with the Semkit.

CW 200 Sump Pump Installation

Scope CW 200.1 Sump Pump Electrical Installation

Figure CW 200–1: Sump Pump Electrical Installation



FOR REFERENCE ONLY

Note(s):

1. Power supply shall be through a 15 A fuse for the Hydromatic and a 10 A fuse for the Robusta from 120 VAC power source in vault. Use Buss Fusetron Dual-Element FNM-15 fuse for Hydromatic (SAP 10107810) and FNM-10 fuse for Robusta (SAP 10107996), or similar, installed inside a 20 A waterproof inline-type fuseholder (SAP 10107492).
2. Power connector shall be attached to the vault's wall (accessible near vault's entrance) and 1 foot below ceiling. The clamp, for the connector, shall be affixed to the wall by means of two brass anchor bolts. For the cable's connector to fit inside the clamp, half of the indented segment on the hinged base must be cut-off from the base (see Detail "A").
3. Breathing hole at bottom of switch cord plug must always be clean and unobstructed. Any obstruction of the breathing hole will hamper the switch operation. The switch cord shall never be cut or spliced.
4. Seal around plug and socket interface with silicone sealant SAP 10154125.
5. Remove existing diaphragm or level switch and replace with oil smart switch (SAP 10115045, 120 V, 10 foot wire, and piggy back plug; SAP 10115046, 120 V, 20 foot wire, and piggy back plug).
6. For heavy-duty, noncorrosive conditions with 13 inch sump use: Hydromatic 0SP33 (SAP 10085307). For 8 inch sump or corrosive conditions use: ABS Robusta 33TS (SAP 10085316).
7. New Automatic Sump Pump (ASP) installations require approval by Corporate EH&S and T&D Environmental. Refer to Chapter 2 of the EN Manual for more information.

CAUTION

The switch cord breathing hole, when plugged-in, must always be facing downward, as shown in this drawing. It is recommended that the switch and pump motor cords be tied together with a cable tie; and both anchored to the vault wall. This will prevent either plug from accidentally falling into a water filled or wet vault floor.

FOR REFERENCE ONLY

Scope CW 200.2 Installation Instructions for Oil Smart Water Pump Switch

1.0 Replacement of Existing Sump Pump

1.1 Clean the vault and sump per DOM Policy and Procedures Manual.

1.2 If sump pump is in good condition, remove existing float switch and install Oil Smart Water Pump Switch with pigtail adapter.

1.3 Attach Oil Smart Water Pump Switch to existing pump or pump discharge pipe using 2 tie wraps.

1.4 The OFF probe (which is the lowest part of switch) needs to be 1-inch above impeller of pump.

1.5 Verify that the Oil Smart Water Pump Switch is clean and dry after installation.

1.6 Tie wrap the Oil Smart Pump Switch cord to the pump discharge pipe.

1.7 Plug Oil Smart Water Pump Switch power cord into power source.

1.8 Plug sump pump cord into pigtail of Oil Smart Water Pump Switch.

2.0 Installation of New Sump Pump

2.1 Clean the vault and sump per DOM Policy and Procedures Manual.

2.2 Attach Oil Smart Water Pump Switch to new sump pump or pump discharge pipe using 2 tie wraps.

2.3 The OFF probe (which is the lowest part of switch) needs to be 1-inch above impeller of pump.

2.4 Verify that the Oil Smart Water Pump Switch is clean and dry after installation.

2.5 Tie wrap the Oil Smart Pump Switch cord to the pump discharge pipe.

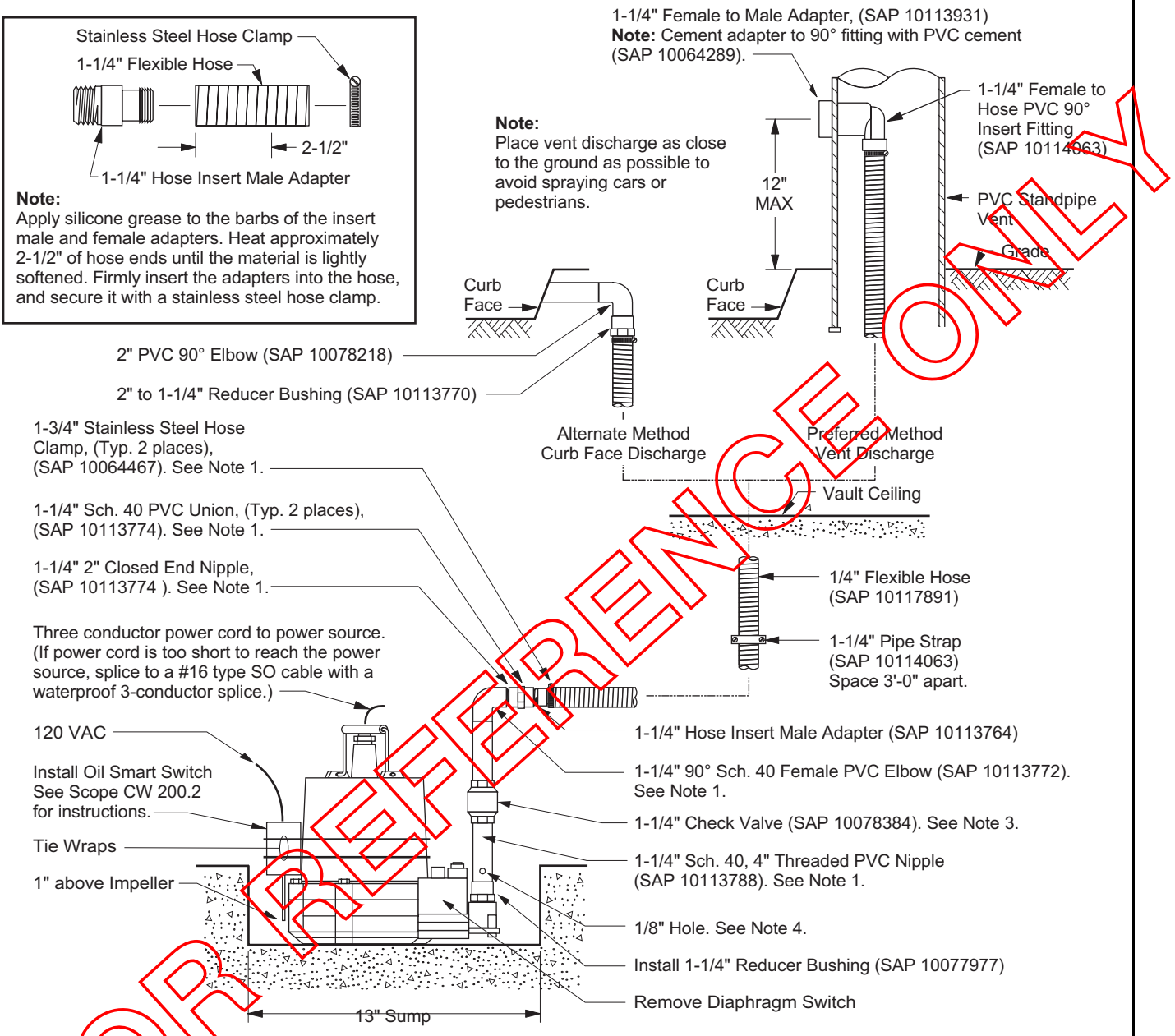
2.6 Plug Oil Smart Water Pump Switch power cord into power source.

2.7 Plug sump pump cord into pigtail of Oil Smart Water Pump Switch.

FOR REFERENCE ONLY

3.0 Sump Pump Installation — Through Vent Discharge

Figure CW 200–2: Sump Pump Installation — Through Vent Discharge



FOR REFERENCE ONLY

Note(s):

1. Hose can be connected directly to pump. Union assembly is optional. Use only where required.
2. When water is discharged through a vent, a check valve IS NOT REQUIRED to be installed. If a sump discharges through a curb outlet as shown on UGS AC 712, a check valve IS REQUIRED.
3. Drilling a 1/8 inch hole in the 1-1/4 inch schedule 40 PVC at the sump pump, see CW 100, is required only when a check valve is installed.
4. When standpipe vent is not adjacent to curb, refer to UGS AC 712 for discharge outlets through a curb or wall face. If these methods are not practical, consult with Distribution Engineering.

Scope CW 200.3 Sump Pump Installation Notes and Material Listing

Table CW 200–1: Sump Pump Material List

Description	SAP	Unit	Quantity
Pump, Sump, 155V, 1/3 HP, Centrifug., for 13" Sump	10085307	each	1
Pump, Sump, 155V, 1/3 HP, Centrifug., for 8" Sump	10085316	each	1
Switch, Replacement w/10' Cord	10115045	each	1
Switch, Replacement w/20' Cord	10115046	each	1
Hose, Flex, 1-1/4"	10117891	foot	20
Adapter, Slip, PVC, 1-1/4"[1/]	10113931	each	3
Strap, Pipe, 2 Hole, Galvanized, 1-1/4"	10112991	each	10
Fitting, Hose Insert, 90°, PVC, 1-1/4"[1/]	10114063	each	1
Fitting, Hose Insert, Male, PVC, 1-1/4"	10113764	each	1
Fitting, 90° Elbow, PVC, 2"[2/]	10078218	each	1
Check Valve, 1-1/4"[2/]	10078384	each	1
Bushing, Reducer, 2" to 1-1/4", Slip to FNPT[2/]	10113770	each	1
Clamp, Hose SST, 1-1/4" SMP/PMP	10064467	each	2
Cement, PVC, 1/4 Pint Can	10064269	each	1
Grease, Silicone, 1/4 oz Tube	10154115	tube	1
Bushing, Reducer, 1-1/2" to 1-1/4"	10077977	each	1
Nipple, 1-1/4", 4" Long	10113788	each	1
Nipple, Closed, 1-1/4", 2" Long	10113771	each	2
Elbow, Female, 90°, PVC Sch. 40, 1-1/4"	10113772	each	1
Union, PVC Thread, 1-1/4"	10113774	each	1
Wire, Meter, 1/C, #12, White	10109778	feet	10
Wire, Meter, 1/C, #12, Black	10109776	feet	10
Wire, Meter, 1/C, #12, Blue/Green	10109787	feet	10
Cord, #16, Port CU, 3/C	10110390	feet	30

[1/] Use on vent discharge installation.
[2/] Use on curb discharge installation.

FOR REFERENCE ONLY

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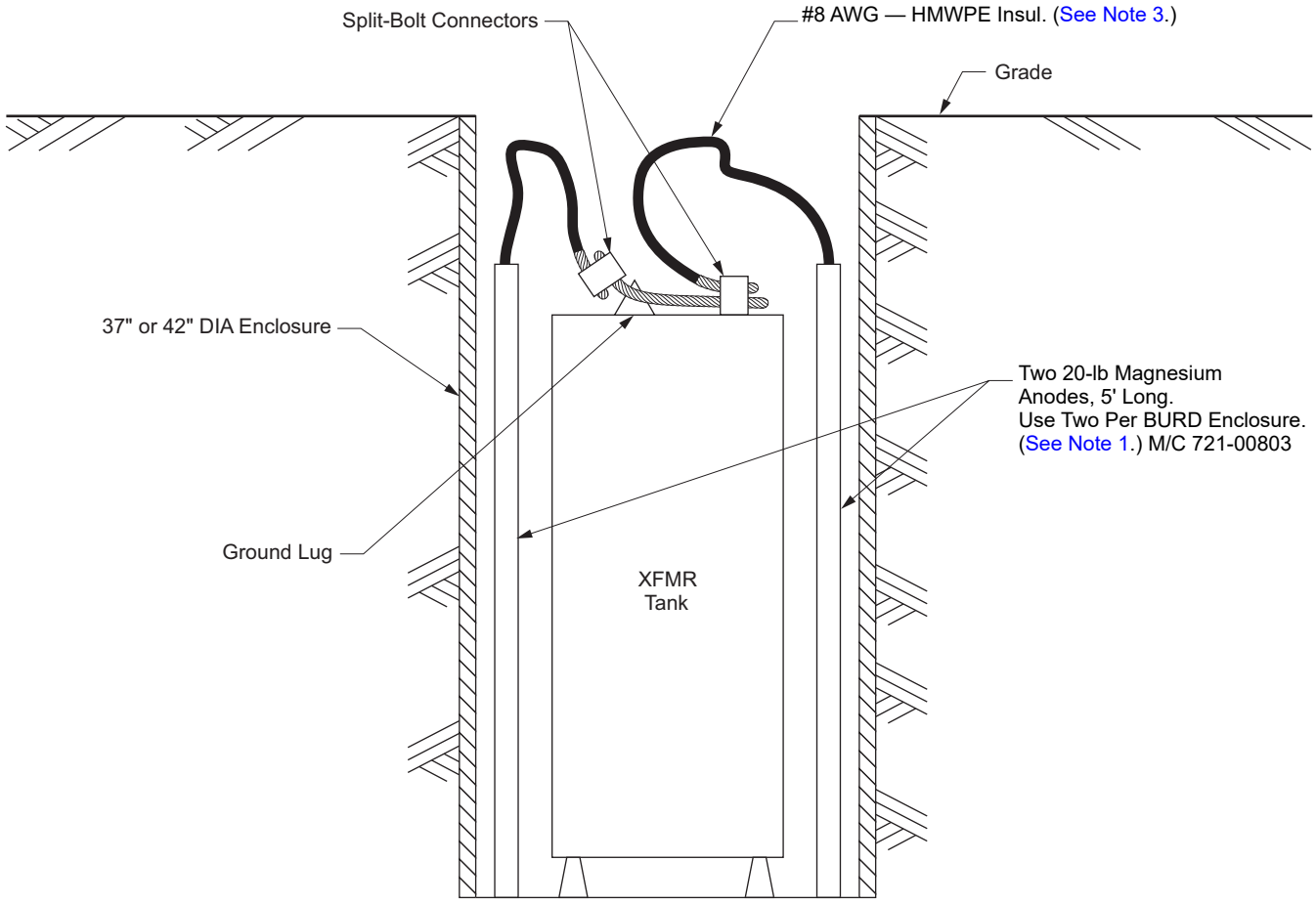
CW 300 Cathodic Protection Anode Installation for BURD Enclosures

Scope CW 300.1 Cathodic Protection Anode Installation for BURD Enclosures

Figure CW 300–1: Cathodic Protection Anode Installation for BURD Enclosures



Note(s):

1. Place anode so that it is not in contact with transformer case or bare conductors inside enclosure.
2. Tape wrap split-bolt connectors.
3. Provide sufficient slack in cables so that cables may be extended approximately 1 foot above ground.

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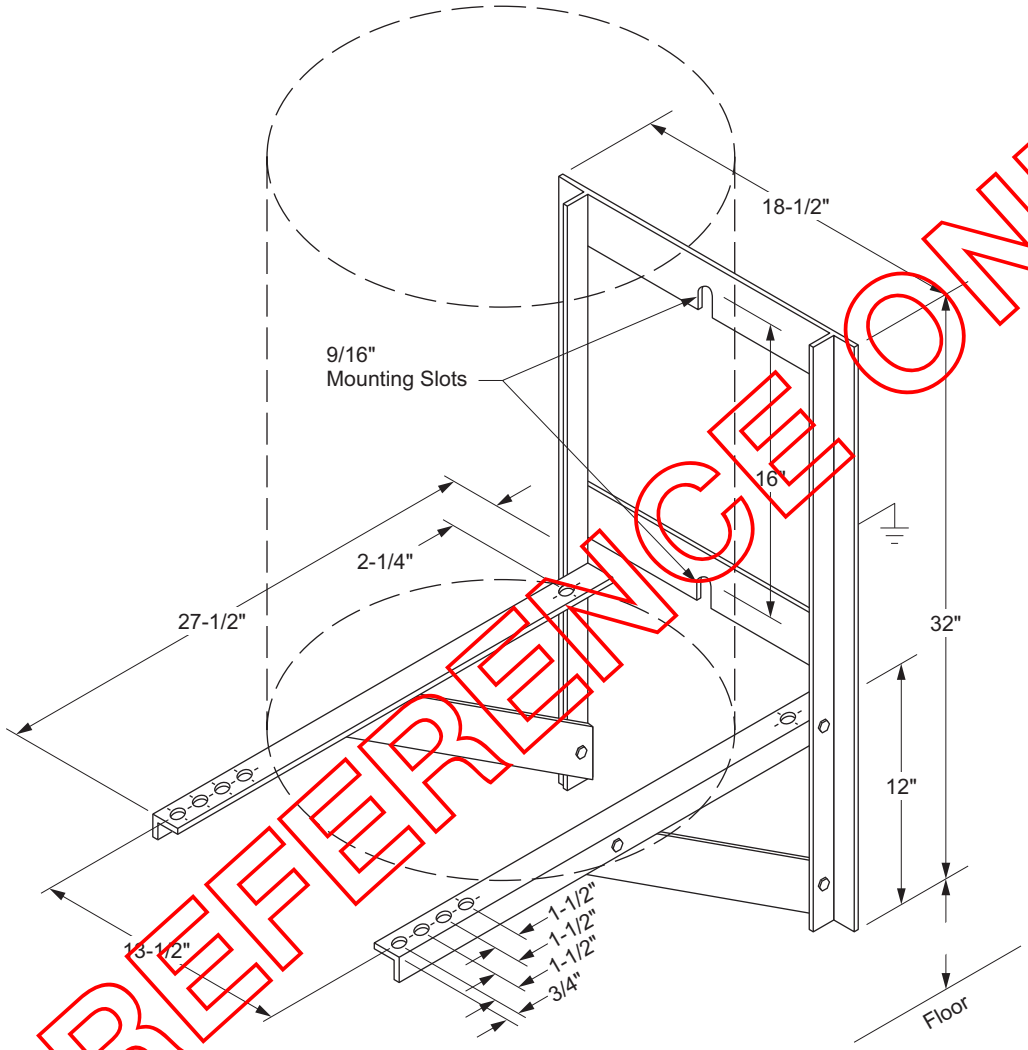
CW 400 Wall Bracket — BURD Transformers and Switches

Scope CW 400.1 Wall Bracket — BURD Transformers and Switches

Figure CW 400–1: Wall Support Bracket for BURD Transformers and Switches — M/C 076-46300



FOR REFERENCE ONLY

Note(s):

1. This wall mounted support bracket is used to prevent equipment corrosion in structures exposed to water flooding.
2. Bracket and equipment mounting methods:
3. Support bracket to be mounted to wall with 1/2 inch anchors (see RS 100 for details). When unistrut is available in structure, use 1/2 inch stainless steel bolts (HDG bolts are not acceptable) and unistrut nuts (M/C 133-66406).
4. Five 9/16-inch holes are provided on each support arm to retain equipment to the bracket.
5. Bottom of wall support bracket should be a minimum of 12 inches from structure floor.
6. Bracket and equipment to be grounded with #2 copper, see CW 100 for details).

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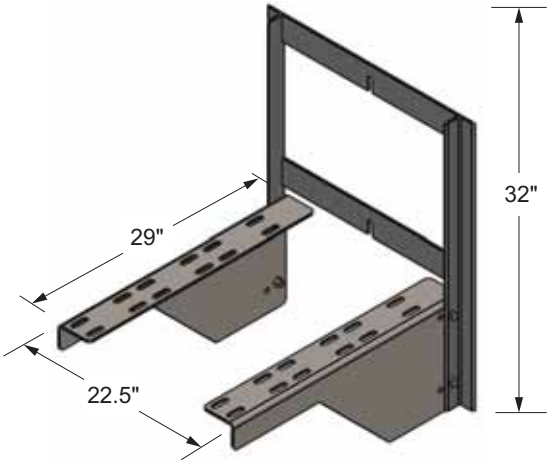
CW 401 Wall Bracket – 200/600 Amp Junction Bars

Scope CW 401.1 Wall Bracket – 200/600 Amp Junction Bars

1.0 Application

The stainless steel wall bracket is used to prevent equipment corrosion, specifically junction bars and associated components, in structures exposed to water flooding. The wall bracket comes with pre-drilled mounting holes. It may be used as an alternative to mounting junction bars at the wall in a vault in order to reduce cable bending and allow for a clean installation.

Figure CW 401–1: Stainless Steel Wall Bracket for 200/600 Amp Junction Bars



Note(s):

1. Support bracket to be mounted to wall with 1/2 inch anchors (see RS 100 for details). When unistrut is available in structure, use 1/2 inch stainless steel bolts (HDG bolts are not acceptable) and unistrut nuts (SAP 10073653).
2. Slots are provided on each support arm to retain junction bars to the bracket.
3. Bottom of wall support bracket should be a minimum of 12 inches from the structure floor.
4. Bracket and equipment shall be grounded with a minimum #2 copper, see GR 100 for details.

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Grounding
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GR 110.1	Installation of Grounds and Bonds in BURD and Pad-Mounted Systems
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GR 120.1	Installation of Grounds and Bonds at 4-Wire BURD Transformers
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GR 100 Structure Grounds

Scope GR 100.1 Installation of Grounding in Pull Boxes, Manholes, Vaults, and Subsurface Structures

1.0 Pullboxes

One ground rod is required in all pull boxes where primary cable is installed, except those pull boxes that have bare copper ground wires laid along with the conduit.

2.0 Manholes/Vaults

2.1 In order to maintain maximum ground capacity, a 4/0 AWG bare copper (minimum) SAP 10181768 ground/neutral bus will be installed encircling the structure. Prior to 1983 the ground bus was installed near the floor in manholes and vaults. Since then, provisions for installing and grounding the bus have been provided approximately 4 inches below the top of the structure. The purpose is to minimize the effect of corrosion on the ground bus. Refer to UGS AC 731 for approved ground bus supports.

2.2 Manholes constructed with ground rods/bars will have one (only) ground rod/bar installed, at one end of the structure, at floor level. Connect this ground rod/bar to the ground bus using #2 str bare copper SAP 10109330, Figure GR 100–3 (Sheet 3).

2.3 Vaults constructed with ground rods/bars will have one ground rod/bar at each end of the structure, at floor level. Both ground rods/bars are to be connected to the ground bus using #2 str bare copper SAP 10109330, Figure GR 100–3 (Sheet 3).

2.4 Tub type structures with 1/2 inch threaded grounding inserts will contain three inserts in each end of the structure, two in the top section and one in the bottom section, Figure GR 100–4 (Sheet 3). Grounding inserts are identified by the abbreviation “GRD” stenciled in red adjacent to the insert. One insert in each end of the bottom section along with one insert in each end of the top section shall be inter-connected to the ground bus using #2 str bare copper SAP 10109330.

2.5 Tunnel vaults installed with 1/2 inch grounding inserts will have two ground inserts in each end near the ceiling. Also each intermediate section of the vault will have one insert on each side of the section near the top. One of the two inserts at each end must be connected to the ground bus. Additionally, one insert of each intermediate section of the vault must be connected to the ground bus using #2 str bare copper SAP 10109330, Figure GR 100–5 (Sheet 4).

2.6 The recommended connection for use in the grounding inserts is a 1/2 inch bronze split bolt connector (SAP 10111624).

3.0 Subsurface Structures (PMH, CSTs, and Surface Operable Structure)

3.1 These structures are provided with one ground rod/bar or two 1/2 inch grounding inserts in the bottom section at each end of the structure[1/]. To provide a maximum ground capacity one ground rod/bar or one grounding insert at each end is connected to the ground bus using #2 str bare copper SAP 10109330.

[1/] When a structure has an extension section in addition to the bottom section, and grounding inserts are provided, install one ground wire between the extension and bottom section at each end per Figure GR 100–7 (Sheet 4). This ground wire shall be #2 stranded bare copper.

3.2 While it is not necessary to encircle these structures with a ground bus, depending upon cable and equipment installed, the bus must be installed along at least one wall near the top of the structure to interconnect the ground inserts at each end, Figure GR 100–6 (Sheet 4) or Figure GR 100–7 (Sheet 4).

3.3 The recommended connection for use in the grounding inserts is a 1/2 inch bronze split bolt connector (SAP 10111624).

4.0 Equipment Ground

Ground all equipment to the ground bus using #2 str bare copper (minimum) SAP 10109330, for example switches, fuse cabinets, junction bars, except where otherwise specified in the individual equipment standard, see Figure GR 100–8 (Sheet 5).

5.0 Cable Grounds

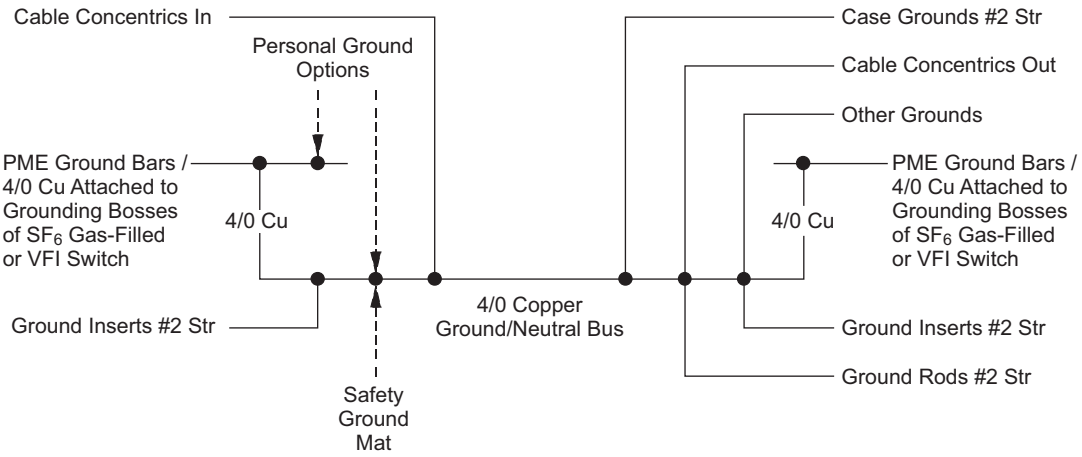
Ground cable concentric wires on all splices or cable terminations, see Figure GR 100–9 (Sheet 5) and Figure GR 100–10 (Sheet 5), using #2 str bare copper (minimum) SAP 10109330. Where non-jacketed concentric neutral cables are pulled straight through a structure, four concentric wires from each conductor will be bonded and grounded as shown in Figure GR 100–11 (Sheet 6). The grounding of Jacketed Concentric Neutral (JCN) cables at every mid-run or pull-through structure is not a requirement. On PILC (paper insulated lead covered) cable ground all splices by soldering one ground braid at each splice to the lead sheath and connect the ground braid to the structure ground.

6.0 Neutral/Ground Bus

When the ground bus in any structure is used as a neutral bus (primary or secondary), a 4/0 bare copper SAP 10181768 neutral conductor shall be used.

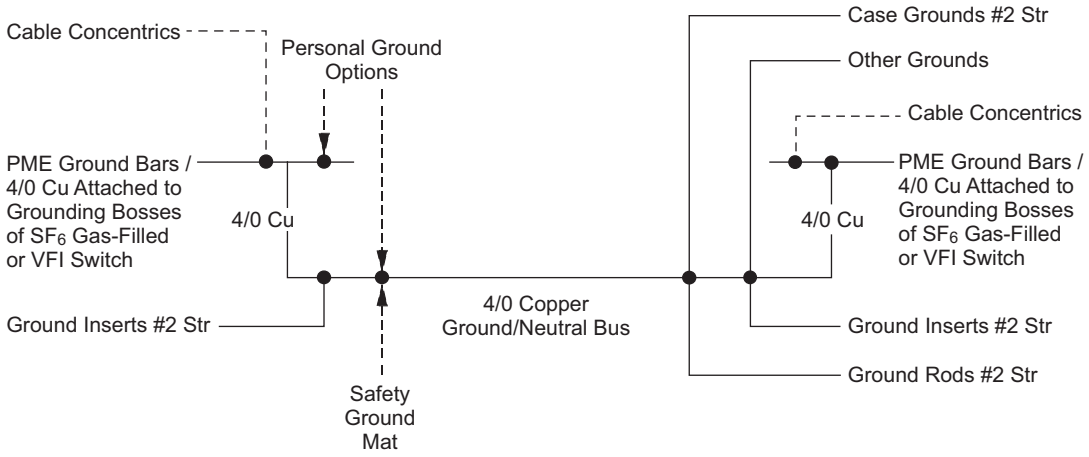
In corrosive areas, use TW copper wire in all structures for grounding and neutral bus.

Figure GR 100–1: Cable Concentrics Attached to Ground Bus (Option 1)



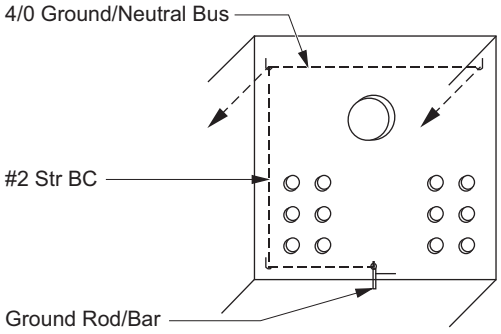
Note(s):
1. Applies to PME, PMH, Primary Metering Cabinet (PMC), and SF_6 switches. Does not apply to transformers and capacitors.
2. Refer to the Grounding Manual for personal grounding requirements.

Figure GR 100–2: Cable Concentrics Attached to PME Ground Bars (Option 2)



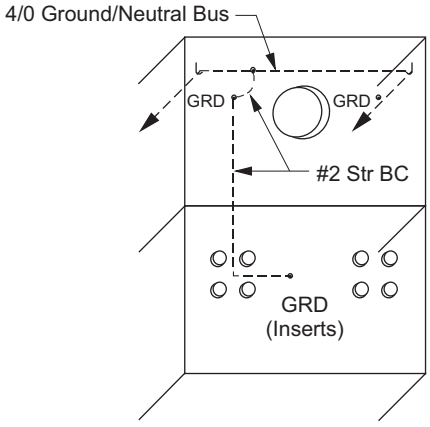
Note(s):
1. Applies to PME and SF_6 switches. Does not apply to transformers and capacitors.
2. For new and existing PME installations, ensure that a 4/0 Cu is connected from all positions to the 4/0 structure ground/neutral bus.
3. Refer to the Grounding Manual for personal grounding requirements.

Figure GR 100–3: Manholes/Vaults with Ground Rods or Ground Bars (End View)



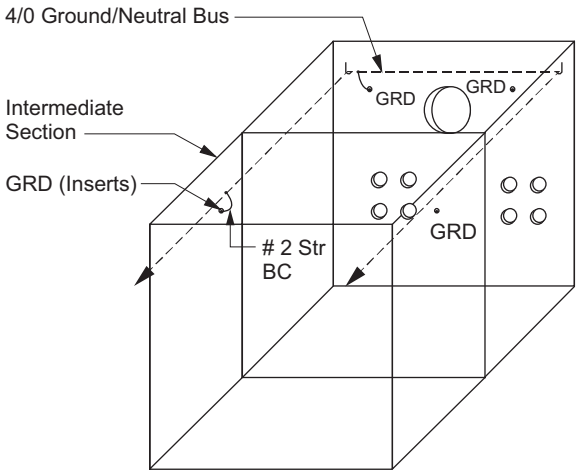
Note(s):
1. Connect the ground rod or ground bar, (one in manholes, two in vaults) to the 4/0 str bare copper ground/neutral bus using #2 str bare copper.

Figure GR 100–4: Manholes/Vaults — Tub Style with Ground Inserts (End View)



Note(s):
1. Interconnect the ground insert in the base section and one of the ground inserts in the top section with #2 str bare copper to the ground/neutral bus.

Figure GR 100–5: Tunnel Style Vaults with Ground Inserts (End View)



Note(s):
1. Connect one ground insert in each end section to the 4/0 str ground/neutral bus with #2 str bare copper.
2. Connect one ground insert of each intermediate section to the ground/neutral bus using #2 str bare copper.

Figure GR 100–6: Subsurface Enclosure (Side View)

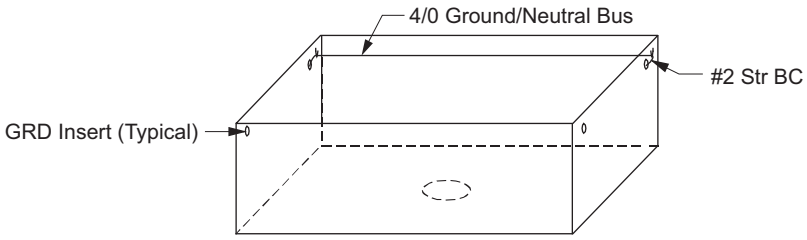
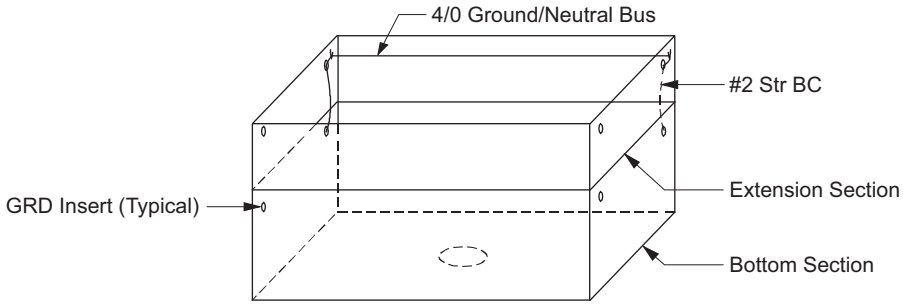
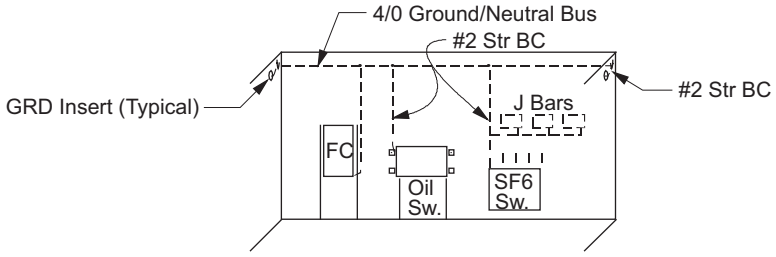


Figure GR 100–7: Subsurface Enclosure (Side View)



Note(s):
1. Ground bus required along one wall (minimum).
2. Connect one ground insert at each end to ground bus using #2 str bare copper.

Figure GR 100–8: Typical Equipment Ground (Side View)



Note(s):
1. Other equipment that requires case or tank grounds would include BURD transformers, BURD switches, fuse cabinets, junction bars, oil switches, and SF_6 switches.

Figure GR 100–9: Structure Ground — Straight Splice

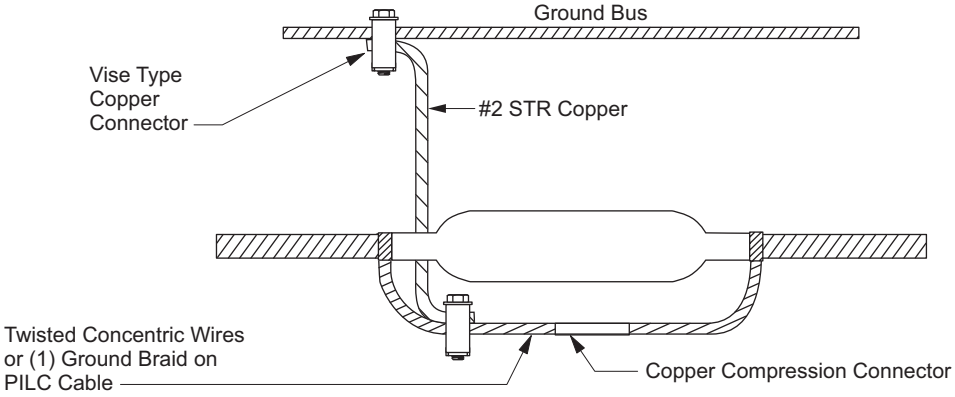


Figure GR 100–10: Structure Ground — "T" Splice

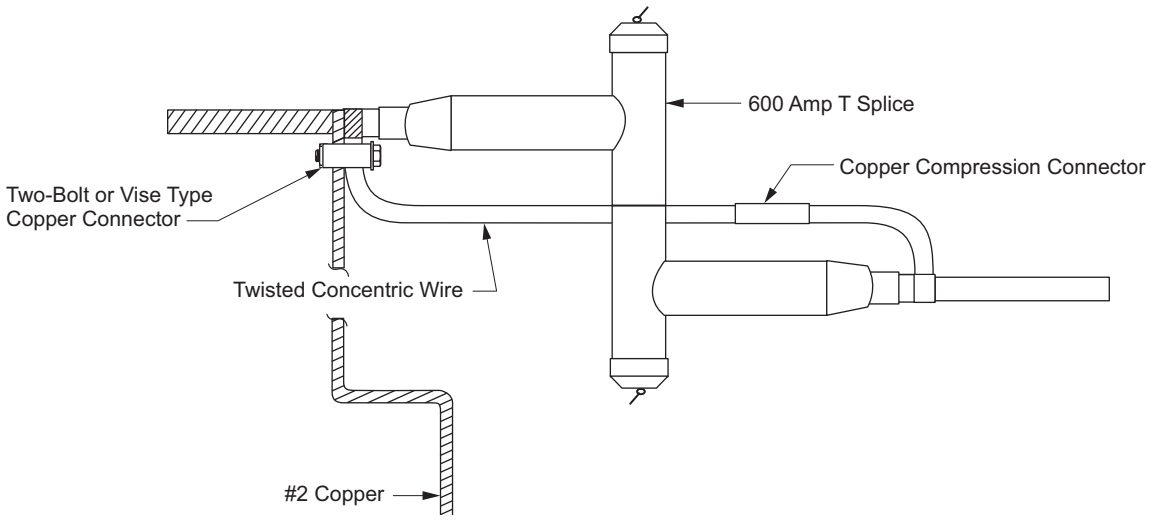
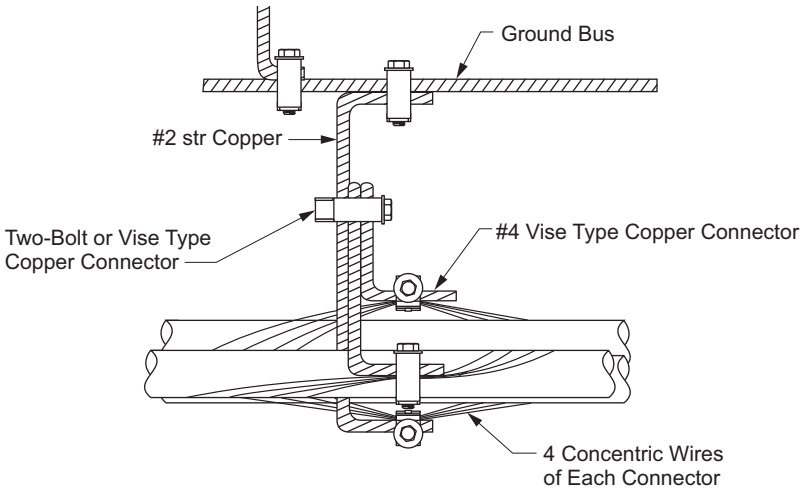


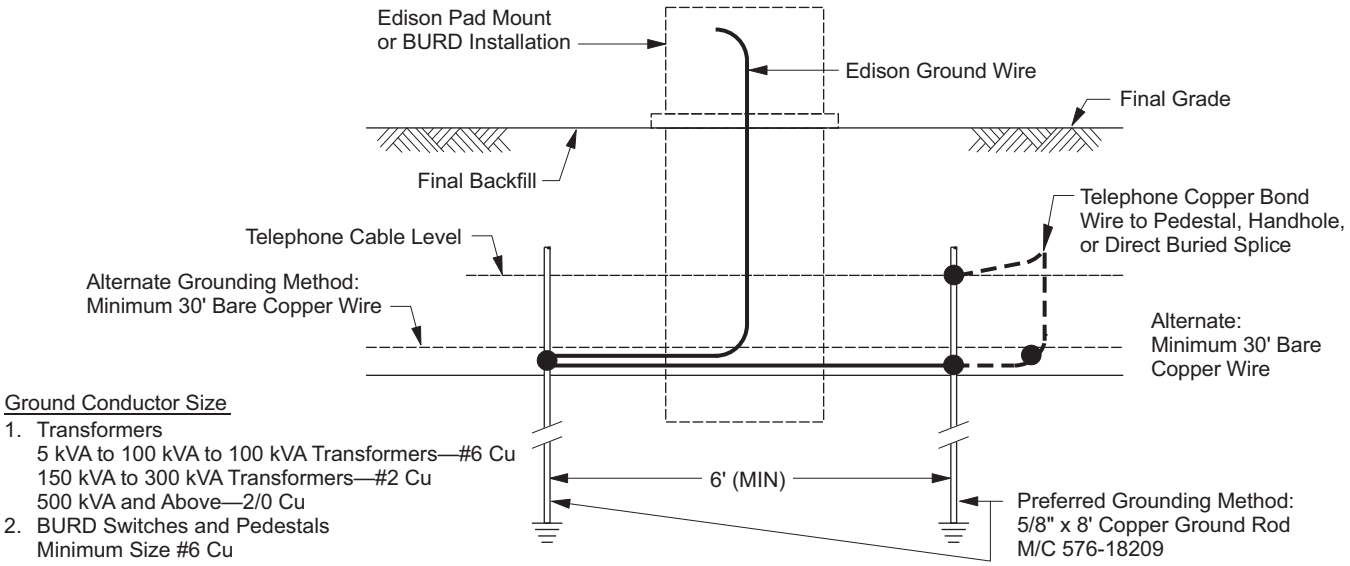
Figure GR 100–11: Structure Ground — Bundled



GR 110 Installation of Grounds and Bonds in BURD and Pad-Mounted Systems

Scope GR 110.1 Installation of Grounds and Bonds in BURD and Pad-Mounted Systems

Figure GR 110–1: Installing Grounds and Bonds in BURD and Pad-Mounted Systems



1.0 Grounding Procedure

1.1 Preferred Method

A. Transformer: (Pad-mounted or BURD)—Two 5/8" x 8' ground rods driven in cable trench with six foot minimum separation. See Figure GR 110–1 (Sheet 1). One ground rod shall be driven to telephone level for attachment of telephone company bond.

B. BURD Switches—One 5/8" x 8' ground rod shall be driven in cable trench similar to Figure GR 110–1 (Sheet 1).

C. Handholes—Grounding is not required at handholes except for telephone bonding. See Paragraph 2.0 (Sheet 2).

D. Pedestals—One 5/8" x 8' ground rod shall be driven to a minimum depth of 18 inches below finish grade.

1.2 Alternate Method

NOTE

The alternate method should only be used where the soil is rocky or difficult for driving ground rods.

A. Transformers—Two 30-foot runs of bare copper wire laid in opposite directions along trench bottom. This method may be used in place of ground rods where soil is rocky or difficult for driving rods.

B. BURD Switches—30 feet of #6 bare copper wire shall be laid along trench bottom.

C. Pedestals—30 feet of #6 bare copper wire shall be laid along the trench bottom.

2.0 Bonding Connections to Telephone Cable

2.1 Transformers: (Pad-Mounted or BURD)

A. The telephone companies will install and furnish labor and material for their bonding connection to the Edison 5/8" x 8' ground rod or direct-buried #6 bare copper ground wire. See Figure GR 110–1 (Sheet 1).

B. Where a bond is required, the connection will be made during the telephone cable installation and before the final backfill is completed.

C. One ground rod shall be driven to the telephone level (approximately 12 inches above Edison level).

2.2 Handholes

Bonding shall not be required at handholes except where located 1,000 feet or more from transformer. One ground rod shall be installed and bonded according to Paragraph 2.1 A. (Sheet 2).

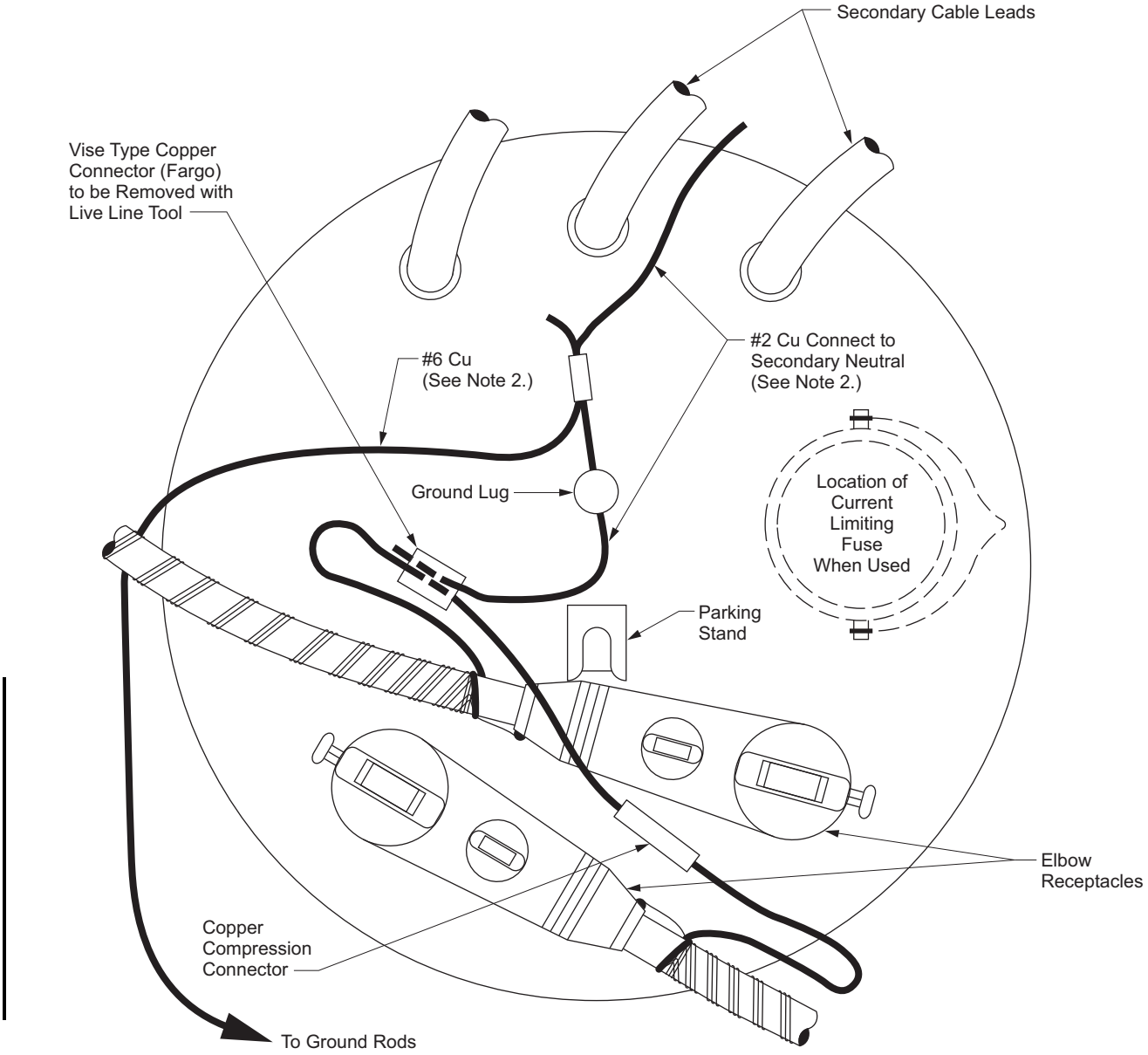
2.3 Pedestals

All pedestals shall be bonded. Telephone companies will connect to 3/8 inch ground clamp stud.

GR 120 Installation of Grounds and Bonds at 4-Wire BURD Transformers

Scope GR 120.1 Installation of Grounds and Bonds at 4-Wire BURD Transformers

Figure GR 120–1: Installation of Grounds and Bonds at 4-Wire BURD Transformers (Plan View)



Note(s):

1. The external tank ground lug shall be solidly connected to the low voltage neutral with No. 2 copper and be solidly grounded to the common neutral of the system.
2. Use TW Cu in corrosive areas.

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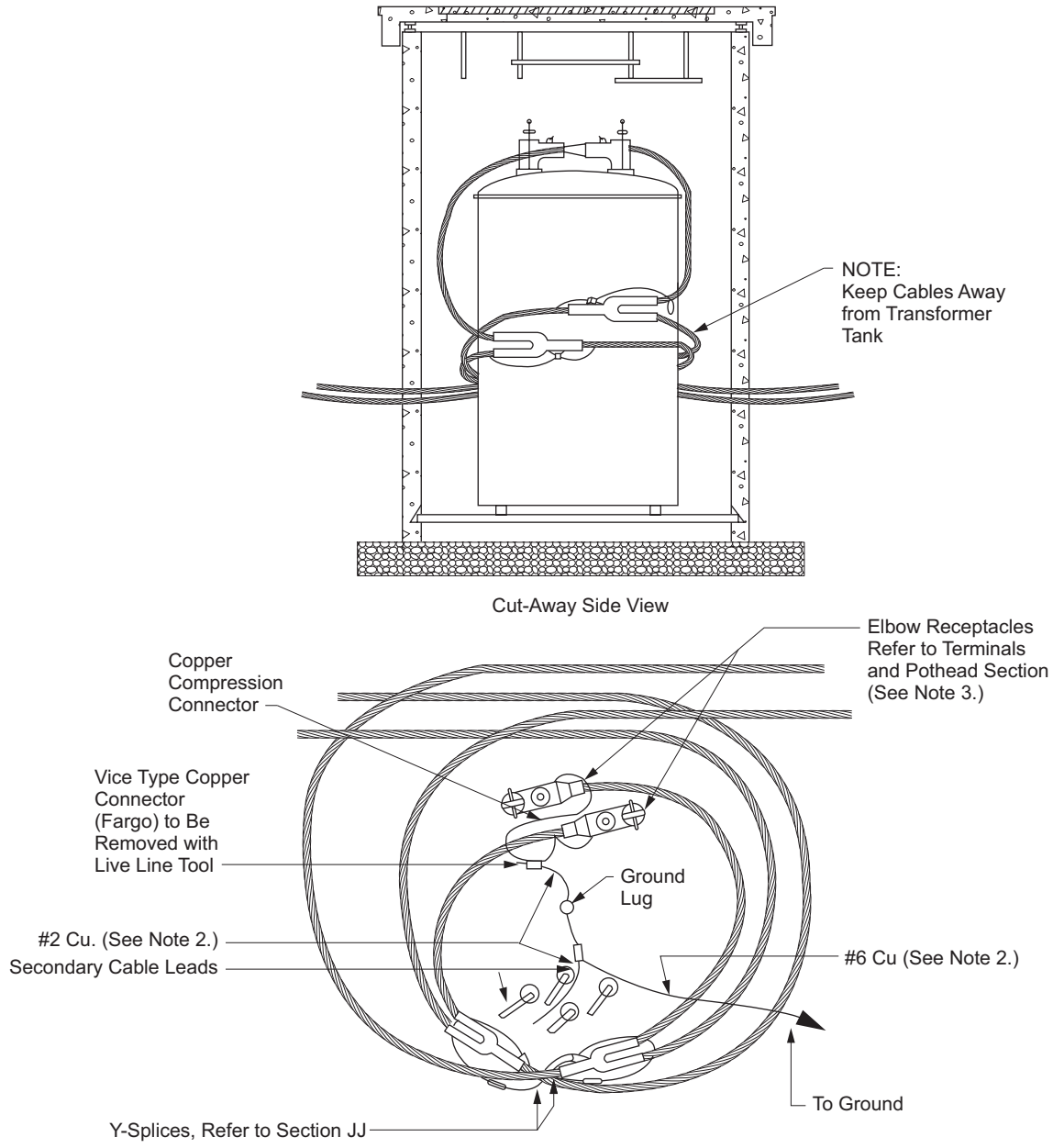
GR 130 Installation of Grounds and Bonds at 3-Wire BURD Transformers

Scope GR 130.1 Installation of Grounds and Bonds at 3-Wire BURD Transformers

Figure GR 130–1: Bonding and Grounding at 3-Wire BURD Transformer



Note(s):

1. The external tank ground lug shall be solidly connected to the low voltage neutral with No. 2 strand bare copper and be solidly grounded to the common neutral of the system.
2. Use TW Cu in corrosive areas.
3. For new installations, 200 A load-break elbows are required. For existing 200 A dead-break elbows, replace 200 A dead-break elbows with 200 A load-break elbows during apparatus replacement due to failure, end of life, or upgrade of equipment.

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GR 140 Transformer Secondary Grounds

Scope GR 140.1 Grounding of Distribution Transformer Secondaries

Figure GR 140–1: One Transformer

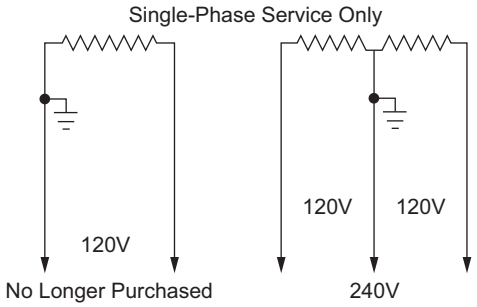


Figure GR 140–2: Two Transformers

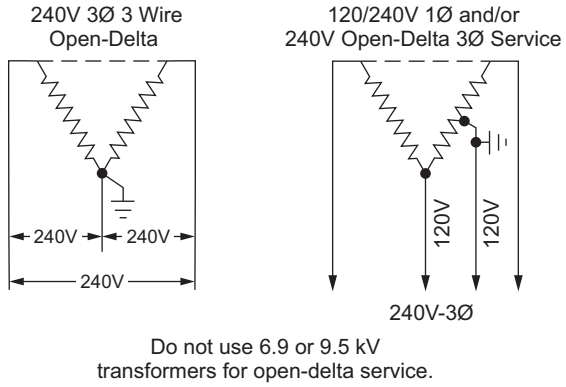


Figure GR 140–3: Three Transformers

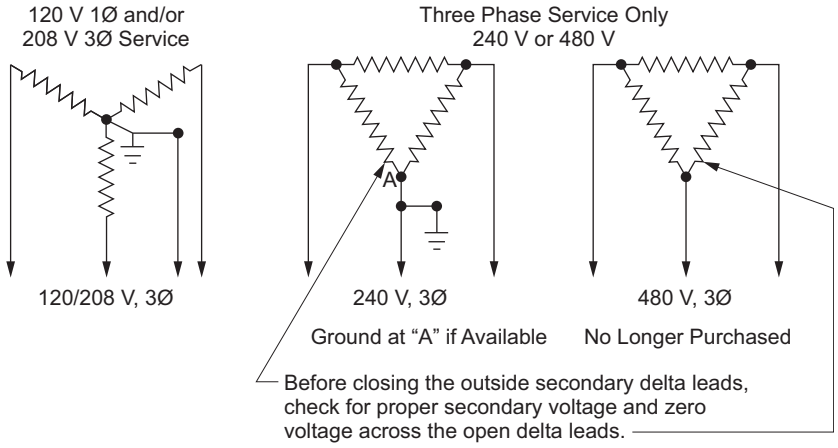


Figure GR 140–4: Three Phase Transformers

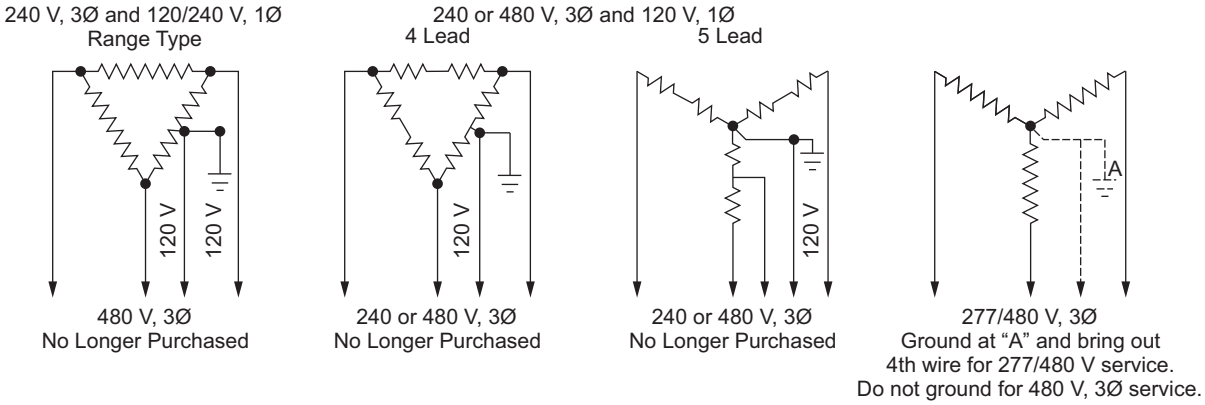
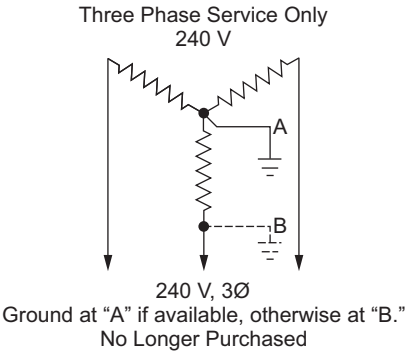


Figure GR 140–5: Three Phase Service Only 240V



GR 230 Grounding Device — Pothead Terminal

Scope GR 230.1 Shows Pothead Terminal Grounding Studs

1.0 General Information

Pothead terminal grounding studs are supplied with the aerial lugs of 350-, 750-, and 1,000-kcmil 12/16-kV CLP potheads. They provide a point of attachment for a ground clamp.

2.0 Installation

2.1 Install the stud after the pothead is completely assembled and the aerial lug is fastened in place. Use the additional nut and lock washer enclosed in the kit to secure the stud to the aerial lug.

Figure GR 230–1: G & W

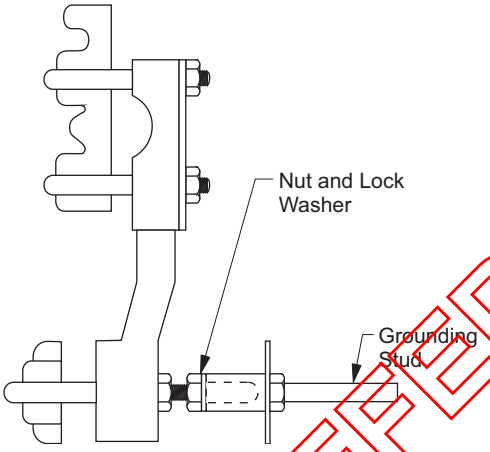
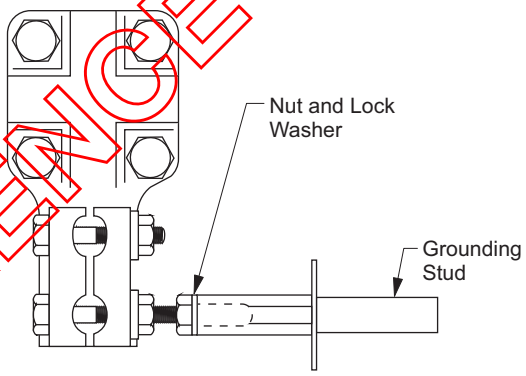
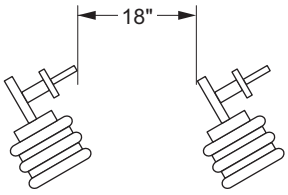


Figure GR 230–2: Joslynj



FOR REFERENCE ONLY

2.2 Whenever possible the studs on a three-phase installation should face in the same direction. When this is not possible, allow adequate clearance between the stud and the energized parts of the adjacent pothead.



2.3 The grounding studs may remain as a permanent part of the installation.

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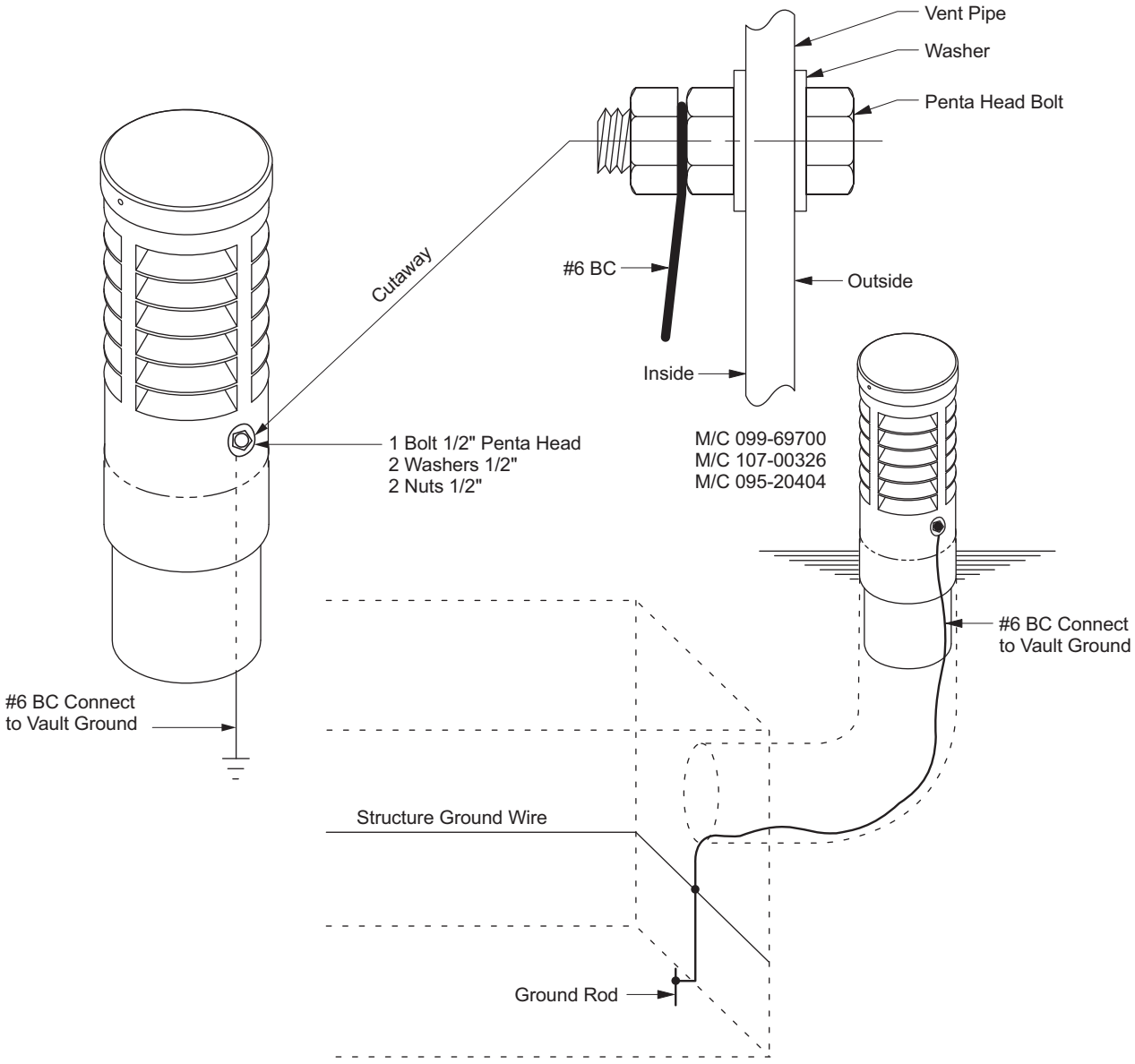
GR 232 Accessible Ground Connection for Standpipe Vents

Scope GR 232.1 Installation of a Ground Wire in a Polyethylene Standpipe Vent

Figure GR 232–1: Installation of a Ground Wire in a Polyethylene Standpipe Vent

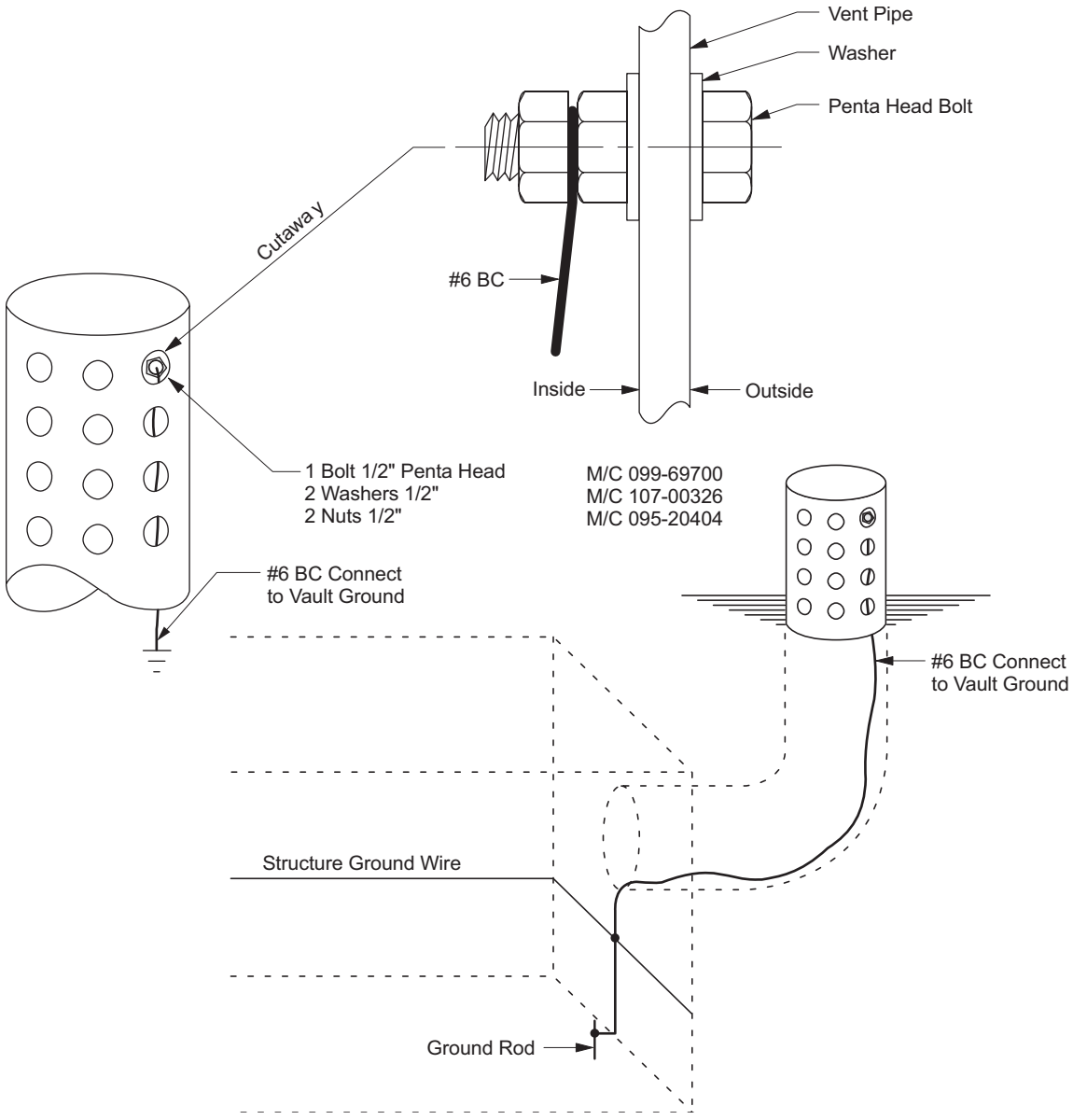


Note(s):

1. To assist in underground structure locating from the surface, install a #6 bare copper wire from inside the vent pipe to the structure ground system. This installation will allow a single person crew to tie into the system ground and locate the facilities unaided. The installation shall be made to a minimum of one vent per vault during new construction, added to the appropriate structures during the routine maintenance cycle, or as the need arises by request for assistance from the contract cable locating company.
2. Drill a 9/16" hole for grounding bolt approximately one inch below the lowest ventilation fin slot. The ground connection should be attached on the side of the vent facing away from the street. This is done to maintain a flat surface for attaching structure identification stickers.

Scope GR 232.2 Installation of a Ground Wire in a PVC Standpipe Vent

Figure GR 232–2: Installation of a Ground Wire in a PVC Vent



Note(s):

1. To assist in underground structure locating from the surface, install a #6 bare copper wire from inside the vent pipe to the structure ground system. This installation will allow a single person crew to tie into the system ground and locate the facilities unaided. The installation shall be made to a minimum of one vent per vault during new construction, added to the appropriate structures during the routine maintenance cycle, or as the need arises by request for assistance from the contract cable locating company.

GR 235 600 Amp 4 kV – 25 kV Deadbreak Ground Adapter Plug

Scope GR 235.1 Application and Installation of 600 Amp Deadbreak Ground Adapter Plug and Insulated Cap with Test Point 4 kV – 25 kV

1.0 Application

To provide a permanently installed component for rated cluster grounds or personal grounds for 600 Amp separable connectors. Not intended for temporary installation (such as 600 Amp to 200 Amp tap positions) or in locations where the cap is obstructed from being removed and from grounds being applied to the copper rod.

Figure GR 235–1: 600 Amp Deadbreak Ground Adapter Plug and Insulated Cap with Test Point 4 kV – 25 kV

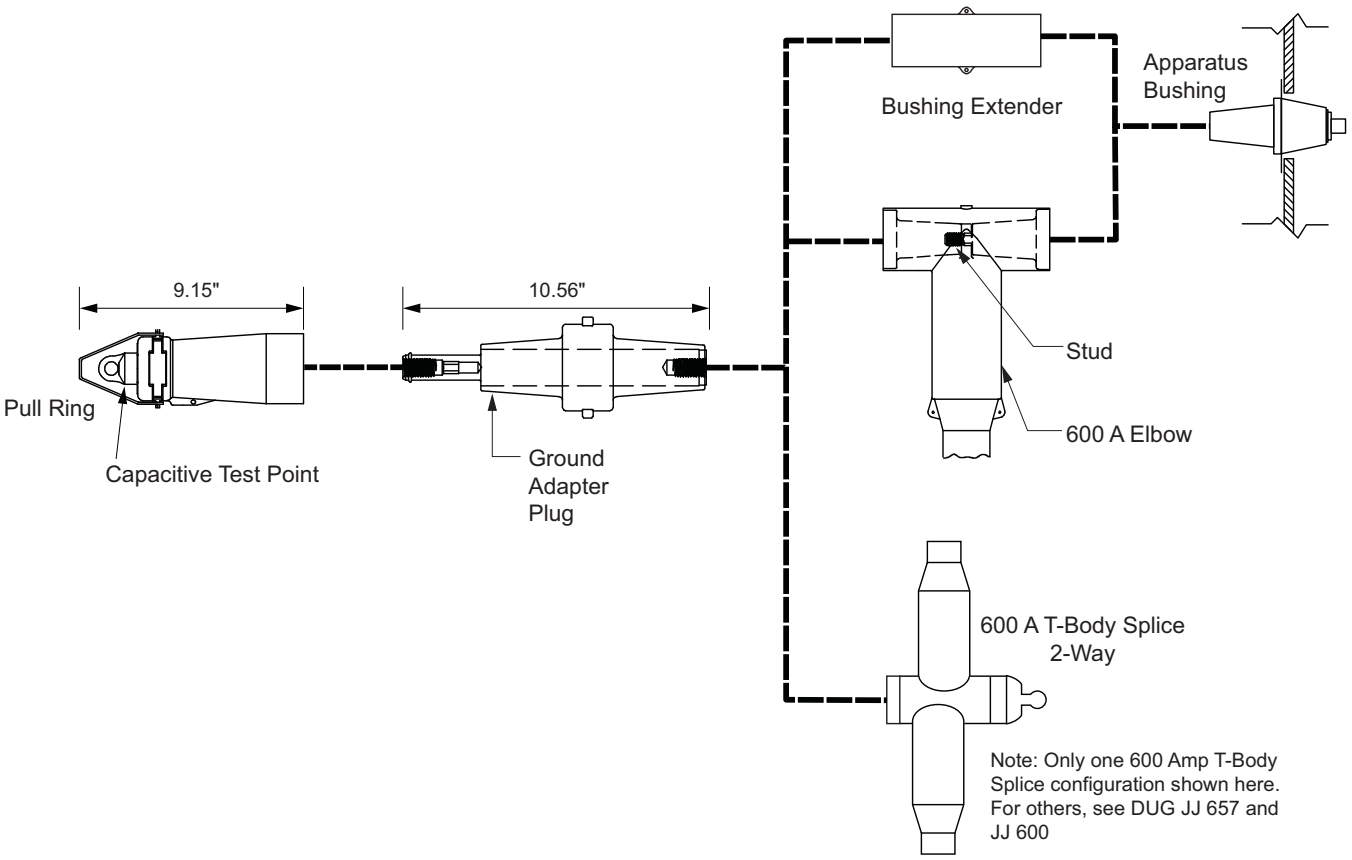


Table GR 235–1: SAP Number, Ground Adapter Plug

Part Name	SAP Number
Ground Adapter Plug	10200141
Insulated Cap with Test Point	10200142

CAUTION Deadbreak components must be de-energized during installation or removal of parts.

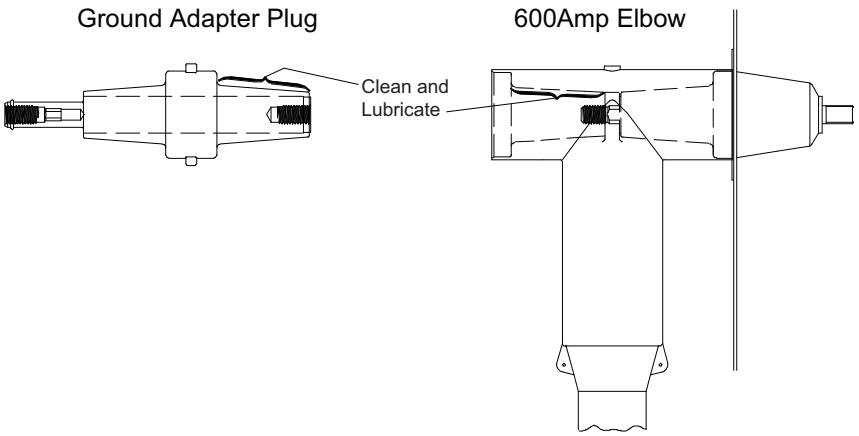
WARNING Always consider conductors/cables energized until they are proven de-energized by testing and grounding.

2.0 Installation Instructions

2.1 Install the 600 Amp elbow or bushing extender onto the apparatus bushing in accordance with DUG JJ 660. Do not install the basic insulating plug (BIP) or cap. For the 600 Amp T-Body splice, assemble in accordance with DUG JJ 657.

2.2 Clean and lubricate the Ground Adapter Plug interface and the 600 Amp component (elbow, bushing extender, or T-Body splice) interface with SCE-approved cleaner (SAP 10177339) and lubricant (SAP 10154115) or the lubricant supplied. **Do not substitute any other cleaner or grease**. See Figure GR 235–2.

Figure GR 235–2: Clean and Lubricate Mating Parts



2.3 Insert the Ground Adapter Plug into the 600 Amp component (elbow, bushing extender, or T-Body splice) and rotate clockwise to engage the stud.

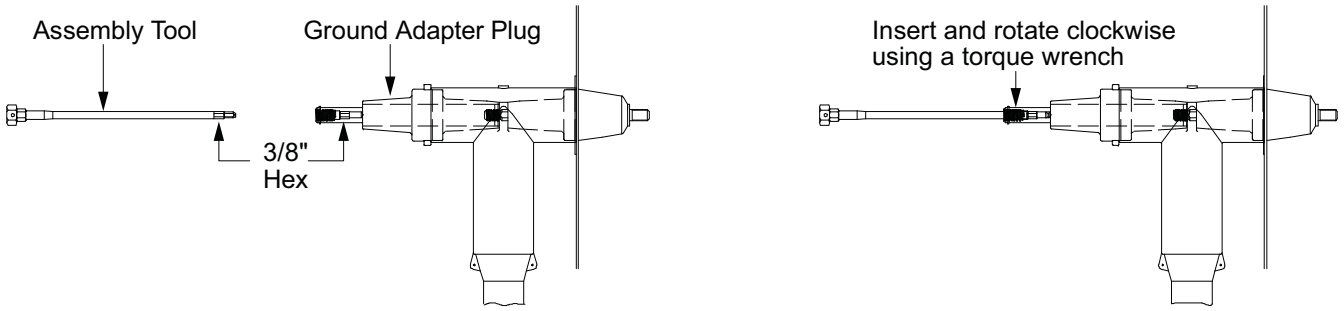
2.4 Select the appropriate assembly tool from Table GR 235-2 below, and insert the assembly tool into the Ground Adapter Plug, using live-line tools, and continue rotating clockwise. See Figure GR 235-3. When the Ground Adapter Plug stops rotating, tighten to 50 to 60 foot-pounds of torque. Remove the tool.

Table GR 235–2: Assembly Tool Selection

Assembly Tool	SAP Number	Torque Limiter
LRTP-12	10158037	1/2"-drive torque wrench required
LRTP/TK55-H-SCE	10174023	55 ft-lb torque limiter built-in

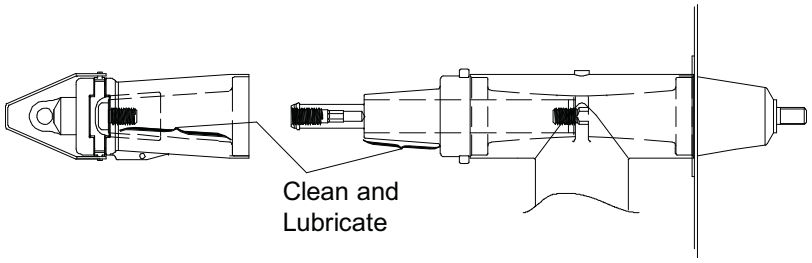
Note(s):
1. Use the adapter tool, TPH-1 (SAP 10183920) to grip the Ground Adapter Plug during assembly.

Figure GR 235–3: Torque Ground Adapter Plug



2.5 Clean and lubricate the interface of the Insulated Cap with Test Point with SCE-approved cleaner (SAP 10177339) and lubricant (SAP 10154115) or the lubricant supplied. **Do not substitute any other cleaner or grease**. See Figure GR 235–4.

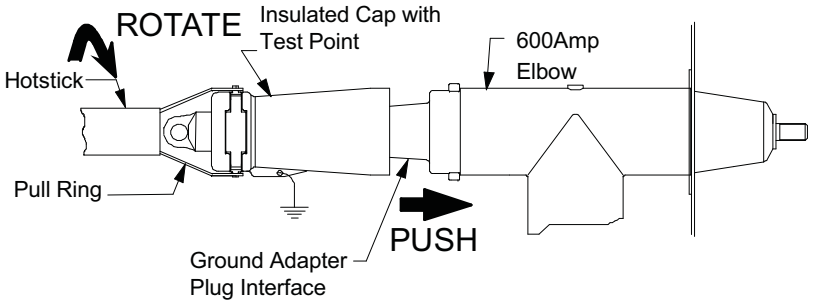
Figure GR 235–4: Clean and Lubricate Mating Parts



2.6 Attach the live-line tool (hotstick) to the Insulated Cap pull ring and push the Insulated Cap onto the Ground Adapter Plug interface as far as it will go. See Figure GR 235–5.

2.7 While pushing the Insulated Cap against the Ground Adapter Plug interface, with the hotstick, twist clockwise until the threads between the two parts engage. Continue turning without pushing until resistance is felt, maximum torque is 15 foot-pounds. **Do not over tighten**.

Figure GR 235–5: Installation of Insulated Cap with Test Point



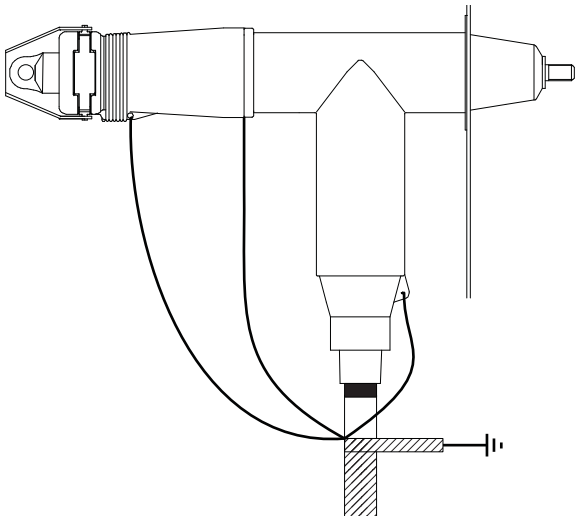
NOTE

Once the Insulated Cap with Test Point has been installed, approved high-voltage rubber gloves will be used to install the bond wire.

2.8 Bond Wire Installation

All premolded rubber 25 kV 600 A components with grounding eyes shall be bonded to ground with #14 AWG copper wire (SAP 10109303) or equivalent. Connect remaining concentric wires to ground as required. See Figure GR 235–6.

Figure GR 235–6: Installation of Bond Wire



Insulated Cable
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Standard	Title
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IC 100 Cable Data — 600 VAC

Scope IC 100.1 Cable Data — 600 V

1.0 Cable Data — 600 V–1/C–Aluminum (CLP)

600 V–1/C–Aluminum (CLP): Stranded Aluminum Conductor (NCR) Cross-linked Polyethylene insulation

Table IC 100–1: 600 V–1/C–Aluminum

Conductor Size (AWG or kcmil)	#8	#2	1/0	4/0	350	700
Insulation Thickness (mil)	60	60	80	80	95	110
Outside Diameter (in)	.266	.412	.533	.688	.871	1.184
Neutral Size (AWG or kcmil)	#8	#4	#2	1/0	4/0	350
Insulation Thickness (mil)	60	60	60	80	80	95

Note(s):
1. Single conductors are not coded but may be ordered as a special item.
2. #8 AWG is used as multiple streetlight cables.

2.0 Conventional Cables (Paralleled on a Single Reel)

Table IC 100–2: Conventional Cables

Streetlight Cable	2–#8				
SAP Number	10216991				
Overall Diameter (in)	.53				
Net Weight (lb/1,000 ft)	64				
Standard Reel Length (ft)	1,000				
Two Phase W/Neutral Cable	2–#2/#4	2–1/0 / #2	2–4/0 / 1/0	2–350 / 4/0	2–700/350
SAP Number	10110160	10110161	10110162	10110164	10110165
Overall Diameter (in)	.84	1.06	1.38	1.75	2.36
Net Weight (lb/1,000 ft)	247	383	669	1,105	2,145
Standard Reel Length (ft)	3,000	3,000	2,000	1,500	1,000
Three Phase W/Neutral Cable	3–1/0 / #2	3–4/0 / 1/0	3–350 / 4/0	3–700/350	
SAP Number	10110166	10110167	10110169	10110170	
Overall Diameter (in)	1.20	1.49	1.97	2.65	
Net Weight (lb/1,000 ft)	529	934	1,527	2,824	
Standard Reel Length (ft)	1,000	2,000	1,500	1,000	

= For Reference Only

3.0 Conventional Cables (Plexed on a Single Reel)

Table IC 100–3: Plexed Conductors

Two Phase w/ Neutral Cable	2-1/0 / #2	2-4/0 / 1/0	2-350 / 4/0	2-700 / 350
SAP Number	10211376	10211377	10211378	10211379
Overall Diameter (in)	1.10	1.42	1.79	2.47
Net Weight (lb/1,000 ft)	387	674	1,110	2,022
Standard Reel Length (ft)	3,000	2,000	1,500	1,000
Three Phase w/ Neutral Cable	3-4/0 / 1/0	3-350 / 4/0	3-700 / 350	
SAP Number	10211381	10211382	10211383	
Overall Diameter (in)	1.58	2.01	2.78	
Net Weight (lb/1,000 ft)	940	1,527	2,828	
Standard Reel Length (ft)	2,000	1,500	1,000	

Table IC 100–4: Color of Stripe for Phase Identification

Cable Configuration	1st Phase	2nd Phase	3rd Phase	Neutral
Two Phases	Red	—	—	Yellow
Two Phases w/Neutral	Red	White	—	Yellow
Three Phases w/Neutral	Red	White	Blue	Yellow

4.0 Cable Data — 600 V–1/C–Copper (CLP)

600 V–1/C–Copper (CLP): Stranded Copper Conductor (NCR) Cross-linked Polyethylene insulation

This cable is obtained by special order and is used only where aluminum will not fit in existing conduit.

Table IC 100–5: 600 V—1/C—Copper

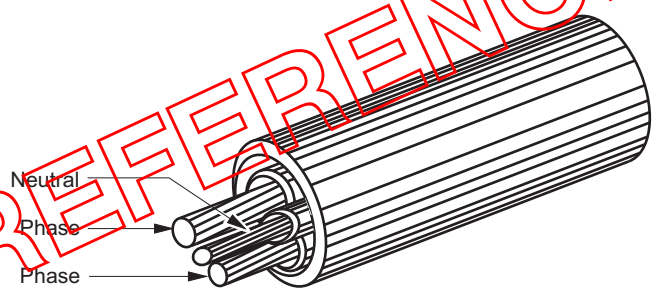
Conductor Size (AWG or kcmil)	#4	#2	2/0	250	500
Insulation Thickness (mil)	60	60	80	80	95
Outside Diameter (in)	.352	.412	.578	.765	1.008
Neutral Size (AWG or kcmil)	#6	#4	#2	2/0	4/0
Insulation Thickness (mil)	60	60	60	80	80

Note(s):
1. Single conductors are not coded, but may be obtained on a special order basis.

5.0 600 V–1/C–Aluminum (CLP) CICØ

600 V–1/C–Aluminum (CLP) CIC: Stranded Aluminum Conductors (NCR) Cross-linked Polyethylene insulation

Figure IC 100–1: Aluminum Conductors



FOR REFERENCE ONLY

Table IC 100–6: CIC Cables

Two Phase W/Neutral Cable	2–#2/#4	2–1/0 / #2	2–4/0 / 1/0	2–350 / 4/0
Code Number	592-23503	592-23800	592-24501	592-25201
Duct Size Diameter (in)	1-1/2	1-1/2	2	2
Net Weight (lb/1,000 ft)	580	890	1,225	1,655
Standard Reel Length (ft)	1,000	1,000	1,000	1,000

Figure IC 100–2: #8 AWG Aluminum Conductors (Stranded)

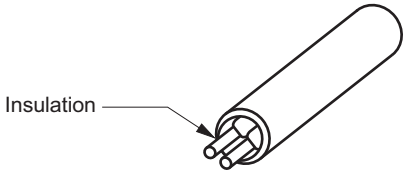


Table IC 100–7: #8 AWG Aluminum Conductors (Stranded)

Streetlight	2–#8
Code Number	592-22000
Duct Size Diameter (in)	1/2
Net Weight[a/] (lb/1,000 ft)	150
Standard Reel Length (ft)	1,000

[a/] The Net Weight of the above cables includes the weight of the duct.

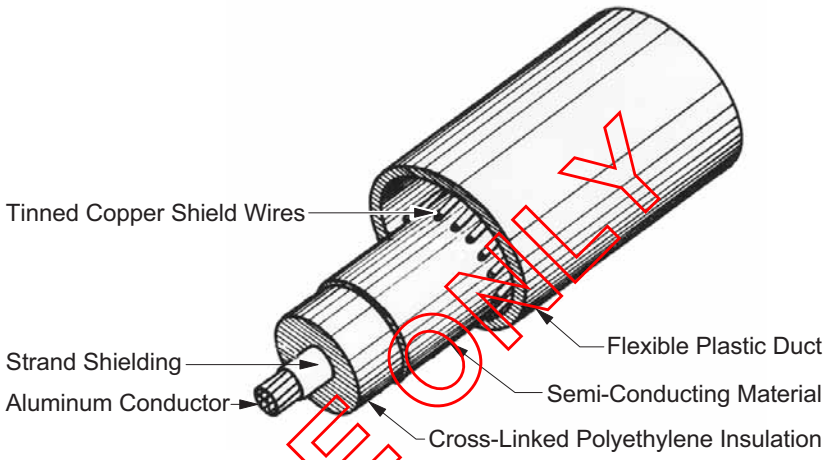
FOR REFERENCE ONLY

IC 110 Cable Data 12/16 kV CIC

Scope IC 110.1 Cable Data — 12/16 kV 1/C CLP CIC

Table IC 110–1: 12/16 kV–1/C–CLP CIC

Standard Cable Lengths (ft)			
	#2		1/0
	CIC	No Duct	CIC and No Duct
1–1/C	2,700	2,700	2,500
2–1/C Paralleled	1,350	2,700	—
3–1/C Paralleled	1,350	2,700	—



Conductor Size (Aluminum)		12/16-kV Cross-Linked Insulation #2	12/16-kV Cross-Linked Insulation 1/0	12/16-kV High Molecular Weight #2	16 kV High Molecular Weight #2
Code Number	1 on Reel with Duct	592-88001	592-88308		
	1 on Reel — No Duct	592-89108	592-89405		
	2 on Reel — No Duct	592-88100	—		
	2 on Reel — No Duct	592-89207	—		
	3 on Reel — No Duct	592-88209	—		
	3 on Reel — No Duct	592-89306	—		
Conductor Type		NCR	NCR	NCR	NCR
Insulation (mil)		220	220	220	295
Insulation Shielding (mil)		30	50	30	30
Shield Wires (No./AWG)		10/#14	16/#14	10/#14	10/#14
Outside Diameter (in)[a/]		1.045	1.127	.995	1.115
Duct Size (in)		1-1/4	1-1/2	1-1/4	1-1/2
Net Weight (lb/1,000 ft)[b/]		645	855	850	865
Reel Size (in)	Flange Diameter (MAX)	96	96	74	74
	Drum Diameter (MIN)	34	40	40	40
	Traverse (Drum Width) (MAX)	48	48	48	48
	Width (Over-All) (MAX)	54	54	53	53

[a/] Includes shield wires. Subtract 130 mil to obtain the O.D. over insulation.
[b/] Includes duct weight

FOR REFERENCE ONLY

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IC 112 Cable Data — 5 kV–35 kV CLP

Scope IC 112.1 Cable Data — 5 kV, 12/16 kV, and 34.5 kV Non–Jacketed 1/C Aluminum (CLP)

Table IC 112–1: 5 kV, 12/16 kV, and 34.5 kV Non–Jacketed 1/C Aluminum (CLP)

Voltage (Insulation Thickness)	Conductor Size (AWG or kcmil)	Number of Strands	Average Outside Diameter (in)	Shield Wires (Number Size)	Average Overall Diameter (in)	Triplexed or Paralleled	Average Net Weight (lb/1,000 ft)	MAX Cable Length (ft)	Code Number (592)
5 kV[a/]	1/0	19	.89	6 #14	1.92	Paralleled	870	2,500	80503
	350	37	1.22	10 #14	2.62	Paralleled	2,060	2,000	81303
	750	61	1.57	14 #12	3.38	Triplexed	3,950	1,200	81709
12 kV–16 kV (220 mil)	#2	7	.99	10 #14	2.14	Paralleled	1,238	2,700	89305
	1/0	19	1.07	9 #14	2.31	Paralleled	1,410	2,000	82509
	350	37	1.49	13 #14	3.22	Triplexed	2,760	500	83200[a/]
	750	61	1.86	15 #12	4.00	Triplexed	4,870	500	83507[a/]
	1,000	61	2.00	15 #12	4.31	Triplexed	6,000	500	83705[a/]
12 kV–16 kV (220 mil)	350	37	1.45	12 #14	3.13	Paralleled	2,826	3,000	—[b/]
	750	61	1.81	15 #14	3.91	Paralleled	4,855	2,000	—[b/]
	1,000	61	2.00	15 #12	4.32	Paralleled	5,907	1,700	—[b/]
16 kV (295 mil)	1/0	19	1.30	12 #14	2.80	Triplexed	2,032	1,500	
	350	37	1.63	15 #14	3.51	Triplexed	3,264	1,000	
	750	61	2.00	15 #12	4.31	Triplexed	5,291	620	
34.5 kV (420 mil)	1/0	19	1.55	15 #14	3.33	Triplexed	3,030	1,200	86807
	750	61	2.26	15 #12	4.87	Triplexed	6,645	550	87508
34.5 kV (345 mil)	1,500	91	2.50	19 #12	5.38	Paralleled	9,520	1,000	77509
34.5 kV (420 mil)	4/0	19	1.69	11 #14	3.65	Paralleled	3,173	2,000	—[b/]
	750	61	2.24	15 #12	4.84	Paralleled	6,441	1,200	—[b/]
34.5 kV (345 mil)	1,500	91	2.49	19 #12	5.38	Paralleled	8,984	1,000	—[b/]

[a/] Use 12 kV–16 kV 200 mil Cable for 5 kV applications.

[b/] These cables in paralleled configuration are prefabricated at division locations using single conductor cable. Material codes for the single conductor cable are listed below:

= For Reference Only

12 kV–16 kV (220 mil)	350 kcmil SAP 10110327 750 kcmil SAP 10110328 1,000 kcmil SAP 10110329	34.5 kV	(420 mil) 4/0 AWG SAP 10110252 (420 mil) 750 kcmil SAP 10110307 (345 mil) 1,500 kcmil SAP 10110306

1.0 Parallel Cable

Maximum lengths for 350, 750, and 1,000 kcmil 12 kV–16 kV and 4/0, 750 and 1,500 kcmil 34.5 kV in paralleled configuration are based on using a three-in-one reel.

Scope IC 112.2 Cable Data — 5 kV–35 kV (CLP) – Jacketed

Table IC 112–2: 4 kV, 12/16 kV, and 34.5 kV 1/C Al/Cu (CLP) – Jacketed

Voltage (kV) (Insulation Thickness)	Conductor Size (AWG or kcmil)	Diameter Over Insulation (in)	Diameter Over Semicon Shield (in)	Average Outside Diameter (in)	CN Wires (Number Size)	Weight (lb/1,000 ft)	Maximum Length on Reel (ft)	SAP Number
4/12/16 (220 mil)	#2 (Al[a/])	0.785	0.865	1.093	10 #14 Cu	543	2,700	10110260
	#2 Cu	0.815	0.905	1.075	14 Flat Strap Cu	671	2,700	10184625
	1/0 (Al)	0.860	0.940	1.168	16 #14 Cu	691	2,700	10110261
	350 (Al)	1.170	1.270	1.498	13 #14 Cu	1,092	8,000	10110262
	750 (Al)[b/]	1.490	1.590	1.912	15 #12 Cu	1,903	5,000	10110263
	1000 (Al)	1.635	1.765	2.087	15 #12 Cu	2,285	4,000	10110264
	1000 (Cu)	1.635	1.765	2.087	15 #12 Cu	4,436	2,500	10110289
34.5 kV (420 mil)	4/0 (Al)	1.410	1.510	1.798	11 #14 Cu	1,286	5,000	10110290
	750 (Al)[b/]	1.905	2.035	2.357	15 #12 Cu	2,512	5,000	10110291
34.5 kV (345 mil)	1500 (Al)	2.063	2.133	2.373	26 (0.025 x 0.150)	2,994	3,500	10210088

[a/] Not approved for new installations.
[b/] See DDS-9, Table 9-1 for utilization of 750 JCN.

Table IC 112–3: 4 kV and 12/16 kV 2–1/C Aluminum (CLP) – Jacketed

Voltage (kV) (Insulation Thickness)	Conductor Size (AWG or kcmil)	Diameter Over Insulation (in)	Diameter Over Semicon Shield (in)	Average Outside Diameter (in)	CN Wires (Number Size)	Weight (lb/1,000 ft)	Maximum Length on Reel (ft)	SAP Number
4/12/16 (220 mil)	#2 (Al)[a/]	0.785	0.865	1.093	10 #14 Cu	1,085	2,700	10110293
	1/0 (Al)	0.860	0.940	1.168	16 #14 Cu	1,382	2,700	10178252

[a/] Not approved for new installations.

Table IC 112–4: 4/12/16 kV 3–1/C Aluminum (CLP) – Jacketed

Voltage (kV) (Insulation Thickness)	Conductor Size (AWG or kcmil)	Diameter Over Insulation (in)	Diameter Over Semicon Shield (in)	Average Outside Diameter (in)	CN Wires (Number Size)	Weight (lb/1,000 ft)	Maximum Length on Reel (ft)	SAP Number
4/12/16	#2 (Al)[a/]	0.785	0.865	1.093	10 #14 Cu	1,628	1,500	10110294
(220 mil)	1/0 (Al)	0.860	0.940	1.168	9 #14 Cu	1,821	1,500	10110295

[a/] Not approved for new installations.

= For Reference Only

IC 113 Cable Tolerances 5 kV–35 kV CLP Non–Jacketed

Scope IC 113.1 Cable Data – 5 kV, 12/16 kV, 34.5 kV 1/C Aluminum (CLP): Cable Tolerances

Table IC 113–1: 5 kV, 12/16 kV, 34.5 kV 1/C Aluminum (CLP): Cable Tolerances

Voltage	Conductor Size AWG or kcmil	Conductor Diameter		Outside Diameter Insulation		Outside Diameter Insulation Shield		Outside Diameter Concentric Neutral	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
12 kV–16 kV (220 mil)	#2	.208	.295	.75	.84	.81	.92	.94	1.05
	1/0	.358	.377	.83	.92	.89	1.00	1.02	1.13
	350	.654	.688	1.13	1.25	1.23	1.41	1.36	1.54
	750	.958	1.45	1.55	1.59	1.55	1.75	1.71	1.91
	1,000	1.106	1.164	1.75	1.75	1.74	1.94	1.90	2.10
34.5 kV (420 mil)	4/0	.507	.533	1.38	1.48	1.48	1.64	1.61	1.77
	750	.958	.978	1.85	1.98	1.99	2.17	2.15	2.33
34.5 kV (345 mil)	1,500	1.356	1.384	2.10	2.23	2.24	2.42	2.40	2.58

Voltage	Conductor Size AWG or kcmil	Conductor Diameter		Outside Diameter Insulation		Outside Diameter Insulation Shield		Outside Diameter Concentric Neutral	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
5 kV (90 mil)	1/0	.373		.58	.67	.68	.83	.81	.97
	350	.681		.91	1.01	1.01	1.17	1.14	1.30
	750	.998		1.22	1.33	1.32	1.49	1.48	1.65
16 kV (295 mil)	#2	.292		.912	.986	.972	1.066	1.10	1.19
	1/0	.373		.99	1.08	1.09	1.24	1.22	1.37
	350	.681		1.32	1.42	1.42	1.58	1.55	1.71
	750	.996		1.63	1.74	1.77	1.93	1.93	2.09
34.5 kV (420 mil)	1/0	.358	.377	1.23	1.34	1.33	1.50	1.46	1.63

FOR REFERENCE ONLY

Note(s):

1. The O.D.s over the above items should range between the specified minimums and maximums when measuring with a circumferential type measurement tape that measures the average diameter.

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IC 120 Cable Data — 5 kV–16 kV 1/C PILC

Scope IC 120.1 Cable Data — 5 kV, 12/16 kV 1/C Copper (PILC and PILC-NJ)

Table IC 120–1: 5 kV 1/C Copper (PILC and PILC-NJ)

	Bare Lead Sheath				Lead Sheath — Neoprene Jacket			
Conductor Size (AWG or kcmil)	#6	#2	500	1,000	#6	#2	4/0	500
Number of Strands	7	19	37	—	7	19	19	37
Conductor Type	NCR	NCR	CR	CRS	NCR	NCR	CR	CR
Insulation Thickness (mil)	90	90	90	90	90	90	90	90
Sheath Thickness (mil)	90	95	105	115	75	75	75	80
Outside Diameter (in)	.60	.72	1.19	1.62	.74	.85	1.04	1.30
Net Weight (lb/1,000 ft)	865	1,145	3,450	6,140	850	1,115	1,855	3,110
Standard Cable Lengths (ft)	3,000	3,000	2,500	1,000	3,000	3,000	3,000	2,500
Reel Size[a/] (in)	42/24	54/32	60/32	60/32	54/32	54/32	60/32	66/36
Material Code Number (590-)					29801	30007		30809

Table IC 120–2: 12 kV 1/C Copper (PILC and PILC-NJ)

	Bare Lead Sheath				Lead Sheath — Neoprene Jacket			
Conductor Size (AWG or kcmil)	—	#2	500	—	#2	4/0	350	500
Number of Strands	—	19	37	—	19	19	37	37
Conductor Type	—	NCR	CR	—	NCR	CR	CR	CR
Insulation Thickness (mil)	—	200	185	—	200	185	185	185
Sheath Thickness (mil)	—	125	135	—	75	75	80	80
Outside Diameter (in)	—	1.0	1.4	—	1.07	1.22	1.37	1.49
Net Weight (lb/1,000 ft)	—	2,060	4,570	—	1,560	2,220	2,880	3,510
Standard Cable Lengths (ft)	—	3,000	1,800	—	3,000	3,000	3,000	2,500
Reel Size[a/] (in)	—	66/36	66/36	—	66/36	78/36	78/36	78/36

Table IC 120–3: 16 kV 1/C Copper (PILC and PILC-NJ)

	Bare Lead Sheath				Lead Sheath — Neoprene Jacket			
Conductor Size (AWG or kcmil)	—	#2	500	—	#2	4/0	350	500
Number of Strands	—	19	37	—	19	19	37	37
Conductor Type	—	NCR	CR	—	NCR	CR	CR	CR
Insulation Thickness (mil)	—	255	240	—	255	240	240	240
Sheath Thickness (mil)	—	125	140	—	75	80	80	85
Outside Diameter (in)	—	1.11	1.55	—	1.18	1.34	1.48	1.60
Net Weight (lb/1,000 ft)	—	2,450	4,980	—	1,780	2,430	3,090	3,790
Standard Cable Lengths (ft)	—	3,000	1,700	—	3,000	3,000	2,500	2,200
Reel Size[a/] (in)	—	66/36	72/36	—	66/36	78/36	78/36	78/36
Material Code Number (591-)	—			—	13308	13704		14306

[a/] Flange diameter/inside traverse

FOR REFERENCE ONLY

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IC 121 Cable Data — 5 kV–16 kV 3/C PILC

Scope IC 121.1 Cable Data — 5 kV, 12/16 kV 3/C Copper (PILC-NJ)

Table IC 121–1: 5 kV 3/C Copper (PILC-NJ)

Conductor Size (AWG or kcmil)	#6	#2	2/0	4/0	350	500
Conductor Type	NCR	NCR	CS	CS	CS	CS
Insulation Thickness (mil)	85	85	85	85	85	85
Belt Thickness (mil)	45	45	45	45	45	45
Sheath Thickness (mil)	75	80	85	85	90	100
Outside Diameter (in)	1.23	1.48	1.52	1.78	2.04	2.26
Net Weight (lb/1,000 ft)	1,890	2,750	3,120	4,700	6,770	8,660
Standard Cable Lengths (ft)	3,000	2,500	2,000	1,800	1,300	1,000
Reel Size[a/] (in)	78/36	78/36	78/36	78/36	78/36	78/36
Material Code Number (590-)		33407			29801	34504

Table IC 121–2: 12 kV 3/C Copper (PILC-NJ)

Conductor Size (AWG or kcmil)	#2	2/0	350	500	750
Conductor Type	NCR	CS	CS	CS	CS
Insulation Thickness (mil)	200	185	185	185	185
Sheath Thickness (mil)	90	95	100	105	115
Outside Diameter (in)	2.01	2.21	2.46	2.70	3.02
Net Weight (lb/1,000 ft)	4,550	6,460	8,600	10,780	14,085
Standard Cable Lengths (ft)	1,800	1,300	900	800	700
Reel Size[a/] (in)	78/36	78/36	78/36	78/36	78/36

Table IC 121–3: 16 kV 3/C Copper (PILC-NJ)

Conductor Size (AWG or kcmil)	#2	4/0	350	500	750
Conductor Type	NCR	CS	CS	CS	CS
Insulation Thickness (mil)	255	240	240	240	240
Sheath Thickness (mil)	95	100	110	115	120
Outside Diameter (in)	2.25	2.46	2.73	2.96	3.32
Net Weight (lb/1,000 ft)	5,370	7,450	9,740	12.050	15,485
Standard Cable Lengths (ft)	1,420	1,090	960	690	620
Reel Size[a/] (in)	78/36	78/36	78/36	78/36	78/36
Material Code Number (591-)	18406			19602	20006

[a/] Flange diameter/inside traverse

FOR REFERENCE ONLY

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IC 122 Cable Data — 35 kV 1/C and 3/C PILC

Scope IC 122.1 Cable Data — 34.5 kV 1/C and 3/C Copper (PILC-NJ)

Table IC 122–1: Single Conductor — 34.5 kV 1/C and 3/C Copper (PILC-NJ)

Conductor Size (AWG or kcmil)	2/0	4/0	350	500
Number of Strands	19	19	37	37
Conductor Type	CR	CR	CR	CR
Insulation Thickness (mil)	455	455	455	455
Sheath Thickness (mil)	85	85	90	95
Jacket Thickness (mil)	80	110	110	110
Outside Diameter (in)	1.616	1.775	1.926	2.056
Maximum Cable Length (78" Reel)	2,680	2,100	1,580	1,515
Maximum Cable Length (84" Reel)	3,450	2,720	2,440	1,905
Net Weight (lb/1,000 ft)	3,443	3,885	4,325	5,660

Table IC 122–2: Three Conductor — 34.5 kV 1/C and 3/C Copper (PILC-NJ)

Conductor Size (AWG or kcmil)	2/0	4/0	350	500
Conductor Type	CR	CR	CS	CS
Insulation Thickness (mil)	455	455	455	455
Sheath Thickness (mil)	120	125	130	135
Jacket Thickness (mil)	140	140	140	140
Outside Diameter (in)	3.43	3.66	3.81	4.04
Maximum Cable Length (78" Reel)	675	630	580	535
Maximum Cable Length (84" Reel)	1,020	960	685	640
Net Weight (lb/1,000 ft)	10,660	12,420	14,500	17,050

FOR REFERENCE ONLY

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IC 125 Cable Data — 5 kV–16 kV 3/C PILC—Substitute

Scope IC 125.1 Cable Data — 5 kV–16 kV 3/C PILC—Substitute Cables

1.0 Application

PILC-substitute cable is a 3/C EPR-insulated, copper cable designed for replacing failed or deteriorating 3/C PILC (lead) cable in existing ducts. To minimize cable diameter, tape shields and solid copper ground conductors are used instead of the concentric neutrals common to other polymer (for example, CLP) cable designs.

Application, planning, and requisition of this cable must be coordinated with Field Engineering, since these cables are special designs to meet duct size requirements and are manufactured only after purchase orders have been placed.

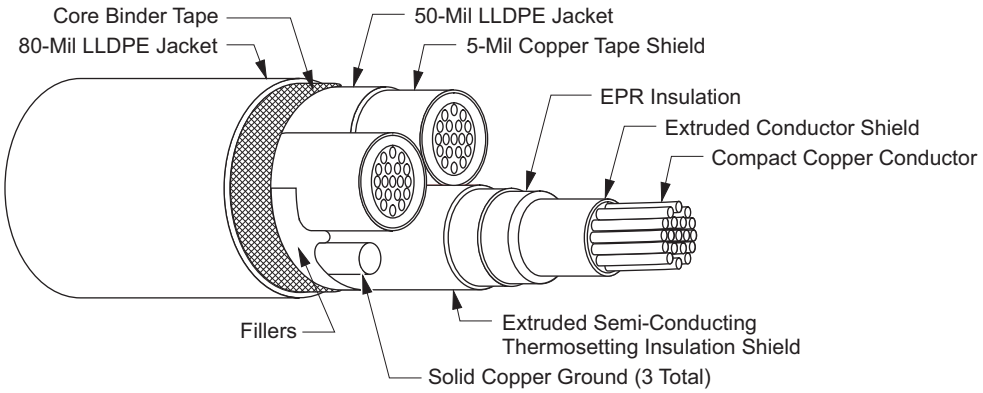
Listed below are maximum cable sizes for various duct diameters:

Table IC 125–1: 3/C EPR Cable Data

System Voltage (kV)	Conductor Size		Insulation Thickness (mil)	Nominal Over-Insulation Diameter (1P) (in)	Nominal Over-Jacket Diameter (1P) (in)	Nominal Overall 3P Diameter (in)	Duct Size (in)	Material Code
	AWG/kcmil	Diameter (in)						
4[a/]	1/0	0.336	115	0.63	0.81	1.96	2-1/2	592-00071
4[a/]	4/0	0.475	115	0.77	0.95	2.23	3	592-00089
4[a/]	250	0.520	115	0.81	0.99	2.31	3	592-00147
4[a/]	350	0.616	115	0.91	1.09	2.53	3-1/2	592-00154
4[a/]	500	0.736	115	1.03	1.21	2.79	3-1/2	592-00162
12/16	1/0	0.336	220	0.84	1.02	2.36	3	592-00196
12/16	4/0	0.475	220	0.98	1.16	2.66	3 – 3-1/2	592-00204
12/16[a/]	250	0.520	220	1.02	1.20	2.83	3-1/2	592-00212
12/16	350	0.616	220	1.12	1.30	3.08	3-1/2 – 4	592-00220
12/16	500	0.736	220	1.24	1.42	3.33	4	592-00238

[a/] Contact TDBU Apparatus Engineering for special order. Note that 4 kV is known as 4.16 kV nominal system voltage, while 115 mil insulation cable is rated for 5 kV.

Figure IC 125–1: 3/C EPR Cable



Note(s):
1. See JJ Section for information on cable component selection and application for 3/C PILC-substitute cables.

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IC 127 Cable Data — 5 kV–16 kV TR-XLPE – Flat Strap – Jacketed

Scope IC 127.1 Cable Data — 5 kV–16 kV TR-XLPE – Flat Strap – Jacketed

1.0 Application

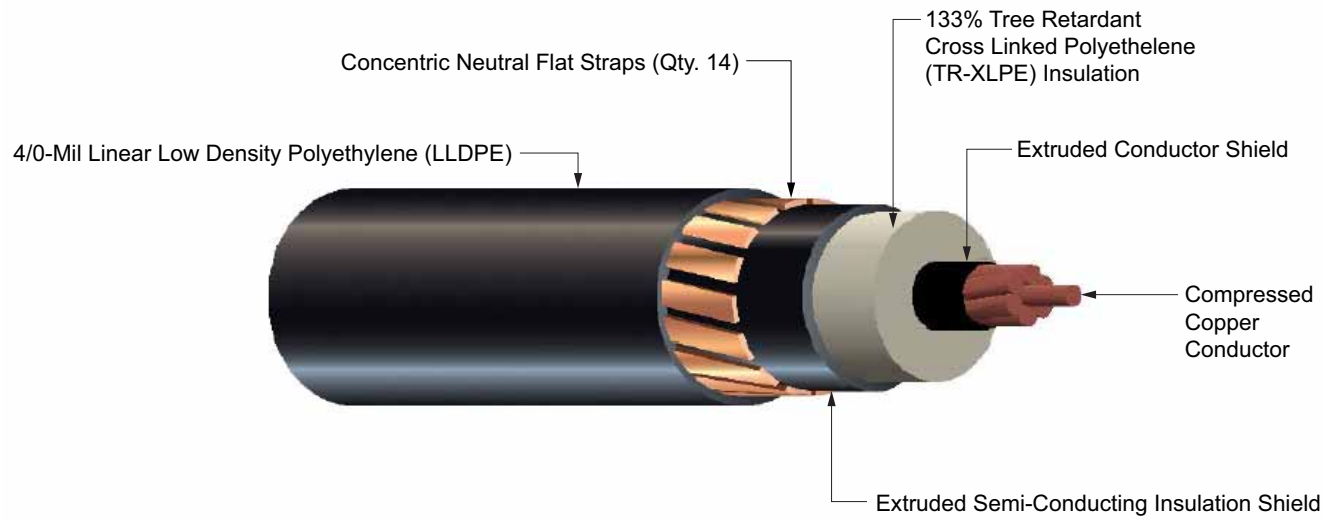
CIC Replacement cable is a single tree retardant cross linked polyethylene insulated copper cable used to replace failed or deteriorating #2 or 1/0 non jacketed aluminum cable installed in flexible conduit. To minimize the jacketed cable diameter, a copper flat strap neutral design was used instead of the concentric neutral wires.

Standard #2 JCN elbows, splices and terminations should be used with this cable. The elbow and splice connectors can be used with both aluminum and copper cables. Pothead terminations should use a copper pin terminal or Cable to Flat terminal, see DUG TP 101.

Table IC 127–1: Cable Data

Voltage (Insulation Thickness)	Conductor Size (AWG)	Diameter Over Insulation (in)	Diameter Over Semicon Shield (in)	Average Outside Diameter (in)	CN Flat Straps (number & Size)	Weight (lb/1,000ft)	Maximum Length on Reel (ft)	Cable Ampacity		Maximum Allowable Pulling Tension	Equivalent Pulling Length	SAP Number
								1 Phase	3 Phase			
4/12/16 (220 mils)	#2 (Cu)	0.815	0.905	1.075	14 (0.150" x 0.25")	671	2700	156 A	188 A	348 lbs	1,495 ft	10184625

Figure IC 127–1: #2 CU TR-XLPE Flat Strap Concentric Neutral Jacketed Cable



Note(s):
1. The minimum bending radius of this cable is 13 inches, measured from the inner surface of the cable.
2. When considering the structure loading tables in DDS-6, this cable is equivalent to 1/0 primary cable.
3. For Ferroresonance critical cable lengths, see DDS-2, Table 2-5 and Table 2-6.

IC 130 Guidelines for Cable in Conduit Replacement

Scope IC 130.1 Guidelines for Cable in Conduit Replacement

1.0 Replacement Concerns

1.1 List of the common cable in conduit (CIC) emergency and unplanned replacement issues that can occur:

A. Pulling cable out of the duct without the concentric neutral wires attached

B. Difficult removal and installation of cables due to:

1. Trees have crushed the flexible CIC duct
2. Oval shape of flexible CIC conduit
3. Long initial cable runs
4. Cable failures that burn/melt the CIC duct. These are usually the most difficult cable replacement jobs.

C. New, non-Edison structures may be located over CIC cable runs, which would make potholing and locating difficult

D. Third party damage to CIC duct

E. Possible unknown splice locations

2.0 Replacement Practices

2.1 Guidelines for replacement practices are listed below:

A. If there is more than one conductor in a run, replace all cables in that run.

B. Locate the path of the cable prior to removing the CIC cable. Use Metro tech, FIM maps, or other mapping tools to locate the path of the cable.

C. Locate any splice locations, if possible. (For example, locate cable tags and marker balls).

D. Perform an air test by blowing air through the CIC duct to determine if cable lube will flow through the entire cable run, if possible. If air does not flow, pothole at the midpoint.

E. If possible, apply cable lubricant the day before on the de-energized CIC cable. This will allow the cable lubricant to be distributed fully.

F. It is preferred to pump cable lube in CIC duct prior to removing/pulling cable.

G. If the CIC cable run is over 600 feet, consider potholing for ease of removing.

H. If there is a significant number of bends, consider potholing before attempting to remove cable.

I. Potholing in the middle of a bend will reduce the cable pulling tension.

J. Use every possible resource to pull cable straight out of CIC duct before bending. The angle is the most important factor in making a successful pull.

K. If cable cannot be removed, pothole the midpoint of the run. Use pull boxes or splice boxes to shorten the cable run.

L. If cable concentric neutrals wires do not come out with the cable, consider using an appropriate size guy wire with a hook bent on the end to fish out loose cable concentric wires.

M. Pull a rag through the CIC duct to clean any debris from the duct, which would decrease the pulling tension or reduce possible damage to the cable as it is being pulled in.

N. Use yacht braid as the preferred pulling line.

O. Tag new cable per standards and procedures per DUG IC 140.

Note(s):

1. When abandoning or identifying current SCE abandoned infrastructure (for example, cable, conduit, CIC, and structures), record the location on FIM maps. This will help avoid additional costs to either SCE or contractors.

IC 135 Cable and Conductor Types

Scope IC 135.1 Cable and Conductor Types

1.0 General

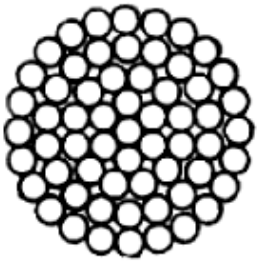
Underground conductor types are identified as compact, compressed, concentric, and segmental. Table IC 135–1 (Sheet 1) provides a description of each conductor type corresponding to the cable type and size. Refer to Figure IC 135–1 (Sheet 1) for visual representation of each cable conductor type.

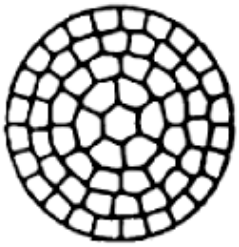
Table IC 135–1: Cable Size and Conductor Type

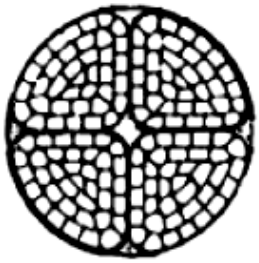
Cable Type	Size	Conductor Type
1/c PILC	Up to 1/0 AWG	Concentric Round
1/c PILC	2/0 AWG to 750 kcmil	Compact Round
1/c PILC	1000 kcmil and Above	Segmental
3/c PILC	All	Compact Sectored
CLP, JCN	All Except 1250-JCN	Compressed Round
EPR	All-EPR and 1250-JCN	Compact Round

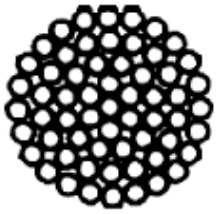
= For Reference Only

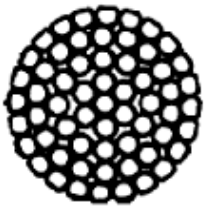
Figure IC 135–1: Cable Conductor Types

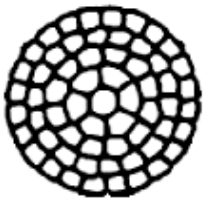

Concentric Round

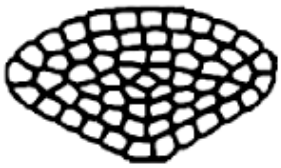

Compact Round


Segmental


Concentric Round


Compressed Round


Compact Round


Compact Sector

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IC 140 Identification of Underground Cables

Scope IC 140.1 Identification of Underground Cables

1.0 Purpose and Scope

To identify cables to ensure uniform application for the purpose of employee safety, to meet routine and operational needs and comply with regulatory requirements.

2.0 Policy

All underground cables are to be identified and tagged at the time of installation or replacement.

Existing cable runs that are found to be untagged, or found to not meet the criteria detailed in Section 4.1 shall be re-tagged with all required information upon replacement, or when subject to maintenance activities that allow for the safe identification of each end of the cable run.

3.0 Material

Tags shall be attached to cables using plastic tie-wraps or tape.

3.1 Stainless steel 1/2-inch embossing tape (SAP 10132205) shall be used in conjunction with metal labeler (SAP 10132167).

3.2 Harsh environment 1/2-inch laminated plastic tape (SAP 10202514) shall be used in conjunction with label maker (SAP 10204876).

3.3 Aluminum 1/2-inch embossing tape (SAP 10132195) shall be used in conjunction with metal labeler (SAP 10132167).

3.4 Waterproof notice tag (SAP 10135004) shall be used in conjunction with underground tagging clip (SAP 10182821) and placed in exposed high voltage compartments.

4.0 Application

4.1 Primary Cables

Primary cables shall be tagged at every piece of equipment and as it enters or leaves a structure in such a manner that the tag is visible and the location is accessible to the worker.

Each cable tag shall include the following information:

A. Adjacent sectionalizing device position

B. Adjacent sectionalizing device number

C. Adjacent sectionalizing structure number

D. Next adjacent structure number (through structure)

E. Footage to next adjacent structure or piece of equipment in same structure

F. Direction to next adjacent structure or piece of equipment in same structure

G. Operating voltage (i.e. 4 kV, 12 kV, 16 kV, 33 kV)

NOTE

A sectionalizing device is defined as, numbered equipment (i.e. switches, transformers, pothead poles, junction bars and other pieces of numbered equipment) typically found on circuit maps, see Figure IC 140–5 (Sheet 3) and Figure IC 140–6 (Sheet 4).

Figure IC 140–1: Primary Cable Tag Example Which Identifies Cable Circuit Adjacent Sectionalizing Device, Next Adjacent Structure, and Operating Voltage

Figure IC 140–2: Primary Cable Tag Example Identifying Cable from J-Bar to O.S. in Same Structure

Figure IC 140–3: Primary Cable Tag Example Identifying Cable from Equipment to J-Bar in Same Structure

Figure IC 140–4: Primary Cable Tag Example Identifying Cable Entering Duct Bank to Equipment in Vault

NOTE

N = North, E = East, W = West, and S = South

Figure IC 140–5: Circuit Tag Examples

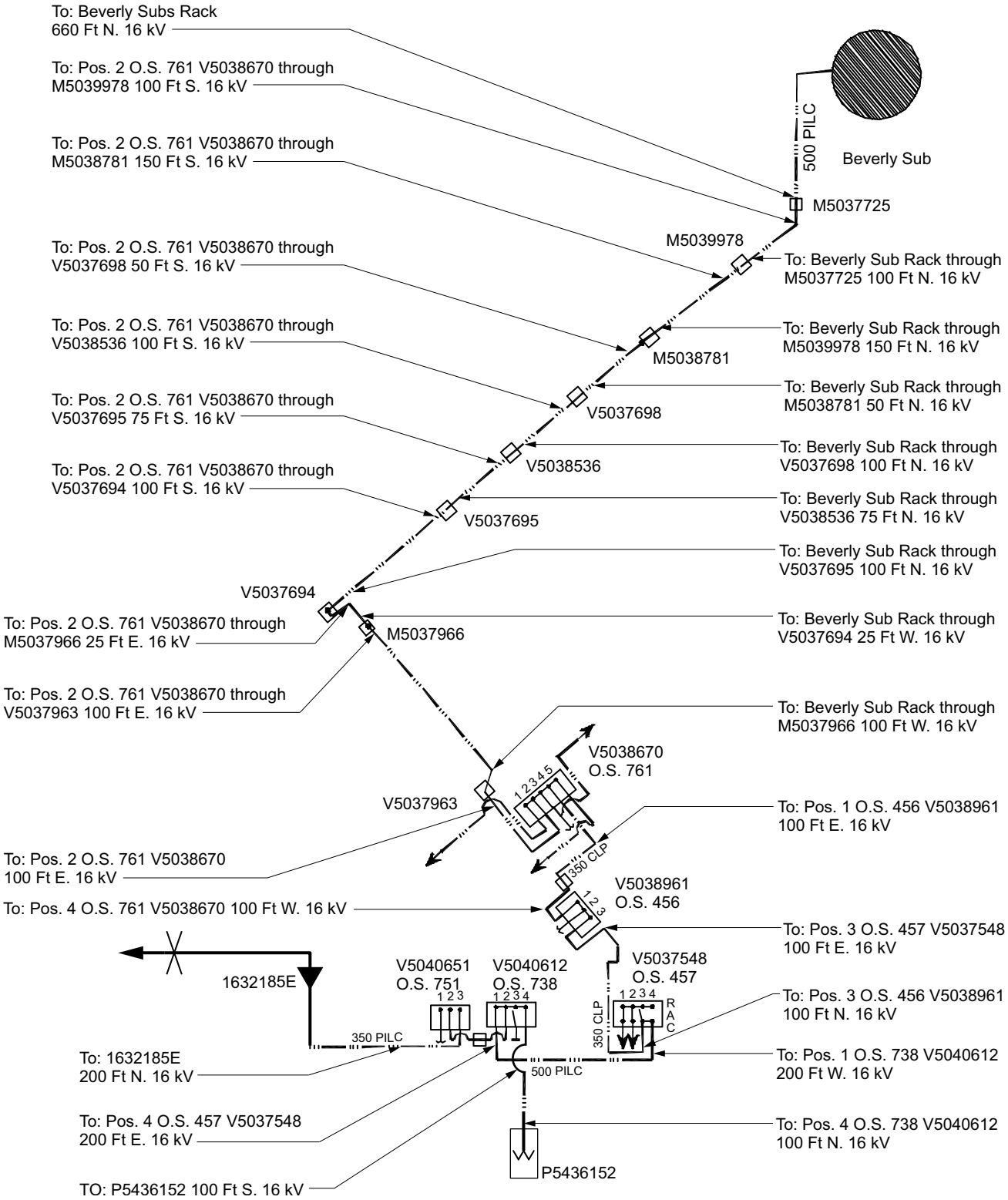
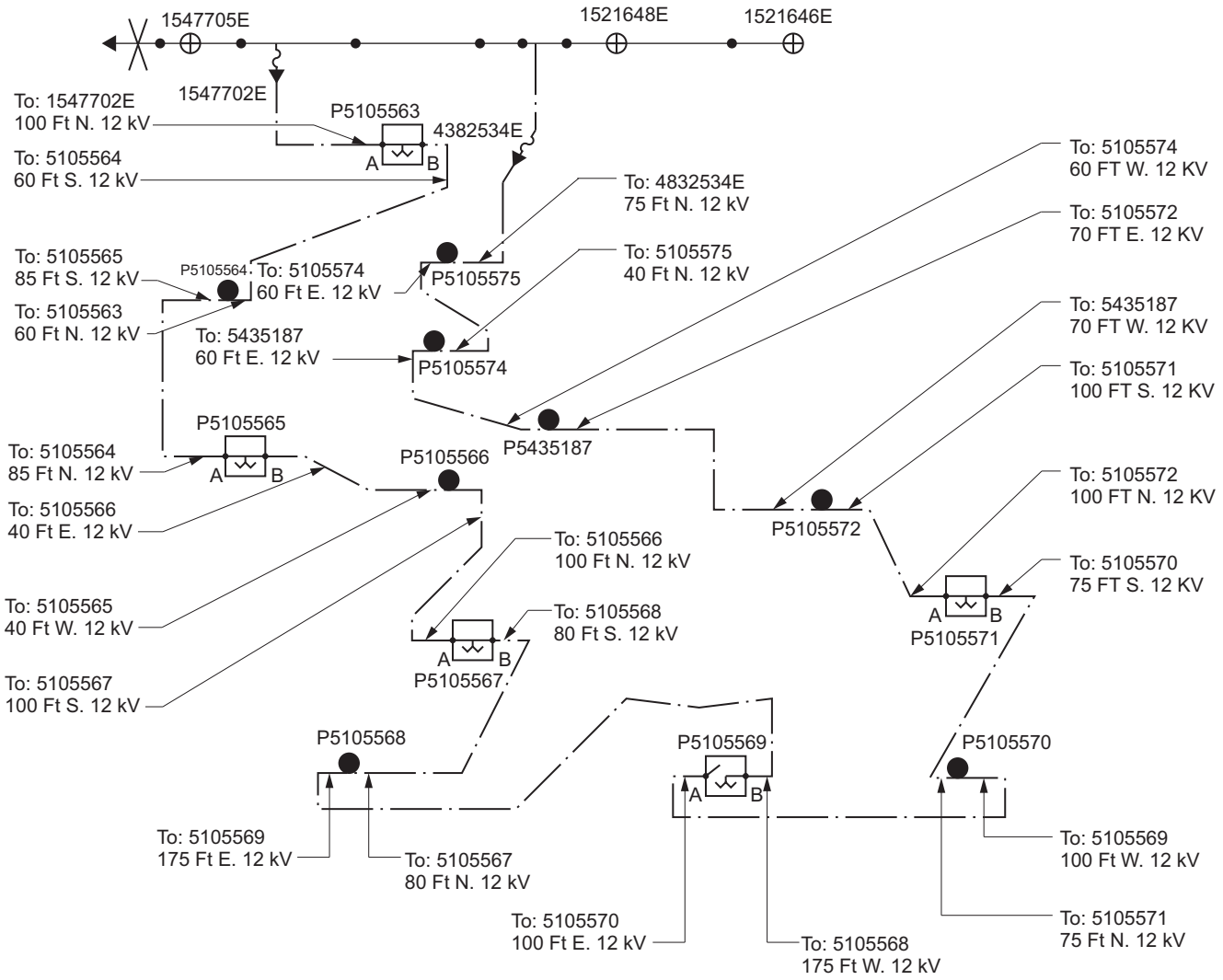


Figure IC 140–6: Circuit Tag Examples



Primary cable runs, to a single customer, shall be identified by using the customer's address as the final cable destination. The tag shall include operating voltage and next adjacent structure information if applicable, see Figure IC 140–7 (Sheet 4).

Figure IC 140–7: Primary Tap Line To Primary Served Customer

TO: CUSTOMER SUB AT 1325 CASHDAN ST. THRU V5415287, 150 FT N. 16 KV

4.2 Placement

A. Tags shall be attached to cables as near as possible to both entrance and exit conduits in the structure.

B. On live-front termination applications an equipment tag or underground tagging clip with tag will be used to prevent a worker from encroaching upon unprotected energized parts per APM Rule 147.

CAUTION On existing live-front termination applications where existing tags are unable to be read without encroaching per APM Rule 147, equipment shall be de-energized to identify tags. After verification of tags, apply additional tags per 4.2 B.

4.3 Substation Getaway Risers

Circuit name and operating voltage shall be identified approximately 8 feet above the ground line.

4.4 Secondary Cables

A. Secondary cables are to be tagged at each accessible location.

Note: A single cable tag should be sufficient per cable run to aid in identification, maintenance or replacement of cables.

Secondary cable run tags shall include the following “To” information:

1. Structure number
2. Distance to structure
3. Direction to structure
4. Voltage (optional)

Figure IC 140–8: Secondary Cable Tag Information Example

TO: P.B. 5436781 110 FT N.

B. Service cable runs shall be marked at the nearest source structure and service entrance location.

Note: Service cable tag(s) should include serving address, footage, source structure number, and direction. Identification of service cables at the electrical panel location may be indicated on the inner door of the pull section cover for panels less than 400 amperes.

4.5 Cable Marking

Cable marking is defined as marking cables as they enter and leave the structure.

A. Primary Circuits

All new primary circuit main-line installations which include substation getaways, must be marked with phase identification upon installation. The marking shall match that of the identified phases at the substation for all new getaway construction.

Phase marking shall use color tape and number of tape wraps to identify phases.

The following phase sequence should be used for permanent phase markings:

1. “Red” with “One” wrap = A phase
2. “White” with “Two separate wraps” = B phase
3. “Blue” with “Three separate wraps” = C phase.

B. Secondary or service cables include a phase identification sequence embedded by the manufacturer. The embedded cable identification markings are acceptable, but in addition the above referenced taping method shall be used.

Note: On three-phase four conductor delta services, identify the power leg (high leg) with orange colored tape when the taping method is used.

4.6 Phase Identification Labeling

Phase identification labeling is defined as labeling phases using the phase identification tool.

1. Primary circuits, which include substation getaways, must be labeled.
2. Phase labeling of underground conductors in below ground structures (vaults, etc.) shall use color coated A, B, C letters. Schotchlite A, B, C decals and die-cut reflective colored letters shall be used to identify phases for uniform labeling in underground, pad-mounted, and above ground structures and equipment.
3. Materials for Phase Labeling

3" Stainless Steel Color-Coated Letters	SAP No.
A (Red)	10175405
B (White)	10175315
C (Blue)	10175314

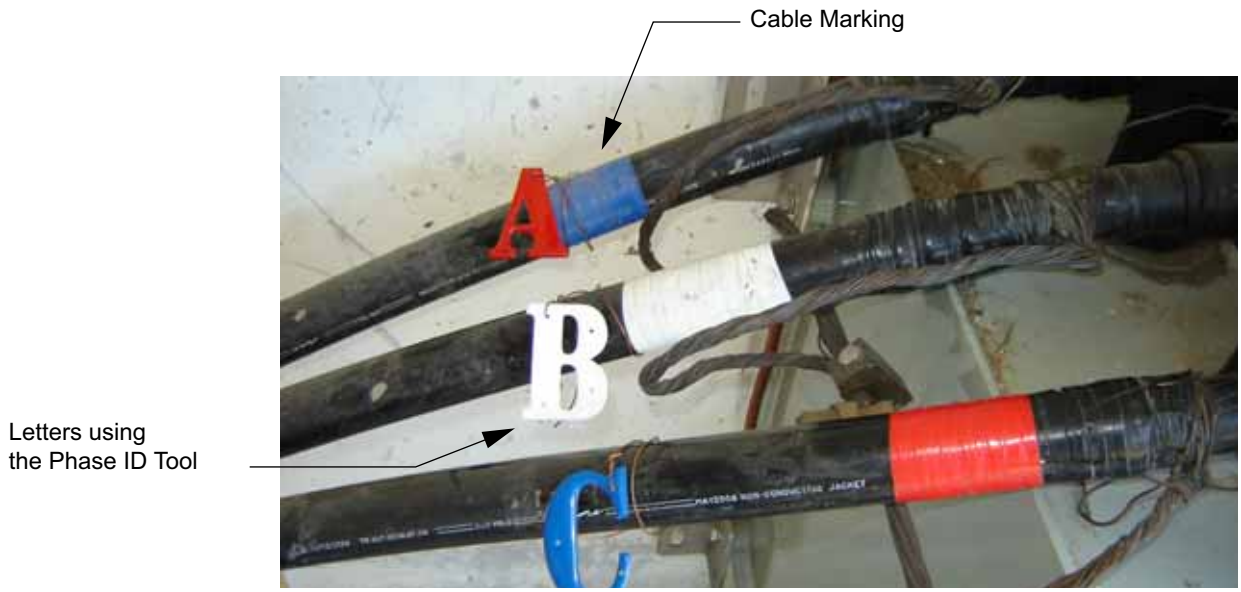
Die-Cut, Reflective 1" Letters	SAP No.
A (Red)	10178621
B (White)	10178622
C (Blue)	10178623

CAUTION Not approved for use on live-front equipment.

1-3/4" x 2-7/9" Scotchlite Letters	SAP No.
A	10132348
B	10132349
C	10132350

4. Cable Marking and Phase Identification Labeling in Underground Structures
   a. Only one run of main line primary cable shall be phase-identified and labeled in an underground structure that contains only one circuit. If there are multiple circuits that terminate on the same piece of equipment only one primary run of cable shall be phase labeled. It shall be identified with color-coated A, B, C letters attached by mousing wire.
   b. The factory markings on underground equipment shall not be modified or removed. The existing ABC's or color coding of the cable that was marked during initial installation shall not be modified or removed.

Figure IC 140–9: Cable Marking and Phase Labeling in Underground Structures



CAUTION When existing underground cable markings are available (123's or color-coded tape), the cable markings **SHALL NOT** be modified to match the verified phase. Modifying existing cable markings could cause an inconsistency with the previous or downstream structure, creating a safety hazard.

5. Cable Marking and Phase Labeling on Surface-Mounted Equipment

   All surface-mounted equipment shall be labeled in the upper right hand corner on the vehicle access side or street side. The labeling shall utilize 3 inch Scotchlites starting with the letter "V" followed by the last two digits of the year that the equipment was labeled.

Figure IC 140–10: Pad-mount Year Verification Marking (Example)

Figure IC 140–11: Vent Pipe Year Verification Marking (Example)

The examples above signify that the equipment was verified by using the phase ID tool in the year “2009.”

CAUTION When cable or equipment needs to be replaced, whether it is planned or emergency, the underground labeling SHALL NOT be replaced until the phase ID tool has been used.

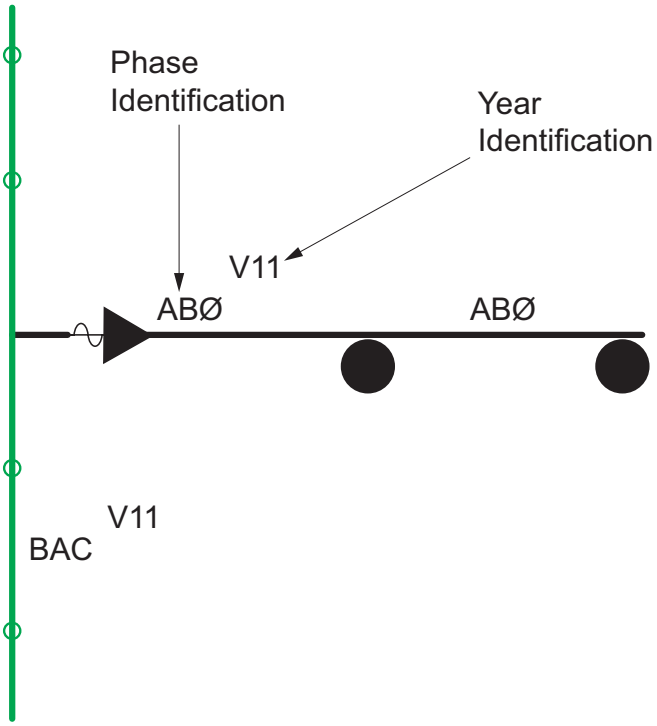
a. When phase identification on equipment has been established, the compartments or equipment shall be marked with 1 inch die-cut reflective colored letters next to the factory markings.

   In addition to reflective color letters, stainless steel color letters can be placed on the cable below termination.

Figure IC 140–12: Factory Marking, Phase Labeling, and Cable Marking on Equipment

CAUTION Existing underground cable marking (e.g. 123's or color-coded tape) **SHALL NOT** be modified to match the verified phase labeling.

Figure IC 140–13: Phase ID and Year Verification (Circuit Map Example)



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IC 200 Cable Pulling Data

Scope IC 200.1 Cable Pulling Instructions

1.0 Conduit Preparation

Condition of the conduit has an important influence on cable pulling. Rough or rusty interior surfaces, for example sand, gravel, or other foreign material in the conduit, or protruding grout at joints, are typical unfavorable conditions. Use steel conduit brush (bottle brush) or mandrels to improve such conditions.

2.0 Pulling Practice

2.1 Pulling Attachment

Makeup the pulling attachment carefully; keep it compact and streamlined. Avoid a bulky makeup or one with projecting parts. When two or more cables are pulled together, keep the pulling attachments even. Do not stagger the cable ends or the pressure from the leading cables may cause the nose of the trailing cable to dig in and block the pull. **EXCEPTION:** This practice is acceptable when using swedge-type pulling nose on JCN cable. See Scope IC 210.2 for installation of a swedge-type pulling device.

2.2 Conduit Preparation and Cable Pulling Lubrication

A. Verify that conduit has been recently swabbed and/or mandrelled before installing new primary cable.

B. For all PILC replacement cables (EPR copper):

Use Pourable Lubricant, Table IC 200–2 (Page IC-4) and Table IC 200–4 (Page IC-4).

C. JCN Primary Cables and CLP Secondary and Service Cables:

Lubricants are recommended to be used on every pull.

D. Primary run 350 or larger:

Lubricants must be used.

E. All Cable Pulls:

Lubricants must be used when there is a riser bend or for pulls exceeding 600 feet.

F. Cable- in-Conduit (CIC) Replacement

Lubricants are recommended to be pumped into cable run prior to cable being removed, for recommended amount of lubricant, See Table IC 200–8 (Page IC-9) and Table IC 200–9 (Page IC-9).

G. Types of lubricants

Pourable or applied by pump — The following lubricants are shown in order of lowest cost, per gallon.

Table IC 200–1: Types of Lubricants (in order of lowest cost per gallon)[a/]

SAP Number	Description	Size (gallon)	Lubricant Application
10153361	Polywater, Type PJ	55	Table IC 200-1,2,6,7
10153755	Polywater, Type PJ	5	Table IC 200-1,2,6,7
10178961	DCD, Tube Lube 326	265	Table IC 200-3,4,6,7
10153396	Polywater, Type NN	5	Table IC 200-1,2
10178960	DCD, Tube Lube 326	5	Table IC 200-3,4,6,7

[a/] For difficult cable pulls, use one of the following shown in order of least coefficient of friction: (1) Type NN, (2) Tube Lube 326, or (3) Type PJ.

1. Applied by hand
   - Polywater Type “J”, 5 gal (SAP 10117662).

2. Lubricant bags ahead of cable pulling nose
   - Polywater Type “G”, 1/2 gal (SAP 10153424).

WARNING Cable pulling lubricants are extremely slippery. Care must be given when handling cables that are coated with cable pulling lubricants. Spills must be cleaned up.

H. Clean up

If cable lubricant is spilled, it should be washed, swept, or squeegeed from the floor using wet mops. Outside, spills should be covered with sand, dirt, or gravel. For more details, see the individual Material Safety Data Sheet (MSDS).

I. Storage and Shelf Life

Always rotate stock to ensure the oldest cable pulling lubricants are used first.

1. Polywater products — Keep containers closed when not in use and store out of direct sunlight. Shelf life is 1 year.
2. DCD products — Keep containers closed when not in use and store out of direct sunlight. No shelf life specified.

2.3 Cable Pulling Considerations

A. Feeding Cable — Assist the cable into the conduit when making a pull. Tests indicate that pulling tension may be doubled or tripled when the cable is pulling itself off the reel and through a feeder tube. By hand-turning the reel and feeding slack cable to the conduit entrance, a difficult pull may be changed to an easy one.

B. Pull Direction — The direction of pulling has a large influence on the pull if bends are included. Whenever a choice is possible, always pull so that the bend or bends are closest to the reel. The worst condition possible is to pull out of a bend at or near the pulling end.

C. Slack Pulling — Slack pulling is where the pull is stopped and started to accumulate slack in the cable. Slack pulling is not recommended, but may be used as a last option.

D. Rollers/Sheaves — Rollers/sheaves should be free turning with a low coefficient of friction. All rollers/sheaves need to be properly maintained and lubricated to provide the lowest possible coefficient of friction.

E. Underground Structures — Assess the condition of the structure and its associated equipment for any hazardous conditions, per Chapter IM-5 of the Distribution Operation and Maintenance (DOM) Policies and Procedures Manual. For structure-related questions, contact the Distribution Structural Engineering Group.

F. Structure Pulling Irons — Inspect the condition of pulling irons and coil inserts prior to pulling cable. Contact the Distribution Structural Engineering Group for details.

G. Cable-in-Conduit (CIC) Replacement — See IC 130 for Guidelines for CIC Replacement.

The following tables include the recommended amount of pourable lubricant in gallons along with the recommended lubricant flow rate when a lube pump is used. Additional lubricant may be required for unfavorable pulling conditions (i.e., rusty, dirty, and significant number of conduit bends). Use enough lubricant on all cable sizes and for all pulling speeds to keep the cable completely coated.

Table IC 200–2: Recommended Amount of Pourable Lubricant[a/] – Polywater PJ, NN

Lubricant Quantity (Gallons)[a/]										
Conduit Size (in)	Length of Conduit Run									
	250 ft	500 ft	750 ft	1,000 ft	1,250 ft	1,500 ft	1,750 ft	2,000 ft	2,250 ft	2,500 ft
3	2	3	4	5	6	7	8	9	11	12
4	2	3	5	6	8	9	11	12	14	15
5	2	4	6	8	10	12	14	15	17	19
6	3	5	7	9	12	14	16	18	21	23

[a/] Quantity is based on conduit inside diameter and conduit length. It is not influenced by cable weight.

Table IC 200–3: Recommended Flow Rate of Pourable Lubricant – Polywater PJ, NN

Lube Flow Rate (Gallons per Minute)[a/ b/]								
Conduit Size (in)	Cable Speed							
	25 fpm	35 fpm	45 fpm	50 fpm	75 fpm	100 fpm	125 fpm	150 fpm
3	1/4	1/4	1/4	1/4	1/2	1/2	3/4	3/4
4	1/4	1/4	1/2	1/2	1/2	3/4	3/4	1.00
5	1/4	1/2	1/2	1/2	3/4	3/4	1.00	1-1/4
6	1/4	1/2	1/2	1/2	3/4	1.00	1-1/4	1-1/2

[a/] To convert the Flow Rate shown above to Gallons per Hour (GPH), multiply the value by 60.
Example: 1.0 GPM is equivalent to (1.0 GPM) x 60 = 60 GPH.

[b/] fpm = feet per minute

Table IC 200–4: Recommended Amount of Pourable Lubricant[a/] – DCD Tube Lube 326

Lubricant Quantity (Gallons)[a/]										
Size (Awg/kcmil)	Length of Conduit Run									
	250 ft	500 ft	750 ft	1,000 ft	1,250 ft	1,500 ft	1,750 ft	2,000 ft	2,250 ft	2,500 ft
#2	1	2	3	3	4	5	5	6	7	7
1/0	1	2	3	3	4	5	6	6	7	8
350	1	2	3	4	5	6	7	8	9	10
750	2	3	4	5	6	8	9	10	11	12
1000 Al	2	3	4	6	7	8	9	11	12	13
1000 Cu	2	3	4	6	7	8	9	11	12	13
4/0	2	3	4	5	6	7	8	9	10	12
750	2	3	5	6	8	9	11	12	13	15
1500	2	4	5	7	8	10	12	13	15	16

[a/] Quantity is based on the number of cables, cable outside diameter, and conduit length. It is not influenced by cable weight.

Table IC 200–5: Recommended Flow Rate of Pourable Lubricant – DCD Tube Lube 326

Size (Awg/kcmil)	Lubricant Quantity (Gallons per Minute)[a/ b/]							
	Cable Speed							
	25 fpm	35 fpm	45 fpm	50 fpm	75 fpm	100 fpm	125 fpm	150 fpm
#2	1/4	1/4	1/4	1/4	1/4	1/2	1/2	1/2
1/0	1/4	1/4	1/4	1/4	1/4	1/2	1/2	1/2
350	1/4	1/4	1/4	1/4	1/2	1/2	1/2	3/4
750	1/4	1/4	1/4	1/4	1/2	1/2	3/4	3/4
1000 Al	1/4	1/4	1/4	1/2	1/2	3/4	3/4	1.00
1000 Cu	1/4	1/4	1/4	1/2	1/2	3/4	3/4	1.00
4/0	1/4	1/4	1/4	1/4	1/2	1/2	3/4	3/4
750	1/4	1/4	1/2	1/2	1/2	3/4	3/4	1.00
1500	1/4	1/4	1/2	1/2	1/2	3/4	1.00	1.00

[a/] To convert the Flow Rate shown above to Gallons per Hour (GPH), multiply the value by 60.
Example: 0.75 GPM is equivalent to (0.75 GPM) x 60 = 45 GPH.

[b/] fpm = feet per minute

NOTE

Where possible, pre-lubricate the conduit with 1/3 to 2/3 of the amount listed in the table. Apply most of the remaining lubricant to the first half of the cable as it enters the conduit.

Table IC 200–6: Recommended Amount of Lubricant for Primary CIC Cable Replacement – DCD Tube Lube 326

	1-1/4" DUCT with #2 CLP NJ		1-1/2" DUCT with #1/0 CLP NJ	
Run Length (Feet)	Sufficient Quantity (Gallons)	Maximum Quantity (Gallons)	Sufficient Quantity (Gallons)	Maximum Quantity (Gallons)
50	1	2	1-1/2	3
100	2	4	3	6
150	3	6	4-1/2	9
200	4	8	6	12
250	5	10	7-1/2	15
300	6	12	9	18
350	7	14	10-1/2	20-3/4
400	8	16	12	23-3/4
450	9	18	13-1/2	26-3/4
500	10	20	15	29-3/4
550	11	22	16-1/2	32-3/4
600	12	24	18	35-1/2
650	13	26	19-1/4	38-1/2
700	14	28	20-3/4	41-1/2
750	15	30	22-1/4	44-1/2
800	16	32	23-3/4	47-1/2
850	17	34	25-1/4	50-1/2
900	18	36	26-3/4	53-1/2
950	19	38	28-1/4	56-1/2
1000	20	40	29-3/4	59-1/4

Note(s):
1. For illustration of sufficient and max lubricant quantity, see Figure IC 200-1
2. As an alternate lubricant, Polywater Type PJ may be used in a 50/50 mixture with water.

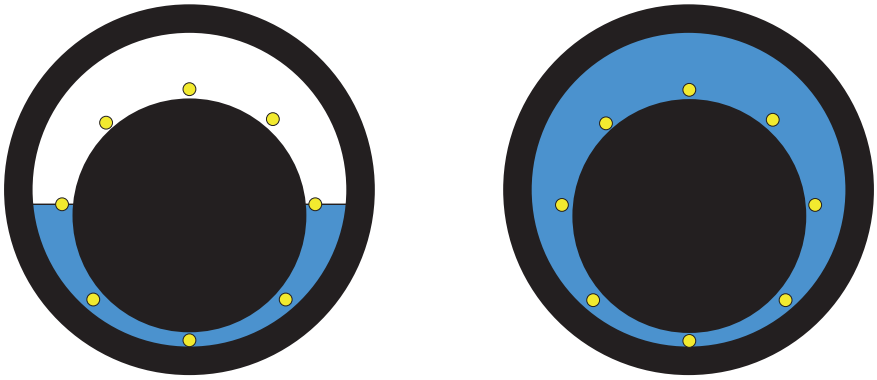
Do not exceed the Maximum Quantity. If maximum amount shown is pumped into duct and the lubricant does not begin to exit the other end of the CIC run there is a leak in the run, stop pumping lubricant and investigate.

Table IC 200–7: Recommended Amount of Lubricant for Secondary/Service CIC Cable Replacement – DCD Tube Lube 326

	1-1/2" Duct with 2 - #2 & #4 CLP		1-1/2" Duct with 2 - 1/0 & #2 CLP		2" Duct with 2 - 4/0 & 1/0 CLP		2" Duct with 2 - 350 & 4/0 CLP	
Run Length (Feet)	Sufficient Quantity (Gallons)	Maximum Quantity (Gallons)	Sufficient Quantity (Gallons)	Maximum Quantity (Gallons)	Sufficient Quantity (Gallons)	Maximum Quantity (Gallons)	Sufficient Quantity (Gallons)	Maximum Quantity (Gallons)
50	2-1/2	4-1/4	2	3-1/4	3	5	1-1/2	2-1/2
100	5	8-1/4	4	6-1/2	5-3/4	9-3/4	3	5
150	7-1/2	12-1/2	6	9-3/4	8-3/4	14-1/2	4-1/2	7-1/2
200	10	16-1/2	8	13	11-1/2	19-1/4	6	10
250	12-1/2	20-1/2	10	16-1/2	14-1/2	24	7-1/2	12-1/4
300	15	24-3/4	12	19-1/2	17-1/2	29	9	14-3/4
350	17-1/2	29	14	23	20-1/4	33-3/4	10-1/2	17-1/4
400	20	33	16	26	23-1/4	38-1/2	12	19-3/4
450	22-1/2	37	18	29-1/2	26	43-1/2	13-1/2	22-1/4
500	25	41-1/4	20	32-3/4	29	48-1/4	15	24-1/2

Note(s):
1. For illustration of sufficient and max lubricant quantity, see Figure IC 200-1.
2. As an alternate lubricant, Polywater Type PJ may be used in a 50/50 mixture with water.

Figure IC 200–1: Lubricated CIC Cable



Sufficient Amount in CIC

Maximum Quantity in CIC

2.4 Pulling Speed — The average normal pulling speed is estimated to be between 10 to 50 feet per minute (fpm).

A. Results from an industry test indicated that friction is independent of cable pulling speed for pulling speeds up to 50 fpm. At higher pulling speeds, there is an increased rate of frictional heating in bends/sweeps and can result in additional wear.

B. Take additional care at higher speeds, to ensure that the cable from the feed in reels does not back lash when the pull is completed.

C. Plastic Bends or Sweeps — To reduce the possibility of “sawing through” plastic sweeps or riser bends, it is recommended that pulling speeds be reduced to the lower value, for example, 25 fpm. This will minimize the abrasive effect on the conduit caused by a combination of tension, friction, and speed.

D. Installing the bull line — While there is no established speed for pulling in a bull line, it should be noted that pulling a bull line in with excessive speed can cause damage to plastic bends and sweeps (by the abrasive action on the conduit materials).

E. H.D.G. Bends and Sweeps — Pulling speed is not a factor when using H.D.G. bends and sweeps.

F. Pulls should never be stopped and restarted unnecessarily.

Scope IC 200.2 Design Reference – Maximum Cable Pulling Equivalent Lengths and Tensions

Table IC 200–8: Maximum Equivalent Length (ft) and Tension (lb) through Riser Bend or Split "Y" Based on Sidewall Pressure for Jacketed Cable

Type of Riser Bend	12/16-kV ft (lb)					34.5 kV ft (lb)		
	#2 AWG	1/0 AWG	350 kcmil	750 kcmil	1,000 kcmil	4/0 AWG	750 kcmil	1,500 kcmil
5" PVC	1,293 (796)	1,586 (1,267)	2,702 (3,853)	843 (2,753)	479 (2,043)	1,380 (2,359)	—	—
4" PVC	1,196 (796)	1,446 (1,267)	3,809 (2,579)	—	—	—	—	—
3" PVC	993 (796)	1,157 (1,267)	—	—	—	—	—	—
6" HDG	1,293 (796)	1,586 (1,267)	3,045 (4,200)	2,032 (4,940)	1,353 (4,285)	1,574 (2,359)	871 (3,441)	763 (4,627)
5" HDG	1,293 (796)	1,586 (1,267)	3,045 (4,200)	1,046 (2,954)	626 (2,410)	1,380 (2,359)	—	—
4" HDG	1,196 (796)	1,446 (1,267)	1,844 (2,994)	—	—	—	—	—
3" HDG	993 (796)	1,157 (1,267)	—	—	—	—	—	—
6" Fiberglass	1,293 (796)	1,586 (1,267)	3,045 (4,200)	2,229 (5,262)	1,548 (4,628)	1,574 (2,359)	1,014 (3,794)	920 (5,201)
5" Fiberglass	1,293 (796)	1,586 (1,267)	3,045 (4,200)	1,245 (3,309)	777 (2,763)	1,380 (2,359)	—	—
4" Fiberglass	1,196 (796)	1,446 (1,267)	2,225 (3,384)	—	—	—	—	—
3" Fiberglass	993 (796)	1,157 (1,267)	—	—	—	—	—	—

Table IC 200–9: Maximum Equivalent Length (ft) and Tension (lb) through Sweep Based on Sidewall Pressure for Jacketed Cable

Type of Riser Bend	12/16-kV ft (lb)					34.5 kV ft (lb)		
	#2 AWG	1/0 AWG	350 kcmil	750 kcmil	1,000 kcmil	4/0 AWG	750 kcmil	1,500 kcmil
6" HDG	1,293 (796)	1,586 (1,267)	3,045 (4,200)	3,140 (5,262)	2,244 (4,628)	1,574 (2,359)	2,245 (3,794)	1,552 (5,201)
5" HDG	1,196 (796)	1,586 (1,267)	3,045 (4,200)	3,140 (3,309)	2,244 (2,763)	1,380 (2,359)	—	—
4" HDG	993 (796)	1,446 (1,267)	2,544 (3,384)	—	—	—	—	—
3" HDG	1,293 (796)	1,157 (1,267)	—	—	—	—	—	—

FOR REFERENCE ONLY

Table IC 200–10: Maximum Equivalent Straight Pull in Feet (lb) for Jacketed Cable

Type of Riser Bend	Structure Lift Plate Rating		Maximum Available Cable Length (ft)
	10,000 lb Swivel	20,000 lb Swivel	
12/16 kV ft (lb)			
5" Duct			
#2 AWG	1,293 (796)	1,292 (796)	2,700
1/0 AWG	1,586 (1,267)	1,586 (1,267)	1,500
350 kcmil	3,045 (4,200)	3,045 (4,200)	3,000
750 kcmil	1,744 (5,000)	3,139 (9,000)	2,000
1,000 kcmil	1,272 (5,000)	2,442 (9,600)	1,700
4" Duct			
#2 AWG	1,196 (796)	1,196 (796)	2,700
1/0 AWG	1,446 (1,267)	1,446 (1,267)	1,500
350 kcmil[a/]	2,544 (4,200)	2,544 (4,200)	3,000
3" Duct			
#2 AWG[a/]	993 (796)	993 (796)	2,700
1/0 AWG[a/]	1,157 (1,267)	1,157 (1,267)	1,500
34.5 kV ft (lb)			
6" Duct			
4/0 AWG	1,574 (2,539)	1,574 (2,539)	2,000
750 kcmil	1,247 (5,000)	2,245 (9,000)	1,200
1,500 kcmil	808 (5,000)	1,552 (9,600)	1,000
5" Duct			
4/0 AWG	1,380 (2,539)	1,380 (2,539)	2,000

[a/] See Note 2.

FOR REFERENCE ONLY

Note(s):
1. Verify standard cable length on reel, lengths may be subject to change.
2. Not recommended for new installations.
3. The values given above are specified for appropriate sizes of Kellems grips and pulling noses.

Table IC 200–11: Maximum Equivalent Pull Length Based on Maximum Allowable Pull Strength of 3/C EPR Cable Pulls

Cable Size	One Grip over Three Conductors	Three Grips – One over Each	Pulling Nose Attached to Conductors	
			Structure Lift Plate Rating	
			10,000 lb Swivel	20,000 lb Swivel
	4" Duct			
1/0 AWG	878	1,484	1,484	1,484
4/0 AWG	578	1,155	1,956	1,956
350 kcmil	395	790	1,975	2,212
500 kcmil	305	609	1,523	2,437
	3.5" Duct			
1/0 AWG	878	1,484	1,484	1,484
4/0 AWG	578	1,155	1,956	1,956
350 kcmil	395	790	1,975	2,212
500 kcmil	—	—	—	—
	3" Duct			
1/0 AWG	878	1,484	1,484	1,484
4/0 AWG	578	1,155	1,956	1,956
350 kcmil	—	—	—	—
500 kcmil	—	—	—	—

FOR REFERENCE ONLY

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IC 209 Cable Pulling Grips for Jacketed Cable

Scope IC 209.1 Instructions for Attaching Pulling Grip for Jacketed Concentric Neutral (JCN) Cable

1.0 Instructions

1.1 Strip back the jacket enough for the length of the grip. Never install the grip over the cable jacket.

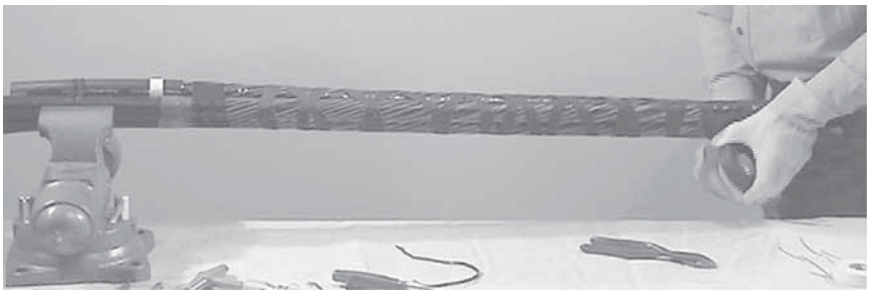
Figure IC 209–1: Stripping Jacket on JCN Cable

1.2 Seal the cable ends with end caps and the jacket ends with tape to prevent water intrusion during the pull.

Figure IC 209–2: Sealing Cable Ends on JCN Cable

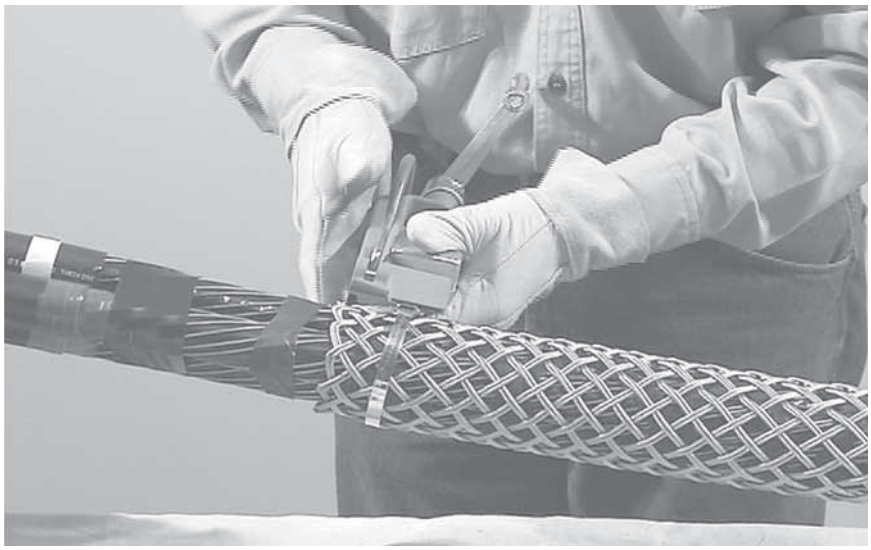
1.3 Wrap friction tape over the concentric neutrals to provide more adhesion.

Figure IC 209–3: Wrapping Concentric Neutrals on JCN Cable



1.4 Install the pulling grip over cable and reinforce the tail-end of the grip with two lock-band or copper mousing wire.

Figure IC 209–4: Installing Pulling Grip on JCN Cable



1.5 Discard the section of cable under the grip after pulling additional length of cable for make-up. Table IC 209–1 (Sheet 2) includes information pertinent to pulling grips.

Table IC 209–1: Pulling Grip Data

Primary Cable Size	Grip Sizes (in)	SAP Number	Rated Work Load (lb)
3 – 1,000 JCN	4–4-1/2	10144653	9,600
3 – 750 JCN	3-1/2–4	10144652	9,600
3 – 350 JCN	3–3-1/2	10144651	8,200
3 – 1/0 JCN	2–2-1/2	10144620	5,440
3 – #2 JCN	2–2-1/2	10144620	5,440
3 – 1/0 JCN	3/4–1	10144647	1,360
3 – #2 JCN	3/4–1	10144647	1,360

IC 210 Cable Pulling Noses for Synthetic Cables

Scope IC 210.1 Pulling Noses for Synthetic-Insulated Cables (with Concentric Wires)

1.0 Instructions

1.1 The compression type pulling nose, Figure IC 210–1 (Sheet 1), is sized for all three of the single-conductor aluminum cables and is compressed over all three.

Cable Size	Pulling Nose M/C
3–1/C #2 Al	838-38102
3–1/C 1/0 Al	838-38003

1.2 Install five circular crimps, making the first compression nearest the nose and working towards the end of the body. Use Alcoa 12 HA or Burndy Y35 hydraulic tool with die set #U31 ART (M/C 851-53708) or die set #15CA96R (M/C 851-57501).

1.3 Fill all voids and spaces between the conductors and the pulling nose with Aqua-Seal, and apply three layers of half-lapped jacketing tape.

1.4 Group the concentric wires into a flat configuration and lay them over the jacketing tape through the pulling clevis. Bend the concentrics back over the pulling nose and serve or bandit them to the body of the nose. Apply two layers of plastic tape over this served area.

1.5 The pulling nose is reusable and can be used in 4-, 5-, or 6-inch conduit. Copper hylugs (swage tubing type only) are individually compressed on the conductors and bolted to the nose. Use standard crimping methods.

Exception: To crimp copper-hylugs on 1,000 kcmil Al conductors, use 15C14OR circular die set (M/C 851-57105) in the UT15 compression tool. Install 4 crimps rotated 90 degrees.

Figure IC 210–1: Nose for 3-1/C and 1/0 Al Conductors

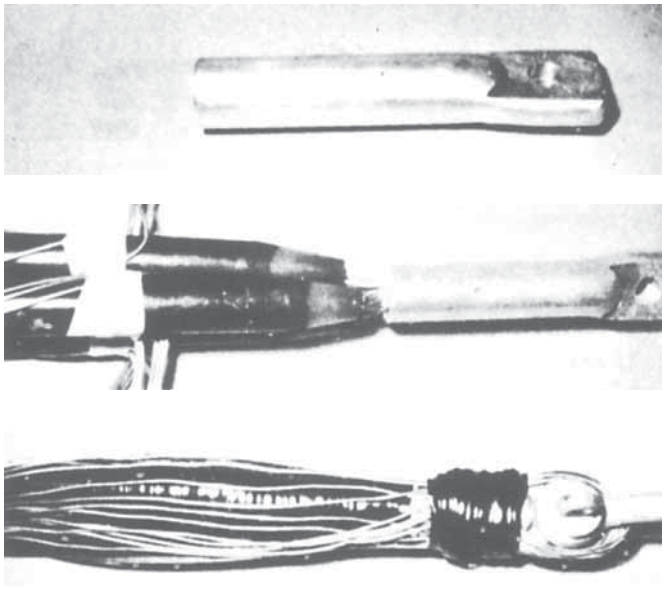
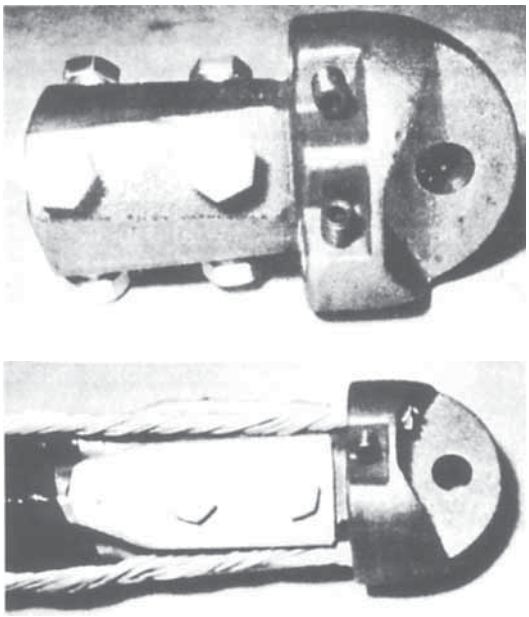


Figure IC 210–2: Nose for 3-1/C 4/0 through 1,000 kcmil Al Conductors (M/C 838-37609)



1.6 Apply heat shrinkable tubing or jacketing tape over the cable insulation and hylug.

1.7 Position each set of twisted concentric wires into an adjacent valley of the triplexed cable configuration and insert them into the holes of the pulling nose. Tighten the set screws.

1.8 Properly installed pulling eyes are satisfactory for pulling cable through ducts with water but shall be removed from the cable once the pull is completed and the cable ends sealed. Swage tubing type connectors left submerged in water will let water migrate through the swage tubing connector into the conductor strands.

Scope IC 210.2 Pull Nose for Synthetic Cables Swedge

Figure IC 210–3: Pull Nose for Synthetic Cables Swedge

The swedge cable pulling nose consists of three (3) basic components: the trailing fitting, wedge, and leading fitting (swivel head). When assembled, these components make up the swedge cable pulling harness kit.

1.0 Instructions

1.1 Strip each conductor to the appropriate stripping distance, see Table IC 210–1 (Sheet 4). Push the bared conductors through the trailing fitting, see Figure IC 210–3.1 (Sheet 3).

1.2 Install the wedge by cocking the wedge between the stranded layers, Figure IC 210–3.1 (Sheet 3). Then twisting with the lay of the conductor until the wedge is halfway into the conductor, push the trailing fitting forward until only 3/8 inch of the conductor ends show. Tap the wedge into the conductor.

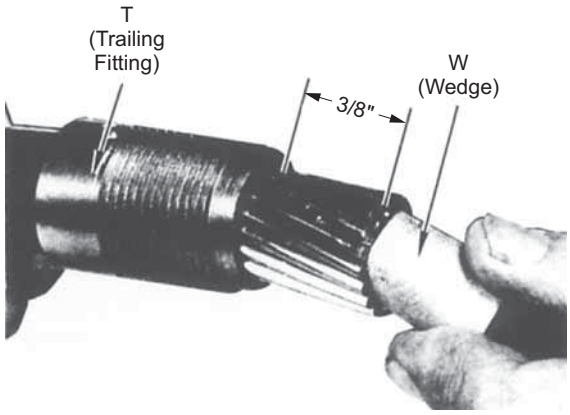


Figure IC 210–3.1

1.3 Screw the leading fitting (swivel head) onto the trailing fitting until manually tight. Line up the slot on the trailing fitting with set screw. Then tighten the set screw.

1.4 Waterproof the exposed conductor, using Aqua Seal. Then trail the concentrics over the aqua-seal and trailing fittings.

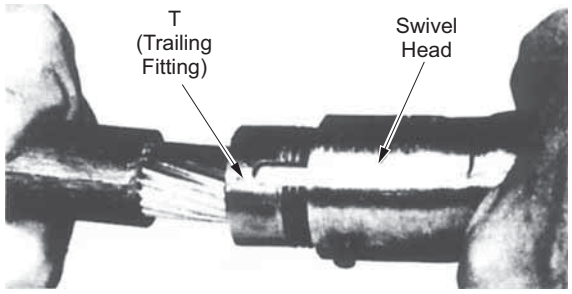


Figure IC 210–3.2

1.5 To capture the concentric wires, use plastic "Tywraps." Place the first wrap over the concentrics at the aqua-seal. Then form the concentrics over the trailing fitting. Place the second Tywrap just behind the leading fitting (swivel head). Cut concentrics to fit behind the swivel head and then tape thoroughly, see Figure IC 210–3.3 (Sheet 4) and Figure IC 210–3.4 (Sheet 4).

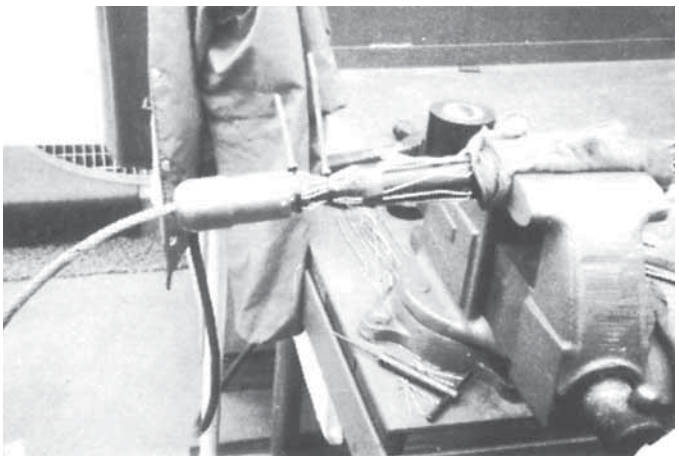


Figure IC 210–3.3

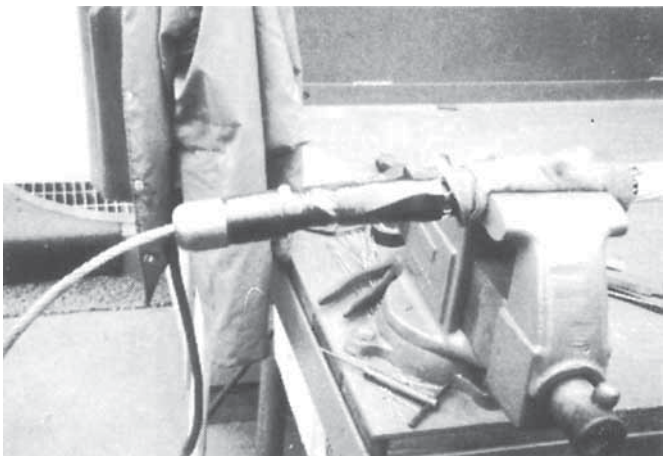


Figure IC 210–3.4

Table IC 210–1: Swedge Cable Pulling Harness

Cable Conductor Size Range	Harness Kit Material Code	Cable Stripping Distance (in)	Wedge Color Material Code
350 kcmil	"B" 850-85124	3	Blue 850-85165
750 kcmil	"C" 850-85090	3-1/2	Yellow 850-85140
1,000 kcmil	"C" 850-85090	3-1/2	Red 850-85157
1,500 kcmil	"D" 850-85132	4	No Color 850-85132

IC 215 Cable Pulling Structure Attachments

Scope IC 215.1 Cable Pulling Structure Attachments

Figure IC 215–1: Cable Pulling Attachments

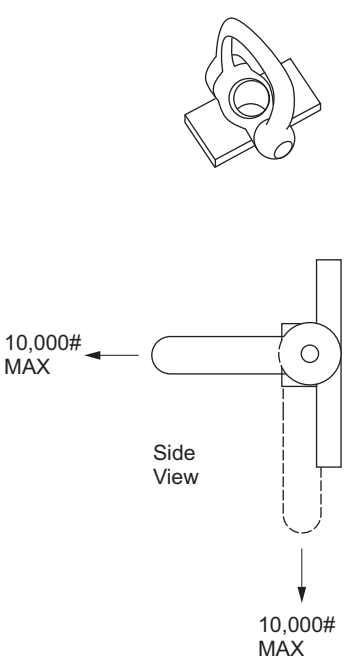


Figure IC 215–1.1

1" Swivel Lift Plate
M/C 655-32301

Figure IC 215–1.2

1" Diameter x 4" Tylag
M/C 656-99027

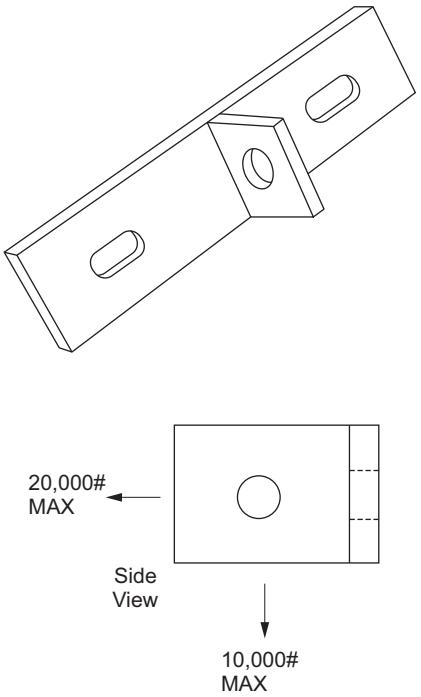


Figure IC 215–1.3

1" Double Edge Lift Plate
M/C 655-32400

Note(s):

1. The 1 inch Swivel Lift Plate (Figure IC 215–1.1 [Sheet 1]) may be used at any angle up to a maximum cable pull of 10,000 pounds. For attachment, it requires 1—1 inch (diameter) X 4 inch (length) Tylag (Figure IC 215–1.2 [Sheet 1]) which should be tightened snugly but not tight.
2. The Double Edge Lift Plate (Figure IC 215–1.3 [Sheet 1]) has a maximum loading of 20,000 pounds for direct in-line pulls, however, it reduces down to 10,000 pounds at 90 degrees to direct in-line pulls. Attachment of this plate requires 2—1 inch (diameter) X 4 inch (length) Tylags (Figure IC 215–1.2 [Sheet 1]) and can only be installed where a double threaded coil insert is available. Both Tylags should be tightened securely.
3. CAUTION: Do not substitute size and type of Tylag bolts when attaching plates.
4. When calculating pulling loads, remember that temporary jamming may result in loads in excess of those calculated. Although the Swivel Lift Plate (See Note 1) can be used for most applications, utilization of the Double Edge Lift Plate (See Note 2) should be considered whenever doubt exists concerning actual pulling loads that may develop.

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IC 220 Cable Bending Radius

Scope IC 220.1 Bending Radius for CLP Insulated Nonjacketed Cable

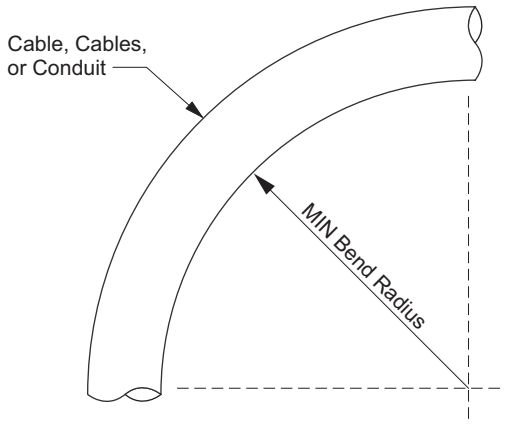
Table IC 220–1: Bending Radius for CLP Insulated Nonjacketed Cables

Cable Voltage (kV)	Insulation Thickness (mil)	Cable Size	Minimum Bending Radius (in)[a/]	
			1-1/C	3-1/C[b/]
5	90	1/0 AWG	5	12
	90	350 kcmil	8	16
	90	750 kcmil	10	21
12/17	220	#2 AWG	7	16
	220	1/0 AWG	8	17
	220	350 kcmil	11	23
	220	750 kcmil	13	29
	220	1,000 kcmil	15	32
34.5	420	1/0 AWG	13	28
	420	4/0 AWG	14	30
	420	750 kcmil	19	40
	345	1,500 kcmil	21	46
Cable in Duct (3)[c/]			Minimum Bending Radius for 1-1/C in Duct (in)[a/]	
12/17	220	#2	17	
	220	1/0	20	

[a/] The bending radius is to be measured from the inner surface of the cable, cables, or duct.
[b/] The values shown are for three single conductor (1/C) cables that are triplexed, twisted, or paralleled and are racked or trained as a bundle.
[c/] The values shown are for the duct. When the cable exits the duct, the values for one 1/C cable can be used for the cable.

= For Reference Only

Figure IC 220–1: Bending Radius for CLP Insulated Nonjacketed Cables



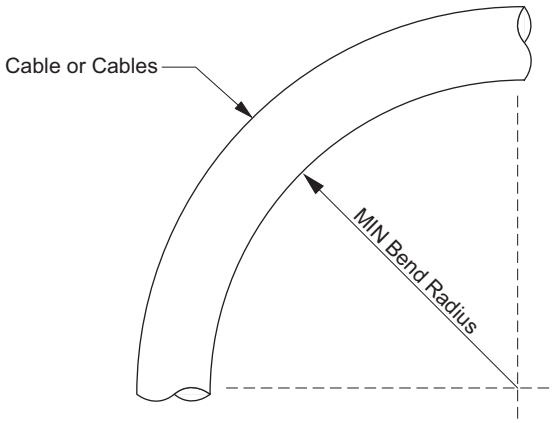
Note(s):
1. The bending radius is to be measured from the inner surface of the cable, cables, or duct.

Table IC 220–2: Bending Radius for CLP Insulated Jacketed Cable

Cable Voltage (kV)	Insulation Thickness (mil)	Cable Size	Minimum Bending Radius (in)[a/]	
			One 1/C[b/]	Three 1/C[c/]
12/16	220	#2 AWG (Cu)	13	17
	220	#2 AWG	9	17
	220	1/0 AWG	9	18
	220	350 kcmil	12	23
	220	750 kcmil	15	29
	220	1,000 kcmil (Al/Cu)	17	32
34.5	420	4/0 AWG	15	27
	420	750 kcmil	19	36
	345	1,500 kcmil	19	40

[a/] The bending radius is to be measured from the inner surface of the cable, cables, or duct.
[b/] One 1/C is the bending radius for a single cable.
[c/] The values shown are for three 1/C cables that are triplexed, twisted, or paralleled and are racked or trained as a bundle.

Figure IC 220–2: Bending Radius for Insulated Jacketed Cables



Note(s):
1. The bending radius is to be measured from the inner surface of the cable or cables.

Table IC 220–3: Bending Radius for EPR Cable

Cable Voltage (kV)	Insulation Thickness (mil)	Cable Size	Minimum Bending Radius (in)[a/]	
			One 1/C[b/]	Three 1/C[c/]
4	115	1/0 kcmil	10	14
	115	4/0 kcmil	11	16
	115	250 kcmil	12	16
	115	350 kcmil	13	18
	115	500 kcmil	15	20

Cable Voltage (kV)	Insulation Thickness (mil)	Cable Size	Minimum Bending Radius (in)[a/]	
			One 1/C[b/]	Three 1/C[c/]
12/16	200	1/0 kcmil	12	17
	220	4/0 kcmil	14	19
	220	250 kcmil	14	20
	200	350 kcmil	16	22
	220	500 kcmil	17	23

a/ The bending radius is to be measured from the inner surface of the cable, cables, or duct.
b/ EPR- One 1/C bending radius values are for individual cables when the overall jacketed is removed.
c/ The values shown are for three 1/C cables that are triplexed, twisted, or paralleled and are racked or trained as a bundle.

Table IC 220–4: Bending Radius for Secondary and Service Cable (CLP)

Cable Voltage	Insulation Thickness (mil)	Cable Size	Minimum Bending Radius (in)[a/]		
			One 1/C[b/]	Two phase w/neutral	Three phase w/neutral
600 V	60	#2 kcmil	2	3	N/A
	80	1/0 kcmil	2	5	6
	80	4/0 kcmil	3	7	7
	95	350 kcmil	3	9	10
	110	700 kcmil	6	14	16

a/ The bending radius is to be measured from the inner surface of the cable, cables, or duct.
b/ One 1/C is the bending radius for a single cable.

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IC 225 Cable Protection — Sealing/Moisture Proofing

Scope IC 225.1 Describes Methods to Moisture Proof Splices, Terminations, and Exposed Cable Ends

All cable conductors, insulation and shielding shall not be left exposed other than during the time work is being performed on the cable. Partial reels of cable that are stored in company warehouses or district yards shall have caps installed on the cable ends. Exposed cable conductors, insulation, and shielding shall be protected from moisture and contaminants in the following manner:

1.0 Splice

1.1 A plastic sleeve from Universal Protection Kit (SAP 10118097) shall be pulled over each end of the splice prior to installing the connector.

1.2 Pull plastic sleeve over the unfinished splice.

1.3 Insert desiccant and humidity indicator inside of plastic sleeve.

1.4 Tape the ends of the plastic sleeve to the jacketing with plastic tape sealing the splice. Take care that the surface of the jacketing is clean and free from dirt and pulling compound to ensure a good seal.

1.5 Wrap waterproof paper around the splice; tape ends to the jacketing to hold in place.

2.0 Terminations

2.1 Pull plastic sleeve Universal Protection Kit (SAP 10118097) over unfinished termination.

2.2 Insert desiccant and humidity indicator into plastic sleeve.

2.3 Tape lower end of plastic sleeve to jacketing. Make sure the surface of the jacketing is free from dirt and pulling compound to ensure a good seal.

2.4 Tape upper end of plastic sleeve tightly together near the end. Fold taped section over on itself and apply tape until a satisfactory seal is obtained.

2.5 Wrap waterproof paper around cable—extending it beyond the end of the cable—and tape lower end to the cable jacketing to secure it. Roll the extended end over on itself, and tape with plastic tape to secure.

3.0 Exposed Cable Ends (Primary, Secondary, and Service Cables)

3.1 Pull concentric neutral wires at least 2 inches back from cable end and safeguard the concentric neutral wires with plastic tape.

3.2 Make sure exposed cable ends and semiconducting shield or jacketing (if jacketed cables are used) are free from dirt and pulling compound.

3.3 Apply Aqua-Seal (SAP 10116816) over exposed cable end and extend over jacketing a minimum of 1 inch. Maintain an even thickness of Aqua-Seal over the surface.

Three layers of self-fusing rubber insulating tape (SAP 10116970) may be substituted for aqua seal.

3.4 Apply a minimum of 2-1/2 layers of plastic tape over the aqua seal onto the surface of the cable jacketing to form a good seal, or cover with plastic sleeve and waterproof paper in the same manner indicated when installing protection kit on splices/terminations.

NOTE Rubber cable end caps with hose clamps for CLP type cable may be used in lieu of this section and Section 2.0 (Sheet 1) above. See Table IC 225–1 (Sheet 2).

3.5 In manholes, vaults, and other subsurface structures the sealed cable ends will also be secured as high as practical on the structure to avoid the possibility of moisture entering the cable.

3.6 Lead cables will be sealed by soldering the end of the cable or using rubber cable end caps (see Table IC 225–2 [Sheet 3]).

4.0 CLP Type Cable Caps

Table IC 225–1: Cable Temporary End Caps for JCN-Type Cable

SAP Number	Catalog Number	600 V Secondary Cable	5 kV 90 mil	12/16 kV 220 mil	34.5 kV 420 mil
10117639	Cap 35	#8 through #2			
10117640	Cap 45	1/0			
10117641	Cap 65	4/0			
10117642	Cap 85	350	1/0	2 through 1/0	
10117643	Cap 95	700	350		
10117644	Cap 135		750	350	1/0
10117645	Cap 135			750	
10117646	Cap 145			1,000	

= For Reference Only

5.0 PILC Cable Caps

Rubber caps and clamps are available for temporary sealing of PILC cables. The use of these reusable caps eliminates the need for “lead sealing” cable ends. In applying these caps, it is recommended that a 1/2-inch space be maintained between the cable end and the cap before tightening the clamp. This will protect the cap from damage caused by protruding conductors.

Table IC 225–2: Cable Temporary End Caps for PILC-Type Cable

Material Code	Cap Size (in)
655-29109	1
655-29208	1-1/2
655-29307	2
655-29406	2-1/2
655-29505	3

= For Reference Only

6.0 Heat-Shrink and Cold-Shrink Cable Caps

Heat-shrink and cold-shrink cable caps are available for the temporary sealing of CLP (1/C) and EPR (3/C) cables. Heat-shrink and cold-shrink cable caps may be used in lieu of Section 2.0 (Sheet 1) and Section 3.0 (Sheet 1) above, or in place of the cable caps in Table IC 225–1 (Sheet 2).

Table IC 225–3: Cable Temporary End Caps for CLP and EPR Type Cable

Voltage	Cable Size	Heat Shrink (Canusa)		Cold Shrink (3M)	
		Part #	Material Code	Part #	SAP Number
4/12/16 kV (1/C)	350 kcmil	CCAP-2750	655-03310	EC-3	10117609
	750 kcmil[a/]				
	1,000 kcmil			EC-4	10117608
34.5 kV (1/C)	4/0 AWG	CCAP-3500	655-03336	EC-3	10117609
	750 kcmil[a/]			EC-4	10117608
	1,500 kcmil				
12/16 kV (3/C EPR)	250 kcmil	CCAP-4700	655-03344	EC-4	10117608
	350 kcmil				
	500 kcmil				

[a/] Not approved for use on new construction.

6.1 Installation Instructions for Heat-Shrink Cable Caps

A. Slide the end cap onto the cable and hold in place using forefinger or thumb.

Figure IC 225–1: Heat-Shrink Cap over Cable End

B. Beginning at closed end (that is, at cap shoulder), shrink the tubing by applying heat from a torch or heat gun. A torch is recommended when recovering medium/heavy wall material. Keep torch moving at all times. Blue thermochromatic lines will begin to disappear at 150° C. Gradually, move heat source to open end and around cap and then shrink toward the end to avoid air entrapment. Once lines are no longer visible and adhesive flows out of open end, discontinue heating. The installation is complete when the whole tube has tightly conformed to the shape of the cable end, and the sealant is seen to flow at the open end.

Figure IC 225–2: Heat-Shrinking Cap on Cable

6.2 Installation Instructions for Cold-Shrink Cable Caps

Position the cold-shrink cable cap at the end of the cable. Next, unwind the inner-supporting plastic core. The cold-shrink cable cap will shrink into position automatically.

Figure IC 225–3: Cold-Shrinking Cap on Cable

Note(s):
1. To remove the cold-shrink cable cap, lift the edge of the cap and then slice the material with a utility knife.

IC 226 Cable Protection – Arc Resistance (Long Beach Network System ONLY)

Scope IC 226.1 Arc Resistant Tape

Arc resistant tape is designed to protect insulated electrical cables from arc-fault generated heat and flames. The material is completely free of asbestos, is salt water resistant, does not impact cable ampacity, and meets all applicable Environmental Services Department (ESD) standards.

The application of the arc resistant tape shall be required for new cable installations in conjunction with the criteria provided in this standard. Existing energized conductors which meet the criteria for arc resistant taping shall be wrapped when specifically detailed in the work order. Street closure time durations, allowable working hours due to city restrictions, circuit identification, disturbing energized cables, and increase in work scope complexity are examples of considerations for determining whether or not to wrap existing cables, though it is preferred to install the arc resistant tape when the opportunity allows in conjunction with other related work in the structure. Consult the Long Beach District Manager for guidance on questions regarding when work should include wrapping existing cable and terminations.

1.0 Materials

Table IC 226–1: Arc Resistant Tape Installation Materials

SAP	Description	Width (in)	Roll Length (ft)
10116878	Arc Resistant Tape, Black	1-1/2"	20'
10116896	Arc Resistant Tape, Black	3"	20'[a/]
10116862	Glass Cloth Tape, White	3/4"	66'

[a/] One 20 foot roll will cover approximately 2 linear feet of 3-1/C 1000 kcmil cable, or approximately 4 linear feet of 3-1/C 1/0 AWG cable.

The following formula may be used to approximate the number of rolls of 3" arc resistant tape needed to wrap a length of cable:

$$\text{Number of Rolls Needed} = \frac{\text{Cable Outside Diameter (in)} \times \text{Length of Cable (ft)} \times \pi}{15}$$

2.0 Application Criteria

2.1 Follow all appropriate policies and procedures per the Accident Prevention Manual.

2.2 When necessary, cables that are to be moved and/or lifted shall be carefully inspected before and after moving when energized, per DOM and APM policies and procedures. Cables energized in excess of 600 volts shall be moved only under the direction of the supervisor or employee in charge.

2.3 All asbestos cable wrapping must be removed from cables, splices and terminations before the application of arc resistant tape. The asbestos cable wrap must be removed and disposed of according to the appropriate SCE EH&S procedures for asbestos handling.

2.4 Network primary feeder cables which meet any of the following conditions shall have arc resistant tape applied within the corresponding manhole or vault:

- Located within a manhole or vault which also contains network system secondary cable.
- Racked within 24" of any other run of primary cable.
- Located within a structure which also contains oil filled equipment.

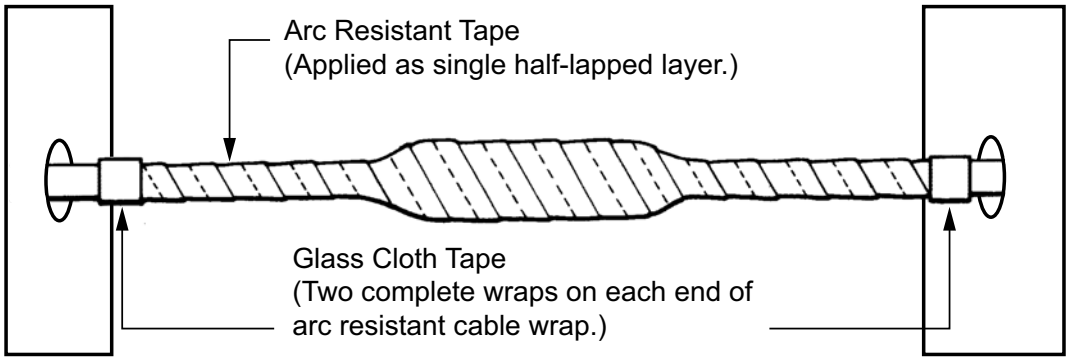
2.5 Conventional radial primary feeder cables which meet any of the following conditions shall have arc resistant tape applied within the corresponding manhole or vault:

- Located within a manhole or vault which also contains network system secondary cable.
- Racked within 24" radially of a network primary feeder cable.

3.0 Installation

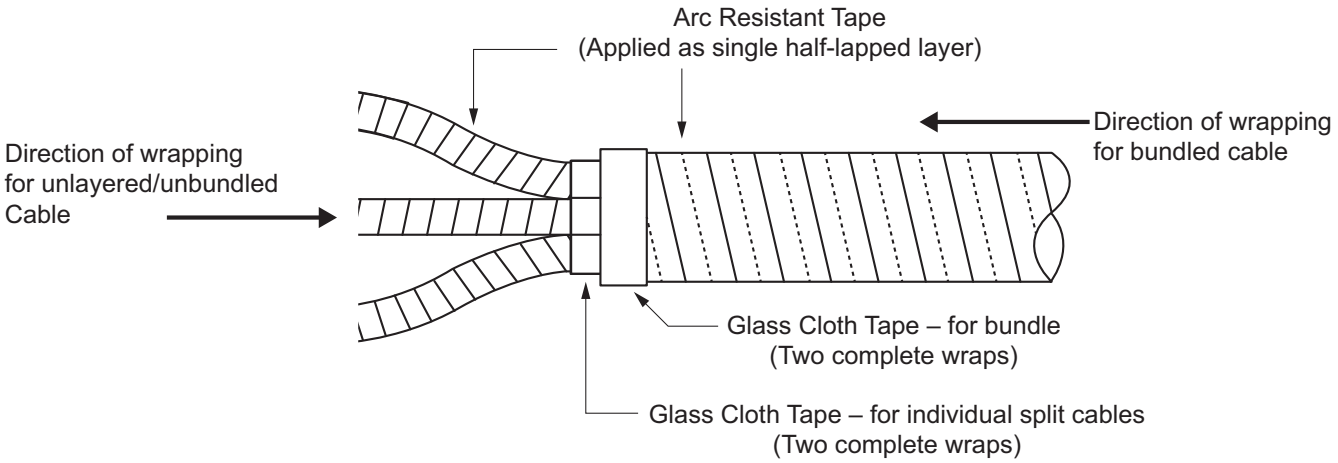
3.1 The 3-inch black arc resistant tape shall be applied to primary cables as one single half-lapped layer, from duct-edge to duct-edge in manholes and vaults. The 1-1/2 inch black arc resistant tape shall be applied to primary cable splices and terminations. See Figure IC 226–1 for application details. The tape may be applied with either side toward the cable and may be stretched to obtain a snug, wrinkle-free wrap which conforms to the cable.

Figure IC 226–1: Application of Arc Resistant Cable Wrapping



3.2 Where bundled cables are present, apply the arc resistant tape around the cable bundle up to the point of the split cable termination. At the split cable termination, apply the arc resistant tape to each of the split cables in the direction towards bundle cable split termination, refer to Figure IC 226–2.

Figure IC 226–2: Application of Arc Resistant Tape Cable Wrapping Bundle Split Detail



3.3 When starting a new roll of arc resistant tape, overlap the last 6 inches of wrapped cable and its corresponding glass cloth (tie-down) tape.

3.4 Secure the ends of the 3-inch wide black arc resistant tape with two complete wraps of glass cloth (tie-down) tape, flush with tape end, as required to maintain the integrity of the wrapping, refer to Figure IC 226–1 and Figure IC 226–2.

3.5 Apply a half lapped layer of 1-1/2 inch wide black arc resistant tape to fill-in any gaps or windows found after applying the 3-inch cable wraps. Secure the ends of the 1-1/2 inch wide arc resistant tape with two complete wraps of glass cloth (tie-down) tape.

3.6 Splices shall be wrapped using 1-1/2 inch wide black arc resistant tape. Each layer of the 1-1/2 inch arc resistant tape wrap should be applied so that it telescopes smoothly onto the outer cable housing. The tape may be applied with either side toward the cable and may be stretched to obtain a snug, wrinkle-free wrap which conforms to the cable. The arc resistant tape wrap shall be secured with two complete wraps of glass cloth (tie-down) tape.

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IC 230 Instructions for Sealing Jacketed Concentric Neutral CLP Cable Jackets

Scope IC 230.1 Instructions for Sealing Jacketed Concentric Neutral CLP Cable Jackets

1.0 General

This standard shows the approved method of sealing the cable jacket for jacketed concentric neutral type cable when installing terminations or splices.

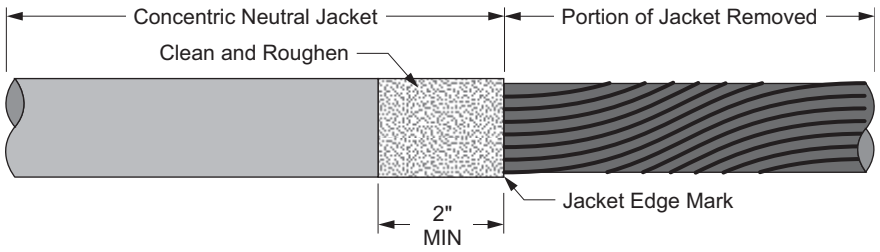
2.0 List of Required Materials

Table IC 230–1: Required Materials for Sealing JCN CLP Cable Jackets

Item	Description	Quantity	Material Code
1	100 Grit Nonconductive Abrasive Cloth	As Required	057-24208
2	Aqua-Seal or Equivalent	As Required	645-28201
3	Scotch 33+ Vinyl Tape, 3/4"	As Required	646-72108
4	Tie-Wrap, 1/4" Wide Minimum	1	716-91307

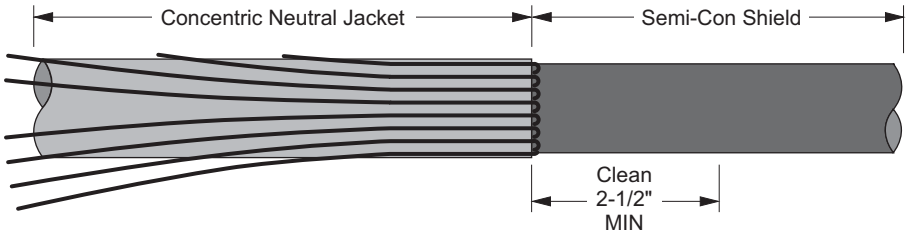
3.0 Installation

3.1 After the cable jacket has been removed per the applicable elbow or splice standard, clean and then, with light pressure, roughen a minimum of 2 inches of the concentric neutral jacket with 100 grit nonconductive abrasive cloth until a uniform dull finish is achieved, see below.

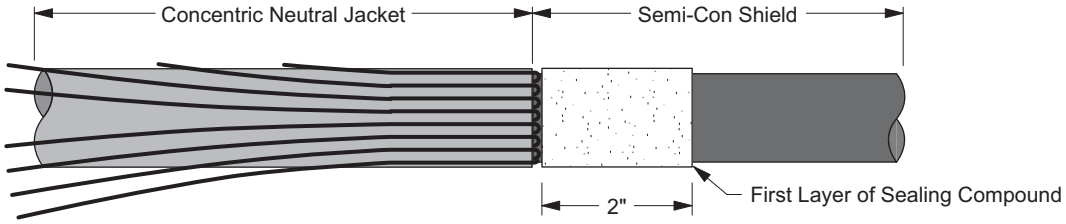


3.2 Bend the concentric neutral wires back and away from the semiconducting (semicon) insulation shield.

3.3 Use a dry cloth to clean the semicon for a minimum of 2-1/2 inches from the concentric neutral jacket as shown below. Do not use solvent in this area.

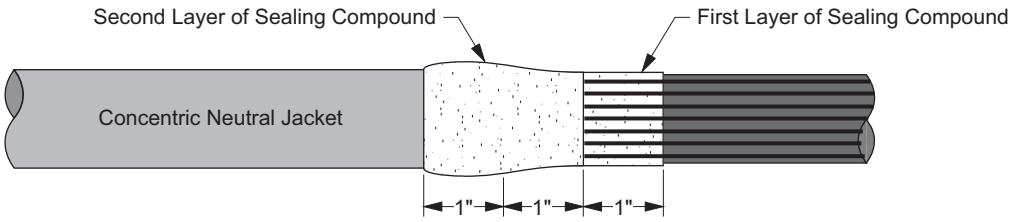


3.4 Apply a 2-inch wide strip of sealing compound over the semicon as close as possible to the concentric neutral jacket as shown below.



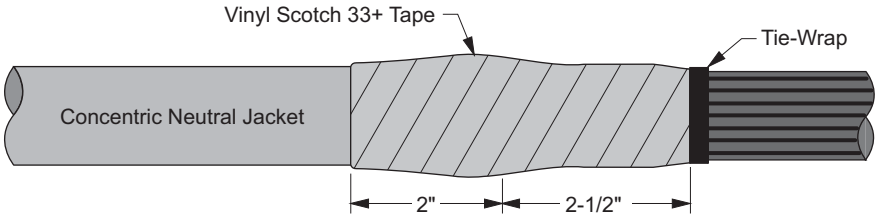
3.5 Bend concentric neutral wires back into place around the cable and press them into the sealing compound.

3.6 Apply a second 2-inch wide layer of sealing compound as shown below. One inch of this strip shall be wrapped over the concentric neutral jacket and the remaining 1 inch will be over the concentric neutral wires and a portion of the first layer of sealing compound.



3.7 Apply 3 layers of 33+ tape starting on the cable jacket 1 inch from the end of the sealing compound and extending 3/4 inch past the sealant on the semicon. When finished applying the tape layers, cut the tape—do not tear—to ensure the tape from unraveling in the future.

3.8 Permanently bind the concentric neutrals with a tie-wrap placed over the last wrap of the tape layer as shown below.



3.9 Sealing of cable jacket is complete. Cable is now ready to be terminated or spliced.

IC 233 Instructions for Sealing Jacketed Flat Strap Concentric Neutral CLP Cable Jackets

Scope IC 233.1 Instructions for Sealing Jacketed Flat Strap Concentric Neutral CLP Cable Jackets

1.0 General

This standard shows the approved method of sealing the cable jacket for jacketed flat strap concentric neutral flat strap type cable when installing terminations or splices.

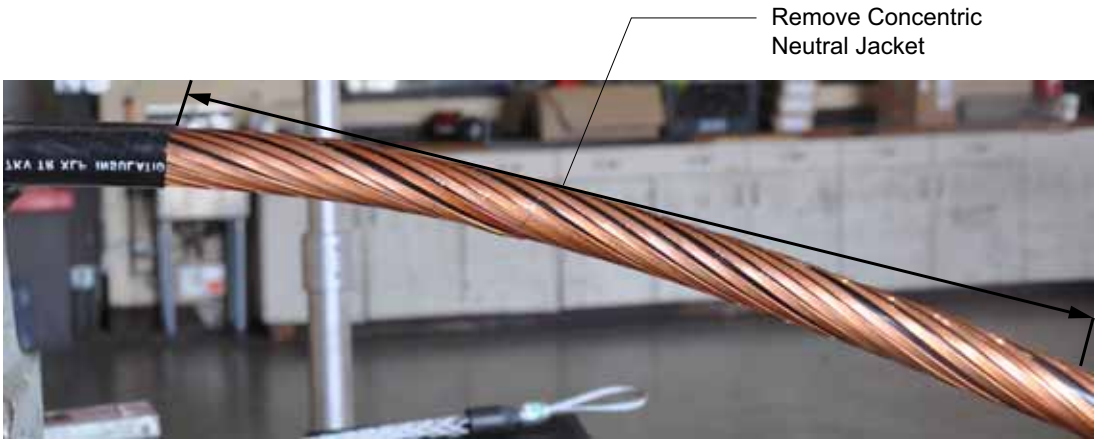
2.0 List of Required Materials

Table IC 233–1: Required Materials for Sealing JCN CLP Cable Jackets

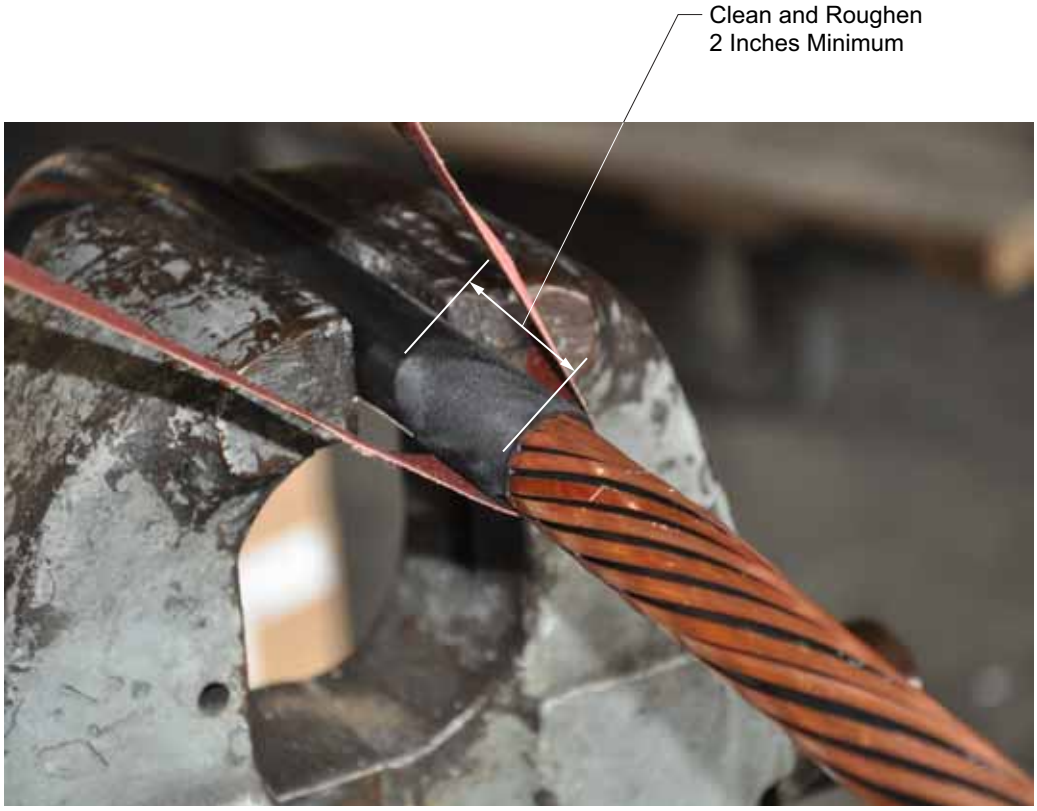
Item	Description	Quantity	Material Code
1	100 Grit Nonconductive Abrasive Cloth	As Required	10063581
2	Aqua-Seal or Equivalent	As Required	10116816
3	Scotch 33+ Vinyl Tape, 3/4"	As Required	10116918
4	Tie-Wrap, 1/4"Wide Minimum	1	10120916
5	Solvent, Cable Cleaner, Towellete	As Required	10177339
6	Lint-Free Cloth	1	10132242

3.0 Installation

3.1 Remove concentric neutral jacket per the applicable elbow or splice standard.



3.2 After the cable jacket has been removed per the applicable elbow or splice standard, clean using approved solvent cleaner wipes (SAP 10177339) and then, with light pressure, roughen a minimum of 2 inches of the concentric neutral jacket with 100 grit nonconductive abrasive cloth until a uniform dull finish is achieved, see below.

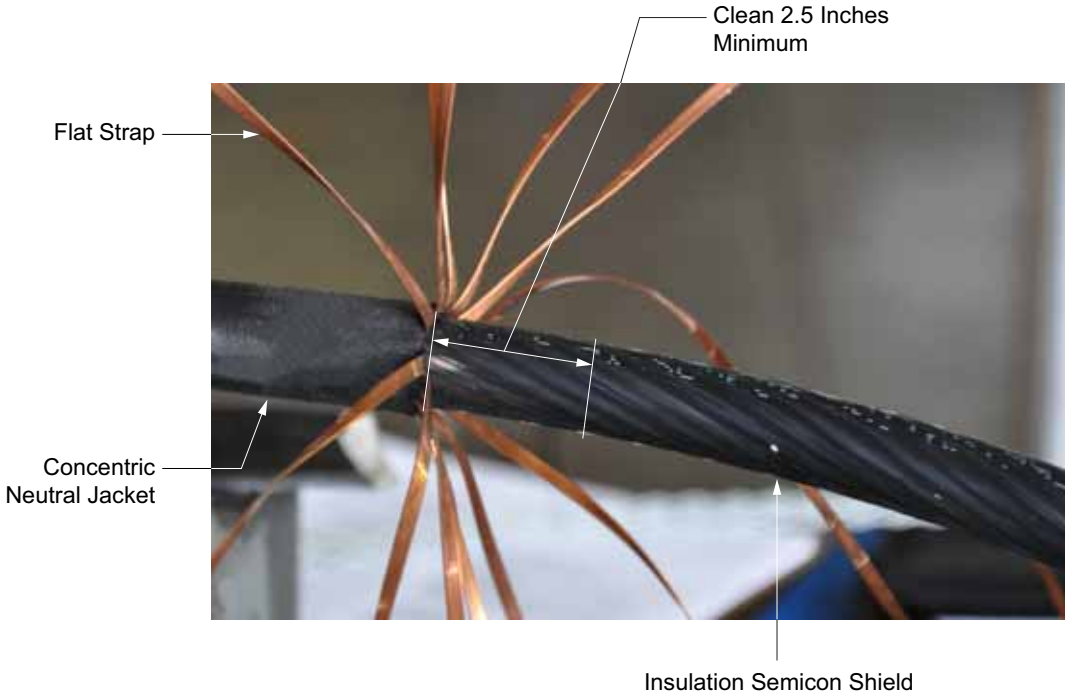


3.3 Carefully unwind and bend the concentric neutral flat straps back and away from the semiconducting (semicon) insulation shield.

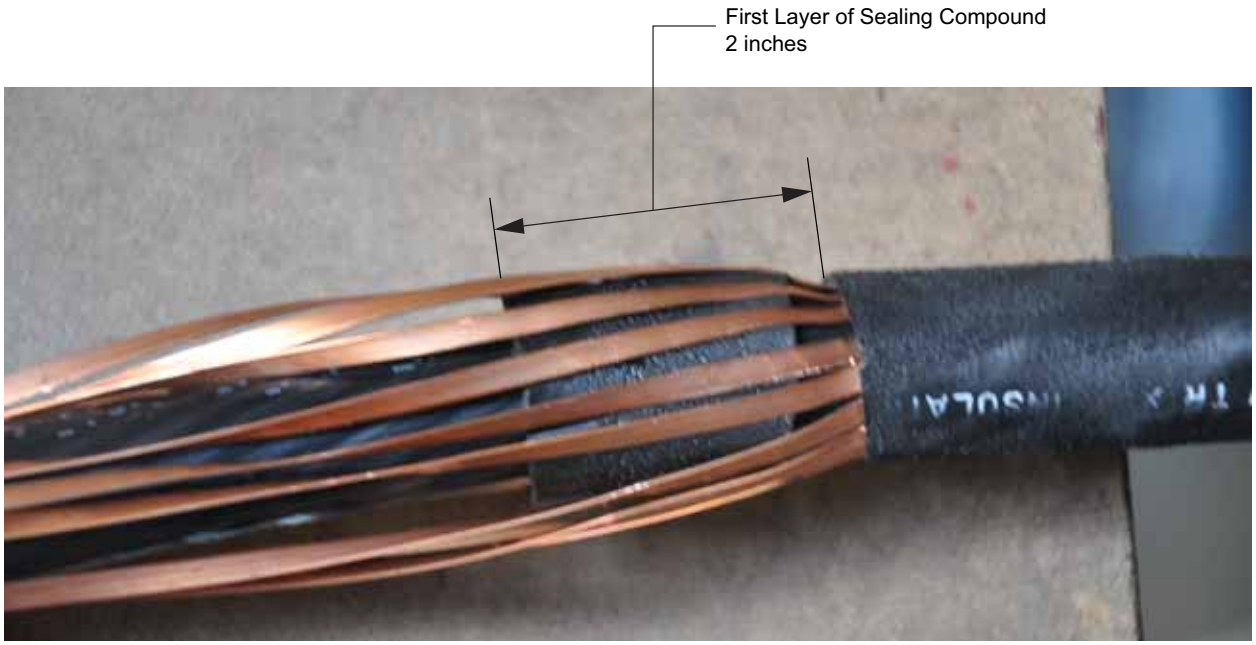
NOTE

Be careful to not bend flat strap wires more than what is necessary to prevent straps from breaking.

3.4 Use a lint-free dry cloth to clean the semicon for a minimum of 2-1/2 inches from the concentric neutral jacket as shown below. Do not use solvent in this area.

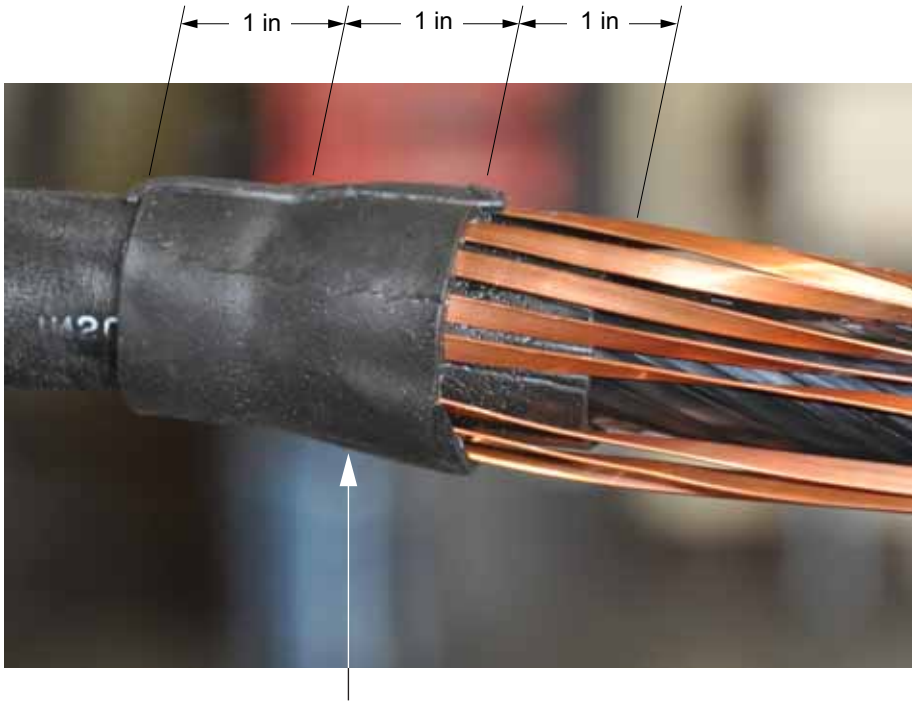


3.5 Apply a 2-inch wide strip of sealing compound over the semi-con as close as possible to the concentric neutral jacket as shown below.



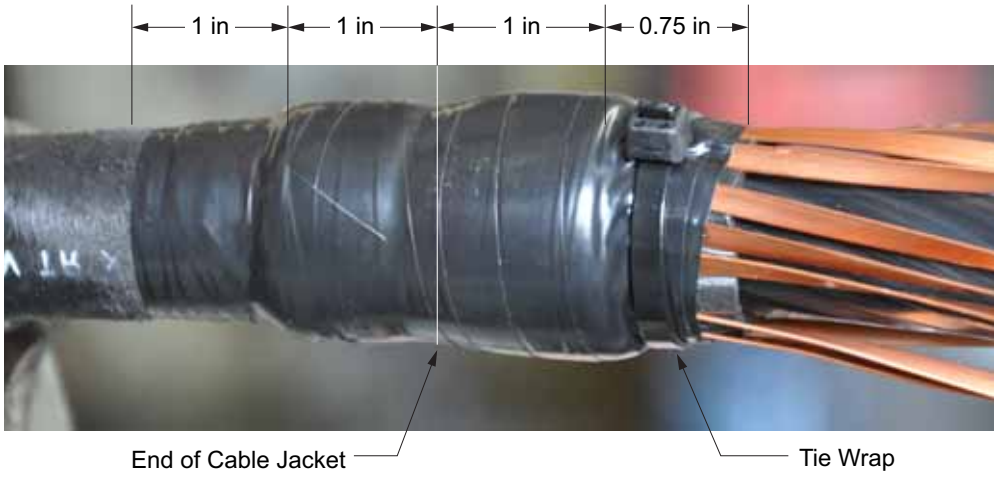
3.6 Bend concentric neutral wires back into place around the cable and press them into the sealing compound.

3.7 Apply a second 2-inch wide layer of sealing compound as shown below. One inch of this strip shall be wrapped over the concentric neutral jacket and the remaining one inch will be over the concentric neutral wires and a portion of the first layer of sealing compound.

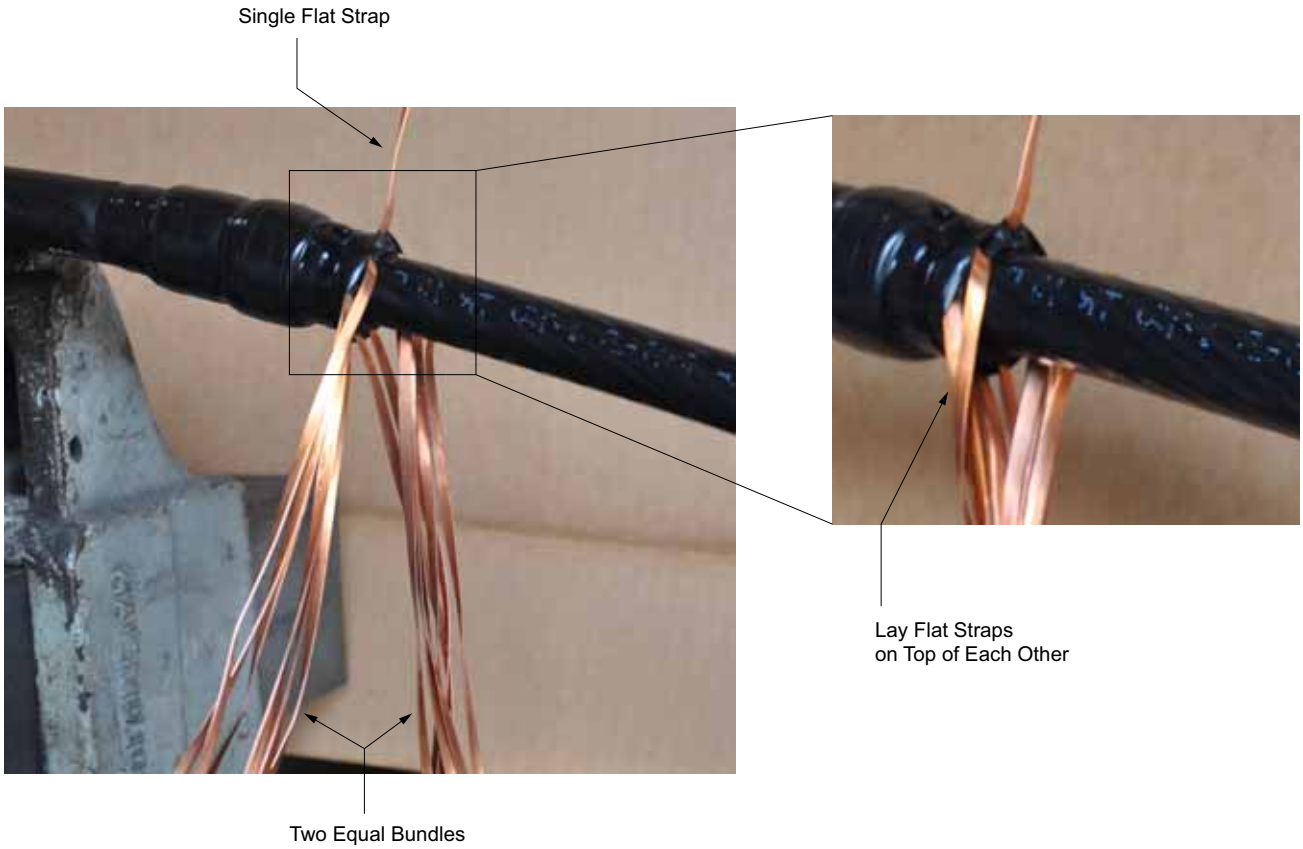


3.8 Apply 3 layers of 33+ tape starting on the cable jacket 1 inch from the end of the sealing compound and extending 3/4 inch past the sealant on the semi-con. When finished applying the tape layers, cut the tape—do not tear—to ensure the tape from unraveling in the future.

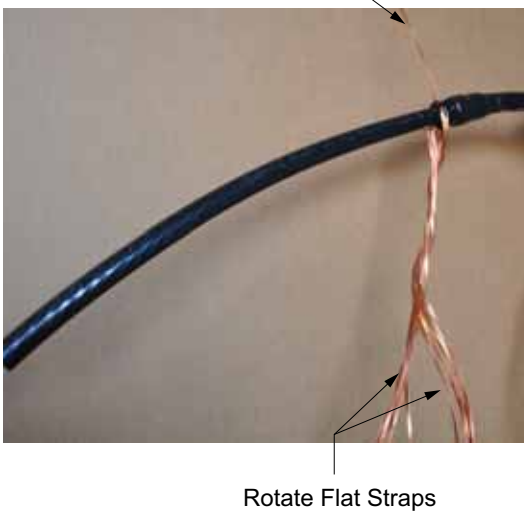
3.9 Permanently bind the flat strap concentric neutrals with a tie-wrap (SAP 10120916) placed over the last wrap of the tape layer as shown below.

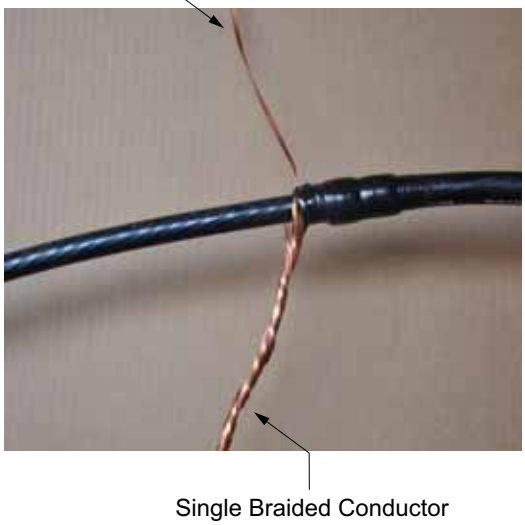


3.10 Pull a single flat strap out for elbow grounding eye connection. Separate remaining flat straps into two equal bundles laying straps on top of each other.

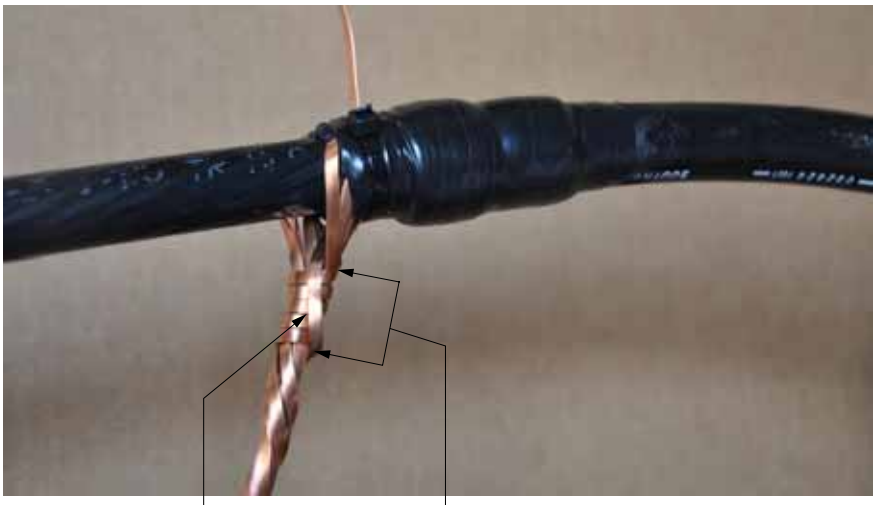


3.11 Rotate flat strap concentric neutrals into a single braided conductor, keeping the straps flat to each other as they twist.





3.12 Using the single Flat Strap, install 4-5 button wraps over the braided bundle of flat strap concentric neutrals. Bring single strap up through bundles of flat strap concentric neutrals and pull tight.



3.13 Sealing of cable jacket is complete. Cable is now ready to be terminated or spliced.

IC 235 Raychem Gelwrap Ground/Sealing Kit for JCN Cable Mid-Run and Pull-Through Structure

Scope IC 235.1 Raychem Gelwrap Ground/Sealing Kit for JCN Cable Mid-Run and Pull-Through Structure

1.0 Application

The grounding of Jacketed Concentric Neutral (JCN) cable at every mid-run or pull-through structure is not a requirement. However, if there is a need to provide a mid-run grounding point, the following procedures should be followed for grounding and sealing JCN cable.

Table IC 235–1: Gelwrap Kits

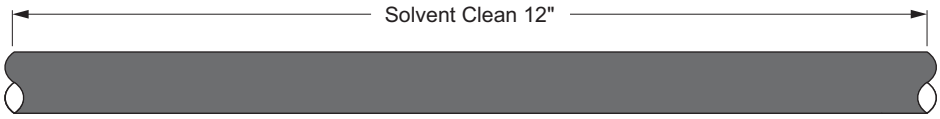
Voltage	Kit Description	Conductor Size	SAP Number
12/16 kV	Gelwrap–MS–GRD–1	#2, 1/0	10117966
12/16 kV	Gelwrap–MS–GRD–2	350; 750 kcmil	10117967
12/16 kV	Gelwrap–MS–GRD–3	1,000 kcmil	10117968
33 kV	Gelwrap–MS–GRD–2	4/0	10117967
33 kV	Gelwrap–MS–GRD–3	750; 1,500 kcmil	10117968

Note(s):
1. Not for new construction.

1.1 Use approved solvent cleaner wipes, American Polywater LoVoc SAP 10177339 to clean cable jacket a distance of 12 inches.

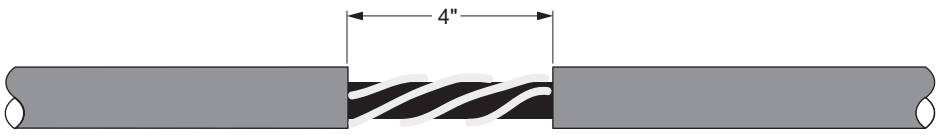
CAUTION Only an approved cable cleaner shall be used. Using non approved cable cleaners may leave a residue or negatively affect the cable or component material.

Figure IC 235–1: Clean Cable



1.2 Remove 4 inches of jacket with cable jacket stripping tool (Ripley SAP 10145849 and Ripley mid-span blade SAP 10142943, or Speed Systems stripping tool SAP 10145787). Do not cut or nick concentric neutral wires.

Figure IC 235–2: Remove Jacket



1.3 Fold and position the grounding braid so that the moisture block, that is, the solder block, will extend over the cable jacket when turned over the spring clamp (this is the only braid in kit GRD-1). See Figure IC 235–3 (Sheet 2) for positioning.

Figure IC 235–3: Position First Braid

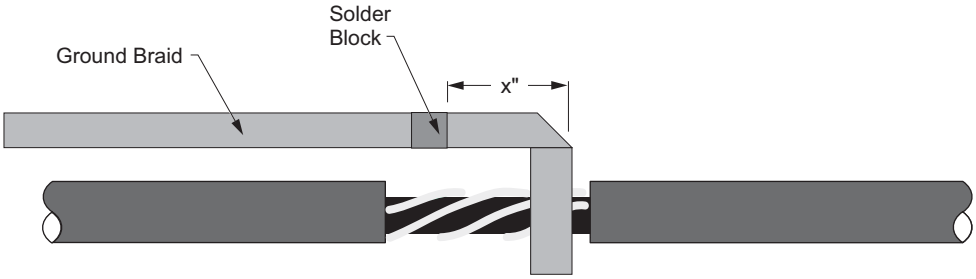
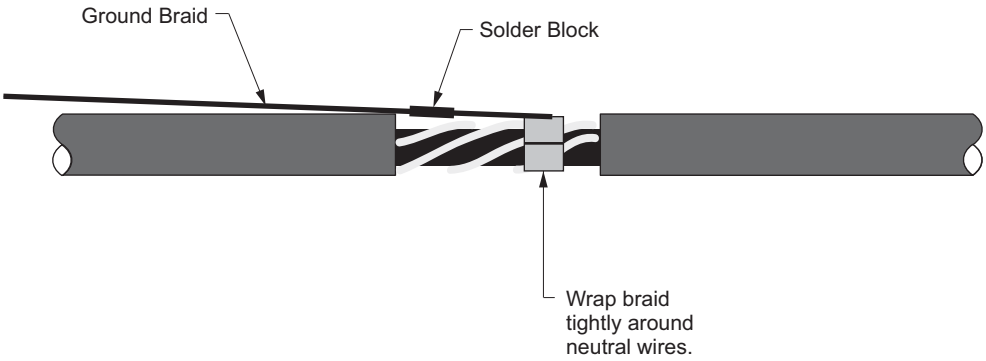


Table IC 235–2: Position for First Braid

Kit	x
GRD-1	3"
GRD-2/3	4"

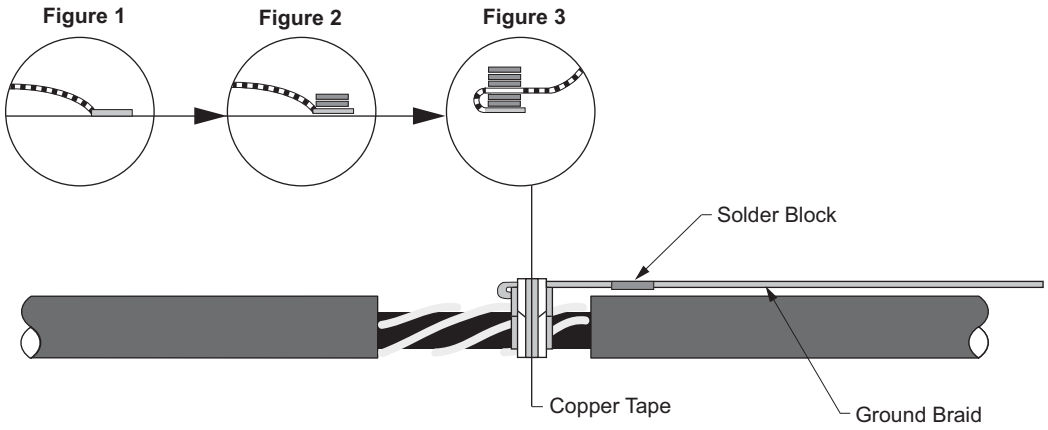
1.4 Wrap the braid tightly around the neutral wires as shown in Figure IC 235–4 (Sheet 2).

Figure IC 235–4: Wrap Braid



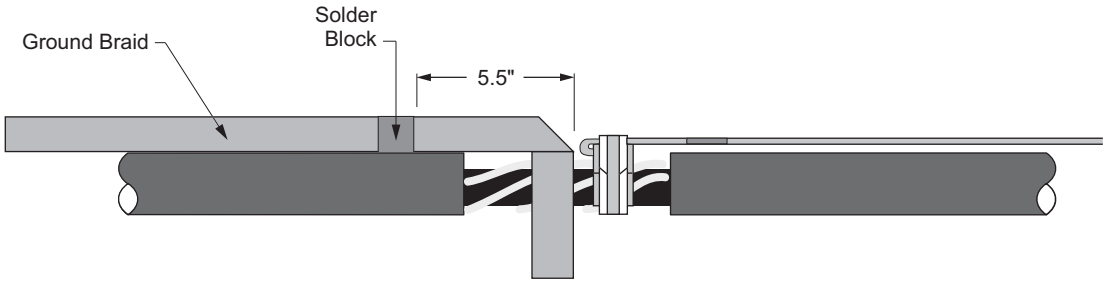
1.5 Unwind the spring clamp 1/4 turn and place over the wrapped ground braid. Make two complete wraps with the spring around the cable and braid as shown in Figure 2 of Figure IC 235–5 (Sheet 3). Fold the braid back over the spring clamp and completely wrap the remaining spring coils over the braid and cable. Completely wrap remaining second spring clamp over exposed wrapped braid. Cinch and tighten spring clamps as shown in Figure 3 of Figure IC 235–5 (Sheet 3). Secure with copper tape. Be sure the solder block extends over the cable jacket.

Figure IC 235–5: Attach Braid



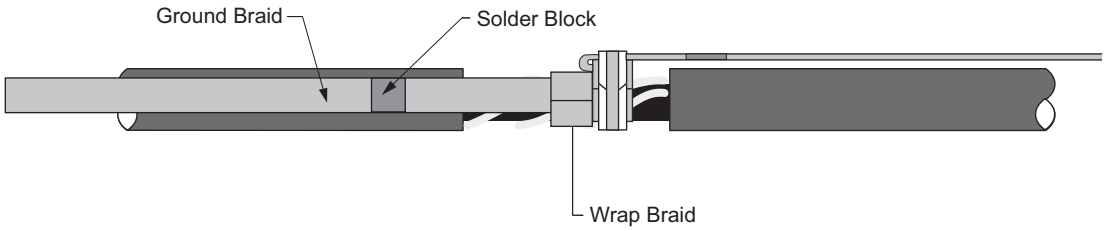
1.6 Fold and position the second grounding braid (kits GRD-2 and GRD-3) so that the moisture block, that is, the solder block, will extend over the cable jacket when turned over the spring clamp. See Figure IC 235–6 (Sheet 3) for positioning.

Figure IC 235–6: Position Second Braid



1.7 Wrap the braid tightly around the neutral wires as shown in Figure IC 235–7 (Sheet 3).

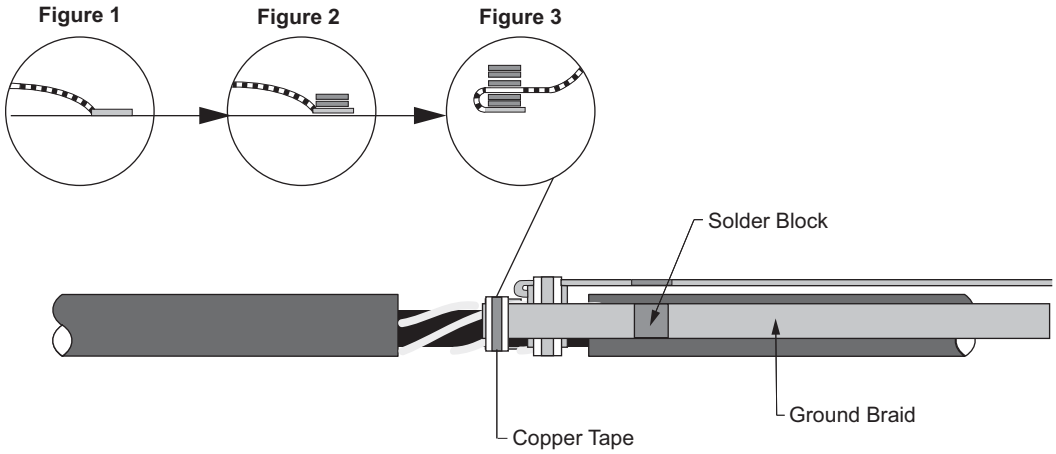
Figure IC 235–7: Wrap Braid



1.8 Unwind the spring clamp 1/4 turn and place over the wrapped ground braid. Make two complete wraps with the spring around the cable and braid as shown in Figure 2 of Figure IC 235–8 (Sheet 4). Fold the braid back over the spring clamp and completely wrap the remaining spring coils over the braid and cable. Completely wrap remaining second spring clamp over exposed wrapped braid. Cinch and

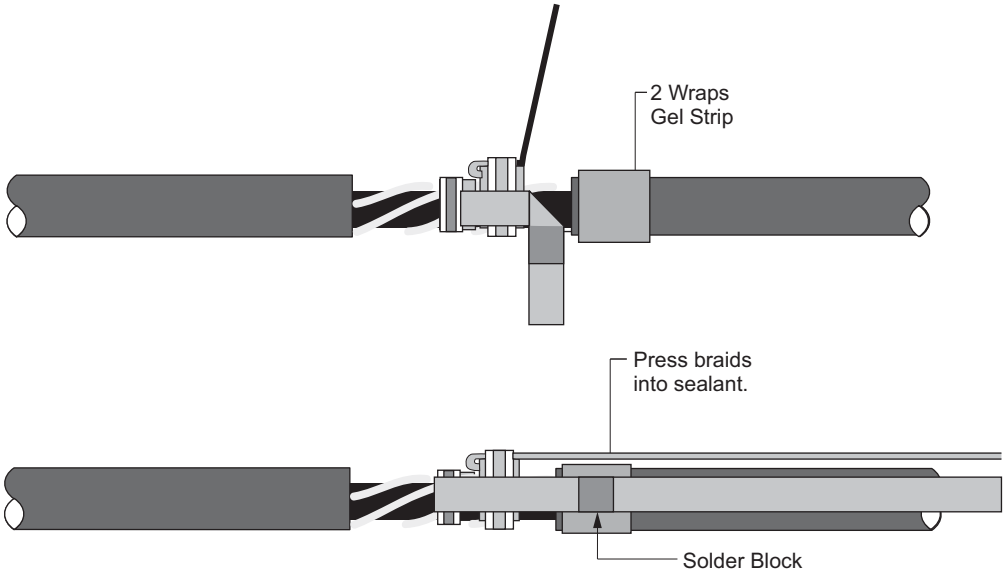
tighten spring clamps as shown in Figure 3 of Figure IC 235–8 (Sheet 4). Secure with copper tape. Be sure the solder block extends over the cable jacket.

Figure IC 235–8: Attach Braid



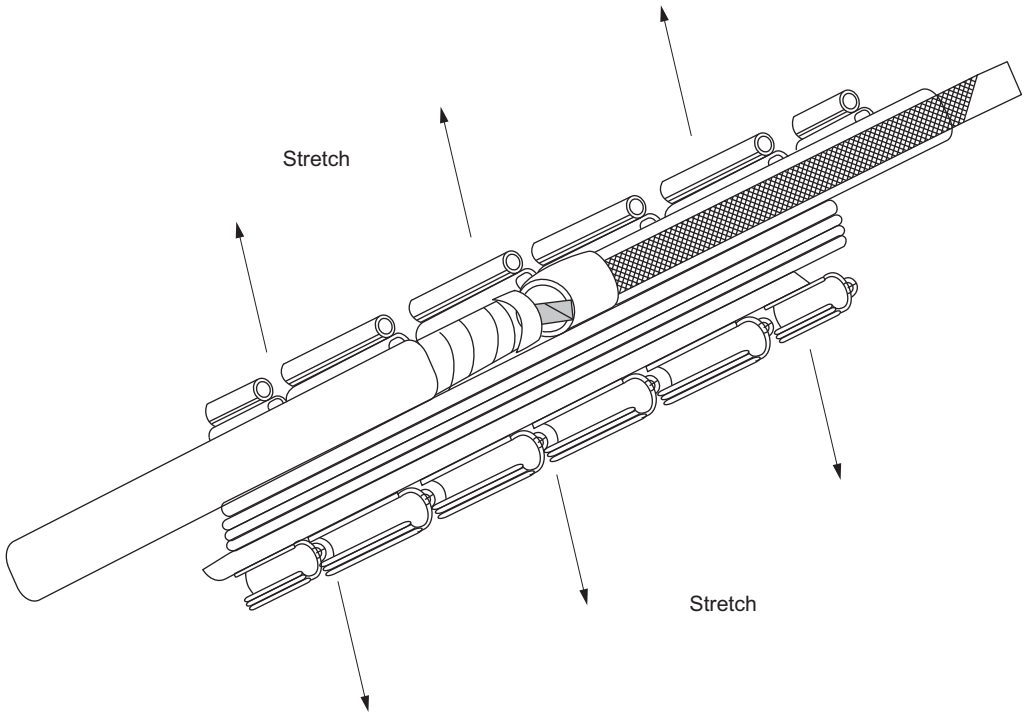
1.9 Lift up the braid and apply two complete wraps of gel sealant strip on the cable jacket at the jacket edge under the solder block. Press braid down into sealant.

Figure IC 235–9: Apply Sealant



1.10 Stretch sleeve as shown in Figure IC 235–10 (Sheet 5), then center GelWrap closure over the jacket opening.

Figure IC 235–10: Pre-Stretch Sleeve and Center



1.11 Wrap sleeve around cable. Starting at one end, compress snap locks over entire length of sleeve. Ensure that flap seats under snap locks as shown in Figure IC 235–11 (Sheet 5)

Figure IC 235–11: Wrap Sleeve Cutaway View

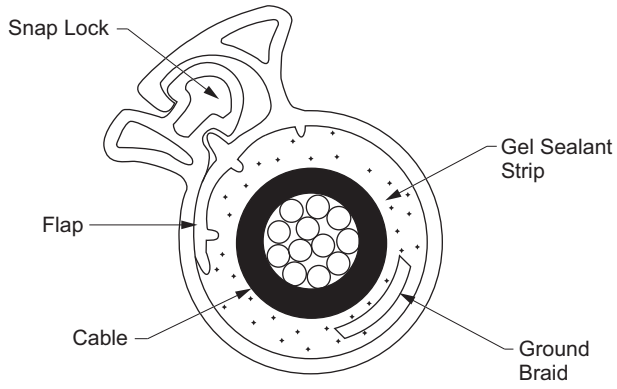
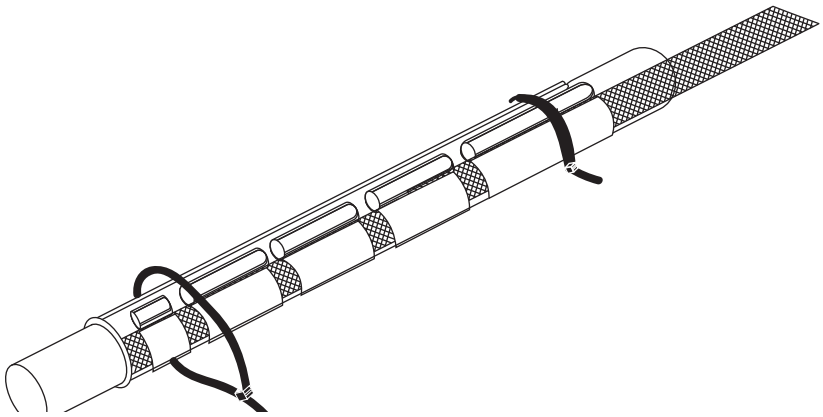


Figure IC 235–12: Wrap Sleeve

1.12 Install cable ties at outermost notches of snap lock. Splice is complete and ready for service.

Figure IC 235–13: Cable Ties



IC 300 Current-Carrying Capacities — 600 V CLP

Scope IC 300.1 Current-Carrying Capacities: 600 V — Aluminum CLP

Table IC 300–1: Single-Phase Service or Secondary Al Cable (Load Factor 75 Percent)

Size (AWG or kcmil)	Number of Runs in Duct Bank									Direct Buried	In Riser Conduit	In Air
	1	2	3	4	5	6	7	8	9			
#2 a/	131	124	117	112	107	102	100	98	96	150	113	136
1/0 b/	172	163	154	147	140	133	130	128	125	194	153	184
4/0	258	244	229	218	208	197	192	188	183	281	238	287
350	350	328	306	290	275	259	253	248	242	371	330	397
700	525	490	454	428	403	377	369	362	354	543	520	626

a/ Not approved for use on new construction.
b/ Not approved for use on 400 A panels fed underground for new construction.

Note(s):
1. Maximum conductor temperature is 90°C.
2. Earth temperature is 25°C.
3. Air temperature is 40°C.
4. Load factor of cables in duct bank is 75% (loss factor 62%) or 100% (loss factor 100%).
5. Load factors of cables in Riser and in Air: 100 percent
6. Soil RHO 120°C — CM/Watt
7. For Climate Zone 9 areas, multiply the given ampacity by 0.96

Table IC 300–2: Three-Phase Service or Secondary Al Cables (Load Factor as Shown)

Size (AWG or kcmil)	Number of Runs in Duct Bank																		Direct Buried		In Riser Conduit	In Air
	1		2		3		4		5		6		7		8		9					
	75%	100%	75%	100%	75%	100%	75%	100%	75%	100%	75%	100%	75%	100%	75%	100%	75%	100%	75%	100%		
#2 a/	108	102	102	94	95	85	90	80	86	75	81	70	78	67	76	65	73	62	150	134	102	123
1/0 a/	146	137	136	125	126	112	119	105	112	97	105	90	102	86	98	83	95	79	194	173	139	167
4/0	223	208	206	187	188	165	177	154	166	142	155	131	149	125	144	120	138	114	286	253	217	262
350	304	281	278	250	252	219	236	203	220	187	204	171	196	164	189	156	181	149	380	333	303	364
700	457	449	412	382	367	315	342	291	317	266	292	242	280	232	268	221	256	211	554	479	469	570

a/ Not approved for use on new constructions.

Note(s):
1. Maximum conductor temperature is 90°C.
2. Earth temperature is 25°C.
3. Air temperature is 40°C.
4. Load factor of cables in duct bank is 75% (loss factor 60%) or 100% (loss factor 100%).
5. Load factors of cables in Riser and in Air: 100 percent
6. Soil RHO 120°C — CM/Watt
7. For Climate Zone 9 areas, multiply the given ampacity by 0.96
8. Refer to Linear and Structural Strategies for numbers of runs or load factor not shown in this table.

Scope IC 300.2 Current-Carrying Capacities: 600 V — Copper CLP

Table IC 300–3: Single-Phase Service or Secondary CU Cables (Load Factor 75 Percent)

Size (AWG or kcmil)	Number of Runs in Duct Bank									In Riser Conduit	In Air	Direct Buried
	1	2	3	4	5	6	7	8	9			
	Amp	Amp	Amp	Amp	Amp	Amp	Amp	Amp	Amp			
#4	130	125	119	114	110	105	103	101	99	108	131	150
#2	174	165	156	149	143	136	133	131	128	144	175	195
2/0	260	247	233	223	212	202	198	193	189	225	272	290
250	380	358	335	319	302	286	280	273	267	342	409	409
500	568	532	495	469	443	417	407	397	387	525	637	600

Table IC 300–4: Three-Phase Service or Secondary CU Cables (Load Factor 75 Percent)

Size (AWG or kcmil)	Number of Runs in Duct Bank									In Riser Conduit	In Air	Direct Buried
	1	2	3	4	5	6	7	8	9			
	Amp	Amp	Amp	Amp	Amp	Amp	Amp	Amp	Amp			
#4	114	107	99	94	90	85	83	82	80	97	117	140
#2	150	140	130	123	117	110	108	105	103	130	158	180
2/0	227	210	193	183	172	162	158	154	150	204	247	265
250	332	304	276	260	244	228	222	217	211	318	374	374
500	492	447	401	376	352	327	318	309	300	477	580	543

Note(s):
1. Maximum conductor temperature is 90°C.
2. Earth temperature is 20°C.
3. Air temperature is 40°C.
4. Load factor of cables in duct bank is 75% (loss factor 60%).
5. Load factors of cables in Riser Conduit and in Air: 100 percent.
6. Soil RHO 120°C — CM/Watt

IC 310 Current Carrying Capacities — 5 kV 1/C PILC and RL

Scope Scope IC 310.1Current Carrying Capacity: 5 kV — 1/C Copper

Table IC 310–1: Paper Insulated Lead Covered

Size (AWG or kcmil)	Number of Circuits in Duct Bank				In Air
	One	Three	Six	Nine	
	Amp	Amp	Amp	Amp	Amp
#6	88	80	73	68	84
#2	149	133	120	111	145
4/0	287	250	221	203	291
500	466	396	342	313	496
1,000	655	542	468	419	741

Note(s):
1. Maximum conductor temperature 90°C.
2. Earth temperature 20°C.
3. Air temperature 40°C.
4. Load factor of cables in duct bank 75%.
5. Soil RHO 120°C — CM/Watt

Table IC 310–2: Rubber-Like Insulation — Shielded — Jacketed

Size (AWG or kcmil)	Number of Circuits in Duct Bank				In Riser	Direct Buried
	One	Three	Six	Nine		
	Amp	Amp	Amp	Amp		
#6	76	70	64	60	66	99
#2	131	118	107	100	115	164
4/0	262	228	202	187	229	314
350	351	302	264	263	308	412
500	428	363	316	289	375	495
750	531	446	383	351	457	602
1,000	608	505	432	396	516	675

Note(s):
1. Maximum conductor temperature 70°C.
2. Earth temperature 20°C.
3. Air temperature 40°C.
4. Load factor of cables in duct bank 75%.
5. Soil RHO 120°C — CM/Watt

FOR REFERENCE ONLY

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IC 320 Current Carrying Capacities — 5/8 kV — 3/C PILC

Scope IC 320.1 Current Carrying Capacity: 5/8 kV — 3/C Copper PILC

Table IC 320–1: 5 kV, Paper Insulated — Belted — Lead Covered

Size (AWG or kcmil)	Number of Circuits in Duct Bank				In Riser	In Air
	One	Three	Six	Nine		
	Amp	Amp	Amp	Amp		
#6	75	71	65	62	68	65
#2	128	118	109	101	118	109
2/0	192	174	158	148	179	167
4/0	253	226	204	189	241	217
350	341	301	268	247	333	294
500	420	364	321	296	418	365

Table IC 320–2: 8 kV, Paper Insulated — Belted — Lead Covered

Size (AWG or kcmil)	Number of Circuits in Duct Bank				In Riser	In Air
	One	Three	Six	Nine		
	Amp	Amp	Amp	Amp		
2/0	192	174	158	148	179	150
500	420	364	321	296	418	344
750	527	450	391	358	541	435

Note(s):
1. Maximum conductor temperature 80°C.
2. Earth temperature 20°C.
3. Air temperature 40°C.
4. Load factor of cables in duct bank 75%.
5. Soil RHO 120°C — CM/Watt

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IC 325 Current Carrying Capacities — 12/16 kV PILC

Scope IC 325.1 Current Carrying Capacity: 12/16 kV — 1/C and 3/C Copper

Table IC 325–1: 12/16 kV Single Conductor Cables (PILC)

Size (AWG or kcmil)	Number of Circuits in Duct Bank				In Air	In Riser
	One Amp	Three Amp	Six Amp	Nine Amp		
#2	146	129	116	107	141	125
4/0	278	241	211	193	277	237
350	370	316	273	249	380	313
500	448	378	324	294	472	376

Table IC 325–2: 12/16 kV Three Conductor Cables (PILC-NJ)

Size (AWG or kcmil)	Number of Circuits in Duct Bank				In Air	In Riser
	One Amp	Three Amp	Six Amp	Nine Amp		
#2	142	126	113	106	135	118
4/0	274	237	209	191	268	216
350	361	311	270	247	364	296
500	438	373	321	293	451	367
750	541	464	387	351	671	465

Note(s):
1. Maximum Conductor Temperature 80°C
2. Earth Temperature 20°C
3. Load factor of cables in duct bank 75%
4. Air Temperature 40°C
5. Soil RHO 120°C — CM/Watt
6. Refer to Table 9-8, DDS-9 for ampacity of PILC cables rated at 25°C Earth Temperature and 60% Load Factor. Other parameters remain the same.

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IC 330 Current Carrying Capacities — 35 kV PILC

Scope IC 330.1 Current Carrying Capacity: 34.5 kV — 1/C and 3/C Copper

Table IC 330–1: 34.5 kV Single Conductor Cables (PILC-NJ)

Size (AWG or kcmil)	Number of Circuits in Duct Bank			In Riser
	One	Three	Six	
	Amp	Amp	Amp	
2/0	237	200	174	202
4/0	302	253	218	262
350	393	325	276	340
500	470	383	322	413

Table IC 330–2: 34.5 kV Three Conductor Cables (PILC-NJ)

Size (AWG or kcmil)	Number of Circuits in Duct Bank			In Riser
	One	Three	Six	
	Amp	Amp	Amp	
2/0	229	195	170	200
4/0	293	246	212	255
350	375	318	270	341
500	459	373	313	402

Note(s):
1. Maximum conductor temperature 80°C.
2. Earth temperature 20°C.
3. Load factor 65%.
4. Soil RHO 120°C — CM/Watt

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IC 340 Current Carrying Capacities — 5 kV–35 kV CLP Cables

Scope IC 340.1 Shows Typical Current Carrying Capacity for 5 kV, 12/16 kV, and 34.5 kV 1/C Aluminum Cross-Linked Polyethylene Insulated Cables

Table IC 340–1: Cross-Linked Polyethylene Insulated

Voltage	Size (AWG or kcmil)	Number of Runs in Duct Bank						In Riser	In Air	CIC
		One	Two	Three	Four	Five	Six			
5 kV	1/0	170	154	145	139	133	129	150	167	—
	350	332	300	280	265	253	244	307	364	—
	750	513	466	432	407	387	372	479	598	—
12/16-kV	#2 HMW	124	—	—	—	—	—	—	—	151
12/16-kV (220 mil)	#2	139	128	119	112	106	101	120	135	166
	1/0	177	162	150	141	135	127	153	178	217
	350	355	318	293	282	258	243	313	372	—
	750	559	492	449	413	390	366	486	591	—
	1,000	651	569	516	473	446	418	574	698	—
16 kV (295 mil)	1/0	177	159	149	142	136	132	153	178	—
	350	349	313	292	276	263	254	313	372	—
	750	535	474	438	412	392	376	486	591	—
	1/0	184	170	160	151	—	—	153	182	—
34.5 kV	4/0	270	246	226	211	198	188	240	276	—
	750	531	474	426	391	365	343	510	588	—
	1,500	722	639	564	514	476	447	684	746	—
	1,500[a/]	721	637	570	535	501	473	682	—	—

[a/] Jacketed Flat Strap Cable

= For Reference Only

Note(s):

IN UNDERGROUND DUCTS

1. Conductor temperature 90°C (75°C for HMW).
2. Load factor 60% (75% for CIC).
3. Soil RHO 120°C-CM/Watt.
4. Earth temperature 25°C (20°C for CIC)
5. Diversity factors included.
6. Circuits in bore casings:
   a. If existing bore casing is filled with dry sand, the ampacity loading for each cable conductor size is reduced to the ampacity loading of one conductor size smaller as shown in Table IC 340–1 (Sheet 1).
   b. All new bore casings installed after 1986 will be filled with a sand/cement slurry (refer to UGS CD 121).
7. Ampacities stated above are for “normal” loading.

IN RISER AND IN AIR

8. Ambient air temperature 40°C.
9. Load factor 100%.

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JJ 100 Adapter — Cable Reducing — Cu

Scope JJ 100.1 Adapters — Cable Reducing — Tinned Copper (Do Not Use on Aluminum Conductors)

Figure JJ 100–1: Burndy 500 4/0

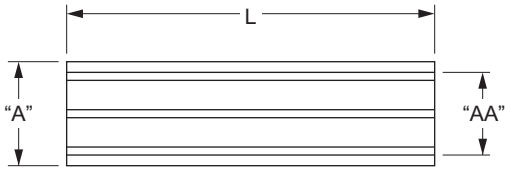

Table JJ 100–1: Burndy 500 4/0

Conductors		Material: Copper Finish: Corrugated — Tinplated	
"A" Copper	"AA" Copper	Material Code	Length (in)
4/0 str	#2 str	606-40406	1.75
4/0 str	2/0 str	606-40604	1.75
350 kcmil	4/0 str	606-41602	2.12
500 kcmil	#2 str	606-42006	2.50
500 kcmil	2/0 str	606-42204	2.50
500 kcmil	4/0 str	606-42402	2.50
500 kcmil	250 kcmil	606-42600	2.50
500 kcmil	350 kcmil	606-42808	2.50
750 kcmil	500 kcmil	606-43004	2.88

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JJ 110 Coupler — Compression — Al

Scope JJ 110.1 Coupler, Cable to Cable, Compression — Aluminum

Figure JJ 110–1: Coupler

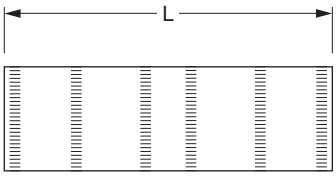

Figure JJ 110–2: Tapered Coupler

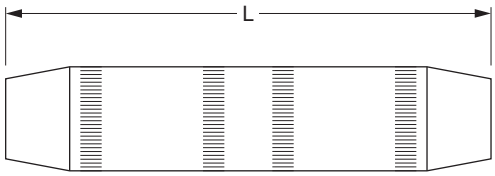

Table JJ 110–1: Coupler, Cable to Cable, Compression — Aluminum

Conductor	Material: Aluminum Finish: Smooth & Unplated				Installation Data					
	Coupler		Tapered Coupler		Circular Crimps Per End					
Aluminum Cable	SAP Number	Length (in)	SAP Number	Length (in)	MD-6		UT-15		Y-39	
					Die	No.	Die	No.	Die	No.
#8 str	10112171	2.00	—	—	W-163	3	—	—	—	—
#4 str	10112170	1.88	—	—	W-162	3	—	—	—	—
#2 str	10112172	2.38	10112271	2.62	W-163	3	—	—	—	—
1/0 str	10112173	2.12	10112272	2.62	BG	3	—	—	—	—
2/0 str	10112174	2.38	—	—	W-245	3	—	—	—	—
4/0 str	10112175	2.75	10112273	3.75	W-K840	3	15CA71R[1/]	1	15CA71R	1
250 kcmil	609-98507	2.94	—	—	—	—	15CA74R[1/]	2	15CA74R	2
350 kcmil	10112176	3.50	10112274	5.00	—	—	15C96R	2	15CA96R[1/]	2
500 kcmil	10112177	4.00	—	—	—	—	15C106R	2	—	—
700/750-kcmil	10112178	4.62	10112275	6.88	—	—	15C140R	3	—	—
1,000 kcmil	10111809	5.2	10112235	8.85	—	—	15C161R	4	—	—
1,500	10111810	6.50	10112236	9.75	—	—	[2/]	2	—	—

[1/] Will fit in UT-15 with adapter die SAP 10148852.
[2/] Use Y60 tool and L46ART die. Overlap crimps on tapered couplers.

Note(s):

1. Barrel partly filled with inhibitor and sealed. After installation, carefully remove excess inhibitor.
2. Nontapered coupler application:
   a. Preferred for premolded splicers.
   b. Not to be used for primary voltage taped splices.
3. Tapered coupler application:
   a. For use in primary voltage taped splices.
   b. Not to be used for conductors larger than 750 kcmil in premolded and heat sink splices.
4. Insulinks, SAP 10112122, 10112125, 10112128, water proofed with heat/cold shrink sleeves may be used to repair underground service wires (No. 4, No. 2, and 1/0) where space requirements will not permit the use of the MD-6 compression tool. The insulinks should be compressed with the OH 25 (or equivalent) tool SAP 10148823.

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JJ 112 Coupler — Reducer — Compression — Al

Scope JJ 112.1 Coupler, Cable Reducer, Compression — Aluminum to Aluminum, Aluminum to Copper

Figure JJ 112–1: Coupler, Cable Reducer, Compression — Aluminum to Aluminum, Aluminum to Copper

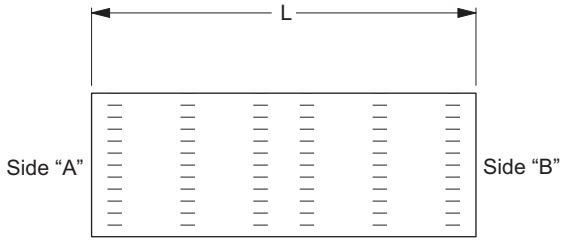

Table JJ 112–1: Coupler, Cable Reducer, Compression — Aluminum to Aluminum, Aluminum to Copper

Conductors		Material: Unplated Aluminum		Crimps Per Side					
“A”	“B”			MD-6		UT-15		Y-39	
Aluminum	Copper or Aluminum	Material Code	Length (in)	Die	No.	Die	No.	Die	No.
1/0 str	#2 str	610-30607	3.02	BG	3				
2/0 str	#2 str	610-30706	3.25	W-245	3				
4/0 str	#2 str	610-30805	3.31	W-K840	3	15CA71R[1/]	1	15CA71R	1
4/0 str	1/0 str	610-31001	3.37	W-K840	3	15CA71R[1/]	1	15CA71R	1
4/0 str	2/0 str	610-30904	3.81	W-K840	3	15CA71R[1/]	1	15CA71R	1
350 kcmil	250 kcmil	610-31100	4.62			15C96R	2	15CA96R[1/]	2
500 kcmil	350 kcmil	610-31506	5.69			15C106R	3		
700/750-kcmil	500 kcmil	610-31704	6.19			15C140R	3		

[1/] See Note 3

Note(s):
1. Barrel partly filled with inhibitor and sealed. After installation, carefully remove excess inhibitor.
2. Not to be used on insulated cables above 35 kV or in taped splices.
3. Will fit in UT-15 with adapter die M/C 851-25102.

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JJ 114 Coupler — Tapered — Reducer — Compression — Al

Scope JJ 114.1 Coupler, Tapered Cable Reducing, Compression — Aluminum to Aluminum, Aluminum to Copper

Figure JJ 114–1: Coupler, Tapered Cable Reducing, Compression — Aluminum to Aluminum, Aluminum to Copper

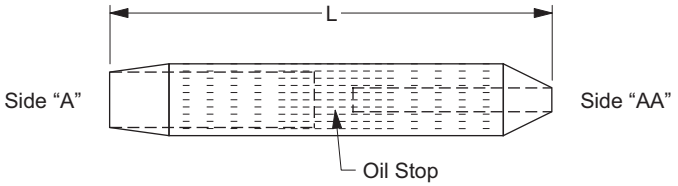

Table JJ 114–1: Coupler, Tapered Cable Reducing, Compression — Aluminum to Aluminum, Aluminum to Copper

Conductors		Material: Aluminum Finish: Smooth and Unplated		Installation Data Circular Crimps Per End					
"A"	"AA"			MD-6		UT-15		Y-39	
Copper or Aluminum	Copper or Aluminum	Material Code	Length (in)	Die	No.	Die	No.	Die	No.
#2 str	#2 str	610-27603	3.00	BG	Overlap		Overlap		Overlap
1/0 str	#2 str	610-27645	3.75	BG					
350 kcmil	#2 str	610-27702	6.00			15C96R		15CA96R[1/]	
350 kcmil	1/0 str	610-27801	6.00			15C96R		15CA96R[1/]	
350 kcmil	4/0 str	610-28007	6.00			15C96R		15CA96R[1/]	
500 kcmil	#2 str	610-28205	5.42			15C106R			
500 kcmil	1/0 str	610-28239	7.90			15C106R			
500 kcmil	350 kcmil	610-28262	7.90			15C106R			
750 kcmil	#2 str	610-28304	6.36			15C140R			
750 kcmil	350 kcmil	610-28361	9.30			15C140R			
750 kcmil	500 kcmil	610-28403	9.88			15C140R			
1,000 kcmil	500 kcmil	610-00014	10.00			15C161R[2/] 15C150R			
1,000 kcmil	750 kcmil	610-28502	10.00			15C161R[2/] 15C150R			

[1/] Will fit in UT-15 with adapter die M/C 851-25102.
[2/] The preferred die.

Note(s):
1. Tapered reducer for use on insulated cable 2.4 kV and above.
2. Barrel partly filled with inhibitor and sealed. After installation, carefully remove excess inhibitor.

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JJ 116 Coupler — Compression — Copper

Scope JJ 116.1 Coupler, Cable to Cable — Copper Compression

Figure JJ 116–1: Tin-Plated Copper Hylink

Figure JJ 116–2: Tin-Plated Copper Hylink — Oil Stop

Table JJ 116–1: Coupler, Cable to Cable — Copper Compression

Conductor	Installation Data																Y34A Hypress Die Set for Rounding Dies	
	Material: Copper Finish: Smooth — Tinned				Circular Crimps Per End						Indents Per End							
	Hylink		Hylink — Oil Stop		MD-6		UT-15		Y-39		Y34A and Y48B							
Copper Cable	Length (in)	Material Code	Length (in)	Material Code	Die	No.	Die	No.	Die	No.	Nest	Indenter	No.	Head Die	Ram Die
#6 str					W-161	2					A6CD	Y34PR	1		
#4 str			1.906	604-55201	W-161	2					A4CD	Y34PR	1		
#2 str			2.050	604-55300	W-162	2					A2CD	Y34PR	1		
2/0 str			2.218	604-55508	W-241	2					A26D	Y34PR	1	A26AH	A26AP
4/0 str			2.375	604-55607	BG	2	15CA54R[1/]	1	15CA54R	1	A28D	Y34PR	1	A28AH	A28AP
250 kcmil			2.562	604-55706	W-166	4	15CA60R[1/]	1	15CA60R	1	A29D	Y34PR	1		
350 kcmil			2.781	604-55805			15CA71R[1/]	2	15CA71R	2	A31D	Y34PR	1	A31AH	A31AP
500 kcmil	4.000	604-52703	3.520	604-55904			15CA87R[1/]	2	15CA87R	2	A34D	Y34PR	1	A34AH	A34AP

[1/] Will fit in UT-15 with adapter die (M/C 851-25102).

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JJ 120 Squeezon Connector — Aluminum and Copper

Scope JJ 120.1 Aluminum and Copper Compression Connectors (Squeezons)

Figure JJ 120–1: Aluminum-Aluminum or Aluminum-Copper Compression Connectors

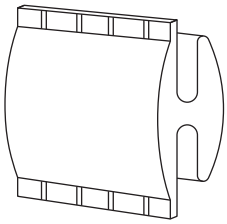

Table JJ 120–1: Aluminum Compression Connectors

Aluminum-Aluminum or Aluminum-Copper Connections			Installation Data			
			Total Crimps Required			
Cable Size		Material Code	MD-6		UT-15	
Side "A" (Run)	Side "B" (Run)		Die	No.	Die	No.
No. 4	No. 4	609-93300	W-O	4		
No. 2, 1/0, 2/0	No. 2, No. 4	609-92500	W-O	5		
1/0, 2/0	1/0, 2/0	609-92609	D_3	5	U-D_3 [1/]	2
4/0	No. 4, No. 2	609-92708	D_3	5	U-D_3 [1/]	2
4/0	1/0, 2/0	609-94605	D_3	7	U-D_3 [1/]	3
4/0	4/0	609-94704	D_3	7	U-D_3 [1/]	3
350 kcmil	No. 4, No. 2, 1/0, 2/0	609-92807			U-N [1/]	2
350 kcmil	4/0	609-95107			U-N [1/]	2
350 kcmil	350 kcmil	609-95206			U-N [1/]	3

[1/] Will fit in UT-15 with adapter die M/C 851-25102.

= For Reference Only

Figure JJ 120–2: Copper Compression Connectors (Squeezons) for Grounding and Bonding Connections in Vaults

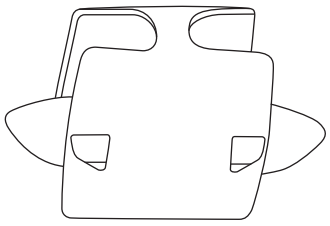

Table JJ 120–2: Copper Compression C onnectors

Copper-Copper Connections			Installation Data					
			Total Crimps Required					
Cable Size		Material Code	MD-6		UT-15		Y-39	
Side "A" (Run)	Side "B" (Run)		Die	No.	Die	No.	Die	No.
2/0-4/0	2/0-4/0	604-78906	D_3	3	U-D_3 [1/]	1	U-D_3	1

[1/] Will fit in UT-15 with adapter die (M/C 851-25102).

Note(s):
1. The UT-15 or Y-39 compression tool is the preferred tool for compressing copper.

JJ 122 Split Sleeve Connector — Cu

Scope JJ 122.1 Split Sleeve Connector — Cu

Figure JJ 122–1: Split Sleeve Connector — Cu

Table JJ 122–1: Split Sleeve Connector — Cu

Conductor	Material: Copper Finish: Smooth — Tinned		Installation Data			
			Y34A Hypress Die Set for Rounding Dies		Y48B Hypress Die Set for Rounding Dies	
Copper Cable	Material Code	Length (in)	Head Die	Ram Die	Head Die	Ram Die
500 kcmil	604-75001	3.00	A34AH	A34AP	—	—
750 kcmil	604-75209	3.50	—	—	C39AH	C39AP
1,000 kcmil	604-75407	4.50	—	—	—	—

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JJ 125 Bar-Type Connector #6 AWG-350 kcmil, Al or Cu

Scope JJ 125.1 Typical Bar-Type Connectors #6 AWG-350 kcmil

Figure JJ 125–1: Typical Bar-Type Connectors #6 AWG-350 kcmil

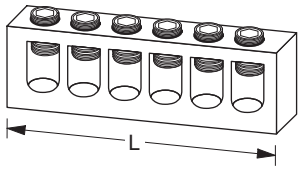


Figure JJ 125–1.1Bar-Type Connector for Use in Pedestals Only

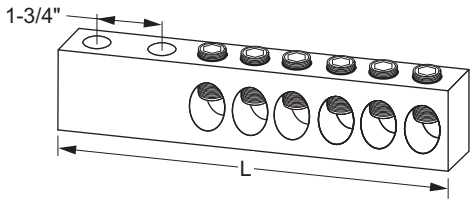


Figure JJ 125–1.2Bar-Type Connector for Use on Spades of 1Ø Pad-Mounted Transformers

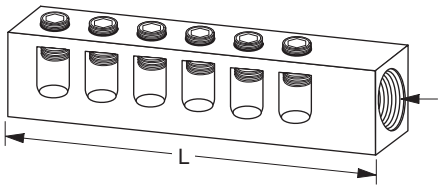


Figure JJ 125–1.3Bar-Type Connector for Use on Threaded Studs of 1Ø Standard Pad-Mounted Transformers

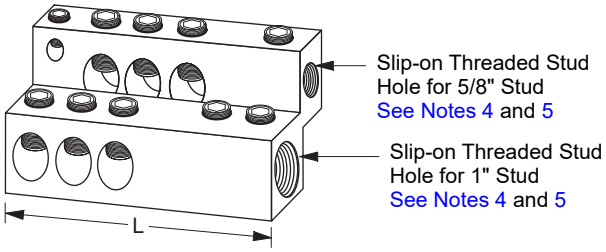


Figure JJ 125–1.4Bar-Type Connector for Use on 5/8" and 1" Threaded Studs of 1Ø Mini-Pad-Mounted Transformers

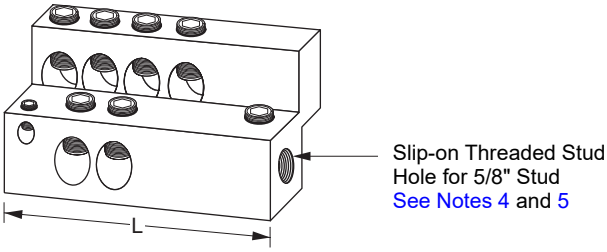


Figure JJ 125–1.5Bar-Type Connector for Use on 5/8" Threaded Studs for 1Ø Mini-Pad-Mounted Transformers

Table JJ 125–1: Material Codes for Typical Bar-Type Connectors #6 AWG-350 kcmil

Material Code	Number of Conductors	Conductor Range	Length (in) (L)	Figure	Maximum Amp per Way	Maximum Amp per Bar	Stud Size
609-89902	6	350-6	5-5/8	JJ 125–1.1	300	720	N/A
609-89209	6	350-6	8-13/16	JJ 125–1.2	300	720	N/A
609-00339	6	350-6	7-5/8	JJ 125–1.3	300	720	5/8"
609-00347	6	350-6	7-3/4	JJ 125–1.3	300	720	1"
609-00388	6	350-6	5-3/8	JJ 125–1.4	300	720	5/8", 1"
609.00537	6	350-6	4-1/4	JJ 125–1.5	300	720	5/8"

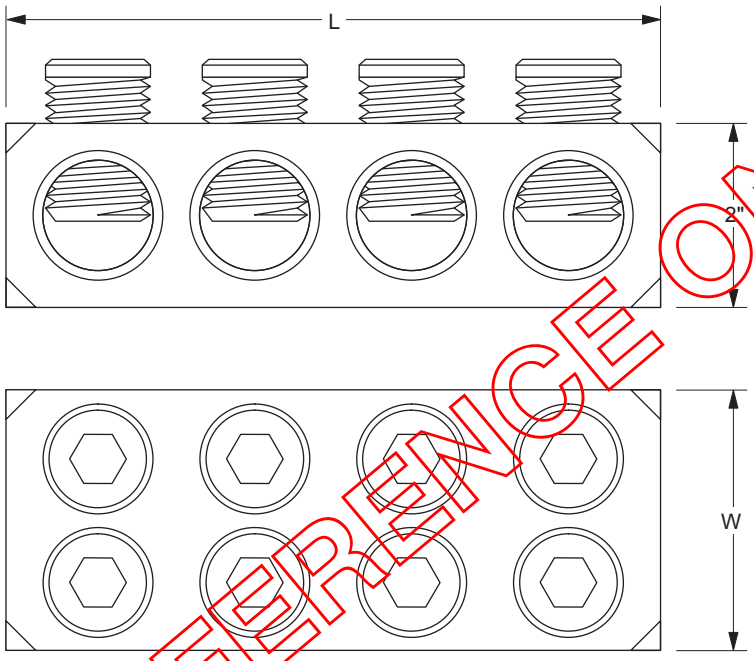
Note(s):

1. These connectors are not recommended for use on secondary leads of BURD transformers.
2. Tighten set screws to 25 foot-pounds to obtain proper torque values, and retighten twice.
3. See TP 115 for installation of Figure JJ 125–1.3 (Sheet 1), Figure JJ 125–1.4 (Sheet 1), and Figure JJ 125–1.5 (Sheet 1) aluminum bar-type connectors to threaded studs of 1Ø pad-mounted transformers.
4. Insulated covers for the "Z" bar connector use M/C 609-00511 for Figure JJ 125–1.4 (Sheet 1) and M/C 609-00404 for Figure JJ 125–1.5 (Sheet 1).
5. The "Z" bar connector is designed to be used with mini-pad-mounted transformers. Mini-pad-mounted transformers are provided with 5/8" or 1" threaded studs. The "Z" bar connector is designed to be slipped over the threaded studs and secured with allen head set screws. This design allows the secondary bar to be disconnected from the transformer for easy transformer changeout.

JJ 126 Bar-Type Connector 750 kcmil Al or Cu

Scope JJ 126.1 Bar-Type Connector 750 kcmil — Aluminum

Figure JJ 126–1: Bar-Type Connector 750 kcmil — Aluminum



This connector is not recommended for use on secondary leads of BURD transformers.

Table JJ 126–1: Bar-Type Connector 750 kcmil — Aluminum

Aluminum or Copper Conductors						
Material Code	Number of Conductors	Conductor Range	Length (in)	Width (in)	Maximum Amp per Way	Maximum Amp per Bar
609-89001	4	750–500	5-9/16	2-7/16	600	1,200

FOR REFERENCE ONLY

Note(s):
1. Tighten set screws and retighten twice at intervals of 3 to 5 minutes.

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JJ 130 Insulating End Cap

Scope JJ 130.1 Insulating End Cap (for use in Endbells on 5 kV to 16 kV PILC Cable)

Figure JJ 130–1: Insulating End Cap

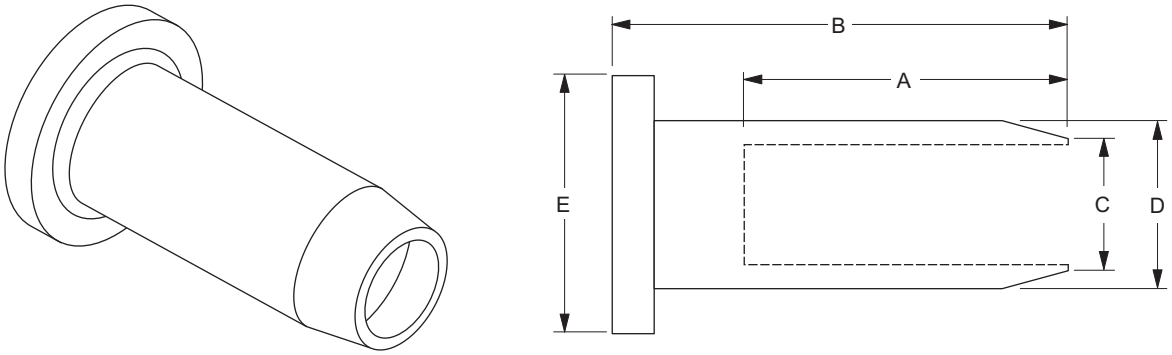

Table JJ 130–1: Insulating End Cap — Dimensions

End Cap Material Code	A (in)	B (in)	C (in)	D (in)	E (in)
655-01538	3.0	4.1	1.04	1.5	2.35
655-01546	3.0	4.1	1.54	1.5	2.35

Table JJ 130–2: Insulating End Cap — Applications

Cable Insulation and Voltage		End Cap Material Code	
		655-01538: Will Fit Cable Sizes:	655-01546: Will Fit Cable Sizes:
PILC	5 kV 12 kV 16 kV	#2 through 500 kcmil	350 through 500 kcmil

Note(s):
1. See JJ 350 for installation instruction.

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JJ 150 Tapes, Braids, Solvents, and Accessories

Scope JJ 150.1 Tapes, Braids, Solvents, and Accessories

Table JJ 150–1: Tapes, Braids, Solvents, and Accessories

Trade Name	Dimensions	Material Code	Description
Aqua Seal/Electro Seal	3-3/4" × 10' × 1/8"	645-28201	Electrical and Water Insulation
Bishop #53	3"	646-00034	Fireproofing all Cables & Splices
Varnished Cambric	1/2" × 4 yd	646-95703	Up to 16 kV PILC Splices — Insulating (Replaces Fibermat Black #3)
Varnished Cambric	1" × 18 yd	646-95901	Up to 16 kV PILC splices — Insulating (Replaces Fibermat Black #3)
High-Voltage Insulating Tape	3/4"	647-31003	Up to 34.5 kV CLP Splices — Self-Fusing Rubber
High-Voltage Insulating Tape	1"	647-31102	Up to 34.5 kV CLP Splices — Self-Fusing Rubber
High-Voltage Insulating Tape	1-1/2"	647-31201	Up to 34.5 kV CLP Splices — Self-Fusing Rubber
High-Voltage Silicone Rubber Tape	1"	646-85605	Up to 16 kV PILC to CLP Splices — Semiconducting
Scotch #13	3/4"	656-69608	Up to 34.5 kV CLP Splices — Semiconducting
Shielding Tape (Braid)	1"	656-69202	PILC and CLP Splices — Shielding
Bonding Braid (Beldon)	—	576-96106	Bonding and Grounding of PILC Sheaths
Scotch #33	3/4"	646-72108	Up to 34.5 kV CLP Splices — Jacketing
Electrical Tape, Vinyl	3/4"	646-72009	600-Volt Cable
Scotch #35 (White Vinyl)	3/4"	646-72207	Marking Tape (Used when preparing cable for premolded components)
Scotchkote Electrical Coating	—	656-52620	Oilstop
Friction Tape	3/4"	646-31005	General Purpose
Fiberglass Tape	1"	646-42002	Reinforcement of Lead Sleeves
Glass Cordage (Oiled)	—	645-43002	PILC Splices — Between Connector and Insulation
Sandpaper, Al Oxide, 100 Grit	1-1/2" × 50 yd	057-24208	Poly-Splicing
Sandpaper, Al Oxide, 240 Grit	1-1/2" × 50 yd	057-24703	Poly-Splicing
Splice Master — Ecolink	55 gal.	898-01344 898-01914	Cable Insulation Cleaner[1/] Cable Insulation Cleaner[1/]
Splice Master — Ecolink	Pel-Pac Kit	898-02334	Cable Insulation Cleaner (3 Towellettes)
Polywater, Solvent Wipe, Type TR	8" × 12"	898-04124	General purpose solvent wipe for cleaning cable insulation

[1/] Check price difference.

= For Reference Only

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JJ 152 Filling Compounds

Scope JJ 152.1 Filling Compounds

Table JJ 152–1: Filling Compounds

Trade Name	Manufacturer or Vendor	For Use In	Recommended MIN and MAX Pouring Temp. (degrees)	Material Code
Novoid X[1/]	G&W Electric	PILC Splices & Potheads	275–320	645-28003
Vinsol[1/]	Rusgreen	PILC Splices & Potheads	275–320	645-28003
Novoid 217 (or X 92)	G&W Electric	Polyethylene Insulated Cable Splices or Terminals	275–320	645-28102

[1/] Novoid X and Vinsol compounds may be intermixed when required.

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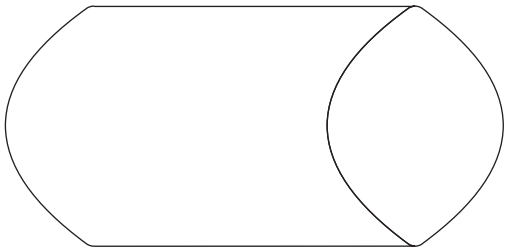
JJ 160 Heat Shrink Splice Sleeves

Scope JJ 160.1 Heat Shrinkable Splicing Sleeves for Splicing and Terminating 600V CLP and Rubber-Like Insulated Cables Only

Figure JJ 160–1: Heat Shrinkable Splice Sleeve



NOTE: Internal surface is completely coated with adhesive.

Table JJ 160–1: Heat Shrinkable Splicing Sleeve

Material Code	Nominal Length (in)	Minimum Expanded I.D. (in)	Maximum Recovered I.D.	Nominal Recovered Wall (in)	Cable Size
656-52901	6	1.2	.300	.170	#2 to 350
656-53107	9	2.0	.650	.170	350 to 750

Note(s):
1. The smallest cable to be used must be this dimension or larger. Otherwise the joint may not seal properly.
2. Only the sleeves shown here are to be used for splice insulation. Other sleeves have thinner walls.
3. See JJ 162 for cold applications.

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JJ 162 600 V Secondary Splice Sleeves — 3M, Homac, and Raychem

Scope JJ 162.1 Splicing Sleeves for Splicing and Terminating 600 V CLP and Rubber-Like Cable

Figure JJ 162–1: 3M Cold Shrinkable Splicing Sleeve

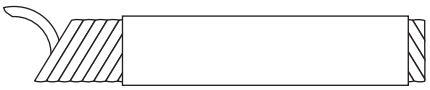

Figure JJ 162–2: 2-Piece Homac Splice Cover

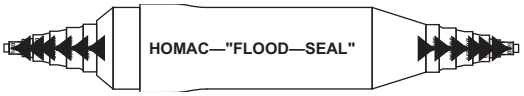

Table JJ 162–1: 600 V Secondary Splice Sleeves — 3M and Homac

SAP Number	Cable Size	Use Range (in)			Typical Cable O.D. (in)
		3M—Cold Shrink		Homac Catalog Number	
		MIN[1/]	MAX		
10117825	#8—1/0	0.10	0.82		0.266
10117821	#2—1/0	0.39	0.70		0.412
10118090	#8—2/0	N/A	N/A	FSS 20	0.533
10117824	2/0—4/0	0.51	1.00		0.578
10118089	#8—350	N/A	N/A	FSS 350	0.688
10117822	350 kcmil	0.69	1.30		0.871
10117838	700 kcmil	0.95	1.90		1.184
10117894	#2—1,000	N/A	N/A	FSS 1,000	1.337
10117823	CIC Duct	1.16	2.67	N/A	N/A

[1/] The smallest cable to be used must be this dimension or larger.

= For Reference Only

Note(s):

1. If there are severe irregularities in the insulation, use Scotchkote Electrical Coating SAP 10118091 over cable insulation before applying splice.

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JJ 164 Raychem Wraparound Sleeve Repair/Sealing Kit

Scope JJ 164.1 Shows Raychem GelWrap Sleeve Repair/Sealing Kit Information

1.0 Application

These kits are used for repairing cracks and splits in secondary cable, including direct buried, and in sealing secondary connectors in wet or congested structures. These “wraparound” sleeves may be installed without cutting the cable or disturbing the connector. The silicone gel seals on contact. The sleeve has been material coded in two sizes: 6 inch and 10 inch. The 6 inch is for cable repair, while the 10 inch may be used for cable repair or for sealing connectors.

Table JJ 164–1: Raychem GelWrap Sleeve Repair/Sealing Kit Application

Material Code	Raychem Part #	Installation Range	Nominal Length
656-01601	GelWrap-33/10-150	#2 AWG—500 kcmil	6"
656-01627	GelWrap-33/10-250	#2 AWG—500 kcmil	10"

2.0 Installation Instructions

A minimum seal length is required on each side of the cable damage or connector. For the 6" sleeve, the damaged length is limited to 2"; for the 10" sleeve, the damaged cable or connector length is limited to 6".

Use a clean rag to clean and wipe dry the section of the cable to be covered, then follow the instructions below.

Figure JJ 164–1: Raychem GelWrap Sleeve Repair/Sealing Kit Installation Instructions

1. Center GelWrap sleeve over the connector (or damaged cable), leaving at least 2" at both ends.

2. Wrap sleeve around connector (or damaged cable) and shut snap locks over entire length of sleeve.

3. Install cable ties at outermost notches of snap lock. Splice is complete.

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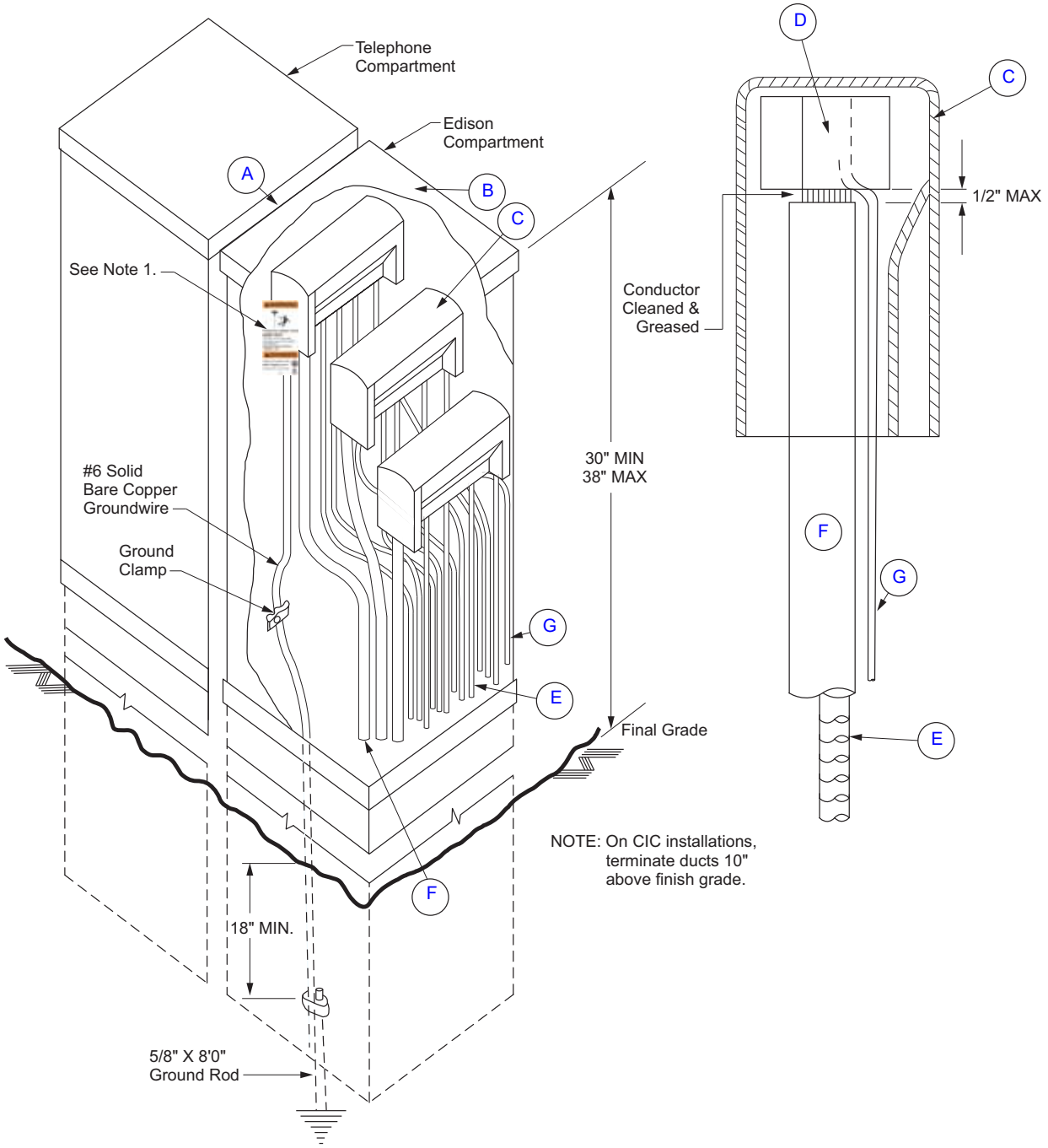
JJ 200 Service Pedestal Secondary Connections

Scope JJ 200.1 Service Pedestal Secondary Connections

Figure JJ 200–1: Joint Service Pedestal



Note(s):

1. See DUG CR 150 for riser conduit warning label SAP code. Label should be installed on the SCE side of the pedestal, near the top, and on a smooth service.

Table JJ 200–1: Joint Service Pedestal

Item	Description	Quantity	Material Code
A	Post (Not shown)	1	656-18001
B	Electrical Compartment	1	656-19009
C	Insulating Cap		655-31840
D	Connector	3	609-89902
E	Service Cables	As Req'd.	
F	Secondary Cables	As Req'd.	
G	Streetlight Conductor	As Req'd.	592-22000

Note(s):
1. On CIC installations, terminate ducts 10 inches above finish grade.

JJ 210 Plastic Handhole Secondary Connections

Scope JJ 210.1 Plastic Handholes for use with CIC and DB Distribution

Figure JJ 210–1: Plastic Handhole (M/C 655-47903)

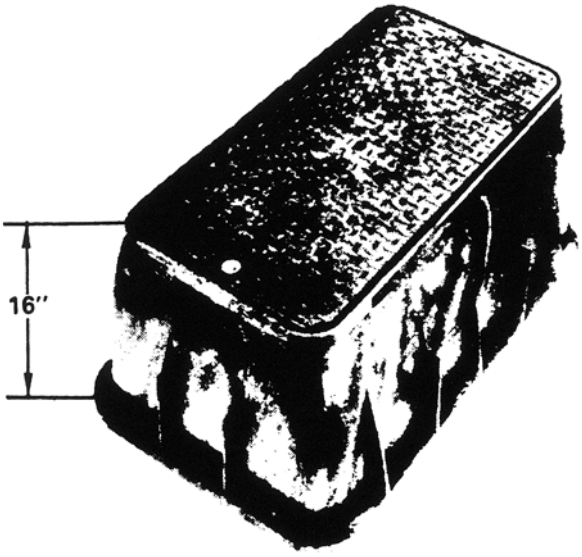
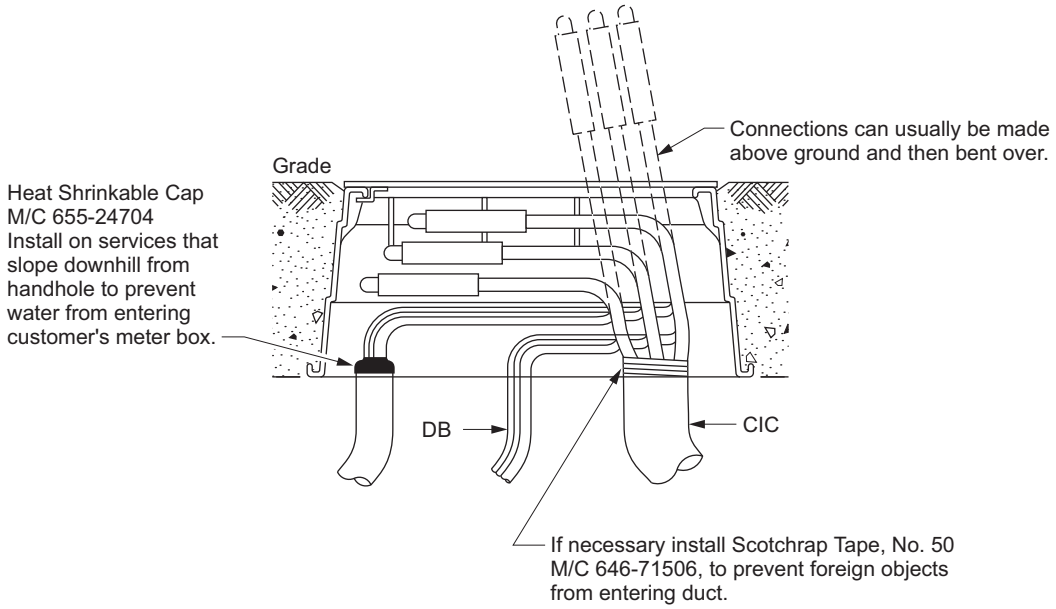


Figure JJ 210–2: Handhole Installation



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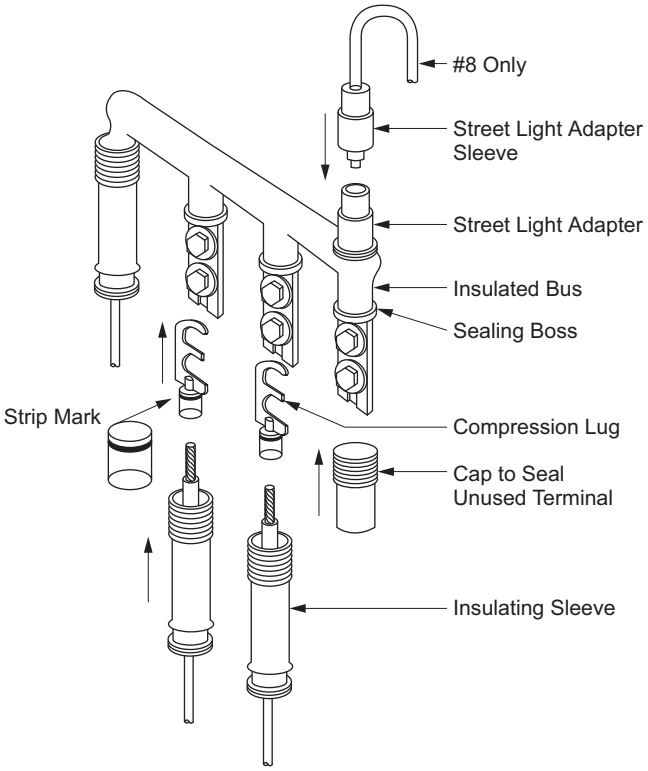
JJ 220 Secondary Connections — Insulated Bar — (Handhole)

Scope JJ 220.1 Secondary and Service Connections — Insulated Bus

1.0 Application

These connectors are to be used to connect aluminum cables (350 kcmil maximum) in handholes, pullboxes, and so forth.

Figure JJ 220–1: Secondary and Service Connections — Insulated Bus (Expanded Illustration for Assembly)



2.0 Instructions

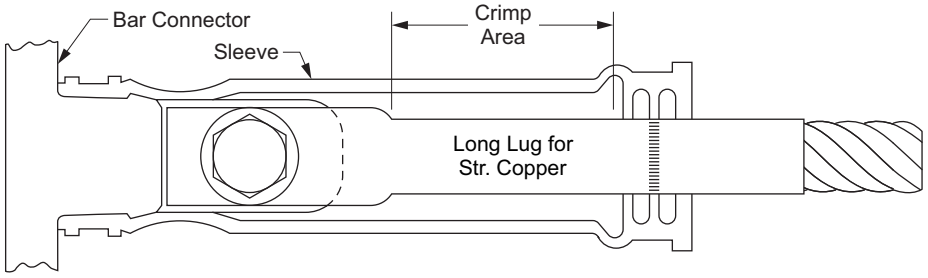
2.1 Lubricate insulating sleeves by applying a small amount of the supplied lubricant to the inside of sleeves at both the large open end which assembles to the connector body and the opposite end which is installed over the conductor.

2.2 Select the proper lug and sleeve. Slide the insulating sleeves down on the conductors before stripping the insulation or compressing the lugs.

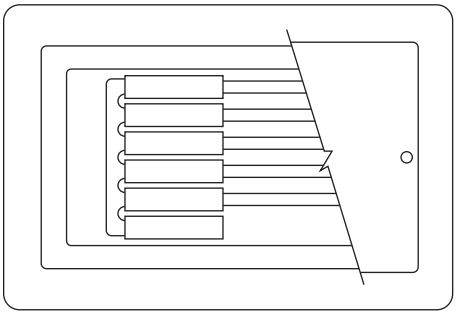
2.3 Remove insulation from cable using the strip mark shown on the lugs as a guide. Crimp lugs on conductors.

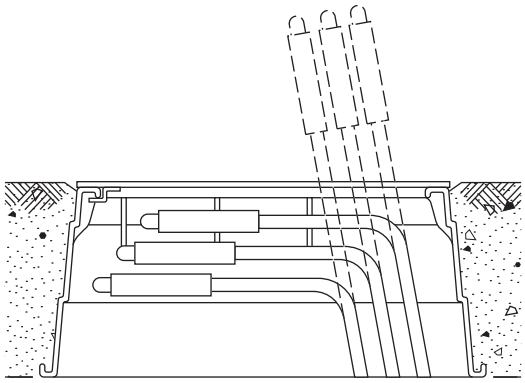
2.4 Bolt lugs to bus and slide the insulating sleeves over lug connection and onto the insulated sealing boss of the bus. To assure maximum seal, the sleeves should be pushed as far as they will go over the boss.

2.5 Unused terminals must be sealed with a sealing cap (M/C 659-26107). If the streetlight position is not used, the plug must not be removed from the wire end of the streetlight adapter sleeve.



2.6 The long copper lug for bare copper wire must be crimped only in area as shown on lug to provide a proper seal.





2.7 When all sleeves are in the final position, bend cables down into handhole as shown and install cover.

Table JJ 220–1: Secondary and Service Connections — Insulated Bus — Installation Data

	Circular Crimps					
	MD-6 Hypress		UT-15 Hypress		Y-39	
Conductor	Die	No.	Die	No.	Die	No.
#4 Al	W-K840	4				
#2 Al						
1/0 Al						
2/0 Al						
4/0 Al						
350 Al			15C96R	3	15CA96R[1/]	3
2/0 Cu	W-241	#				
4/0 Cu	BG	3	15CA54R[1/]	3	15CA54R	3

[1/] Will fit in UT-15 with adapter die M/C 851-25102.

3.0 Selection of Component Parts

The selection of the pre-insulated bus should be determined by the number of conductors. Since replacement of this pre-insulated bus is an easy task, buses should not be selected to provide for spare terminals. The minimum size bus should be used.

Figure JJ 220–2: Component Parts Pre-Insulated Bus

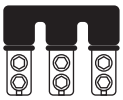


Figure JJ 220–2.1

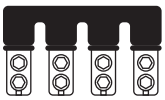


Figure JJ 220–2.2

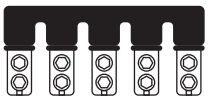


Figure JJ 220–2.3

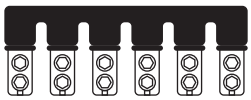


Figure JJ 220–2.4

Table JJ 220–2: Component Parts — Pre-Insulated Bus

Material Code	Figure	No. of Terminals 2-Bolt	Includes Streetlight Terminals
659-20050	Figure JJ 220–2.1	3	No
659-21074		3	Yes
659-20506	Figure JJ 220–2.2	4	No
659-21504		4	Yes
659-20555	Figure JJ 220–2.3	5	No
659-21553		5	Yes
659-20605	Figure JJ 220–2.4	6	No
659-21603		6	Yes

Figure JJ 220–3: Component Parts — Lug and Sleeve Kit for 2-Bolt Terminals

Figure JJ 220–3.1

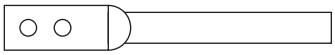


Figure JJ 220–3.2

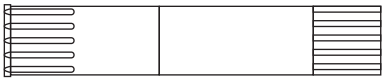


Figure JJ 220–3.3

Table JJ 220–3: Component Parts — Lug and Sleeve Kit for 2-Bolt Terminals

Material Code	Conductor	Figure	
		Lug	Sleeve
659-38201	#4 Al	Figure JJ 220–3.1	Figure JJ 220–3.3
659-38300	#2 Al	Figure JJ 220–3.1	Figure JJ 220–3.3
659-38409	1/0 Al	Figure JJ 220–3.1	Figure JJ 220–3.3
659-38508	2/0 Al	Figure JJ 220–3.1	Figure JJ 220–3.3
659-38607	4/0 Al	Figure JJ 220–3.1	Figure JJ 220–3.3
659-38706	350 Al	Figure JJ 220–3.1	Figure JJ 220–3.3
659-35009	2/0 Cu	Figure JJ 220–3.2	Figure JJ 220–3.3

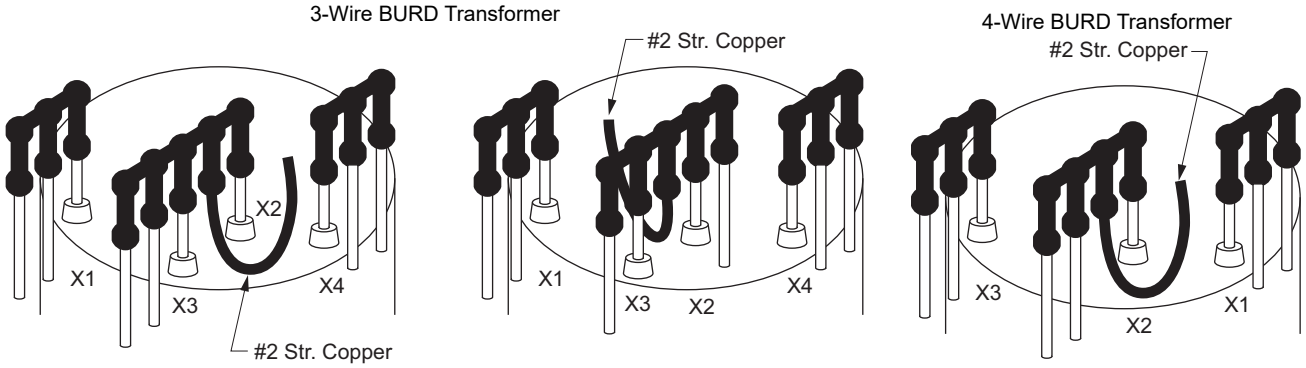
JJ 221 Secondary Connections — Insulated Bar — (BURD TR)

Scope JJ 221.1 Secondary Connections for BURD Transformers

1.0 Application

These connectors are used to connect aluminum cables to the secondary leads on BURD transformers.

Figure JJ 221–1: Typical Connection



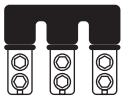


Figure JJ 221–1.1

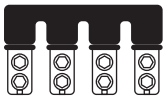


Figure JJ 221–1.2

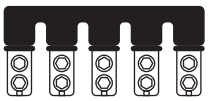


Figure JJ 221–1.3

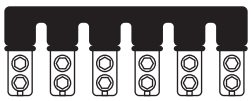


Figure JJ 221–1.4

Figure JJ 221–1.5

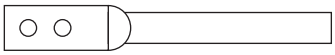


Figure JJ 221–1.6

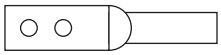


Figure JJ 221–1.7

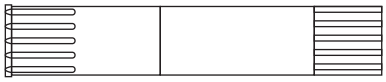


Figure JJ 221–1.8

Table JJ 221–1: BURD Transformers — Pre-Insulated Bus

Material Code	Figure	Number of Terminals 2-Bolt	Includes Streetlight Terminals
659-20050	Figure JJ 221–1.1	3	No
659-21074		3	Yes
659-20506	Figure JJ 221–1.2	4	No
659-21504		4	Yes
659-20555	Figure JJ 221–1.3	5	No
659-21553		5	Yes
659-20605	Figure JJ 221–1.4	6	No
659-21603		6	Yes

Table JJ 221–2: BURD Transformers — Lug and Sleeve Kit for 2-Bolt Terminals

Material Code	Conductor	Figure	
		Lug	Sleeve
659-38201	#4 Al	Figure JJ 221–1.5	Figure JJ 221–1.8
659-38300	#2 Al		
659-38409	1/0 Al		
659-38508	2/0 Al		
659-38607	4/0 Al		
659-38706	350 Al		
659-35009	2/0 Cu		

Table JJ 221–3: BURD Transformers — Individual Copper Lugs and Sleeves for 2-Bolt Terminals

Lugs			Sleeves	
Material Code	Conductor	Figure	Material Code	Figure
659-34507	#2 Cu	Figure JJ 221–1.6	659-63308	Figure JJ 221–1.8
659-34903	2/0 Cu	Figure JJ 221–1.7	659-63407	
659-35306	4/0 Cu		659-63407	
659-35504	500 Cu		659-63605	

2.0 Assembly Procedure

2.1 Grease transformer cables using grease supplied with connectors. Slip proper sleeves over transformer cables. Install copper lugs.

CAUTION Copper lugs must be installed so the bar connector can be attached to the lugs in the desired position. The long copper lug for #2 strand bare copper wire must be crimped only in area as shown to provide a proper seal.

2.2 Arrange secondary cables and cut to length. Grease the cables. Slip proper sleeves over cables. Install the aluminum lugs on cables.

2.3 Position sleeves as shown. Sleeves must extend over raised portion of bar connector to provide an adequate seal. If any position on the bar connector is not used, a cap (M/C 659-26107) must be placed over the unused position on the bar.

Figure JJ 221–2: Assembly Procedure

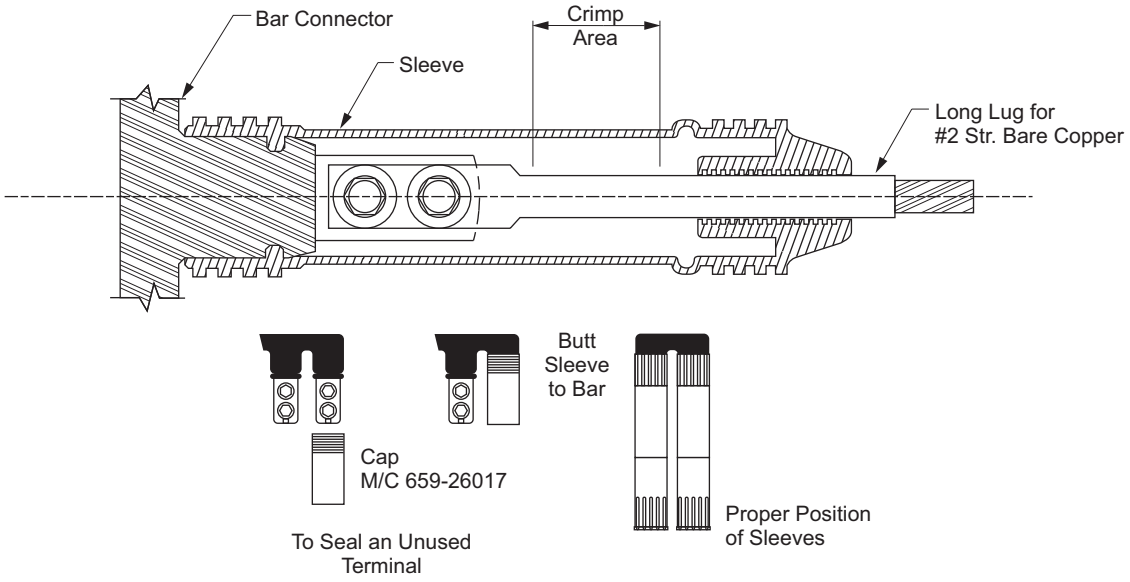


Table JJ 221–4: BURD Transformers — Installation Data

Conductor	Circular Crimps					
	MD-6 Hypress		UT-15 Hypress		Y-39	
	Die	No.	Die	No.	Die	No.
#4 Al	W-K840	4				
#2 Al						
1/0 Al						
2/0 Al						
4/0 Al						
350			15C96R	3	15CA96R[1/]	3
#2 Cu	W-162	3				
2/0 Cu	W-241	3				
4/0 Cu	BG	3	15CA54R[1/]	3	15CA54R	3
500 kcmil Cu			15CA87R[1/]	3	15CA87R	3

[1/] Will fit in UT-15 with adapter die M/C 851-25102.

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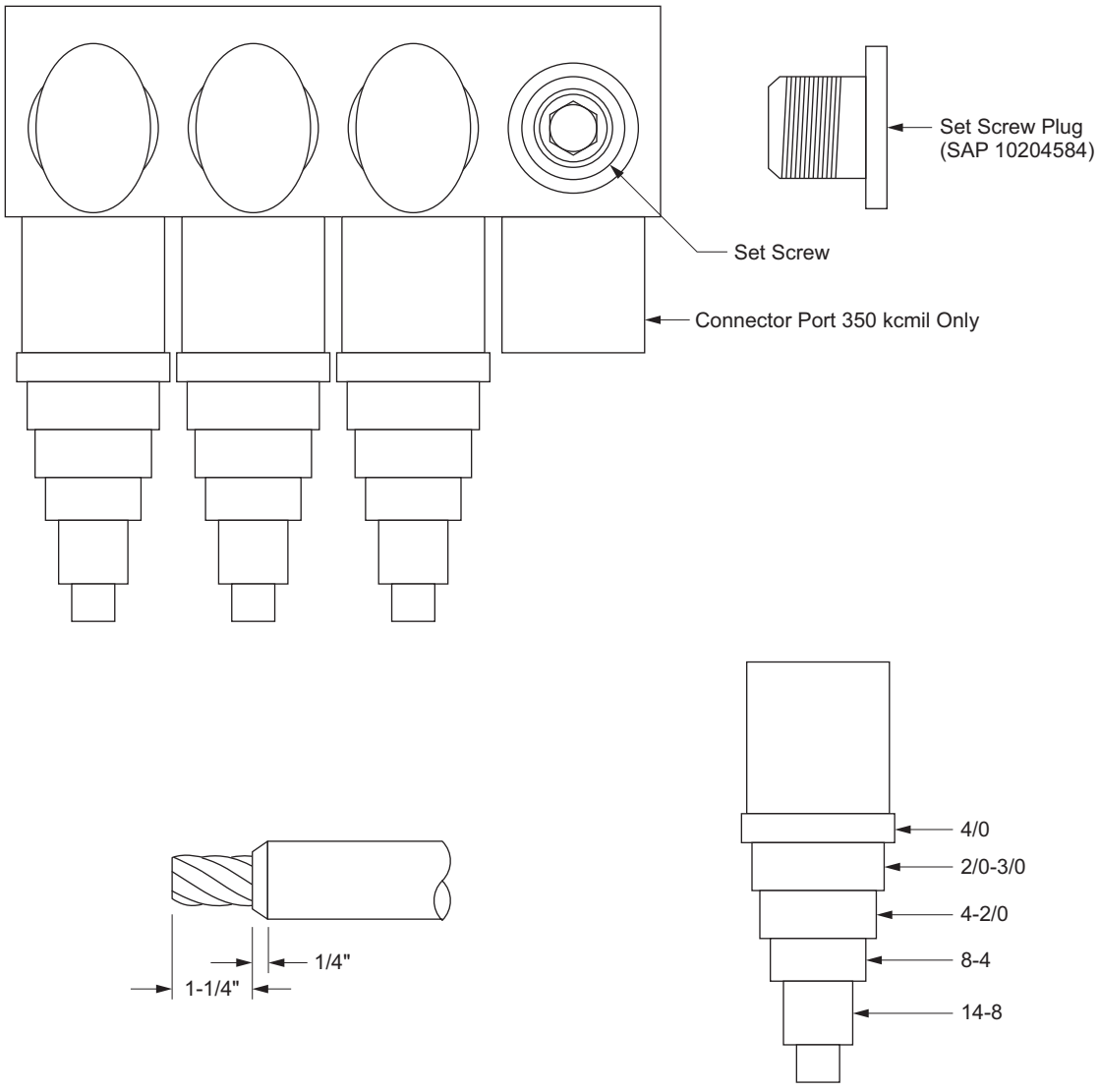
JJ 230 Service-Secondary-Transformer Connections — Homac

Scope JJ 230.1 Service-Secondary-Transformer Connections — Homac

1.0 Application

These connectors are used to connect aluminum cables (#8 to 350 kcmil) and copper cables.

Figure JJ 230–1: Service-Secondary-Transformer Connections — Homac



4-Way	SAP 10118162
6-Way	SAP 10118163
8-Way	SAP 10118164

2.0 Instructions

2.1 Prepare cable as shown in Figure JJ 230–1 (Sheet 1).

2.2 Remove cable adapters and set screw plugs from positions to be used and back off set screws completely. Any unused connector port must have a cable adapter installed to provide insulation and sealing.

2.3 Cut adapters at the appropriate “O” ring as shown in Figure JJ 230–1 (Sheet 1).

2.4 Position adapters over insulated cables (#8 TO 4/0 CABLES ONLY). Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

2.5 Push cable with adapter into connector port until conductor end contacts backing plate inside connector.

For installing a copper ground, follow steps 2.6 to 2.9, to prevent water intrusion into the copper wire strands and seal the service-secondary transformer connection.

Otherwise, tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque values. Retighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor strands. Re-insert set screw plugs.

2.6 Install a copper compression, straight shank (short or long) cable terminal onto the copper ground. See Table TP 101 (Sheet 1). Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

If the copper ground is insulated, remove a minimum of 2 inches of insulation to install the cable terminal directly onto the copper ground wire.

2.7 Push the copper ground, with cable terminal connected, into an adapter that has been cut at the appropriate “O” ring as shown in Figure JJ 230–1 (Sheet 1), for proper sealing.

2.8 Push the copper ground, with cable terminal and adapter connected, into connector post until it makes contact with the backing plate inside the connector.

2.9 Tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque valves. Re-tighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor strands. Re-insert set screw plugs.

Note(s):
1. Verify that adapters and set screw plugs are fully inserted.
2. Cable adapters must be used on all sizes of cable except 350 kcmil. Discard the adapter when 350 kcmil cable is used.

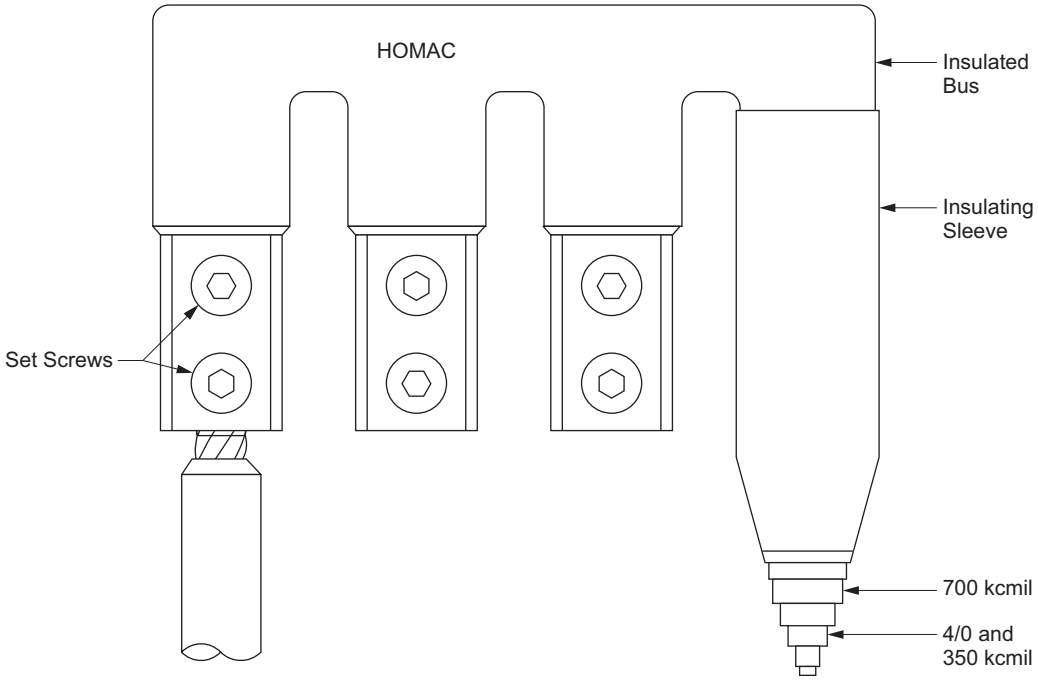
JJ 235 Service-Secondary-Transformer Connections — Homac

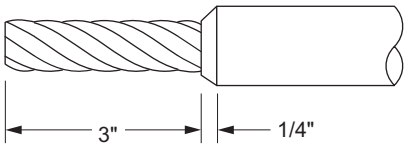
Scope JJ 235.1 Service-Secondary-Transformer Connections — Homac

1.0 Application

These multi-tap insulated connectors shall be used for splicing 600V aluminum or copper cables (4/0–700 kcmil maximum)

Figure JJ 235–1: Service-Secondary-Transformer Connections — Homac





4 Way	M/C 659-00029
6 Way	M/C 659-00011

2.0 Instructions

2.1 Remove the insulation from the cable as shown in Figure JJ 235–1 (Page JJ-1). The edge of the insulation must be beveled.

2.2 Cut insulating sleeves at the appropriate “O” ring as shown in Figure JJ 235–1 (Page JJ-1).

2.3 Lubricate the cable insulation with the silicone grease provided, or Edison approved silicone grease M/C 904-00615.

2.4 Slide the insulating sleeve over the cable, and remove the insulation as shown in Figure JJ 235–1 (Page JJ-1).

2.5 Insert the conductor into the set screw terminal, and tighten the set-screws to a minimum of 25 foot-pounds, to attain the proper torque values. **Retighten all set screws twice.**

2.6 Slide the insulating sleeve over the cable so that sleeves butt against connector bar.

Note(s):
1. To provide insulation and sealing, any unused terminal must have an insulated sleeve installed.
2. Do not apply silicone grease to the inside of the insulated sleeve where it mates with the insulated bus.

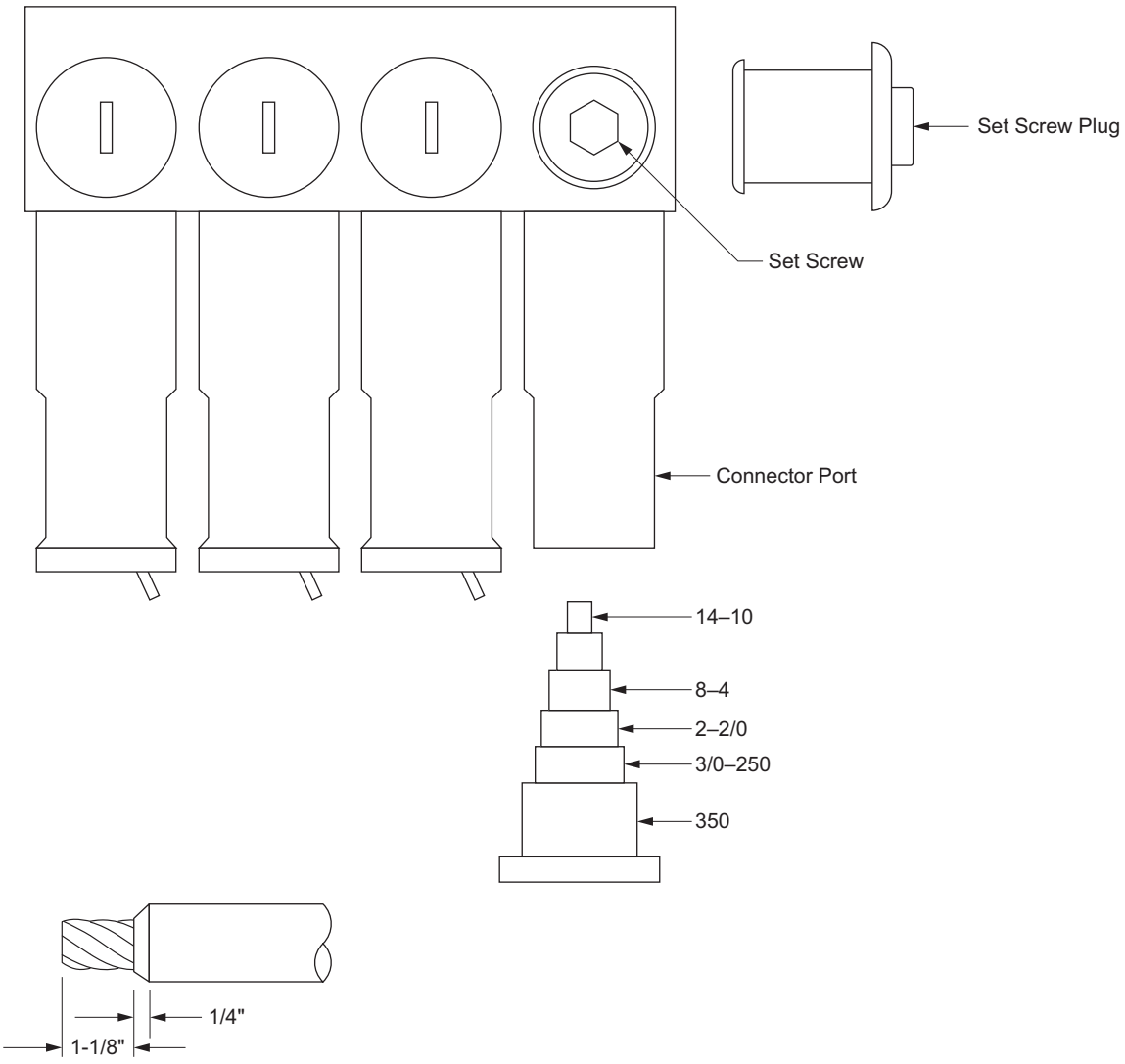
JJ 240 Service-Secondary-Transformer Connections — Thomas & Betts — Elastimold

Scope JJ 240.1 Service-Secondary-Transformer Connections — Thomas & Betts — Elastimold

1.0 Application

These connectors are used to connect aluminum cables (#8 to 350 kcmil) and copper cables.

Figure JJ 240–1: Service-Secondary-Transformer Connections — Thomas & Betts — Elastimold



4 Way	SAP 10118162
6 Way	SAP 10118163
8 Way	SAP 10118164

Note(s):
1. Use the conductor port without cable adapter for wire sizes from 250–350 kcmil.

2.0 Instructions

2.1 Prepare cable as shown in Figure JJ 240–1 (Sheet 1). The insulation strip mark on the back of the bus can be used as a guide.

2.2 Remove cable adapters and set screw plugs from positions to be used and back off set screws completely. Any unused connector port must have a cable adapter installed to provide insulation and sealing.

2.3 Cut adapters at the appropriate “O” ring as shown in Figure JJ 240–1 (Sheet 1).

2.4 Position adapters over insulated cables. Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

2.5 Push cable with adapter into connector port until conductor end contacts backing plate inside connector.

2.6 Slide cable adapters into outlets until fully interlocked.

For installing a copper ground, follow steps 2.7 to 2.10, to prevent water intrusion into the copper wire standards and seal the service-secondary transformer connection.

Otherwise, tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque values. Re-tighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor strands. Re-insert set screw plugs.

2.7 Install a copper compression, straight shank (short or long) cable terminal onto the copper ground. See Table TP 101–1 (Sheet 1). Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

If the copper ground is insulated, remove a minimum of 2 inches of insulation to install the cable terminal directly onto the copper ground wire.

2.8 Push the copper ground, with cable terminal connected, into an adapter that has been cut at the appropriate “O” ring as shown in Figure JJ 240–1 (Sheet 1), for proper sealing.

2.9 Push the copper ground, with cable terminal and adapter connected, into connector post until it makes contract with the backing plate inside the connector.

2.10 Tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque valves. Re-tighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor stands. Re-insert set screw plugs.

Note(s):
1. Verify that adapters and set screw plugs are fully inserted.
2. Cable adapters must be used on all sizes of cable except 350 kcmil. Discard the adapter when 350 kcmil cable is used.

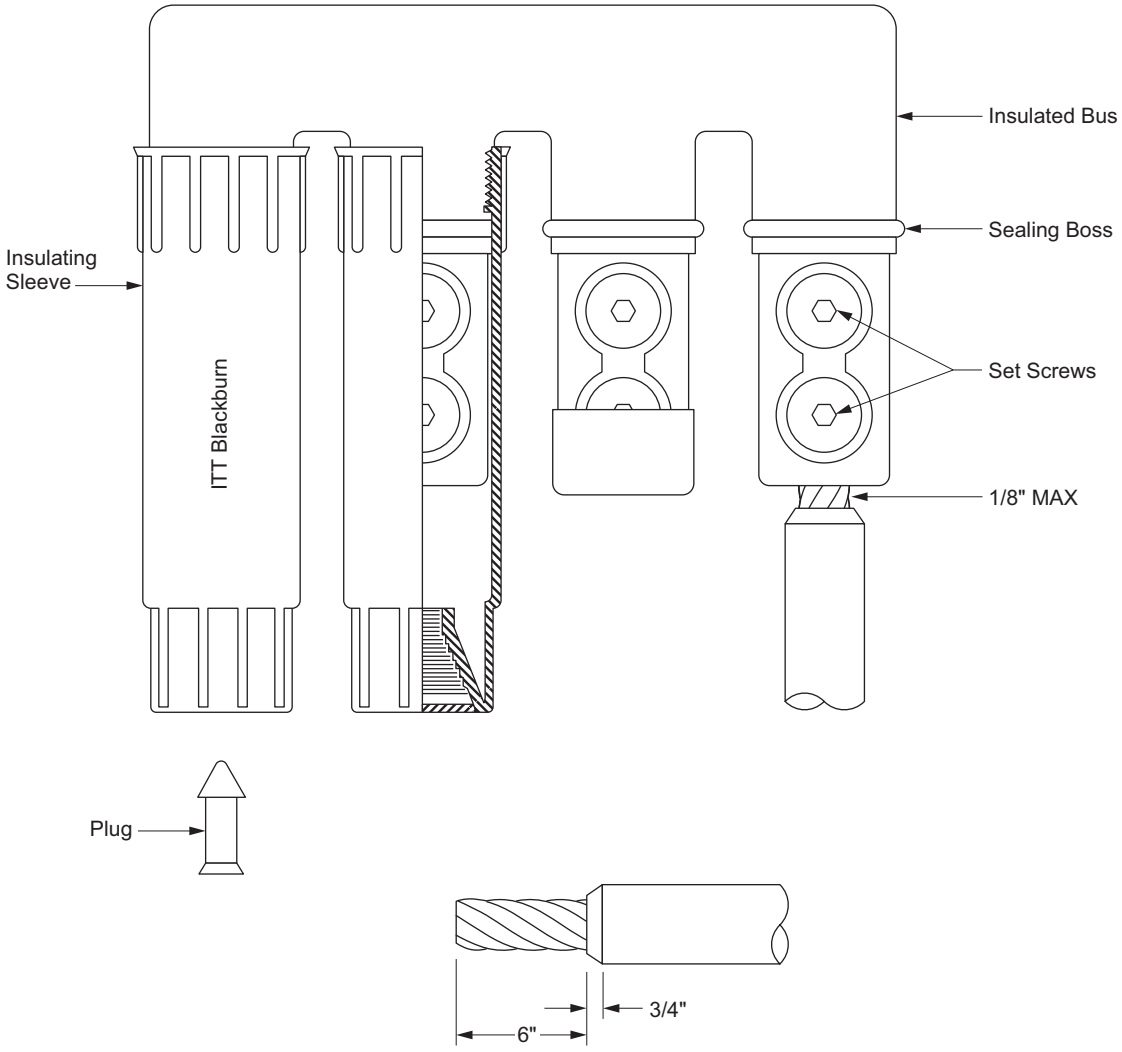
JJ 245 Service-Secondary-Transformer Connections — ITT Blackburn

Scope JJ 245.1 Service-Secondary-Transformer Connections — ITT Blackburn

1.0 Application

These multi-tap insulated connectors shall be sued for splicing 600V aluminum or copper cables (4/0–700 kcmil).

Figure JJ 245–1: Service-Secondary-Transformer Connections — ITT Blackburn



4 Way	M/C 659-00029
6 Way	M/C 659-00011

2.0 Instructions

2.1 Remove the insulation as shown in Figure JJ 245–1 (Sheet 1). The edge of the insulation must be beveled.

2.2 Lubricate the inside ribbed surface at both ends of the sealing sleeve and slide the sleeve over the cable. Use only silicone grease provided, or Edison approved silicone grease M/C 904-00615.

2.3 Slide the insulating sleeve over the cable, and remove the insulation as shown in Figure JJ 245–1 (Sheet 1).

2.4 Insert the connectors into the set screw terminal, and tighten the set-screws to a minimum of 25 foot-pounds, to attain the proper torque values. **Retighten all set screws twice.**

2.5 Slide the insulating sleeve over the connector sealing boss all the way to insulated bus or as far as possible.

Note(s):
1. To provide insulation and sealing, any unused terminal must have an insulated sleeve installed with a plug.

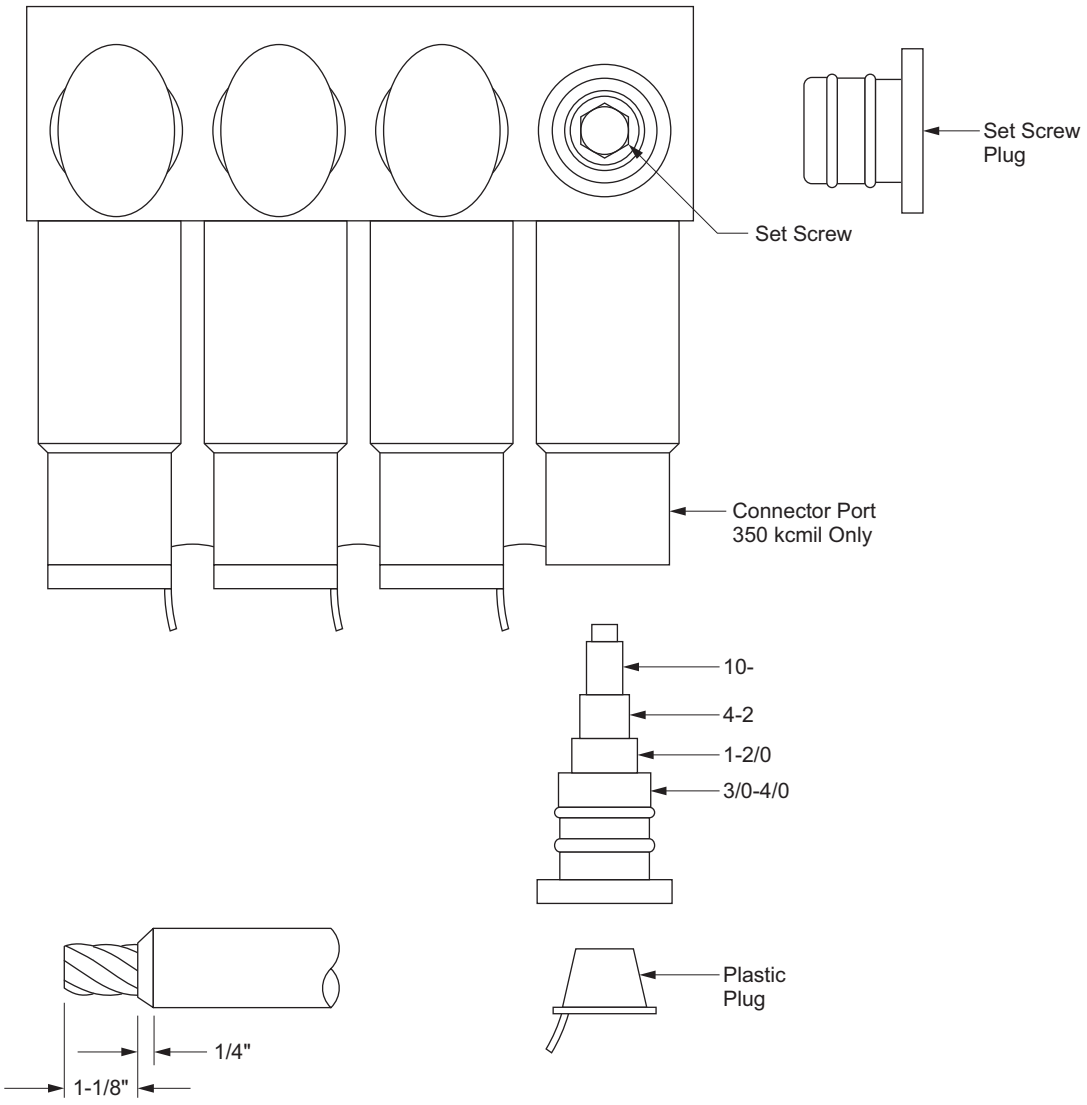
JJ 250 Service-Secondary-Transformer Connections — Utilco

Scope JJ 250.1 Service-Secondary-Transformer Connections — Utilco

1.0 Application

These connectors are used to connect aluminum cables (#8 to 350 kcmil) and copper cables.

Figure JJ 250–1: Service-Secondary-Transformer Connections — Utilco



4 Way	SAP 10118162
6 Way	SAP 10118163
8 Way	SAP 10118164

2.0 Instructions

2.1 Prepare cable as shown in Figure JJ 250–1 (Sheet 1). The insulation strip mark on the back of the bus can be used as a guide.

2.2 Remove cable adapters and set screw plugs from positions to be used and back off set screws completely. Any unused connector port must have a cable adapter installed to provide insulation and sealing.

2.3 Cut adapters at the appropriate “O” ring as shown in Figure JJ 250–1 (Sheet 1).

2.4 Position adapters over insulated cables (#8 TO 4/0 CABLES ONLY). Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

2.5 Push cable with adapter into connector port until conductor end contacts backing plate inside connector.

For installing a copper ground, follow steps 2.6 to 2.9, to prevent water intrusion into the copper wire stands and seal the service-secondary transformer connection.

Otherwise, tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque values. Re-tighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor strands. Re-insert set screw plugs.

2.6 Install a copper compression, straight shank (short or long) cable terminal onto the copper ground. See Table TP 101–1 (Sheet 1). Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

If the copper ground is insulated, remove a minimum of 2 inches of insulation to install the cable terminal directly onto the copper ground wire.

2.7 Push the copper ground, with cable terminal connected, into an adapter that has been cut at the appropriate “O” ring as shown in Figure JJ 250–1 (Sheet 1), for proper sealing.

2.8 Push the copper ground, with cable terminal and adapter connected, into connector post until it makes contact with the backing plate inside the connector.

2.9 Tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque valves. Re-tighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor strands. Re-insert set screw plugs.

Note(s):
1. Verify that adapters and set screw plugs are fully inserted.
2. Cable adapters must be used on all sizes of cable except 350 kcmil. Discard the adapter when 350 kcmil cable is used.

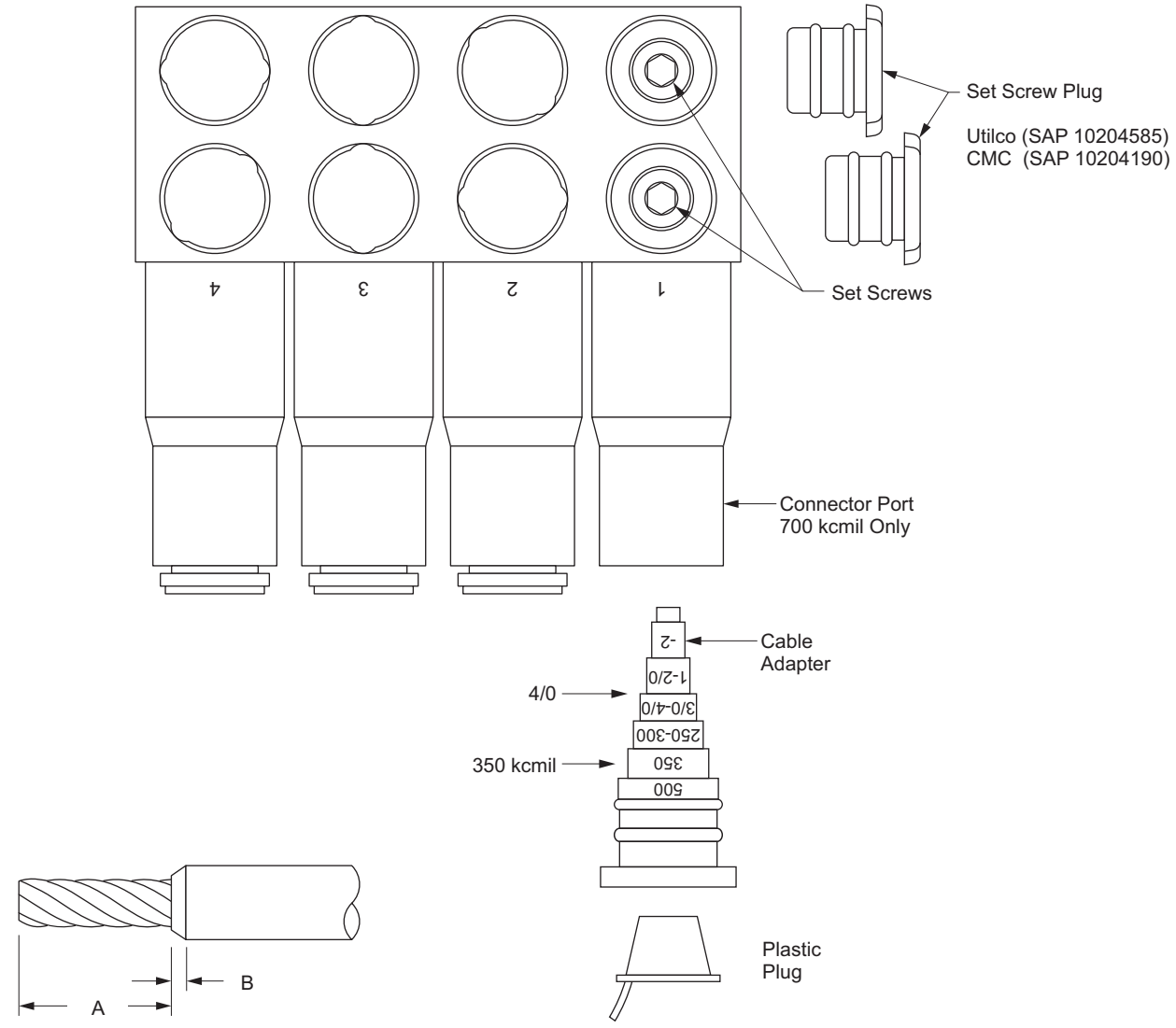
JJ 255 Service-Secondary-Transformer Connections — Utilco and CMC

Scope JJ 255.1 Service-Secondary-Transformer Connections — Utilco and CMC

1.0 Application

These multi-tap insulated connections shall be used for splicing 600V aluminum or copper cables (4/0–700 kcmil maximum).

Figure JJ 255–1: Service-Secondary-Transformer Connections — Utilco and CMC



Dimensions	"A" (in)	"B" (in)
Utilco	2-1/2	1/4
CMC	2-2/3	1/4

4-Way	M/C 659-00029
6-Way	M/C 659-00011

2.0 Instructions

2.1 Prepare cable as shown in Figure JJ 255–1 (Sheet 1). The insulation strip mark on the back of the bus can be used as a guide.

2.2 Remove cable adapters and set screw plugs from positions to be used and back off set screws completely. Any unused connector port must have a cable adapter installed to provide insulation and sealing.

2.3 Cut adapters at the appropriate “O” ring as shown in Figure JJ 255–1 (Sheet 1).

2.4 Position adapters over insulated cables (4/0 to 350 kcmil). Silicone grease provided, or Edison approved silicone grease M/C 904-00615 can be applied to the interior of the adapter to facilitate this step.

2.5 Push cable with adapter into connector port until conductor end contacts backing plate inside connector. Tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque values. **Retighten all set screws twice.** Reinsert set screw plugs.

Note(s):
1. Verify that adapters and set screw plugs are fully inserted.
2. 700 kcmil cable does not require a cable adapter.

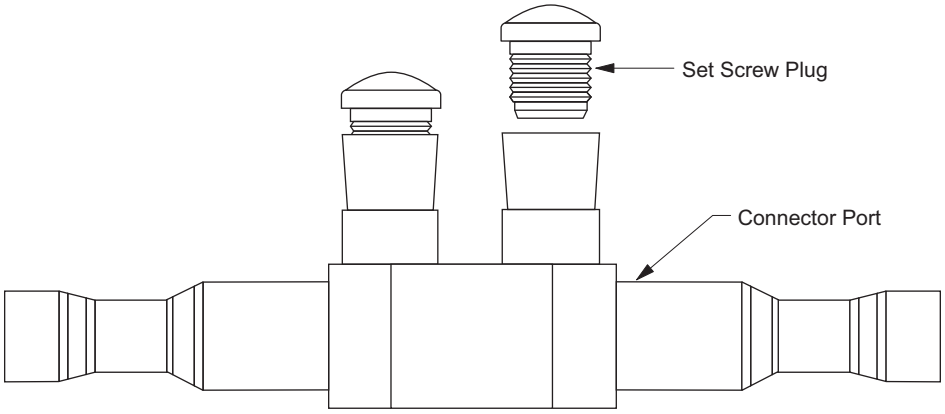
JJ 256 Utilco Watertight In-Line Splice

Scope JJ 256.1 Shows Utilco Watertight In-Line Splice

1.0 Application

Watertight rubber insulated connectors for in-line splicing of copper and aluminum conductors. These multi-tap insulated connectors shall be used for splicing two 600V 1/C #10 to 350 kcmil in underground structures or direct buried installations, where the use of normal splicing procedures becomes impractical due to physical restrictions of the work environment.

Figure JJ 256–1: Watertight In-Line Splice Assembly (M/C 659-00037)



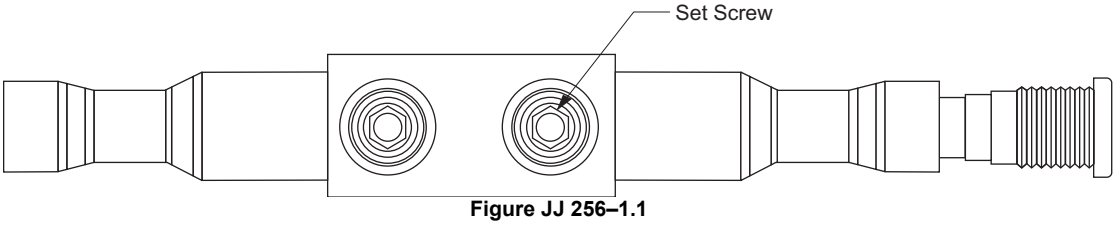


Figure JJ 256–1.1

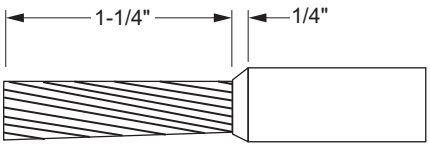


Figure JJ 256–1.2

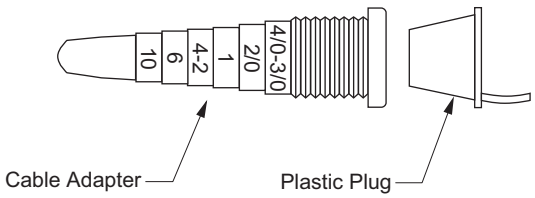


Figure JJ 256–1.3

2.0 Instructions

2.1 Prepare cable as shown in Figure JJ 256–1.2 (Sheet 1). The insulation strip mark on the back of the bus can be used as a guide.

2.2 Remove cable adapters and set screw plugs, from positions to be used, and back off set screws completely.

2.3 Cut adapters at the appropriate “O” ring for the appropriate cable size as shown in Figure JJ 256–1.3 (Sheet 1).

2.4 Position adapter over insulated cables (10 to 350 kcmil). Silicone grease provided, or Edison approved silicone grease M/C 904-00615 can be applied to all surfaces of the adapter to facilitate this step.

2.5 Push cable with adapter into connector port until conductor end contacts backing plate inside connector. Tighten all set screws securely (25 foot-pounds minimum) to attain the proper torque values. **Retighten all set screws twice.** Apply silicone grease and reinsert set screw plugs.

Note(s):
1. Verify that adapters and set screw plugs are fully inserted.
2. Cable adapters must be used on all size of cable except 350 kcmil. Discard the adapter when 350 kcmil cable is used.

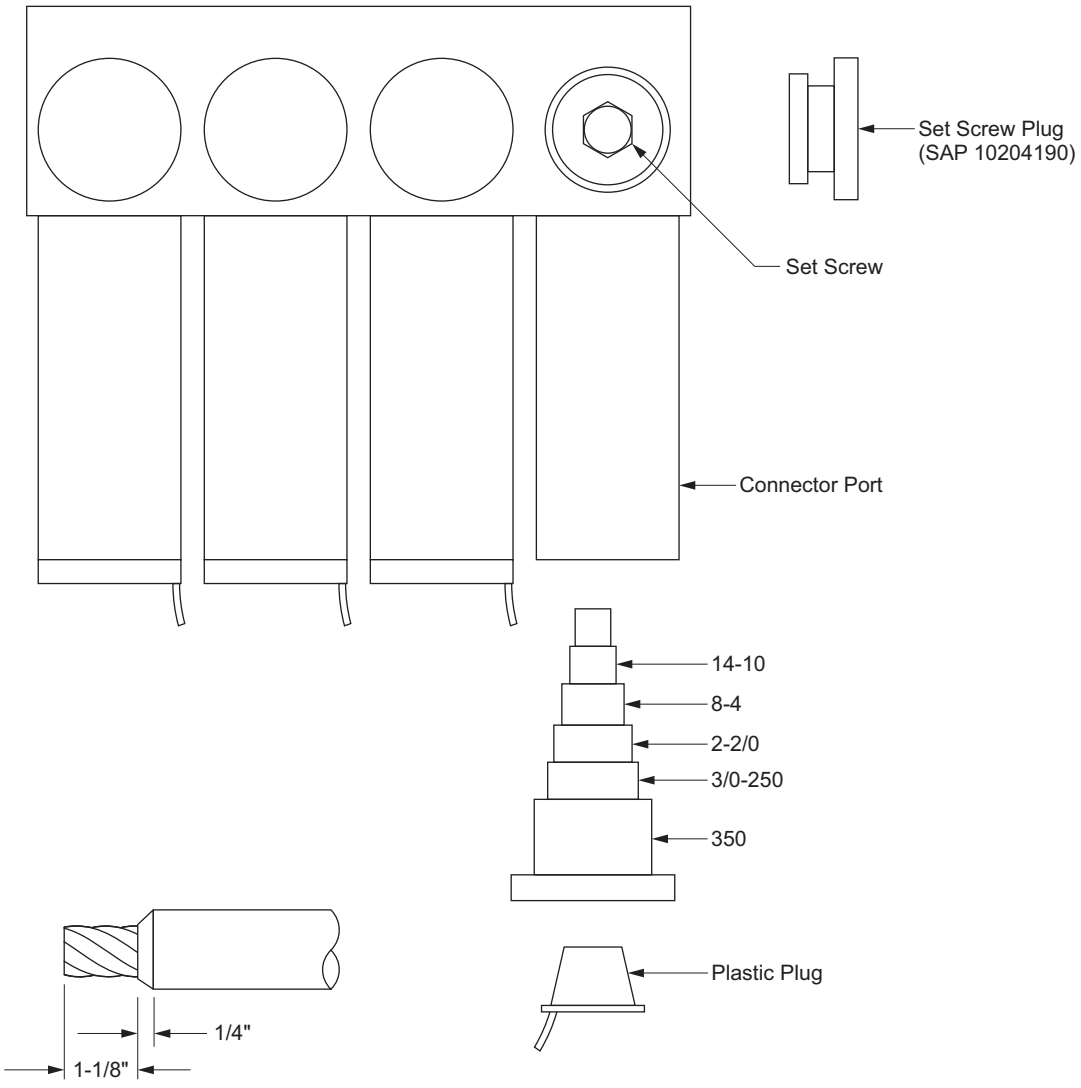
JJ 260 Service-Secondary-Transformer Connections — CMC

Scope JJ 260.1 Service-Secondary-Transformer Connections — CMC

1.0 Application

These connectors are used to connect aluminum cables (#8 to 350 kcmil) and copper cables.

Figure JJ 260–1: Service-Secondary-Transformer Connections — CMC



4 Way	SAP 10118162
6 Way	SAP 10118163
8 Way	SAP 10118164

2.0 Instructions

2.1 Prepare cable as shown in Figure JJ 260–1 (Sheet 1). The insulation strip mark on the back of the bus can be used as a guide.

2.2 Remove cable adapters and set screw plugs from positions to be used and back off set screws completely. Any unused connector port must have a cable adapter installed to provide insulation and sealing.

2.3 Cut adapters at the appropriate “O” ring as shown in Figure JJ 260–1 (Sheet 1).

2.4 Position adapters over insulated cables. Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

2.5 Push cable with adapter into connector port until conductor end contacts backing plate inside connector.

2.6 Slide cable adapters into outlets until fully interlocked.

For installing a copper ground, follow steps 2.7 to 2.10, to prevent water intrusion into the copper wire stands and seal the service-secondary transformer connection.

Otherwise, tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque values. Re-tighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor strands. Re-insert set screw plugs.

2.7 Install a copper compression, straight shank (short or long) cable terminal onto the copper ground. See Table TP 101–1 (Sheet 1). Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

If the copper ground is insulated, remove a minimum of 2 inches of insulation to install the cable terminal directly onto the copper ground wire.

2.8 Push the copper ground, with cable terminal connected, into an adapter that has been cut at the appropriate “O” ring as shown in Figure JJ 260–1 (Sheet 1), for proper sealing.

2.9 Push the copper ground, with cable terminal and adapter connected, into connector post until it makes contact with the backing plate inside the connector.

2.10 Tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque valves. Re-tighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor strands. Re-insert set screw plugs.

Note(s):
1. Verify that adapters and set screw plugs are fully inserted.
2. Cable adapters must be used on all sizes of cable except 350 kcmil. Discard the adapter when 350 kcmil cable is used.

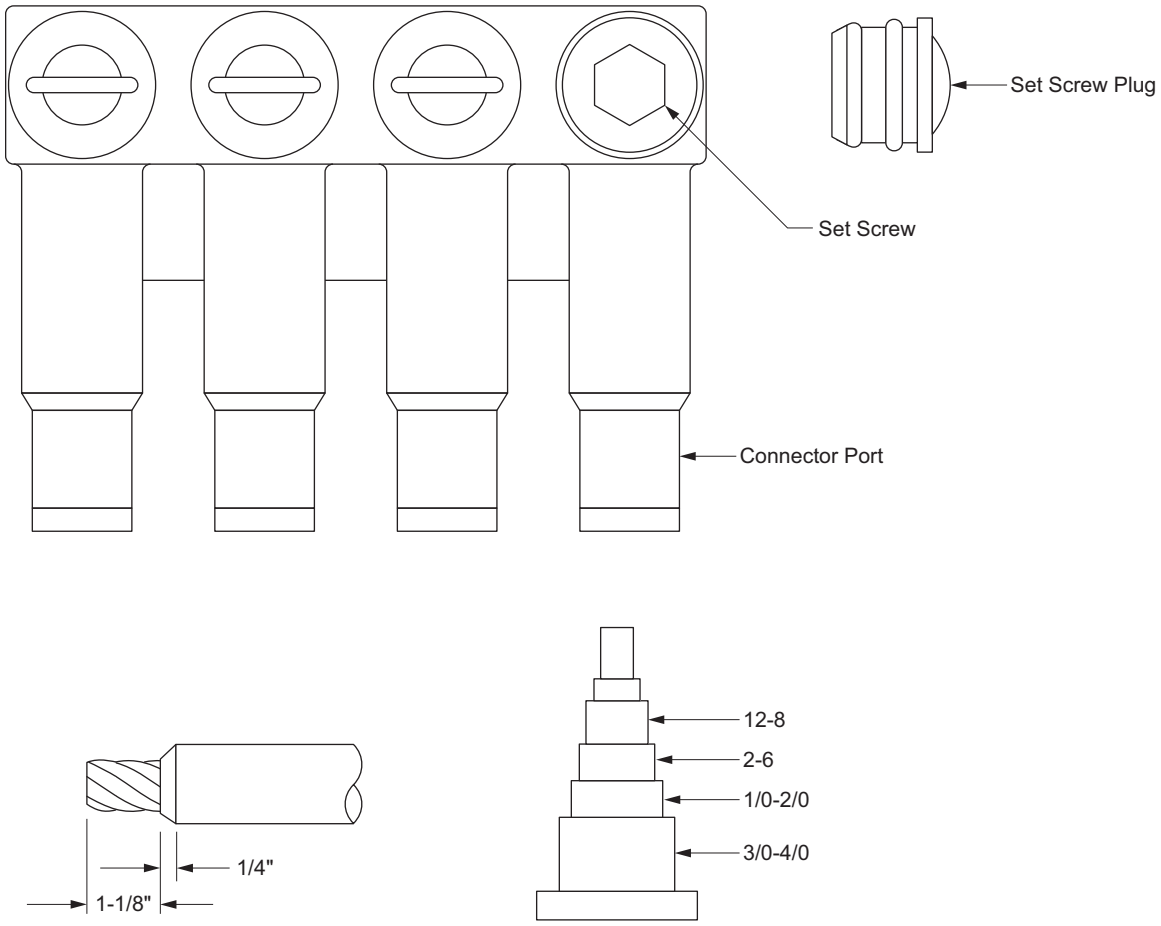
JJ 265 Service-Secondary-Transformer Connections — Electrical Specialty Products

Scope JJ 265.1 Service-Secondary-Transformer Connections — Electrical Specialty Products

1.0 Application

These connectors are used to connect aluminum cables (#8 to 350 kcmil) and copper cables.

Figure JJ 265–1: Service-Secondary-Transformer Connections — Electrical Specialty Products



4 Way	SAP 10118162
6 Way	SAP 10118163

2.0 Instructions

2.1 Prepare cable as shown in Figure JJ 265–1 (Sheet 1). The insulation strip mark on the back of the bus can be used as a guide.

2.2 Remove cable adapters and set screw plugs from positions to be used and back off set screws completely. Any unused connector port must have a cable adapter installed to provide insulation and sealing.

2.3 Cut adapters at the appropriate “O” ring as shown in Figure JJ 265–1 (Sheet 1).

2.4 Position adapters over insulated cables. Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

2.5 Push cable with adapter into connector port until conductor end contacts backing plate inside connector.

2.6 Slide cable adapters into outlets until fully interlocked.

For installing a copper ground, follow steps 2.7 to 2.10, to prevent water intrusion into the copper wire stands and seal the service-secondary transformer connection.

Otherwise, tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque values. Re-tighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor strands. Re-insert set screw plugs.

2.7 Install a copper compression, straight shank (short or long) cable terminal onto the copper ground. See Table TP 101–1 (Sheet 1). Silicone grease provided, or Edison approved silicone grease SAP 10154115 can be applied to the interior of the adapter to facilitate this step.

If the copper ground is insulated, remove a minimum of 2 inches of insulation to install the cable terminal directly onto the copper ground wire.

2.8 Push the copper ground, with cable terminal connected, into an adapter that has been cut at the appropriate “O” ring as shown in Figure JJ 265–1 (Sheet 1), for proper sealing.

2.9 Push the copper ground, with cable terminal and adapter connected, into connector post until it makes contact with the backing plate inside the connector.

2.10 Tighten set screws securely (minimum 25 foot-pounds) to attain the proper torque valves. Re-tighten all set screws twice to insure a good connection, and compensate for any relaxation of the conductor strands. Re-insert set screw plugs.

Note(s):
1. Verify that adapters and set screw plugs are fully inserted.
2. Cable adapters must be used on all sizes of cable except 350 kcmil. Discard the adapter when 350 kcmil cable is used.

JJ 300 PILC — Splicing Instructions

Scope JJ 300.1 Instructions for Splicing Paper-Insulated, Lead-Covered (PILC) Cables

1.0 Form and Cut Cables

Form the cables as nearly as possible into their final position, allowing the ends to overlap. Avoid all sharp bends by using a minimum bending radius of ten times the cable diameter. Determine the center line of the joint, mark cables at this point, and cut them off so that the ends butt together. On three-conductor cables, leave an overlap of approximately one inch, but take subsequent measurements from the center line of the joint.

2.0 Prepare Sleeve

Using a shave hook or rasp, scrape both ends of the sleeve for a distance of approximately one inch and immediately cover the cleaned portions with stearine flux. Then slip the sleeve back out of the way over the end of one of the cables.

3.0 Remove Protective Jacket

Remove neoprene jackets or other protective coverings (if present) for the distances specified on the splice drawings.

4.0 Remove Lead Sheaths

On each cable, locate the point where the lead is to be terminated by marking the sheath at a distance “A” (or “AA”) from the center line of the joint. At this point score the lead to a depth of approximately one half its thickness completely around the cable. After scoring, scrape the lead sheath clean for a distance of approximately two inches beyond the score and apply stearine flux. Carefully slit the sheath from the end of the cable to the score mark and remove the lead.

5.0 Remove Binder Tape or Belt Insulation and Shape Conductors (Three-Conductor Cables)

For three-conductor cables, tie down the metallic binder tape (shielded type cables) or the belt insulation (nonshielded cable) with four to six turns of one-inch wide varnished cambric tape wrapped around the cable at the point where the lead was terminated. Remove the remaining portion of the binder tape or belt insulation and the cable fillers.

Spread the three conductors of each cable and form them approximately into their final position. Do not spread the conductors any more than is necessary to apply connectors and insulating tapes. Cut the conductors so that they butt together.

6.0 Remove Shielding (Not Applicable to Belted Type Cables)

Remove the metallic and/or semi conducting tapes on shielded cables for the distances shown on splice drawings and temporarily tie the tapes in place.

7.0 Step Insulation

On each cable, remove all of the insulation for a distance “C” as shown on the drawings. Beyond this point, step the insulation, using the number, depth, and length of steps specified on the splice drawing.

FOR REFERENCE ONLY

8.0 Install Connector

Use the type of connector specified on the splice drawing and the size (including any reducing shims) as specified in the Underground Construction Standards for the particular cables to be joined. Clean conductor strands thoroughly and position the connector so that it is centered and the cables are butted together. Proceed as follows:

8.1 For Compression Connectors (All Splices on Cables Smaller than 500 kcmil)

Use the compression tool, circular dies, and number of crimps specified in the Underground Construction Standards for the connector to be installed. When more than one crimp per connector is to be made, start from the center of the connector and work toward the ends.

8.2 For Solder-Type Connectors (500 and 750 kcmil Cables or Special Application)

Position the connector so that the split or slot is on top. Compress the connector down tightly with a "smooth jawed"-type of tool so that the surface of the connector remains smooth. Wrap cotton tape tightly around the conductor in the spaces between the ends of the connector and the factory applied insulation to prevent solder from damaging the cable insulation. Solder the connector to the conductors. Smooth off all burrs, remove the cotton tape from the spaces at the ends of the connector, and remove any remaining particles of solder.

9.0 Flushing

Wash off the connector, the exposed conductor strands, and the cable insulation with cable oil heated to a temperature of 225 °F.

10.0 Apply Insulation

Fill in the spaces between the ends of the connector and the first step of the cable insulation with one-sixteenth inch fiberglass cordage. Then apply half-lapped layers of one-half inch wide varnished cambric tape over the glass cordage and the first step of the cable insulation. After building up to the level of the second step with one-half inch wide tape, continue taping with half-lapped layers of one-inch wide varnished cambric tape. When all of the cable insulation has been covered start graduating each layer of tape approximately three-sixteenths inch from the edge of the cable shielding (or belt insulation on nonshielded three-conductor cable) toward the center of the joint. Continue taping until the diameter of the splice is as specified on the drawing.

11.0 Apply Shielding (Not Applicable to Belted-type Cable)

On each conductor cover the applied insulation with a half-lapped layer of one inch wide copper shielding braid. On single conductor cables the braid should overlap the semiconducting shielding tape and the lead sheath at both ends of the splices and should be soldered to the lead sheath. On each conductor of a three-conductor cable, allow the braid to overlap the previously terminated metallic shielding tape approximately three-fourths inch and tack solder it in place.

12.0 Install Binder or Cinch Band (Three-conductor Cable Splices)

Bind the three splices together near the center of the joint with three or four turns of one inch shielding braid (shielded cables) or one inch linen tape (belted cables).

FOR REFERENCE ONLY

13.0 Install Sleeve

Slip the lead sleeve into place so that it is centered over the joint. Uniformly depress the ends of the sleeve so that it fits tightly around the cable sheaths. Install a lead spacer in the crotch space between the three single conductor cables of a “spider” splice. Solder the sleeve to the cable sheaths. Cut two slits (one at each end) in the top of the sleeve and bend back the sides of the openings to form holes for compound filling.

14.0 Compound Filling

Fill the joint with insulating compound which has been heated to the proper temperature as specified on the label of the container. The temperature should be measured with a thermometer and must not be exceeded. Allow the joint to stand until the compound has cooled, and then make a second filling. Seal the joint by hammering down the lips of the filling holes and soldering over them.

FOR REFERENCE ONLY

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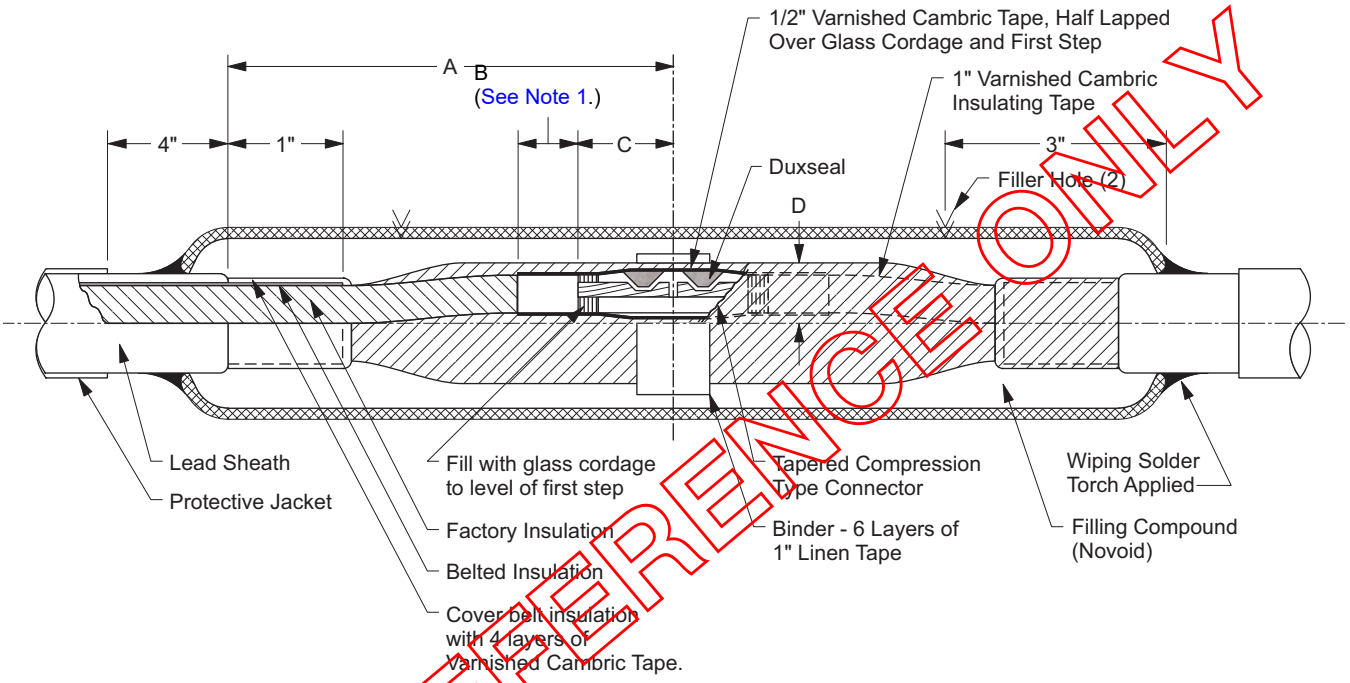
JJ 310 PILC — 5 kV — 3/C to 3/C Splice

Scope JJ 310.1 PILC — 5 kV — 3/C to 3/C Splice

Figure JJ 310–1: PILC — 5 kV — 3/C to 3/C Splice



FOR REFERENCE ONLY

Note(s):

1. Make 1 step in insulation by removing 8 tapes for 3/4 inch.

Table JJ 310–1: PILC — 5 kV — 3/C to 3/C Splices

Dimensions (in)						
	Sleeves		Splices			
Cable Size	I.D.	Length	A	B	C	D
#8–#4	2	24	10-1/2	3/4	1/2 Connector Length Plus 1/4	Connector O.D. Plus 3/8
#2	2-1/2	24				
2/0–4/0	3	24				
350 kcmil	3-1/2	24				
500 kcmil	4	24				

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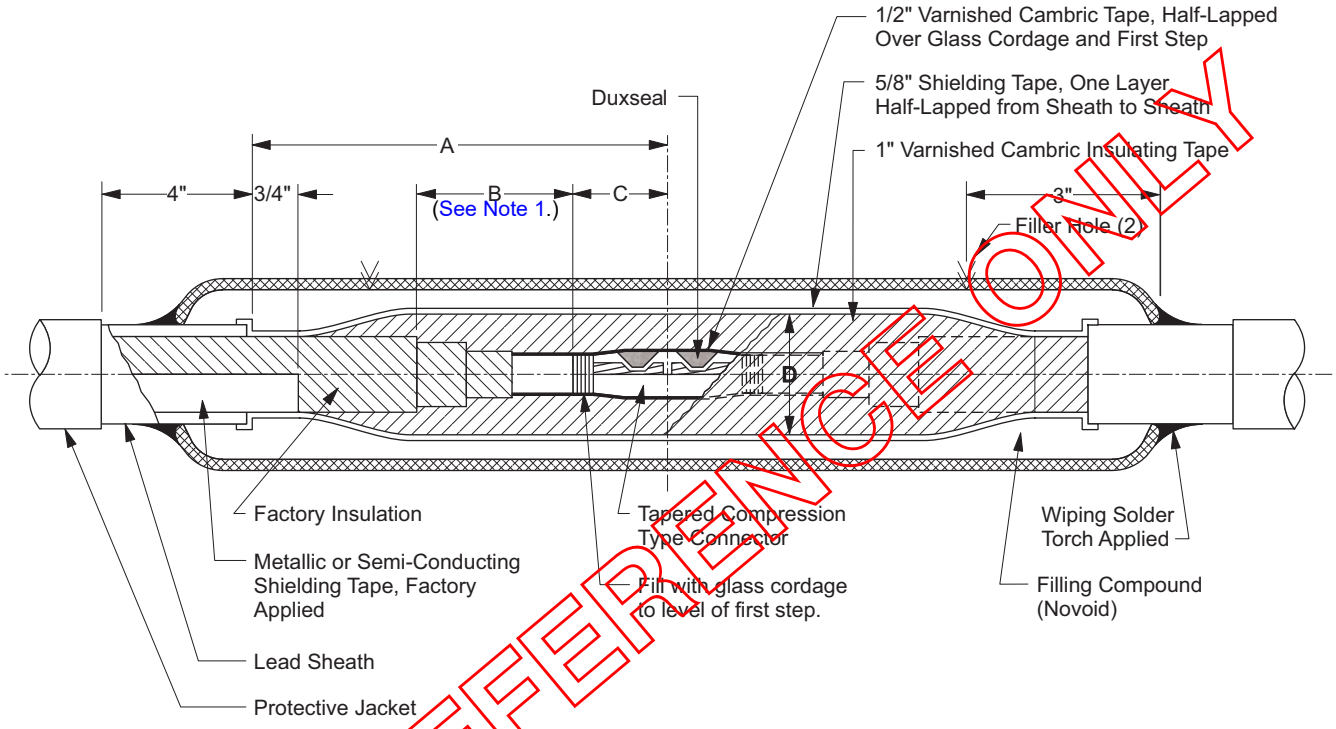
JJ 312 PILC — 5–16-kV — 1/C to 1/C Splice

Scope JJ 312.1 PILC — 5–16-kV — 1/C to 1/C Splice

Figure JJ 312–1: PILC — 5–16-kV — 1/C to 1/C Splice



FOR REFERENCE ONLY

Note(s):

1. Stepping—Steps are 3/4 inches long. Remove 8 tapes per step 5 kV—1 step; 12- or 16-kV—4 steps no installation of shielding tape on 5 kV cables.

Table JJ 312–1: PILC — 5–16-kV — 1/C to 1/C Splice

Dimensions (in)							
		Sleeves		Splices			
Voltage	Cable Size	I.D.	Length	A	B	C	D
5 kV	#6–2/0	1-1/2	13	5	3/4	1/2 Connector Length Plus 1/4	Connector O.D. Plus 3/8
	4/0–500 kcmil	2	13				
12 kV	#2–4/0	2	18	7-3/4	2-1/4	1/2 Connector Length Plus 1/4	Connector O.D. Plus 5/8
	350 kcmil–500 kcmil	2-1/2	18				
16 kV	#2–4/0	2	20	8-3/4	3	1/2 Connector Length Plus 1/4	Connector O.D. Plus 3/4
	350 kcmil–500 kcmil	2-1/2	20				

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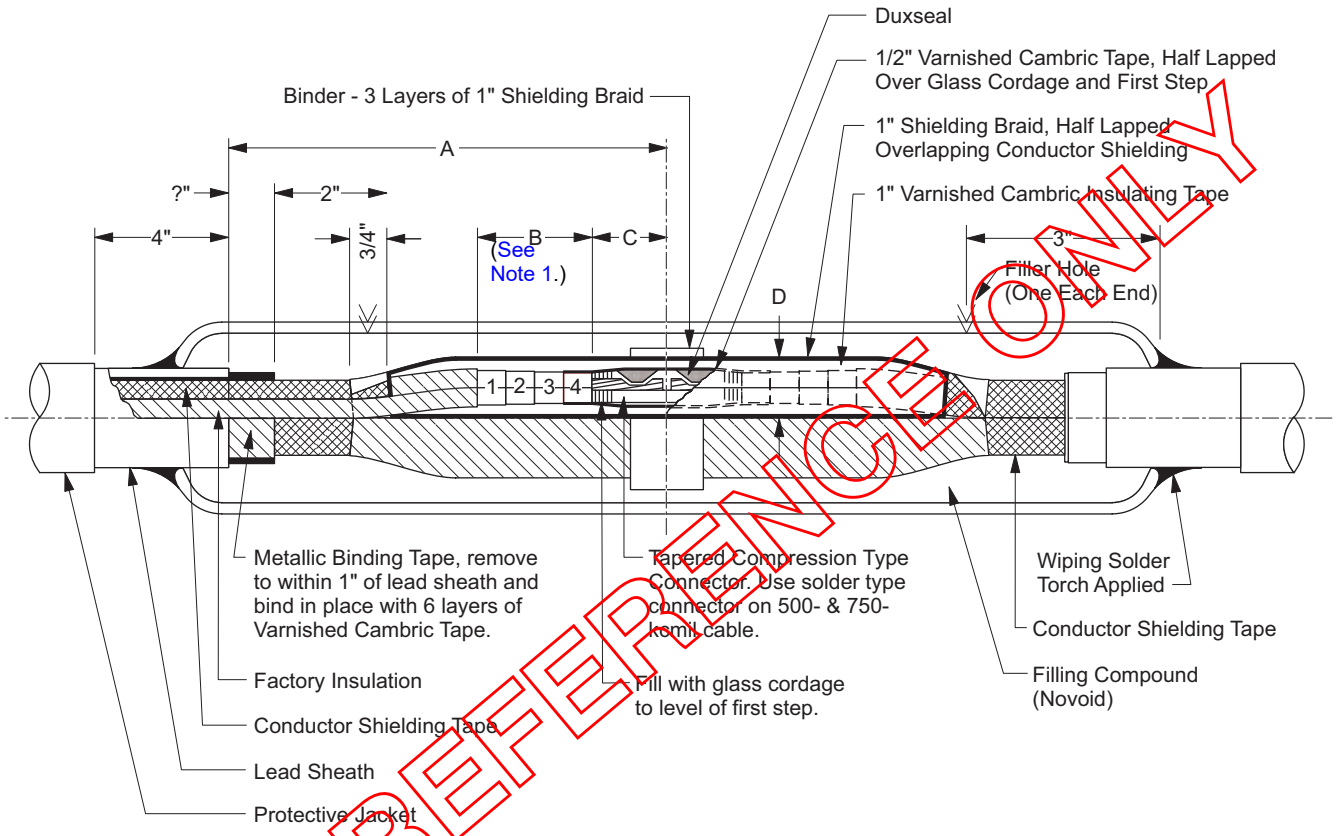
JJ 320 PILC — 12/16-kV — 3/C to 3/C Splice

Scope JJ 320.1 PILC — 12/16-kV — 3/C to 3/C Splice

Figure JJ 320–1: PILC — 12/16-kV — 3/C to 3/C Splice



Note(s):

1. Stepping—Use four 3/4 inch steps. Remove 8 layers of tape per step. (Some of the existing 12 kV cable has reduced insulation and will only allow 3 steps.)

Table JJ 320–1: PILC — 12/16-kV — 3/C to 3/C Splice

Voltage	Cable Size	Dimensions (in)					
		Sleeves		Splices			
		I.D.	Length	A	B	C	D
12 kV and 16 kV	#2–2/0	3-1/2	24	10-1/2	3	1/2 Connector Length Plus 1/2	Connector O.D. Plus 3/4
	4/0	4	24	10-1/2			
	350 kcmil	4-1/2	24	10-1/2			
	500 kcmil	5	24	10-1/2			
	750 kcmil	5-1/2	28	12-1/2			

FOR REFERENCE ONLY

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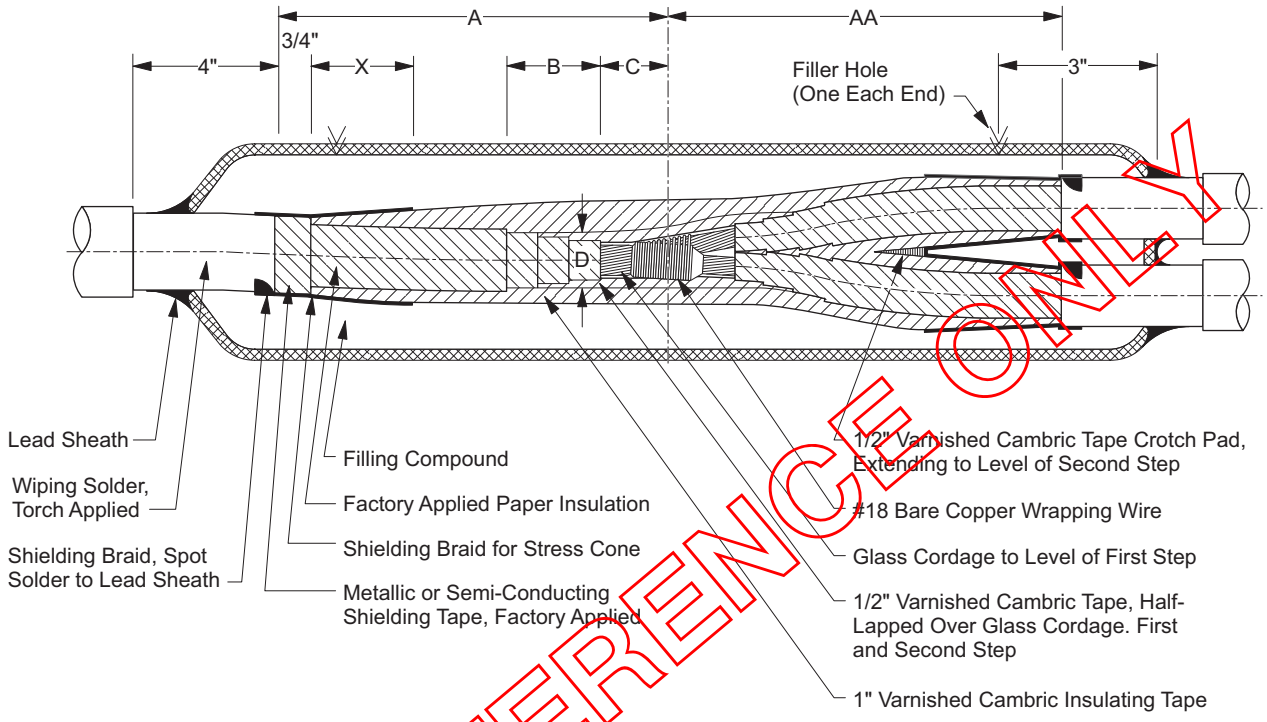
JJ 330 PILC 5–16-kV — 1/C "Y" Splice

Scope JJ 330.1 PILC — 5–16-kV — 1/C "Y" Splice

Figure JJ 330–1: PILC — 5–16-kV — 1/C "Y" Splice



FOR REFERENCE ONLY

Note(s):

1. Dimensions given for left hand end of splice also apply to the right hand end.
2. Stepping
3. 5 kV 1 Step
   12 kV 3 Steps
   16 kV 4 Steps
4. Steps are 3/4 inches long. Remove 8 layers of paper insulation per step.

Table JJ 330–1: PILC — 5–16-kV — 1/C "Y" Splice

Dimensions (in)											
Voltage	Cable Size		Sleeves		Splices						
	1/C End	Y End	I.D.	Length	A	AA	B	C	D	T	X
5 kV[1/]	#6–2/0	#2–4/0	3	13	5	5	3/4	1/2 Connector Length + 1/2	Connector O.D. + Conductor O.D. + 3/8	—	—[1/]
	4/0–500 kcmil	#2–500 kcmil	3-1/2	13							
12 kV	#2–4/0	#2–4/0	3-1/2	19	7-3/4	8-3/4	2-1/4	1/2 Connector Length + 1/2	O.D. + 5/8	1/4	2-1/2
	350–500 kcmil	#2–500 kcmil	4	19							
16 kV	#2–4/0	#2–4/0	3-1/2	21	8-3/4	9-3/4	3	1/2 Connector Length + 1/2	O.D. + 3/4	5/16	3
	350–500 kcmil	#2–500 kcmil	4	21							

[1/] No installation of stress cones on 5 kV cables.

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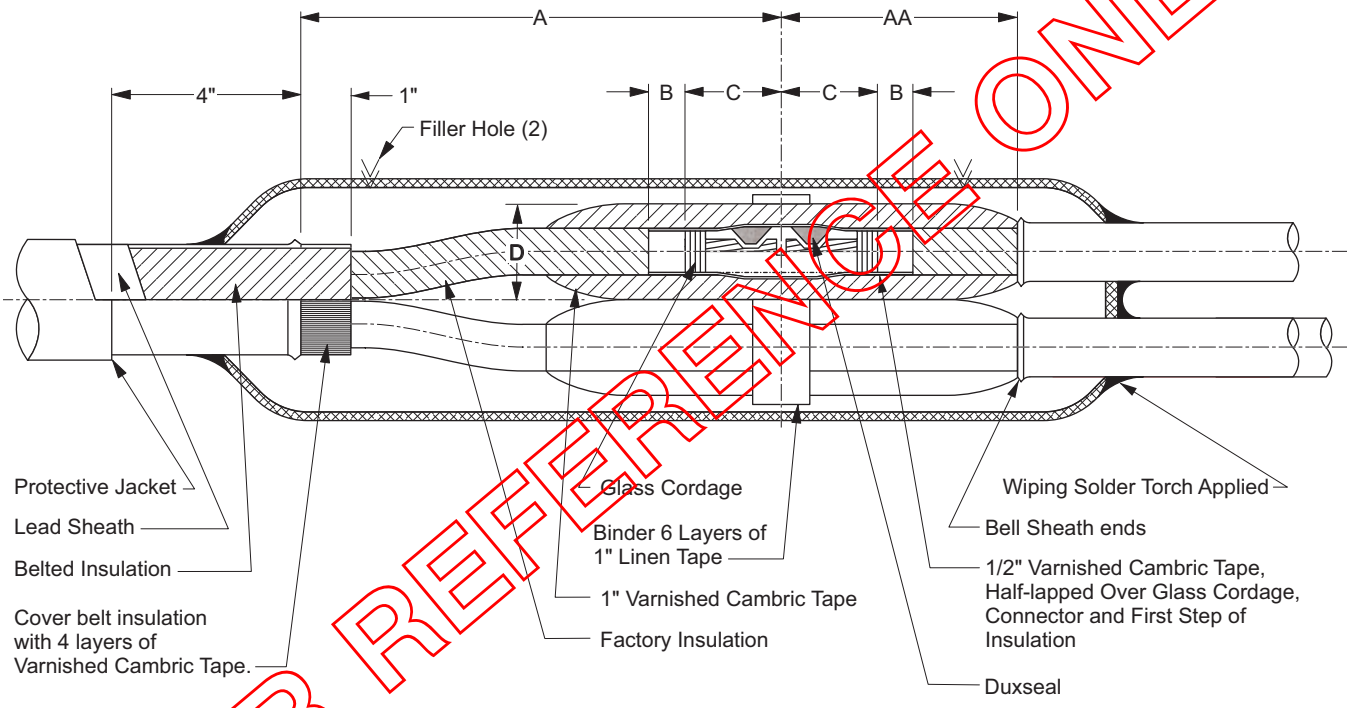
JJ 340 PILC — 5 kV — Spider Splice

Scope JJ 340.1 PILC — 5 kV — Spider Splice

Figure JJ 340–1: PILC — 5 kV — Spider Splice



FOR REFERENCE ONLY

Note(s):

1. Make one step in insulation by removing 8 tapes for 3/4 inches.

Table JJ 340–1: PILC — 5 kV — Spider Splice

Dimensions (in)							
Cable Size	Sleeve		A	AA	B	C	D
	I.D.	Length					
#6–#2	2-1/2	18	10-1/2	5	3/4	1/2 Connector Length + 1/2	Connector O.D. + 3/8
2/0–4/0	3	18					
350 kcmil	3-1/2	18					
500 kcmil	4	18					

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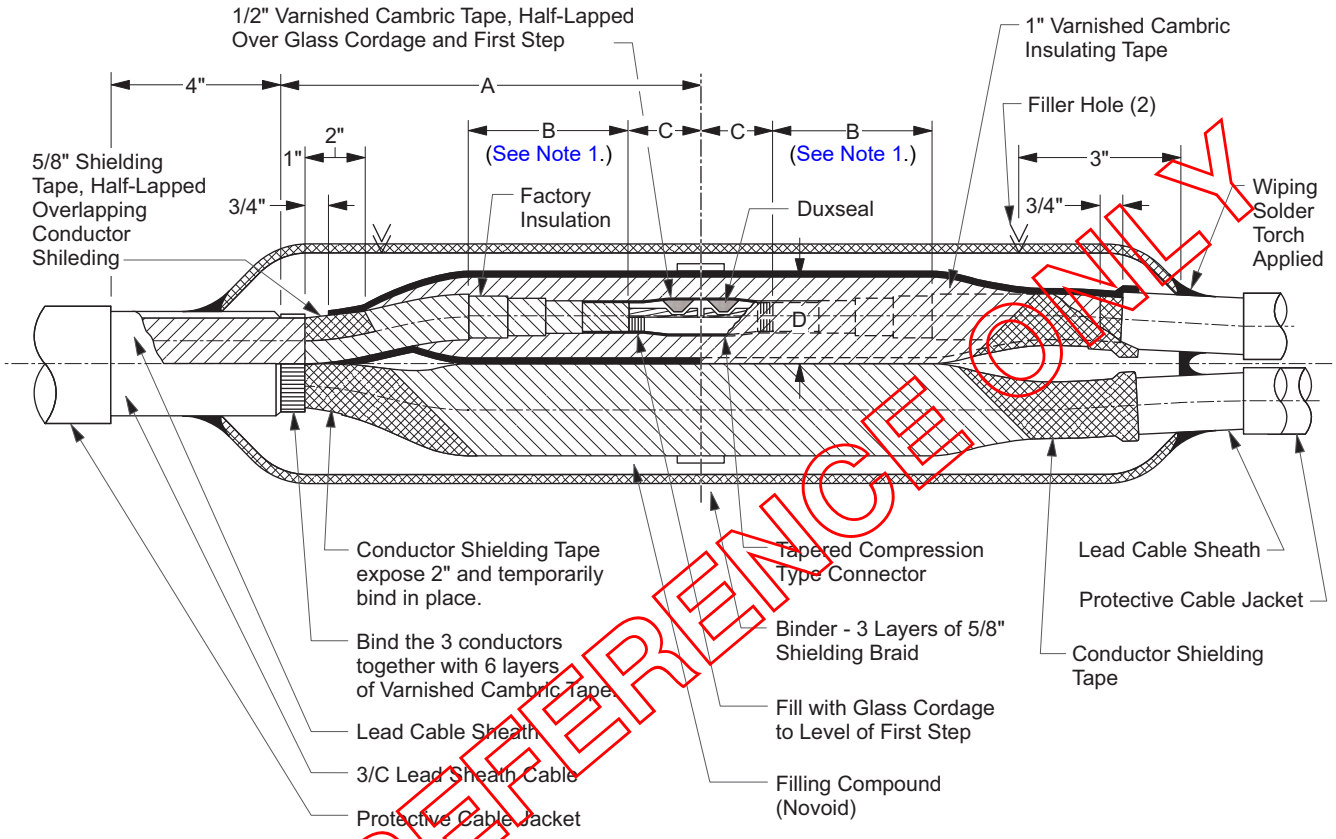
JJ 345 PILC — 12/16-kV — Spider Splice

Scope JJ 345.1 PILC — 12/16-kV — Spider Splice

Figure JJ 345–1: PILC — 12/16-kV — Spider Splice



Note(s):

1. Stepping—Steps are 3/4 inches long. Remove 8 layers of tape per step. 12 kV—3 steps. 16 kV—4 steps.

Table JJ 345–1: PILC — 12/16-kV — Spider Splice

Dimensions (in)								
		Sleeves		Splices				
Voltage	Cable Size	I.D.	Length	A	AA	B	C	D
12 kV	#2–2/0	3-1/2	22	10-1/2	7-3/4	2-1/4	1/2 Connector Length + 1/4	Connector O.D. + 5/8
	4/0–350 kcmil	4	22					
	500 kcmil	4-1/2	22					
16 kV	#2–2/0	3-1/2	22	10-1/2	8-3/4	3	1/2 Connector Length + 1/4	Connector O.D. + 3/4
	#4/0	4	22					
	350 kcmil	4-1/2	22					
	500 kcmil	5	22					

FOR REFERENCE ONLY

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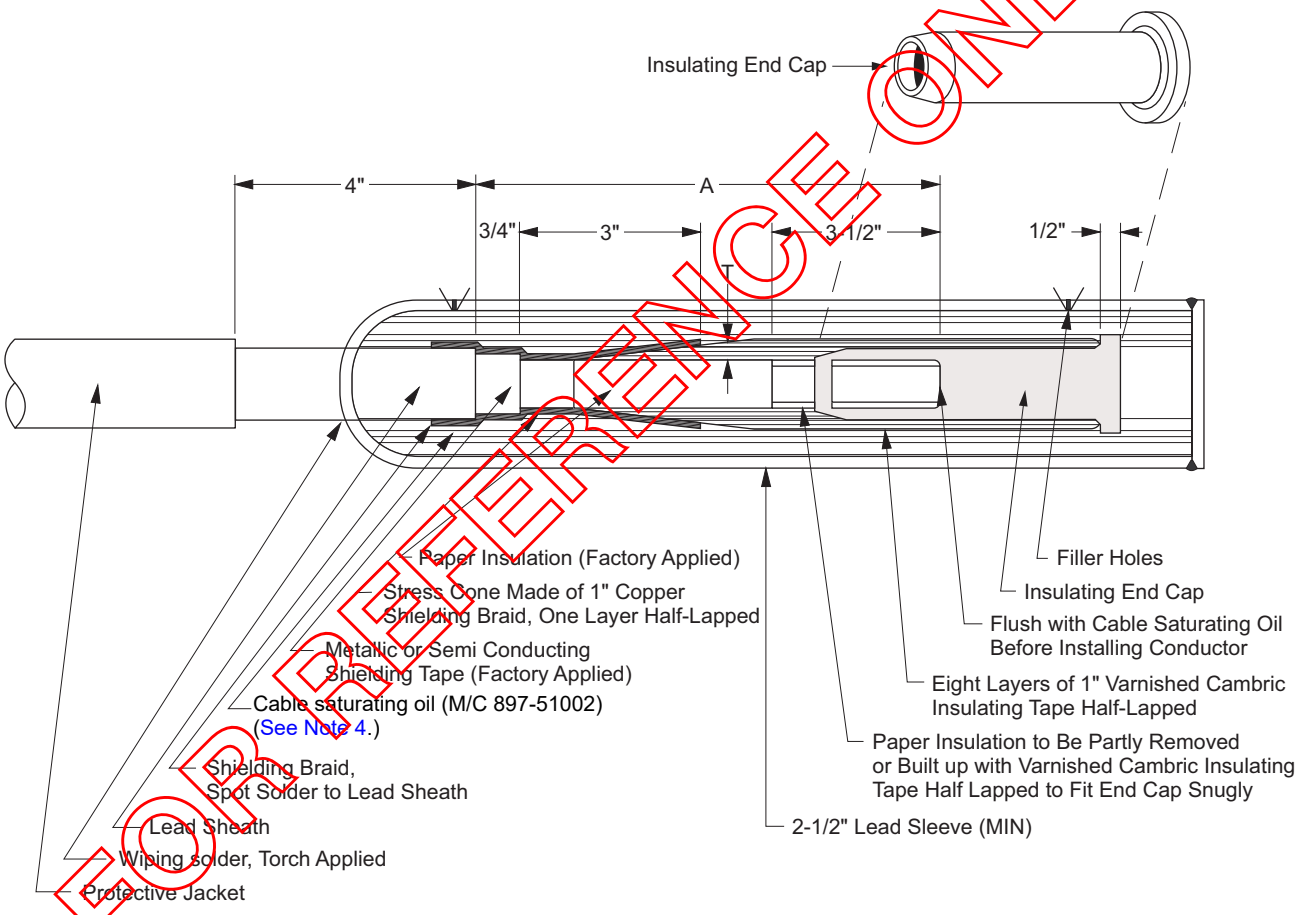
JJ 350 PILC — 5–16 kV — End Bell — 1/C Cable

Scope Scope JJ 350.1PILC — 5–16 kV — End Bell — 1/C Cable

Figure JJ 350–1: PILC — 5–16 kV — End Bell — 1/C Cable



FOR REFERENCE ONLY

Table JJ 350–1: PILC — 5–16-kV — End Bell — 1/C Cable

Sleeve Dimensions (in)					
kV	A	T	Cable Size	I.D.	Length
4	4-1/2	See Note 1	ALL SIZES	2-1/2	10
12	7-3/4	1/4		2-1/2	14
16	8-3/4	5/16		2-1/2	15

Note(s):

1. No stress cone on 5 kV cable.
2. Do not use chipped or cracker end caps.
3. Fasten end cap in place by applying two longitudinal layers of 1/2 inch varnished cambric tape from end of cap to the bottom of the stress cone. Hold in place with 8 layers of varnished cambric tape.
4. Fill with Novoid X if there is a possibility of oil migration out of sleeve.
5. See JJ 130 for material code numbers.

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JJ 355 PILC — 5 kV — End Bell — 3/C Splice

Scope JJ 355.1 PILC — 5 kV — End Bell — 3/C Splice

Figure JJ 355–1: PILC — 5 kV — End Bell — 3/C Splice

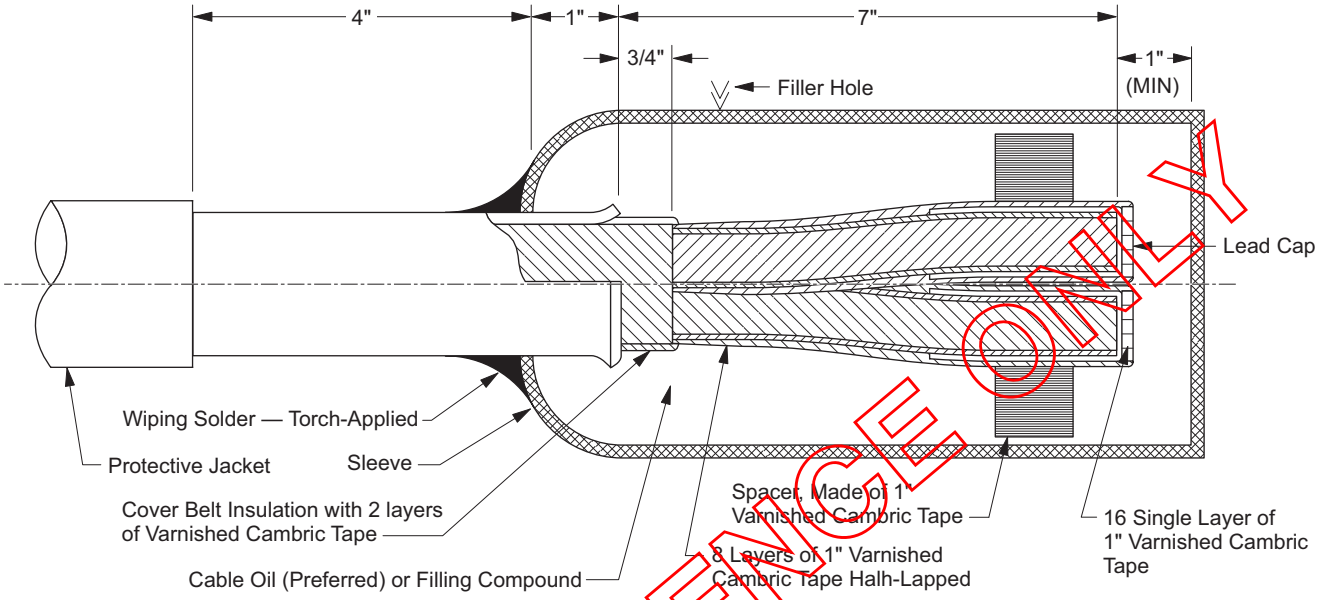

Table JJ 355–1: PILC — 5 kV — End Bell — 3/C Splice

Cable Size	Sleeve (in)
500 kcmil	4-1/2 × 10
350 kcmil	4 × 10
300 kcmil	3-1/2 × 10
4/0	3-1/2 × 10
2/0	3-1/2 × 10
#2	3-1/2 × 10

FOR REFERENCE ONLY

1.0 Application of One-Inch Varnished Cambric Tape for Each Conductor

1.1 Remove first layer of paper insulation to obtain clean surface.

1.2 Apply one half-lapped layer of Varnished Cambric tape, beginning at the belt insulation.

1.3 Cover end of conductor and insulation with two separate longitudinal layers each about 5-1/2 inches long. Rotate the second layer 90 degrees in respect to the first.

1.4 Continue to apply a second half-lapped layer from the conductor end to the belt insulation.

1.5 Apply two layers as described under 1.3 above, over the conductor end, the first layer 45 degrees rotated in respect to the last existing one.

1.6 Continue to alternately apply tape until 9 half-lapped layers over the paper insulation and 16 single layers over the conductor end are obtained.

FOR REFERENCE ONLY

JJ 360 Raychem Heat Shrink PILC Repair Kit

Scope JJ 360.1 Shows Raychem Heat Shrink PILC Repair Kit Information

1.0 Application

These kits are used to repair cracks and splits in PILC splices and lead cable.

Table JJ 360–1: Raychem Heat Shrink PILC Repair Kit Information

SAP Number	Raychem Part #	Installation Range[1/] (in)	Nominal Length[2/] (in)
10117890	HVS-LR-75/15-1200	0.65–2.65	48
10117889	HVS-LR-160/42-1200	1.80–5.70	48
10117888	HVS-LR-200/50-1200	2.15–7.10	48

[1/] The diameter of the splice/cable must be within this range.

[2/] Sleeves can be cut to size for small repairs or to facilitate installation. The remaining portion can be used as another repair kit (sufficient mastic is supplied to complete two repairs).

Note(s):
1. Sleeve ends must extend 6 inches beyond the damaged area.
2. Refer to manufacturer's instructions supplied with kit for complete installation procedures.

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JJ 365 PILC – 600 V 1/C Splice for PILC-to-Extruded Dielectric Secondary Power Cable

Scope JJ 365.1 Instructions for Splicing 600 V 1/C PILC-to-Extruded Dielectric – Raychem

1.0 Application

Oil barrier tubing is designed to provide electrical insulation, restoration of the full insulation over the cable cores and provide barrier against migration of cable oil from other components.

Table JJ 365–1: Raychem Heat Shrink PILC Repair Kit Information

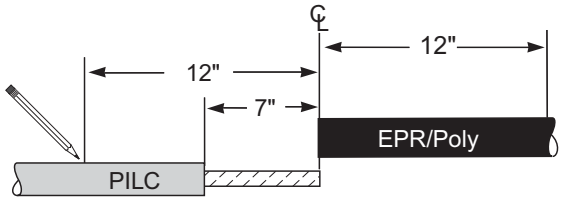
SAP Number	PILC Insulation Diameter (min – max) Inches	Poly Insulation Diameter (min – max) Inches	Part Number
10211620	0.35 – 1.22	0.35 – 1.22	LVS-681
10211618	0.70 – 1.96	0.70 – 1.96	LVS-683

2.0 Instruction

2.1 PILC to EPR/Poly Cable Preparation

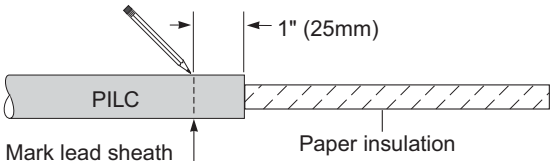
A. From the centerline of splice, abrade and solvent clean 12" of the PILC lead sheath. Remove 7" of the lead sheath then abrade and solvent clean 12" of the POLY cable. Note all dimensions are referenced to the centerline (C_L).

Figure JJ 365–1: Cable Preparation Removal of Sheath



B. Mark lead sheath for application of stress release material (SRM) as shown in Figure JJ 365–2.

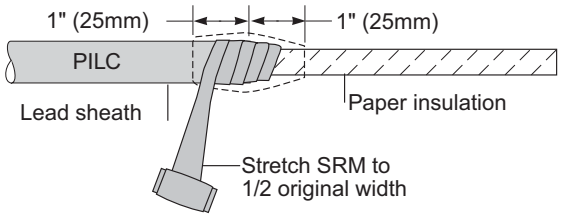
Figure JJ 365–2: Mark Lead Sheath 1" from the Cutback



2.2 Apply Stress Relief Material (SRM) at lead sheath cutback and Oil Barrier Tube

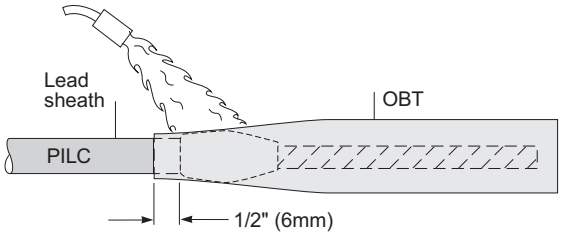
A. Remove the backing from one side of long strip SRM then roll the SRM and remaining backing strip into a convenient size roll. Remove the remaining backing strip and tightly wrap the SRM around the lead sheath and paper insulation, ensuring to stretch the SRM 1/2 its nominal width. Apply a maximum thickness of 1/8" of SRM over the lead sheath.

Figure JJ 365–3: Apply SRM at Lead Sheath Cutback



B. Place the oil barrier tube (OBT) over the cable as shown with the end of the tube, extending past the SRM by 1/2". Shrink in this position, starting at the lead sheath and working toward the end of the cable. Work around the tube with a smooth brushing action using a reduced flame.

Figure JJ 365–4: Position Oil Barrier Tube and Shrink in Place



2.3 Inspect Oil Barrier Tube (OBT), Remove Insulation, and Place WCSM Tube

A. The OBT should have a smooth, wrinkle-free surface after shrinking. If not, reheat to smooth out any wrinkled areas.

B. Remove the OBT and paper insulation from the PILC cable and the insulation from the EPR/Poly cable equal to 1/2 length of the center blocked crimp connector plus 1/4".

C. Place the WCSM tube over either cable as shown.

Figure JJ 365–5: Inspect OBT

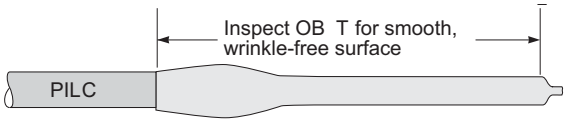
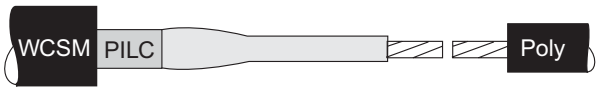


Figure JJ 365–6: Inspect OBT

Figure JJ 365–7: Place WCSM Tube onto Cable for Stroage



2.4 Install Connector and Apply SRM over Connector

A. Install the center blocked crimp connector. After installation, if necessary, deburr the connector.

B. Remove backing from one side of a long strip of SRM. Roll the SRM and remaining backing strip into a convenient size roll. Remove the remaining backing strip and tightly wrap the SRM around the connector, ensuring to stretch the SRM 1/2 its nominal width and additionally fill the voids at the end of the connector.

C. Continue to wrap the SRM onto the solvent cleaned OBT and insulation, overlapping the OBT by 3/4" and the poly insulation by 1/4". Build the SRM up to the height of the insulation plus one wrap. If the connector is larger than the insulation diameter, apply only two half lapped layers of SRM over the entire connector, filling the ends and tapering down onto the OBT by 3/4" and poly insulation by 1/4".

Figure JJ 365–8: Install Conenctor

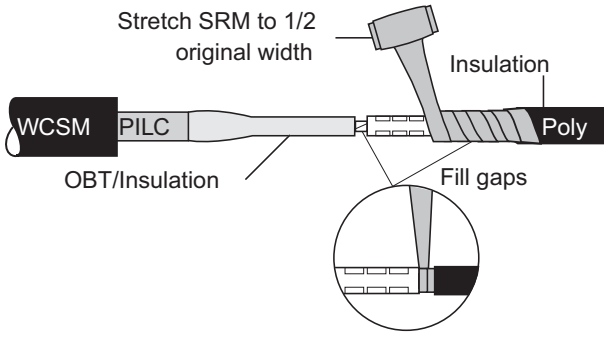
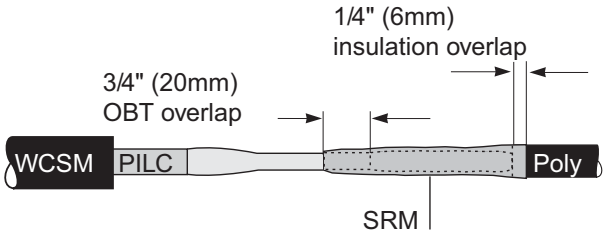


Figure JJ 365–9: Wrap the SRM



2.5 Position WCSM Tube over Splice, Shrink in Place

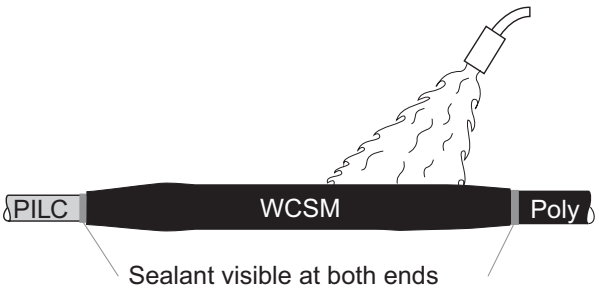
A. Center the black 18" WCSM tube over the splice region

B. Begin shrinking in the center of the WCSM tube and continue heating towards one end until the adhesive is visible. Return to the center and heat towards the other end until the sealant is visible.

C. The splice is complete and the WCSM tube is properly installed when adhesive is visible from both ends.

D. Allow the splice to cool before energizing.

Figure JJ 365–10: Shrink in Place



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JJ 400 PILC — CLP 5–16-kV 1/C Splice

Scope JJ 400.1 Instructions for Splicing 5–16-kV 1/C Aluminum Cross-Linked Polyethylene (CLP) Insulated Cable to 1/C Copper PILC Cable

1.0 Prepare Cable

1.1 Determine the center of the splice. Unwrap concentric shield wires of CLP cable back to about 25 inches from the center of the joint, and secure in place with plastic strap, cut off excess cable.

1.2 Remove the lead sheath and metallic shielding from the PILC cable for the distance as shown on the drawing. Remove all the insulation and semiconducting material from the conductor for the distance "C".

1.3 Remove all insulation and semiconducting material from CLP cable for the distance "C" as shown on the drawing using the end stripper. Remove the semiconducting jacket for the distance "A" as shown on the drawing.

1.4 Pencil the CLP cable with penciling tool. Step the PILC cable as shown in drawing.

1.5 Slip the lead tube over the CLP cable. Build up the outside diameter of the cable with glass fibercloth tape (10-1/2 lap layers minimum) at the location shown on the drawing until the lead tube fits snugly.

1.6 Slide the lead sleeve over the PILC cable.

2.0 Apply Connector

2.1 Install the oil stop connector; using a compression die, make overlapped circular crimps, and remove sharp edges. Do not use copper connector on aluminum cables.

2.2 Apply one half-lapped layer of tinned copper braid over the lead tube and CLP cable jacket to dimensions shown on the drawing. Solder-tack copper braid to lead tube (Item 7A).

2.3 Apply two half-lapped layers of Scotch #33 and coat with Scotch Kote over the lead tube, tinned copper braid, semiconducting sheath, the CLP insulation, and the connector as shown in the drawing (Item 5).

2.4 Fill space between paper insulation and connector with glass cordage.

3.0 Apply Insulation

3.1 Apply one-inch Fibermat insulation tape from the shielding of the PILC cable to the beginning of the hidden semiconducting jacket of the CLP cable as shown in the drawing.

3.2 Apply tinned copper braid over the lead tube, Scotch Kote insulation, and lead on the PILC cable as shown on the drawing. Solder-tack copper braid to lead tube and sheath.

4.0 Finishing the Splice

4.1 Slide sleeve over splice and solder the ends in place. Do not apply excessive heat to CLP cable. Make up the end seal on the CLP cable as shown on the drawing.

FOR REFERENCE ONLY

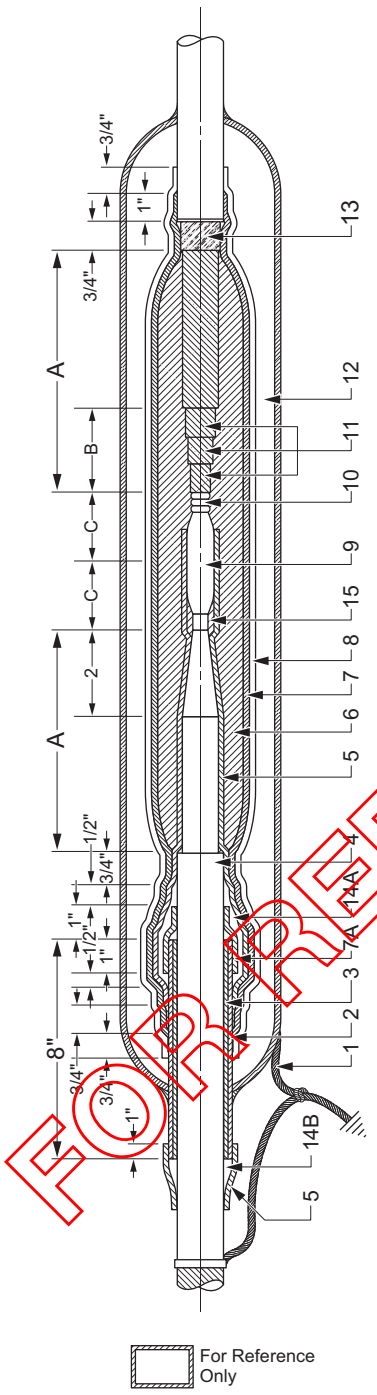
4.2 Fill the sleeve at the PILC end with compound heated to the minimum pouring temperature (275 °F).

4.3 Solder Beldon ground strap to lead sleeve. Connect concentric wires from CLP cable to the Beldon ground strap. Ground the splice.

FOR REFERENCE ONLY

Scope JJ 400.2 **Straight Splice 5–16-kV — 1/C Aluminum Polyethylene or Cross-Linked Polyethylene Insulated Cable to 1/C Copper PILC Cable**

Figure JJ 400–1: Straight Splice 5–16-kV — 1/C Aluminum Polyethylene or Cross-Linked Polyethylene Insulated Cable to 1/C Copper PILC Cable



LEGEND

1. Solder belden ground strap to lead sleeve.
2. Lead tube.
3. Half-lapped layers of glass fibercloth tape, M/C 646-44503, to make tube fit snug (10 layers minimum).
4. Semi-conducting cable jacket.
5. Two half-lapped layers of Scotch 33 tape, M/C 646-72108. Cover tape with Scotchkote Electrical Coating, M/C 656-52620.
6. 1" Fibermat insulating tape, half-lapped layers, M/C 646-95901.
7. Tinned coppershielding braid, one layer, half-lapped, & 7a. M/C 656-69202.
8. Two half-lapped layers of silicone tape, M/C 646-85605.
9. Oil-stop connector, see JJ114 (AL to CU).
10. Glass cordage, M/C 645-43002.
11. Steps are 3/4" long. Remove 8 tapes per step. 5 kV 1 step, 12/17 kV - 4 steps.
12. Filling compound, M/C 645-28003 (to be poured at lowest pouring temperature, 275½, at the PILC end.)
13. Shielding tape, factory applied.
14. High voltage tape, half-lapped to form a gradual slope, M/C 647-31102
A. Over shielding braid
B. From cable to outside diameter of lead tube.
15. Semi-conducting shielding tape, one half-lapped layer, M/C 656-69008

NOTES:

1. 5 kV splice: 220 mil CLP 12/17 kV rated cable - 90 mil PILC 5 kV rated cable.
2. 12/17 kV splice: 220 mil CLP 12/17 kV rate cable - 185 or 240 mil PILC 12 or 17 kV rated cable.

DIMENSIONS

Voltage	Conductor Size CPL AL	Conductor Size PILC CU	A CPL AL	A PILC CU	B	C	D	Lead Tube Dia.	Connector Code
5 kV	#2	#2	4	3	3/4	1/2 Connector Length Plus 1/2 Inch	Connector O.D. Plus 3/8 Inch	1-1/4	610-27603
	#2	500						1-1/4	610-28205
	350	4/0						1-1/2	610-28007
	750	500						2	610-28403
12 / 16 kV	#2	#2	6-1/4	6	3	1/2 Connector Length Plus 1/2 Inch	Connector O.D. Plus 5/8 Inch	1-1/4	610-27603
	#2	500						1-1/4	610-28205
	350	4/0						1-1/2	610-28007
	750	500						2	610-28403
16 kV Ungrounded	#2	#2	8-1/4	6	3	1/2 Connector Length Plus 1/2 Inch	Connector O.D. Plus 3/4 Inch	1-1/4	610-27603
	#2	500						1-1/4	610-28205
	350	4/0						1-1/2	610-28007
	750	500						2	610-28403

LEAD SLEEVE DIMENSIONS

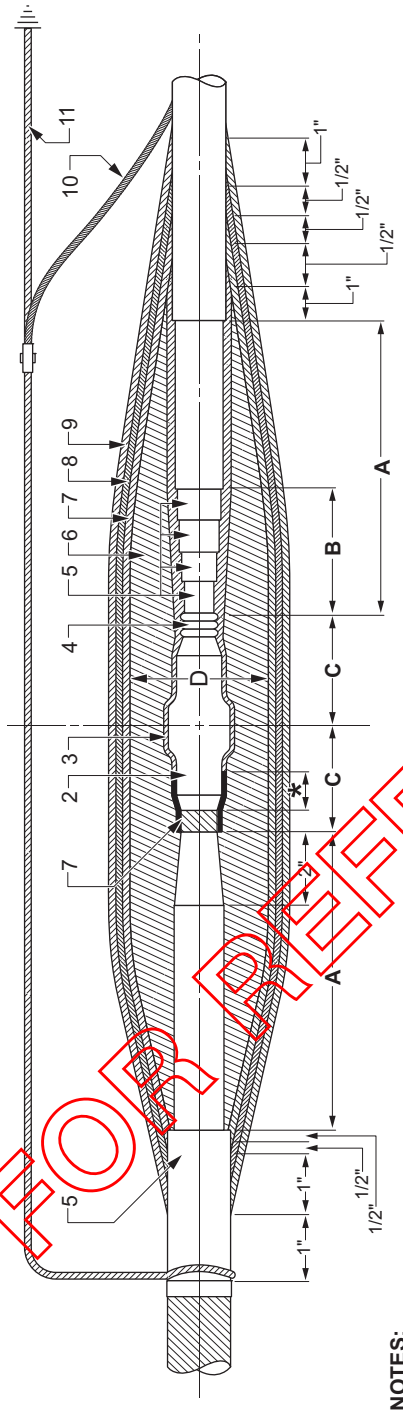
Conductor Size CPL AL	Conductor Size PILC CU	Voltage 5 kV	Voltage 12 / 17 kV	Voltage 17 kV Ungrounded
#2	#2	2" x 24"	2" x 29"	2-1/2" x 29"
#2	500	3" x 26"	3" x 32"	3-1/2" x 32"
350	4/0	3" x 27"	3" x 32"	3-1/2" x 30"
750	500	3-1/2" x 31"	3-1/2" x 36"	3-1/2" x 36"

Splicing Instructions on JJ-400.1
See JJ-400.3 for Alternate
Method of Splicing.

FOR REFERENCE ONLY

Scope JJ 400.3 **Straight Splice 5–16-kV — 1/C Aluminum Cross-Linked Polyethylene Insulated Cable to 1/C Copper PILC Cable**

Figure JJ 400–2: Straight Splice 5–16-kV — 1/C Aluminum Cross-Linked Polyethylene Insulated Cable to 1/C Copper PILC Cable



NOTES:
1. 5kV splice: 220 mil CLP 12/16 kV rated cable – 90 mil PILC 5 kV rated cable.
2. 12/16 kV splice: 220 mil. CLP 12/16 kV rated cable – 185 or 240 mil PILC 12 or 16 kV rated cable.

NOTE: Do not use where subjected to oil pressure, i.e., bottom of riser or hill or where it may be continuously submerged in water.

* 1/4 of the length of the connector.

LEGEND:
1. Semi-conducting cable jacket.
2. Oil-stop connector, overlapped circular crimps remove sharp edges. See JJ114 (AL to CU).
3. Two half-lapped layers of Scotch 33 tape, M/C 646-72108. Cover tape with Scotchkote Electrical Coating, M/C 656-52620.
4. Glass cordage, M/C 645-43002.
5. Steps are 3/4" long. Remove 8 tapes per step: 5 kV-1 step: 12/17 kV-4 steps.
6. High voltage insulating tape, half-lapped layers, M/C 647-31402
7. Semi-conducting shielding tape, one half-lapped layer, M/C 656-69608.
8. Tinned copper shielding braid, two half-lapped layers, M/C 656-64202
9. Splice jacketing tape, six half-lapped layers, M/C 646-72108
10. Solder belden ground strap to lead jacket.
11. Connect concentrics to ground.

DIMENSIONS (Inches)

Voltage	Conductor Size CPL AL	Conductor Size PILC CU	A CPL AL	A PILC CU	B	C	D	Connector Code
5 kV	#2	#2	4	3	3/4	1/2 Connector Length Plus 1/2 Inch	Connector O.D. Plus 3/8 Inch	610-27603
	#2	500						610-28205
	350	4/0						610-28007
	750	500						610-28403
12 / 16 kV	#2	#2	6-1/4	6	3	1/2 Connector Length Plus 1/2 Inch	Connector O.D. Plus 5/8 Inch	610-27603
	#2	500						610-28205
	350	4/0						610-28007
	750	500						610-28403
16 kV Ungrounded	#2	#2	8-1/4	6	3	1/2 Connector Length Plus 1/2 Inch	Connector O.D. Plus 3/4 Inch	610-27603
	#2	500						610-28205
	350	4/0						610-28007
	750	500						610-28403

FOR REFERENCE ONLY

JJ 405 PILC — CLP 5–16-kV 3/C Splice

Scope JJ 405.1 PILC — CLP, 5–16-kV 3/C Splice Module

Figure JJ 405–1: PILC-CLP 5–16-kV 3/C Splice Module

200A
Bushing Plug M/C 656-14505

600A
Basic Elbow M/C
656-34008
Cable Adapter 220 mil
350M/C 655-00209
750M/C 655-00225
1,000M/C 655-00233

Removable Stud M/C 656-16021
Spade Terminal
350M/C 655-28002
750M/C 655-28028
1,000M/C 655-28036

Basic Insl. Plug M/C 656-15908

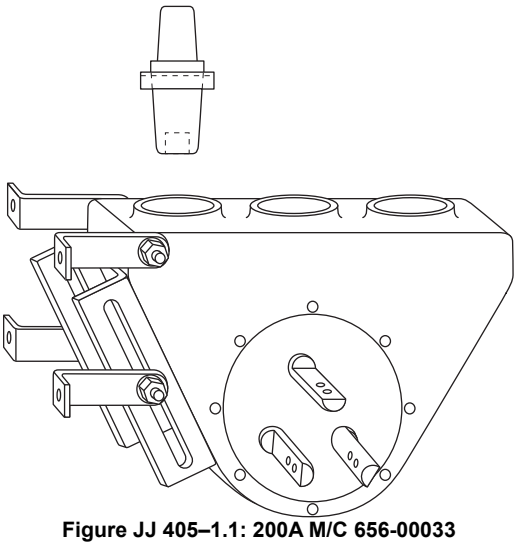


Figure JJ 405–1.1: 200A M/C 656-00033

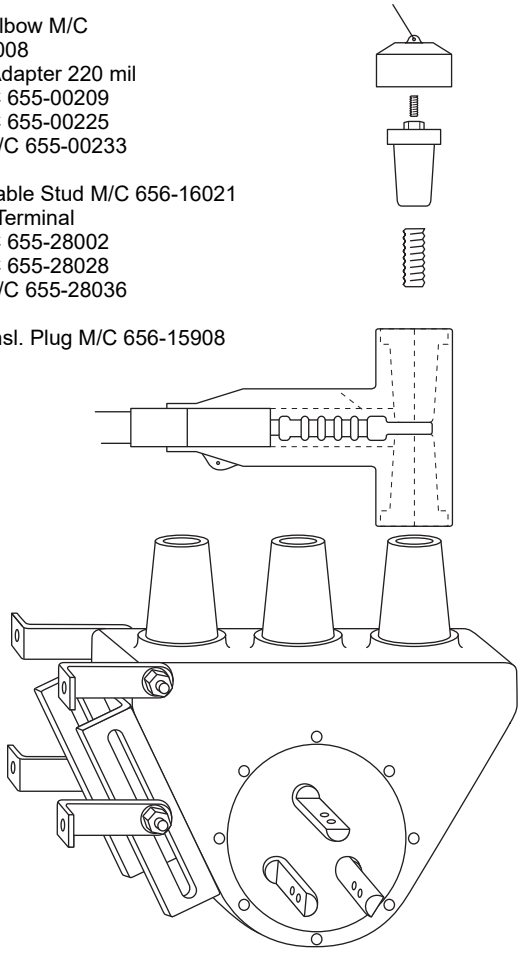


Figure JJ 405–1.2: 600A M/C 656-00041

1.0 Instructions

1.1 Attach Module

Bolt the CTM in its permanent location using hardware that is supplied with the unit.

1.2 Form and Cut Cables

Form the cables as nearly as possible to their final position. Cut the PILC to meet the lug on the module.

1.3 Prepare PILC

Place the spun copper sleeve and gasket on the PILC cable out of the way of the splice. Remove the lead sheath for a distance of 14 inches. Remove the insulation the depth of the solder lug plus 1/2 inch and step the insulation as shown on the drawing. Solder the 3/C copper shielding back onto the sheath.

Scope JJ 405.2 PILC — CLP 5–16 kV 3/C Splice Cable Transition Module

1.0 Instructions

1.1 Attach Module

Bolt the CTM in its permanent location using hardware that is supplied with the unit.

1.2 Form and Cut Cables

Form the cables as nearly as possible to their final position. Cut the PILC to meet the lug on the module.

1.3 Prepare PILC

Place the spun copper sleeve and gasket on the PILC cable out of the way of the splice. Remove the lead sheath for a distance of 14 inches. Remove the insulation the depth of the solder lug plus 1/2 inch and step the insulation as shown on the drawing. Solder the 3/C copper shielding back onto the sheath.

1.4 Solder Lugs

Solder the lugs on the PILC conductor at the same angle as the pads on the module. Attach the lugs to the module. After soldering, wait until cool, and then tighten terminal bolts to 10 foot-pounds.

NOTE To help alignment during soldering, the cable terminals may be bolted in working position on the CTM body. Do not fully tighten terminal bolts—leave a 1/16 inch space to prevent excessive heat transfer during soldering.

1.5 Flushing

Rinse lugs, exposed conductor strands, and cable insulation with cable oil heated to a temperature of 255 °F.

1.6 Apply Insulation

Fill in space between the ends of the lug and the first step of the cable insulation with glass cordage, insulate the lug with 1 inch varnish cambric tape up to within 1/2 inch of the module body and build a stress cone to peak at a distance of 4 inches from the lead sheath and build out to 5/16 inches as shown on the drawing.

1.7 Apply Shielding Braid

Tape the stress cone from just below the peak over the factory shielding 1/2 inch and solder in place.

1.8 Install Lead Sleeve

Attach sleeve onto epoxy module making sure filling hole is on top. Fasten with silicon-bronze capscrews provided. Torque opposite bolts 20 foot-pounds for 3/8 inch diameter and 25 foot-pounds for 1/2 inch diameter.

1.9 Fill with Compound

Remove the vent and fill plugs and fill with compound at a temperature of 275 °F. Allow the module to stand until the compound has cooled and then make a second fill. Install the fill and vent plugs.

1.10 Ground Module

Ground the module with the grounding lug provided with a 2 strand copper conductor. Attach lug to the sleeve flange only (See Figure JJ 405–2 [Sheet 5]). DO NOT attach grounding to module mounting bracket or hardware.

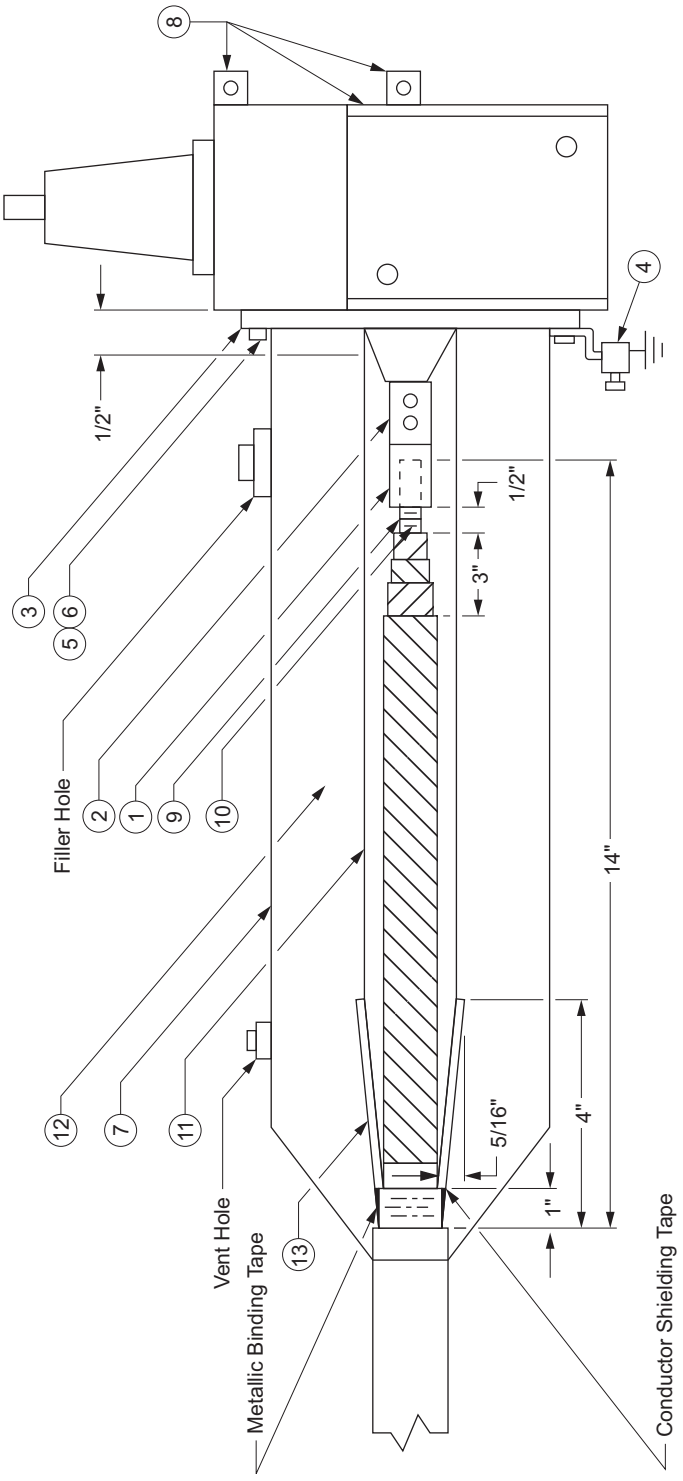
1.11 Complete Assembly

Select and install premolded rubber cable components onto the CLP cables (refer to appropriate underground standards). Attach cable to CTM.

Note(s):
1. The 600A unit is supplied with 750 kcmil lugs. For cables less than 750 kcmil, see JJ 100.
2. See TP 120 for 200A components and accessories.
3. See JJ 655 for 600A components and accessories.

Scope JJ 405.3 **Instructions for Splicing the PC Electric PILC — CLP, 5 kV, 12 kV, and 16 kV 3/C Splice Module**

Figure JJ 405–2: PC Electric PILC-CLP 5–16-kV 3/C Splice Module



Glass Cordage M/C 645-43002
1/2" V.C. Tape M/C 646-95703
1" V.C. Tape M/C 646-95901
Filling Compound M/C 645-28003
Tinned Copper Shielding Braid M/C 656-69202

CTM-II Parts List
Solder Lugs (3)
SSH-55 — 5/16" × 3/4" SS Allen Screws (6)
OR-625 — O-Ring 1/4" × 6-5/8" (1)
SLU-225 — Ground Clamp(1)
EB 612 — 3/8" × 1-1/8" Silicon Bronze Screws (8)
ELW6 — 3/8" Silicon Bronze Lock Washers (8)
WS-11-18 Spun Cu. Sleeve (1)
P-BRK-272 Mounting Bracket Assembly (1)
SS U Channel (1)
L Shaped Clamp (4)
3/8" × 1" SS Bolts W/L.W. and Nuts (2)
3/8" Flat Washers (4)
3/8" × 3/4" Silicon Bronze Screws W/L.W. (4)
Parts Supplied By User

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JJ 410 PILC — CLP 5–16-kV 1/C Splice — Raychem Heat Shrink

Scope JJ 410.1 Instructions for Splicing 5–16-kV 1/C Aluminum Cross-Linked Polyethylene Cables to 1/C Copper PILC Cable (Raychem HVS-1580 Series Heat Shrink Splice)

1.0 Application

The Raychem HVS-1580D and the HVSR-1580 series heat-shrinkable splices are applicable for use to join 1/C aluminum cross-linked polyethylene (CLP) insulated cable to 1/C copper PILC cable for both 4 kV and 12/16-kV applications.

The Raychem heat shrinkable splice is preferred over the taped splice.

2.0 Instructions

2.1 Measure and Cut Cables

A. Form the cables as nearly as possible into their final position, allowing the ends to overlap. Avoid all sharp bends, using a minimum bending radius of twelve times the cable diameter.

B. Determine the centerline of the joint, mark cables at this point and cut them off so that cable ends butt together.

2.2 Remove Jacket, Sheath, and Insulation

A. CLP Cable

1. Unwrap the concentric shield wires back a minimum of 20 inches from the center of the joint and temporarily secure the wires in place with plastic strap.

2. Remove the semiconducting jacket and cable insulation (one process) for a distance of “E” inches. Remove the semiconducting jacket for a distance of “A” inches from the end. Take care when removing the jacket so that the factory insulation is not nicked or damaged.

B. PILC Cable

1. Remove neoprene jacket or other protective covering (if present) of the PILC cable for the distance “B” inches from the center of the joint. Solvent clean and scrape the lead between the lead cutback and jacket cutback, before removal of lead sheath. If using HVSR kits, install jacket shim at the jacket cutback.

2. Remove lead sheath and insulation shield to cutback dimension “C” and “D” as shown in the drawing. Do not intentionally bell the lead.

2.3 Apply Oil Barrier Tube on PILC Cable

A. Make a reference mark 1-1/4 inches behind the lead edge.

B. Remove release paper from the stress relief mastic (SRM). Tension the SRM to one-half its width and apply it evenly over both the lead and paper insulation. Continue half-lapping the mastic under tension on the paper for one inch. Wrap back across the mastic to the reference

mark 1-1/4 inches on the lead sheath. The mastic should have a slight taper from the lead sheath to the paper insulation. Do not apply more than two half-lap layers of mastic, otherwise the oil barrier tube (OBT) may not fit over the mastic.

C. Slide the clear oil barrier tube (OBT) on the paper cable 1/4 inches beyond the mastic. Begin shrinking the oil barrier tube (OBT) at the lead jacket end. Completely shrink a one- to two-inch section before moving to the next section. Reapply heat to any uneven, rough areas with a rapid, brushing motion.

2.4 Install Shim (Only When supplied with Kit) on PILC Cable

A. A shim is included in the splice kit and is required for the following sizes only:

Table JJ 410–1: Shims on PILC Cable

Material Code	Raychem Cat. No.	Voltage	Conductor Size	
			CLP (Al)	PILC (Cu)
656-00470	HVSR-1582	5 kV	350	4/0
656-00413	HVSR-1584	5 kV	750	500
656-00132	HVSR-1584	12/15-kV	1,000	500

B. Position the red shim at a distance “F” from end of PILC cable. Shim must come in contact with the lead sheath. Shrink shim in place, beginning at the cable end and working towards the lead. Position the black (conductive) shim at a distance “G” from end of cable. Shrink shim in place beginning at the cable end and working towards lead. Black shim must come in contact with the lead sheath.

2.5 Slide Splice Tubings

A. Solvent clean the exposed lead sheath and the paper cable jacket a distance equal to the length of the longest tube.

B. Nest the tubes inside of each other (black stress control, red insulating, red/black insulating/conductive, and black outer jacketing). Place the nested tubes onto the clean lead cable jacket.

2.6 Apply Connector and Clean the Insulation

A. Remove insulation for a distance of “E” inches (one-half connector length + 1/2 inch) from each cable end. Chamfer the paper insulation and oil barrier tube for 1/2 inch.

B. Wire brush and clean the bare conductors. Slip compression connector supplied in kit into place, making sure the conductors are in as far as possible. Using appropriate compression tool and die, install circular crimps on each end of the connector. Deburr and smooth any resulting sharp edges on the installed connector. Remove excess compound and loose particles from the connector, taking care to prevent contamination of the cable insulation. Clean the exposed insulation.

2.7 Apply Stress Relief Mastic (SRM) on CLP Cable

Remove release paper from the short, angle-cut piece of stress relief mastic (SRM) and place three to four tight wraps at the semicon cutback of the CLP cable. SRM should be tapered to overlap the semicon and insulation by approximately 1/4 inch. If an HVSR kit (with shim) was used, apply the SRM in the same manner at the black (conductive) shim edge.

2.8 Apply Stress Relief Mastic (SRM) Around Connector

Remove release paper from one side of long strip of stress relief mastic (SRM). Starting at the paper cable side of the connector edge, using half-laps, tightly wrap the SRM around the connector, onto the CLP insulation, filling all voids, compression indents, and the gap between the connector edge and insulation. Wrap back across the connector building the mastic thickness equal to the cable insulation. Fill in the chamfered area with mastic on the paper insulation side and wrap onto the oil barrier tube (OBT) 3/4 inch and onto the CLP cable insulation 1/4 inch.

2.9 Apply Stress Control Tube

Center the innermost stress control tube over the mastic. The tube should completely overlap the oil barrier tube on the paper cable lead sheath. Begin shrinking in the center of the tube, working the propane torch with a smooth brushing motion around the entire circumference of the tube. Heat evenly, making sure enough heat is applied to the back side. After the center portion shrinks, work torch toward one end, then to the opposite end, and complete the shrinking.

2.10 Apply Red Insulating Tube and Red Sealant

Center the red insulating tube evenly over the black stress-control tube and shrink in the same manner as the stress control tube. After shrinking red tube, remove backing from red sealant. Using light tension, wrap sealant over the cable, butted up against the red tube. Build sealant to same level as red tube.

2.11 Apply Dual-Layer Insulating/Conductive Tube

Center the dual-layer (red/black) insulating/conductive tube and shrink into place using the same procedure as the other two tubes.

2.12 Apply Grounding and Jacket Replacement

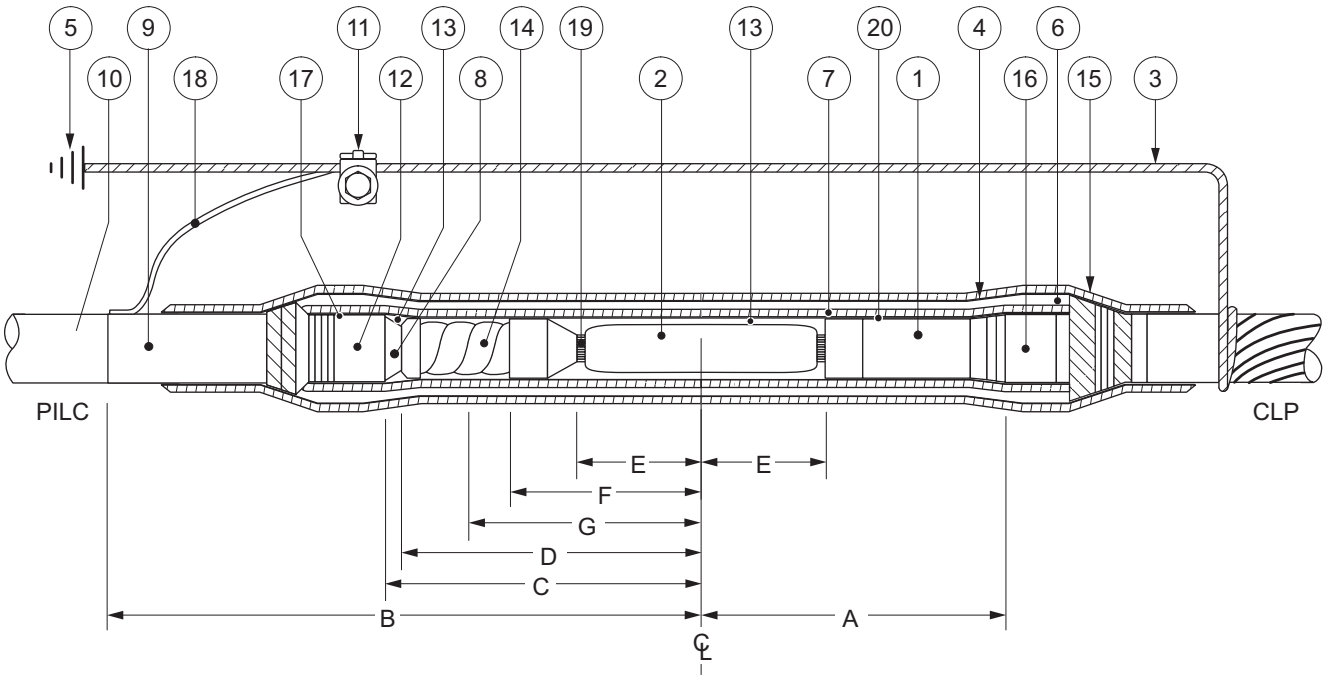
A. Under tension, half-lap the copper shielding mesh across the joint from the concentric neutral semicon shield to the lead sheath. Tie off mesh and remove excess.

B. Wipe clean semicon and lead sheath 3 inches beyond end of copper mesh. Center outer jacketing tube so that at least 3 inches of both lead sheath and semicon are covered. Shrink in place.

C. Solder the external ground braid to lead sheath next to the edge of the outer jacketing tube. Use a neutral wire connector to connect the ground braid and the CLP cable neutral wires to external ground. The splice is now complete.

Note(s):
1. Allow the splice to cool before moving or energizing.

Figure JJ 410–1: PILC — CLP 5–16-kV 1/C Splice — Raychem Heat Shrink



1. Cable Insulation, /Cross-linked Polyethylene (CLP)
2. Compression Connector*
3. Concentric Neutral Wires Twisted and Connected Together Outside of Splice
4. Copper Mesh and Ground Braid*
5. Ground the Splice
6. Insulating/Conductive Sleeve*
7. Insulating Sleeve*
8. Insulation Shiled
9. Lead Sheath
10. Neoprene Protective Jacket
11. Neutral Wire Connecto
12. Oil Barrier Tubing (OBT)*
13. Oil Block Stress Relief Mastic (SRM)*
14. Paper Insulation
15. Outer Jacketing Sleeve*
16. Semi-Conducting Insulation Shield
17. Shim (only when needed and supplied with kit)*
18. Soldered Ground Strap
19. Strand Conductor
20. Stress Control Sleeve*

* Supplied in Raychem Kit

Table JJ 410–2: PILC — CLP 5–16-kV 1/C Splice — Raychem Heat Shrink

Material Code	Raychem Cat. No.	Voltage	Conductor Size		Dimensions (in)						
			CLP (Al)	PILC (Cu)	A	B	C	D	E	F	G
656-00462	HVS-1581D	5 kV	#2	#2	5.50	14.50	7.00	6.50	1/2 Connector Length + 1/2		
656-00488	HVS-1582D	5 kV	#2	500	6.00	14.50	7.50	7.00			
656-00470	HVSR-1582	5 kV	350	4/0	6.00	14.50	8.00	7.50		3.50	7.00
656-00413	HVSR-1584	5 kV	750	500	7.50	16.00	9.50	9.00		5.00	8.50
656-00439	HVS-1581D	12/16-kV	#2	#2	5.50	14.50	7.00	6.50	1/2 Connector Length + 1/2		
656-00330	HVS-1581D	12/16-kV	1/0	#2	5.50	14.50	7.00	6.50			
656-00322	HVS-1582D	12/16-kV	350	4/0	6.00	14.50	7.50	7.00			
656-00447	HVS-1583D	12/16-kV	350	500	7.00	15.50	8.50	8.00			
656-00454	HVS-1583D	12/16-kV	750	500	7.00	16.00	8.50	8.00			
656-00132	HVSR-1584	12/16-kV	1,000	500	7.50	16.00	9.50	9.00		5.00	8.50

JJ 411 PILC — CLP 5–16-kV 3/C Splice — Raychem Trifurcation Heat Shrink

Scope JJ 411.1 Instructions for Splicing 5–16-kV Three 1/C Aluminum Cross-Linked Polyethylene Cables to 3/C Copper PILC Cable (Raychem HVS-T-1580S and HVSR-T-1580 Series Heat Shrink Splice)

1.0 Application

The Raychem HVS-T-1580S and the HVSR-T-1580 series heat-shrinkable trifurcating transition splices are applicable for use to join 1/C aluminum cross-linked polyethylene (CLP) insulated cable to 3/C copper PILC cable for both 5 kV and 12/16-kV applications.

The Raychem heat shrinkable splice is preferred over the taped splice.

2.0 Instructions

2.1 Measure and Cut Cables

A. Form the cables as nearly as possible into their final position, allowing the ends to overlap. Avoid all sharp bends, using a minimum bending radius of twelve times the cable diameter.

B. Determine the centerline of the joint, mark cables at this point and cut them off so that cable ends butt together.

2.2 Remove Jacket, Sheath, and Insulation

A. CLP Cables

1. Unwrap the concentric shield wires back a minimum of 20 inches from the center of the joint and temporarily secure the wires in place with plastic strap.

2. Remove the semiconducting jacket and cable insulation (one process) for a distance of “E” inches. See JJ 411.10. Remove the semiconducting jacket for a distance of “A” inches from the end. Take care when removing the jacket so that the factory insulation is not nicked or damaged.

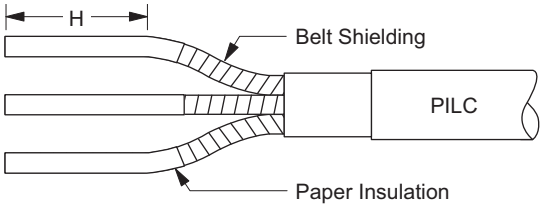
B. PILC Cable

1. Remove neoprene jacket or other protective covering (if present) of the PILC cable for the distance “B” inches from the center of the joint. Solvent clean and scrape the lead between the lead cutback and jacket cutback, before removal of lead sheath. If using HVSR kits, install jacket shim at the jacket cutback.

2. Remove lead sheath and insulation shield to cutback dimension “C” as shown in the drawing. Do not intentionally bell the lead.
   - 5 kV PILC Cable: Cut back belt papers for a distance of 1/2 inch less than dimension “C.”
   - 15 kV PILC Cable: Remove belt shielding to dimension “C”, cut back phase shielding to dimension “D.”

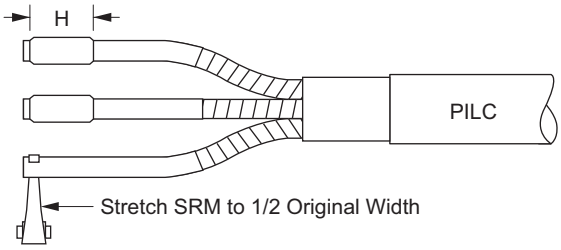
2.3 Apply Stress Relief Material (SRM) and Oil Barrier Tubes on PILC Cable

A. Mark insulation as shown below.



Kit	H (in)
HVS/HVSR-T-1581S	3-1/2
HVS/HVSR-T-1582S	4
HVS/HVSR-T-1583S	5
HVS/HVSR-T-1584S	5-1/2

B. Remove release paper from stress relief material (SRM). Tension the SRM to one-half its width and apply one-half lap layer on SRM around each phase as shown.

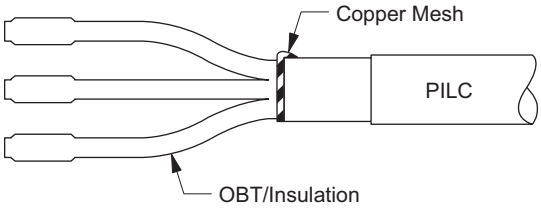


C. Slide the clear oil barrier tube (OBT) over each phase, butted to the lead sheath or the paper cutback. Shrink the three OBTs in place starting at the lead sheath cutback.

D. For 15 kV PILC cable, fold the one-inch wide copper mesh in half lengthwise. Wind mesh around each phase shield as closely as possible to the lead sheath cut. Solder copper mesh to the lead sheath. Cut off excess mesh close to lead sheath.

NOTE Before continuing for kits (HVSR) with shims, go to Paragraph 3.0 (Sheet 10).

2.4 Mark OBT/Insulation at “I.”



2.5 Position Black Conductive Tubes; Shrink in Place

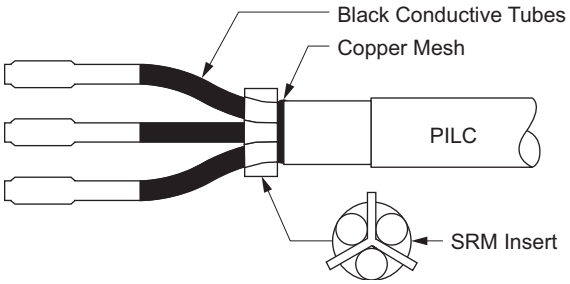
Place black conductive tube over each phase and position at dimension “I”. Shrink in place starting at the end nearest to the center of the splice.

2.6 Clean OBTs

Using an oil free solvent, clean the OBT/Insulation.

2.7 Install SRM Insert

Assemble SRM insert per box instructions. Spread the phases and position the insert as shown. The SRM insert is packaged inside the conductive breakout.



2.8 Trim Excess SRM Insert

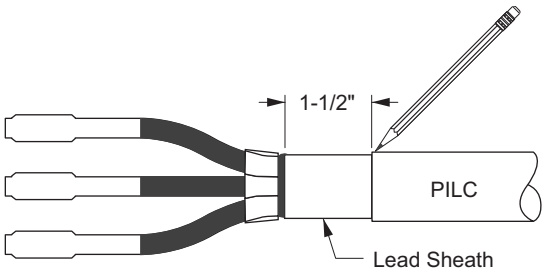
Trim SRM insert to 1/8 inch beyond each phase.

2.9 Clean Lead Sheath

Reclean lead sheath as shown using a oil-free solvent.

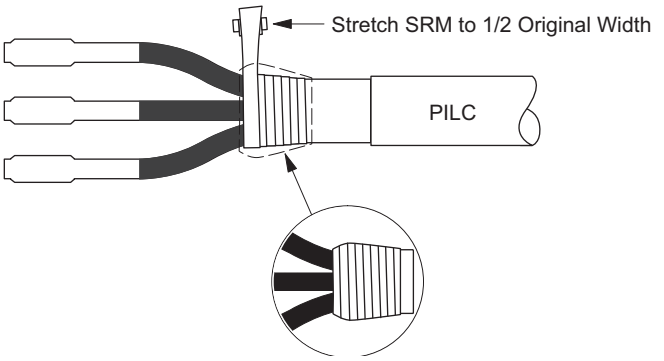
2.10 Mark Lead Sheath as Shown

To ensure SRM to OBT adhesion, gently heat the SRM insert and adjacent OBT before moving to the next step.



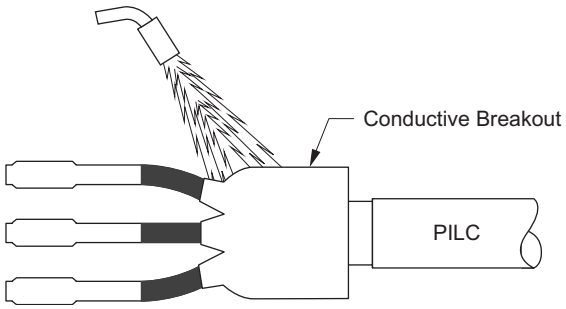
2.11 Install Oil Seal

Remove backing from one side of a long strip of SRM. Roll the SRM and remaining backing strip into a convenient size. Removing the remaining backing strip, tightly wrap the SRM from the mark on the lead sheath to the outer edge of the SRM insert. Four to six strips of SRM should be used to build the SRM to the shape shown. Do not over apply. The finished SRM diameter should not exceed that of the breakout installed in the next step.



2.12 Position Conductive Breakout; Shrink in Place

Position the conductive breakout over the SRM so that the inside butts up hard against the SRM. Shrink in place starting at the fingers and working toward the other end.

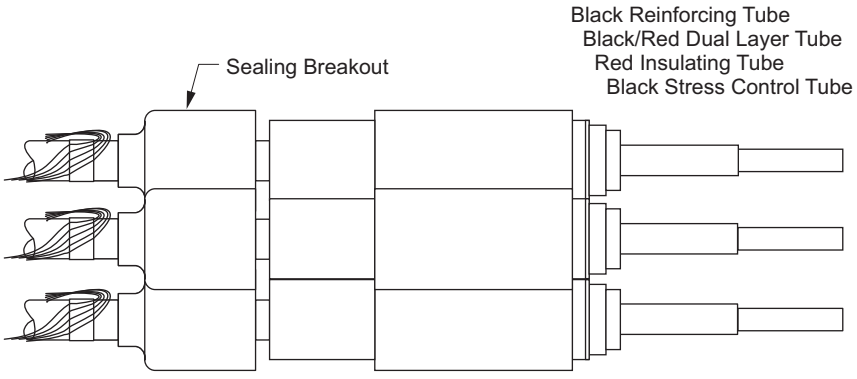


2.13 Inspect Breakout

After the breakout has shrunk, continue to apply heat until breakout has a smooth, uniform surface.)

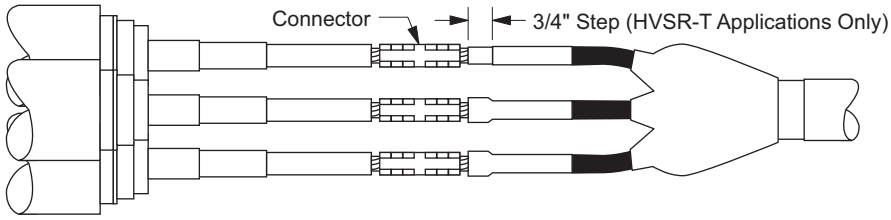
2.14 Clean CLP Cables; Position Splice Components

Abrade insulation, if necessary, to remove imbedded semicon. Clean poly cable jackets for 30 inches. Place sealing breakout over the poly cables with fingers pointing away from the splice center.



2.15 Remove Insulation from the PILC Cables, and Install Connectors

Remove insulation for a distance of “E” inches (one-half connector length + 1/2 inches) from each cable end. Wire brush and clean the bare conductors. Slip the proper size oil stop compression connector (supplied with kit) into place, making sure the conductors are in as far as possible. Using appropriate compression tool and die, install three circular crimps on each end of the connector. Deburr and smooth any resulting sharp edges on the installed connector. Remove excess compound and loose particles from the connectors, taking care to prevent contamination of the cable insulation. Clean the exposed insulation.

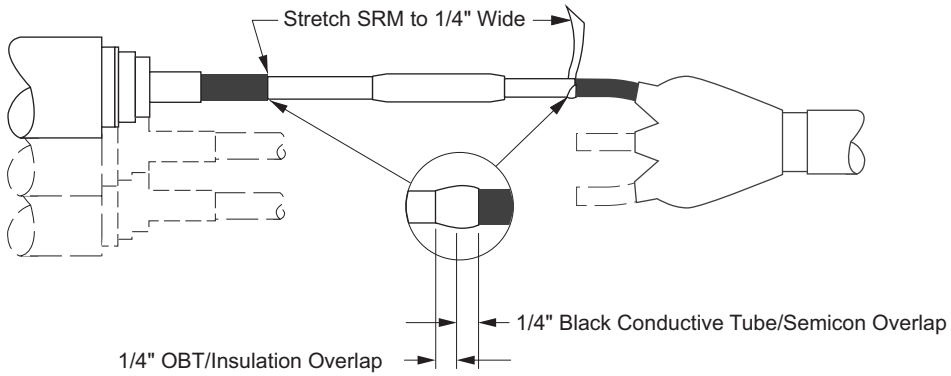


2.16 Apply SRM over Connector

Remove backing from one side of a long strip of SRM. Roll the SRM and remaining backing strip into a convenient size. Removing the remaining backing strip, tightly wrap the SRM around the connector and exposed conductor. Be sure to fill the gaps and low spots around the connector. Continue to wrap the SRM onto the insulation as shown. If the connector diameter is larger than the insulation diameter, apply two half-lapped layers of SRM over the entire connector. Discard any excess SRM (long strips).

2.17 Apply SRM at Black Conductive Tube Step and at Semicon Cutback

Remove backing from the short angle-cut piece of SRM. Place tip of SRM at black conductive tube/semicon step and tightly wrap to fill the step. Overlap black conductive tube/semicon and OBT/Insulation and taper down to meet OBT insulation as shown.



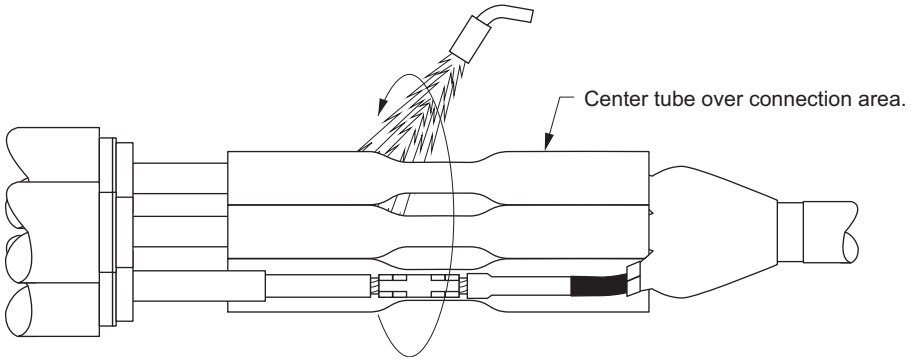
2.18 Position Black Stress Control Tube

A. Center black stress control tube over the completed connector area. Be sure to equally overlap the poly cable semicon and the PILC cable black conductive tube.

B. Repeat steps 18–21 for the remaining two phases.

2.19 Check Position of Black Stress Control Tubes; Shrink in Place

Make sure each tube is centered over the connection, equally overlapping the semicon (poly side) and black conductive tube (PILC side). Shrink all three tubes at the same time. Beginning at the center of tubes (1), working torch as before toward one end (2), then to the opposite end (3). Apply sufficient heat to ensure softening of the SRM, indicated by a smooth surface profile.

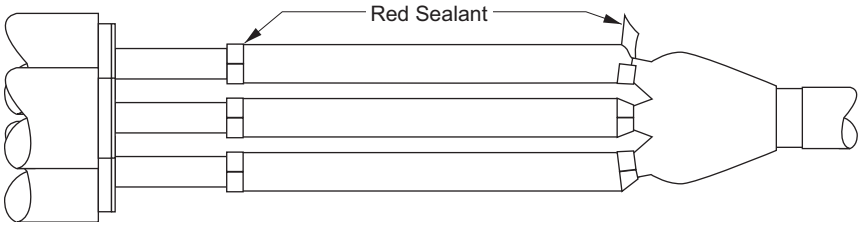


2.20 Position Red Insulating Tubes; Shrink in Place

Center tubes over the black stress control tubes. Shrink in place using the same method as in the previous step.

2.21 Apply Red Sealant

Remove backing from red sealant. Using light tension, wrap sealant over the cable, butted against the red insulation tube as shown. Build the sealant to the level of the red insulating tube.



2.22 Position Black/Red Dual Layer Tubes; Shrink in Place

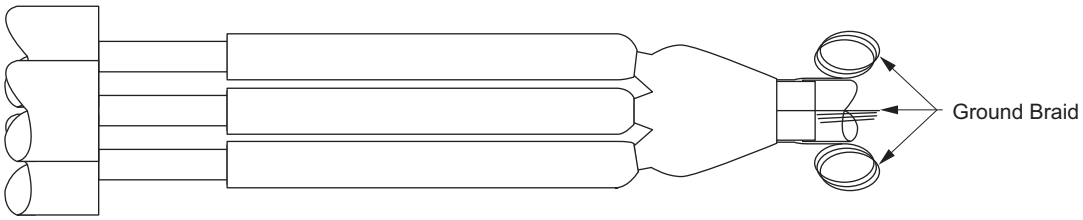
Center tubes over the red insulating tubes. Shrink in place using the same method as previously described.

2.23 Position Black Reinforcing Tubes; Shrink in Place

Center tubes over the black/red dual layer tubes. Shrink in place using the same method as previously described.

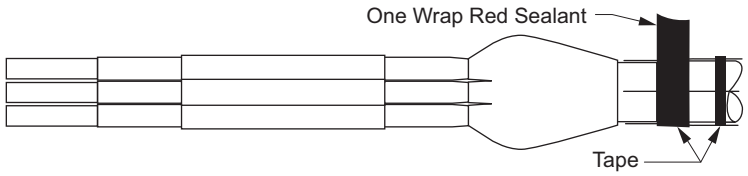
2.24 Install Ground Braids

Space the braids evenly around the PILC cable and solder to the lead sheath. To prevent the ingress of moisture, solder-block the ground braids for two inches from the PILC jacket.



2.25 Apply Red Sealant

Solvent clean and abrade the cable jacket. Apply one layer of red sealant onto the cable jacket. Bring the braids forward and temporarily tape them to the PILC cable to hold them in position. Press the braids onto the sealant. Apply one layer of sealant directly over the braids and the first layer of sealant. Sealant should encapsulate the solderblocked braids.

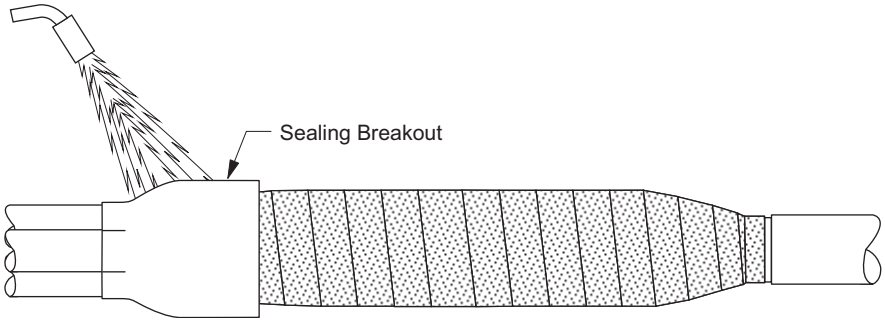


2.26 Apply Shield Mesh

Starting at the poly cable semicon, wrap one half-lapped layer of two-inch wide shielding mesh across the splice and solder to the PILC cable sheath.

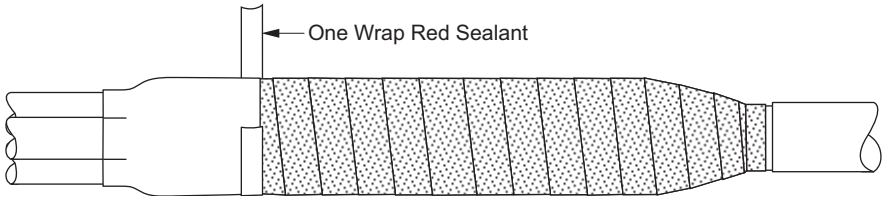
2.27 Install Nonconducting Sealing Breakout

Position the breakout on the poly-cable semicon, with the fingers clear of the neutral wires and the body over the three splices. Shrink in place starting with the fingers and working toward the splice center.



2.28 Apply Red Sealant

When the breakout has cooled sufficiently to touch, apply one wrap of red sealant to the body of the breakout.



2.29 Apply Red Sealant

When the breakout has cooled sufficiently to touch, apply one wrap of red sealant to the body of the breakout.

2.30 Position Wraparound Sleeve and Install Channel Clip

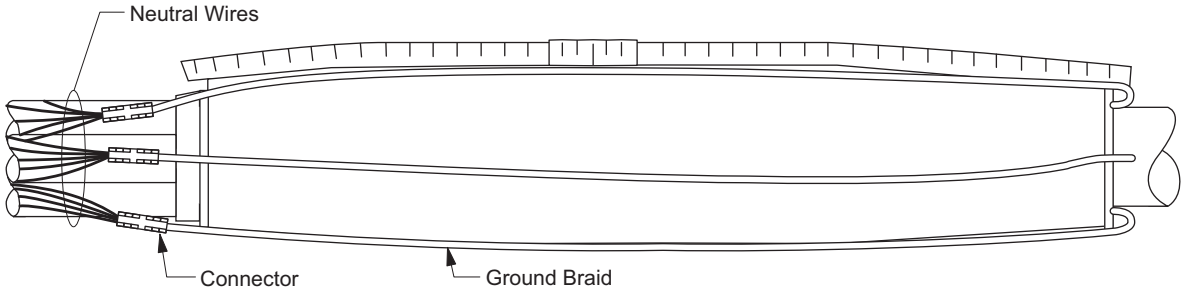
Remove or tape over sharp points to prevent puncture of wraparound sleeve. Remove backing from the wraparound sealing sleeve and center sleeve over splice. Slide metal channel onto butted rails. If two channels are used, connect the channels with the short channel retention clip. Use pliers to install clip. Channel (s) must overlap sleeve edge by 1/4 inch minimum.

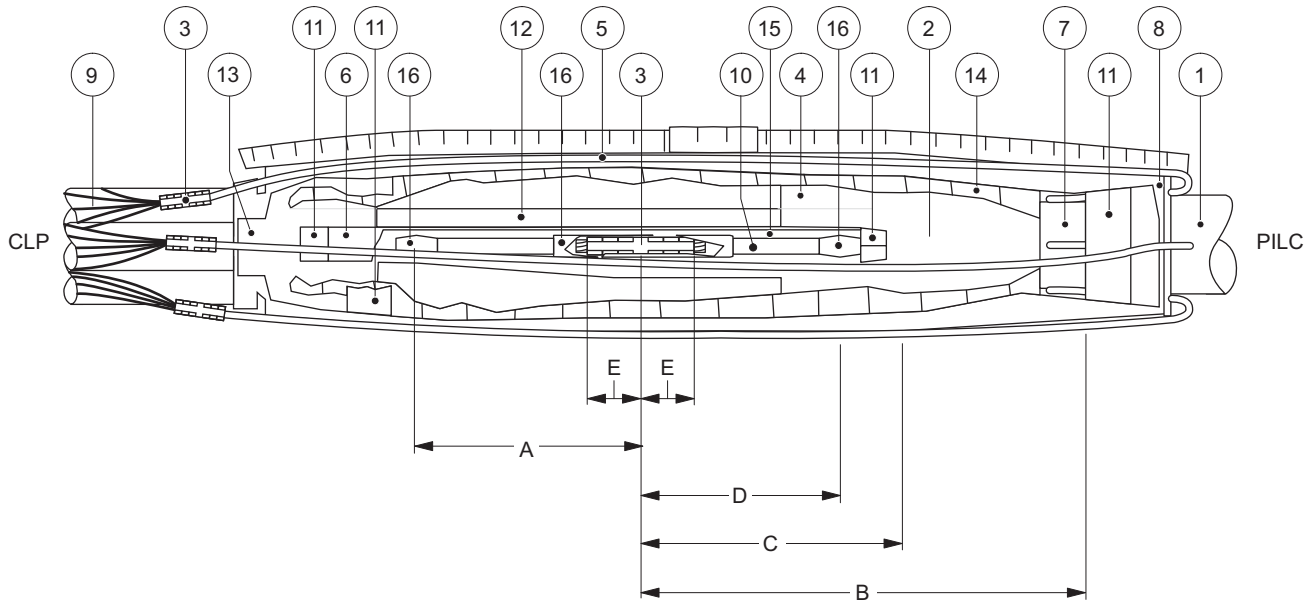
2.31 Shrink Wraparound Sleeve

Begin shrinking at the center of the sleeve and work toward each end. Post heat the entire sleeve, concentrating on metal channel area, for 30 seconds after completely shrunk.

2.32 Connect Ground Braids

Fold braids back over the splice and crimp or solder to the concentric neutral wires. Use a neutral wire connector to connect the ground braid and the CLP cable neutral wires to the external ground. The splice is now complete. Allow the splice to cool before moving or energizing.





1. Cable Outer Jacket
2. Connector Breakout*
3. Connector (center blocked)*
4. Dual Layer Tube*
5. Ground Braid*
6. Insulating Tube*
7. Lead Sheath
8. MBSM Wraparound Sleeve*
9. Neutral Wires
10. Oil Barrier Tube*
11. Red Sealant*
12. Reinforcing Tube*
13. Sealing Breakout* , **
14. Shield Mesh*
15. Stress Control Tube*
16. Stress Relief Mastic*

*Supplied in Raychem kit
**Remove release paper from breakout boot before installing.

Table JJ 411–1: PILC — CLP 5–16-kV 3/C Splice — Raychem Trifurcation Heat Shrink

SAP Number	Raychem Cat. No.	Voltage	Conductor Size		Dimensions (in)				
			CLP (Al)	PILC (Cu)	A	B	C	D	E
10117871	HVS-T-1581S	5 kV	#2	#6	5.50	19.00	14.00	8.00	1/2 Connector Length + 1/2
10117872	HVSR-T-1582	5 kV	350	4/0	6.00	20.00	15.00	9.00	
10117870	HVSR-T-1583	5 kV	750	500	7.00	22.00	16.00	10.00	
10117868	HVS-T-1581S	12/16-kV	#2	#2	5.50	19.00	14.00	8.00	
10117865	HVS-T-1581S	12/16-kV	1/0	#2	5.50	19.00	14.00	8.00	
10117869	HVS-T-1582S	12/16-kV	350	4/0	6.00	20.00	15.00	9.00	
10117866	HVS-T-1583S	12/16-kV	750	500	7.00	22.00	17.00	11.00	
10117867	HVSR-T-1584	12/16-kV	1,000	500	7.50	23.00	17.00	11.00	

3.0 Instructions for Splices Requiring Shims (continued from Paragraph 2.3 [Sheet 2])

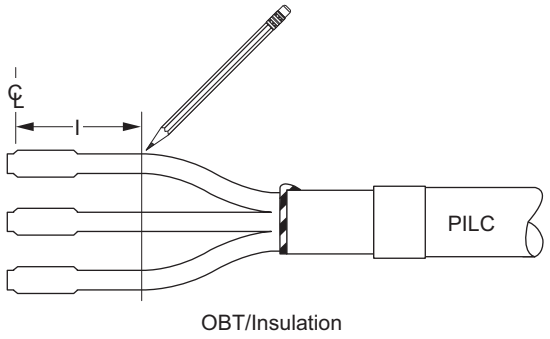
3.1 Install Shim (Only When Supplied with Kit) on PILC Cable

Shims are included in the splice kit and are required for the following sizes only:

Material Code	Kit Number	Voltage	Conductor Size	
			CLP (Al)	PILC (Cu)
656-00728	HVSR-T-1582	5 kV	350	4/0
656-00702	HVSR-T-1583	5 kV	750	500
656-00678	HVSR-T-1584	12/16-kV	1,000	500

3.2 Mark OBT/Insulation at "I"

Raychem Kit	I (in)
HVSR-T-1582	7-1/2
HVSR-T-1583	8-1/2
HVSR-T-1584	9

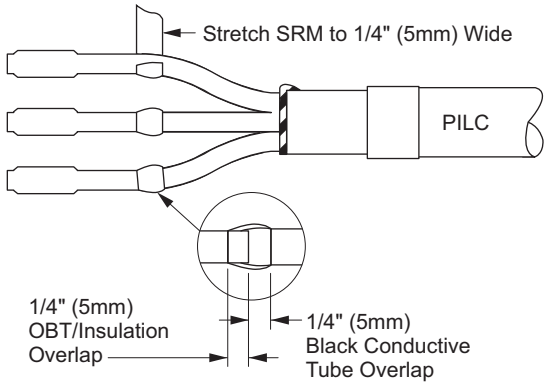


3.3 Position Black Conductive Tubes in Place

Place black conductive tube over each phase and position at dimension I. Shrink in place starting at the end nearest the center of the splice.

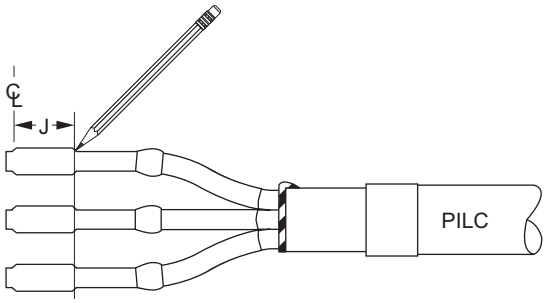
3.4 Apply SRM at Step of Black Conductive Tubes

Remove backings from the short angle-cut piece of SRM. Place tip of SRM on OBT/insulation and tightly wrap to fill black conductive tube step. Taper SRM down to meet OBT/ insulation as shown.



3.5 Mark OBT/Insulation at “J”

Raychem Kit	J (in)
HVSR-T-1582	4
HVSR-T-1583	5
HVSR-T-1584	5-1/2

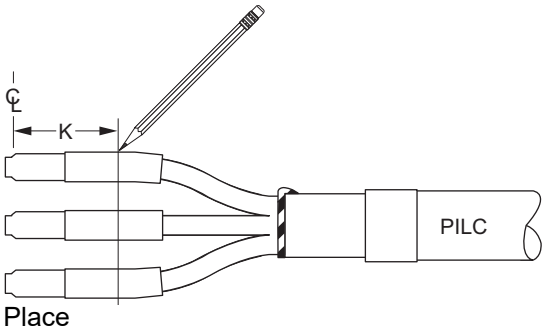


3.6 Position Red Shim Tubes

Place red shim tube over each phase and position at mark made at dimension “J”. Shrink in place starting at the end of the splice.

3.7 Mark Red Shim at “K”

Raychem Kit	K (in)
HVSR-T-1582	7
HVSR-T-1583	8
HVSR-T-1584	8-1/2



3.8 Position Black Shim Tube; Shrink in Place

Place a black shim tube over each phase and position at mark made at dimension “K”. Shrink in place starting at the end nearest the center of the splice.

3.9 Return to Paragraph 2.6 (Sheet 3).

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JJ 450 1/C PILC — 1/C Raychem Adapter for Use with 600 A Elbows

Scope JJ 450.1 Instructions for Installing 600 A Elbows on 1/C PILC Using Raychem Lead-to-Poly Heat Shrink Adapter

1.0 Application

The Raychem lead-to-poly heat shrink adapter can be used to make up 1/C, 500 kcmil or 4/0 AWG PILC for direct connection to a 600 A elbow receptacle (M/C 656-34008).

Table JJ 450–1: Material Code Information for Raychem Lead-to-Poly Heat Shrink Adapter Kits

Material Code	PILC Cable Size	Part Number
655-01454	4/0 AWG	HVE-1592-SCE
655-01462	500 kcmil	HVE-1593-SCE

Note(s):
1. Adapter Kit (M/C 655-01454) includes cable adapter (M/C 655-00225) terminal spade (M/C 655-01744) for compact cable, and terminal spade (M/C 655-02593) for compressed cable.
2. Adapter Kit (M/C 655-01462) includes cable adapter (M/C 655-00225), terminal spade (M/C 655-01728) for compact cable, and terminal spade (M/C 655-02593) for compressed cable.

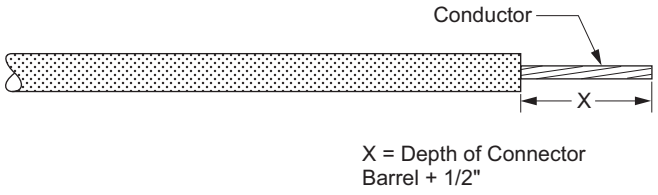
2.0 Instructions

2.1 Train the cable per established procedures outlined in JJ 450.

2.2 Install connector.

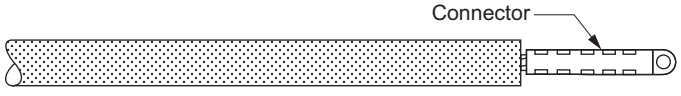
A. Remove cable insulation together with lead sheath and cable jacket (if present) equal to the depth of the connector barrel plus 1/2 inch.

Figure JJ 450–1: Removing Cable Insulation



B. Install the connector per JJ 411.

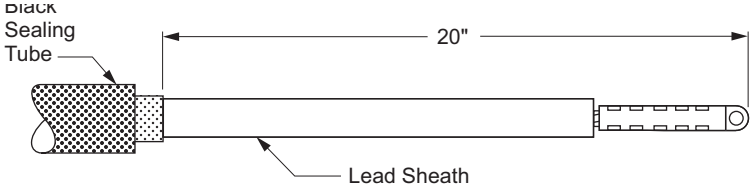
Figure JJ 450–2: Installing Cable Connector



2.3 Remove cable jacket.

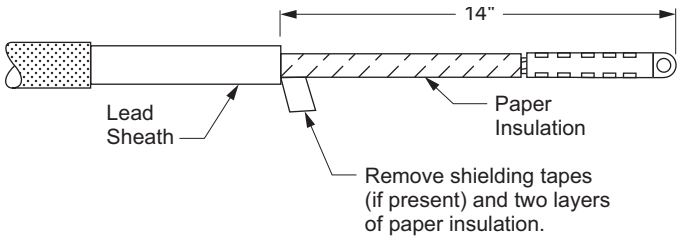
Measuring from the end of the connector, remove the cable jacket to the dimension shown. If required, slide black sealing tube over cable.

Figure JJ 450–3: Removing Cable Jacket



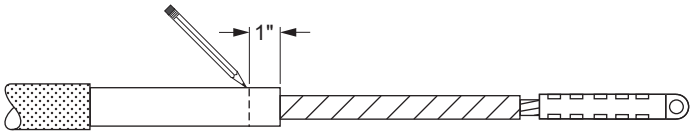
2.4 Clean lead and remove lead sheath. Degrease and abrade the lead sheath for 6 inches from the cable jacket cutback dimension. Measuring from the end of the connector, remove the lead sheath to the dimension shown.

Figure JJ 450–4: Removing Lead Sheath from Cable



2.5 Mark the sheath as shown.

Figure JJ 450–5: Marking Lead Sheath

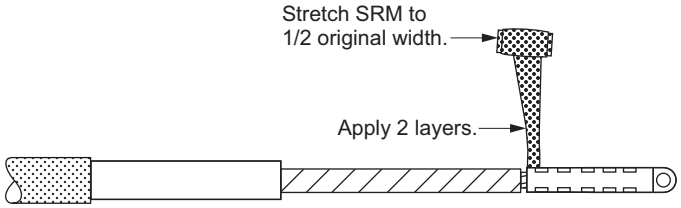


2.6 Install the Stress Relief Material (SRM).

A. Remove backing from one side of the Stress Relief Material (SRM). Roll the SRM and remaining backing strip into a convenient size roll. Starting at the end of the connector barrel, apply two half-lapped layers of SRM stretched to half its original width for the full length of the lug barrel.

CAUTION The Stress Relief Material (SRM) must be applied to both a clean and dry surface to provide a sufficient cable oil seal.

Figure JJ 450–6: Removing Stress Relief Material Backing

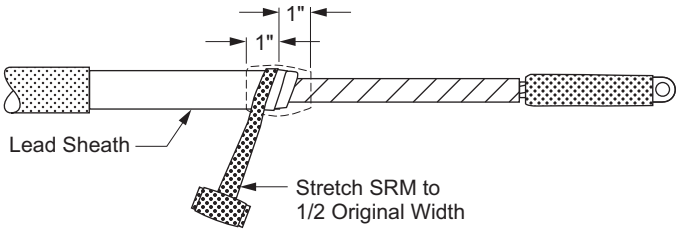


B. Remove backing from one side of a strip of SRM. Roll the SRM and remaining backing strip into a convenient size.

C. Remove the remaining backing strip and tightly wrap SRM around the lead cutback. Continue wrapping to the mark on the lead sheath, then back onto the insulation for one inch as shown.

CAUTION The Stress Relief Material (SRM) must be applied to both a clean and dry surface to provide a sufficient cable oil seal.

Figure JJ 450–7: Wrapping Lead Sheath with Stress Relief Material Backing



D. Apply a maximum thickness of 1/8-inch of SRM over the lead sheath to prevent excessive diameter buildup.

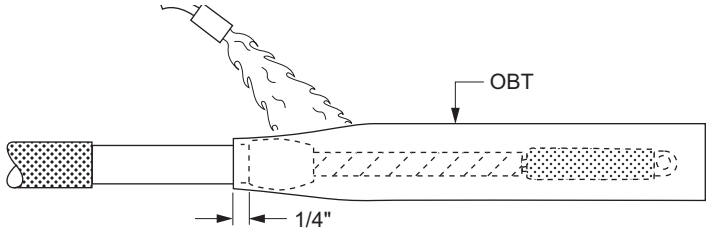
2.7 Position the clear Oil Barrier Tube (OBT) with shrink in place.

A. Position the clear OBT over the lead cutback as shown. Shrink in place starting at the lead cutback. Work around the tube with a smooth brushing motion.

B. To achieve a smooth wrinkle-free installation, use a reduced flame to install the thin-walled OBT. If the OBT “folds back” on itself, immediately eliminate the fold by pulling the OBT end.

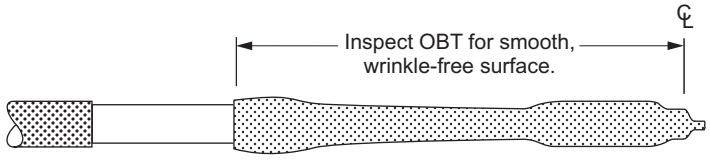
CAUTION The outside surface of the Stress Relief Material (SRM) must be clean and dry, before the Oil Barrier Tube (OBT) is applied. This will ensure a sufficient cable oil seal.

Figure JJ 450–8: Heat-Shrinking of Oil Barrier Tube on Lead Cutback



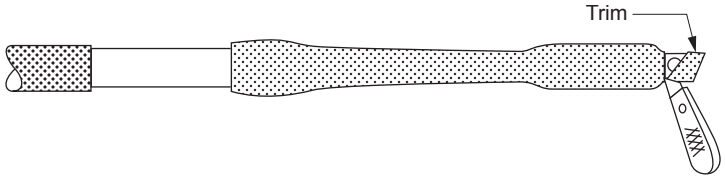
2.8 Inspect OBT.

Figure JJ 450–9: Inspection of Oil Barrier Tube



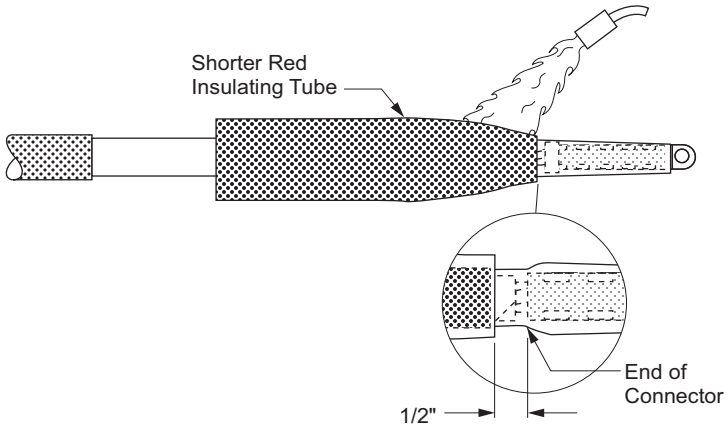
2.9 Trim OBT.

Figure JJ 450–10: Trimming of Oil Barrier Tube



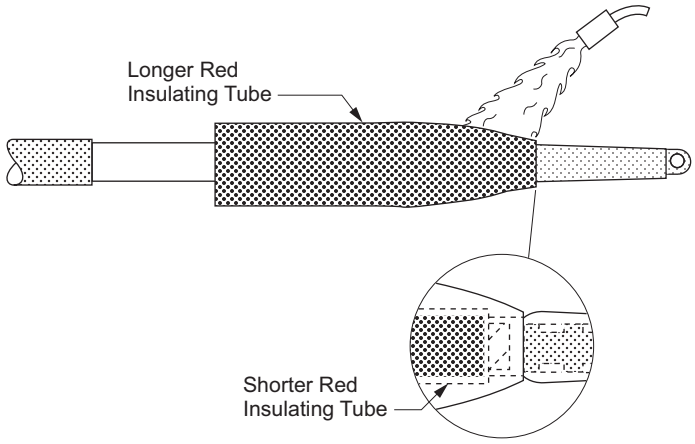
2.10 Position shorter red tube and shrink in place.

Figure JJ 450–11: Heat-Shrinking



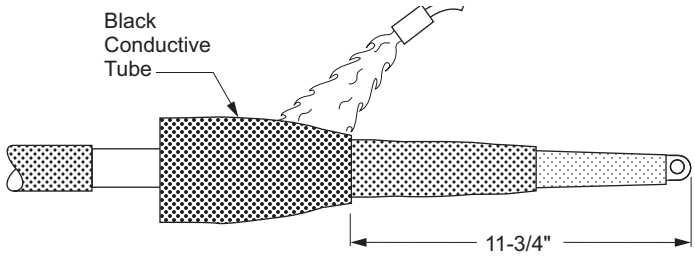
2.11 Position longer red tube and shrink in place.

Figure JJ 450–12: Heat-Shrinking Longer Insulation Tube



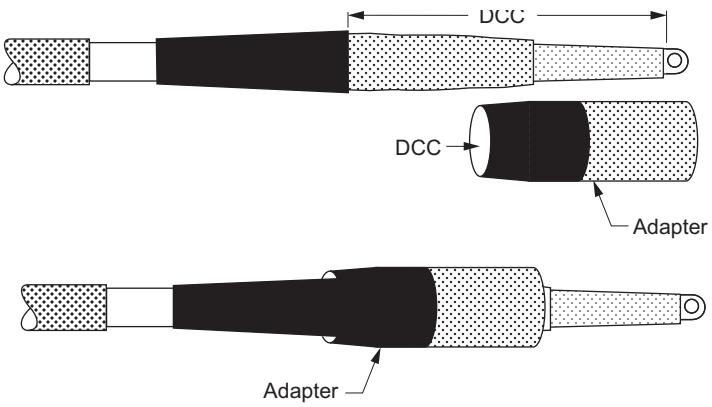
2.12 Position black conductive tube and shrink in place.

Figure JJ 450–13: Heat-Shrinking Conductive Tube



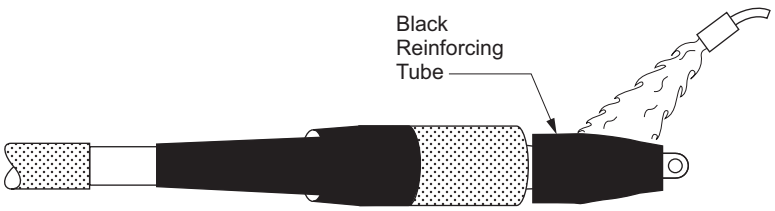
2.13 Apply Discharge Control Compound (DCC). Install adapter.

Figure JJ 450–14: Application of Discharge Control Compound and Adapter Installation



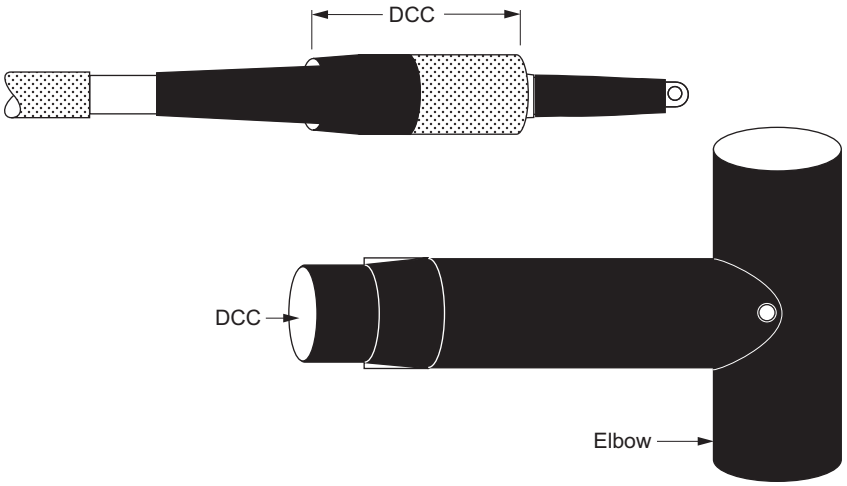
2.14 Position black reinforcing tube and shrink in place.

Figure JJ 450–15: Heat-Shrinking Reinforcement Tube



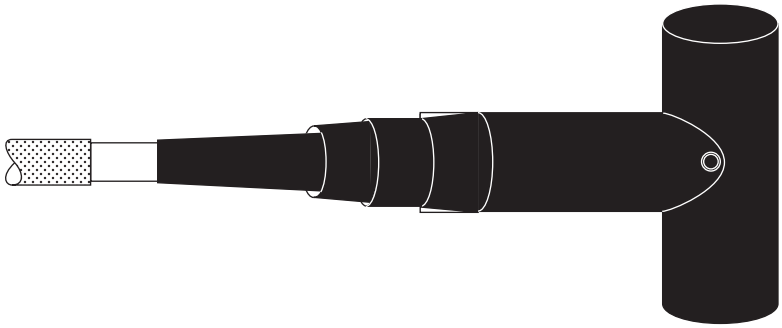
2.15 Apply Discharge Control Compound (DCC).

Figure JJ 450–16: Application of Discharge Control Compound



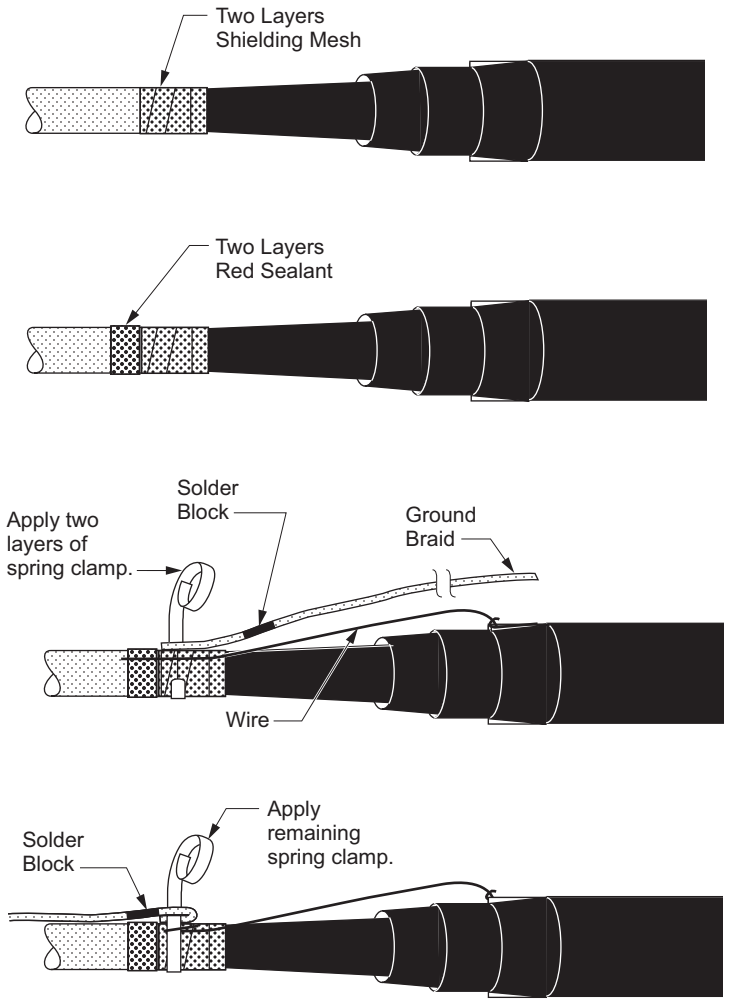
2.16 Push elbow housing onto adapter.

Figure JJ 450–17: Pushing Elbow Housing on to Adapter



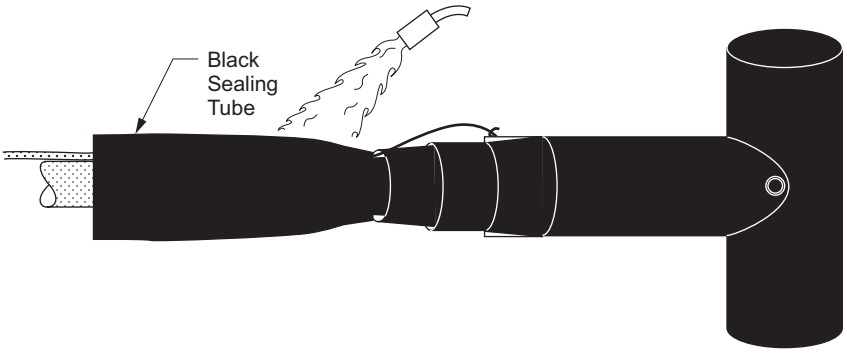
2.17 Install ground braid and bonding wire.

Figure JJ 450–18: Installation of Ground Braid and Bonding Wire



2.18 Position black sealing tube and shrink in place.

Figure JJ 450–19: Heat-Shrinking Sealing Tube



JJ 500 Poly-Taped Splicing Instructions

Scope JJ 500.1 Instructions for Taped Splicing 1/C 5–34.5-kV Polyethylene-Insulated Cables (Refer to JJ 505)

1.0 General

These instructions cover the procedure for splicing single conductor aluminum cable with crosslinked polyethylene insulation, semiconducting jacket, and concentric neutral wires. Whenever possible, use premolded rubber splice in lieu of hand taping. Use taped splicing only if premolded components are not available.

2.0 Measure and Cut Cables

Form the cables as nearly as possible into their final position, allowing the ends to overlap. Avoid all sharp bends, using a minimum bending radius of 12 times the cable diameter. Determine the location of the vertical centerline of the joint, and cut the cables so that one end extends at least 30 inches beyond the centerline. Cut the other end at the centerline. Use plastic strap to secure concentric wires on cable as shown on the drawing. Make sure the concentric wires from one cable are long enough to wrap around the finished splice. Unwrap the concentric wires and spread away from the cable. Cut off excess cable at joint center.

3.0 Remove Insulation and Semiconducting Jacket

Remove the semiconducting jacket and cable insulation (one process) for a distance of “C” inches. Remove the semiconducting jacket for distance of “A” inches. Take care when removing the jacket so that the factory insulation is not nicked or damaged.

4.0 Pencil Insulation

Pencil the cross-linked polyethylene insulation using approved tool. Be careful not to nick the conductor.

5.0 Apply Connector and Clean the Insulation

Clean the conductor strands and slip the proper size and type compression connector (See JJ 110) into place. Using appropriate die, compress connector. Clean the exposed insulation.

6.0 Extend Strand Shielding

Apply one half-lapped layer of semiconducting tape over the connector and the stranded conductor, extending 1/4 inch onto the penciled insulation.

7.0 Apply Insulation

Apply high-voltage insulating tape, half-lapped, to a diameter “D” forming gradual slopes at each end, extending tape to edge of semiconducting jacket. Do not overlap the semiconducting insulation jacket with insulating tape. Apply tape in a uniform manner. Use 3/4 inch-wide tape near connector. 1 inch or 1-1/2 inch can be used to build up tape to a “D” diameter.

8.0 Extend Shielding

8.1 Apply one half-lapped layer of semiconducting tape and two half-lapped layers of copper shielding braid to the required dimensions as shown on the drawing. Run one concentric wire part way along the shielding braid and terminate inside the splice. Apply two layers of insulating tape under the concentric wire and two layers of insulating tape over the concentric wire as shown on the drawing. Apply Jacket

8.2 Apply six half-lapped layers of splice jacketing tape to the required dimensions as shown on the drawing.

9.0 Apply Concentric Wires Over Splice

Wrap the concentric neutral wires from the cable onto the splice and terminate beyond the end of the splice as shown on the drawing. Secure the wires with plastic straps or tape.

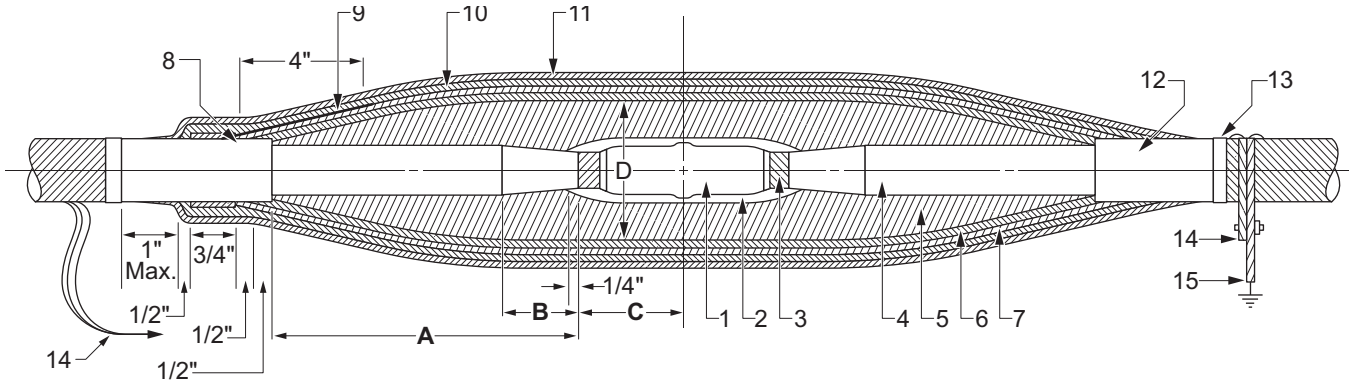
10.0 Completing the Splice

Twist the concentric neutral wires and apply a connector close to one end of the splice as shown. Connect concentrics to ground.

JJ 505 Poly 5–35-kV 1/C Straight Splice (Taped)

Scope JJ 505.1 Taped Straight Splice 5–34.5-kV 1/C Cross-Linked Polyethylene Insulated Concentric Neutral Type

Figure JJ 505–1: Taped Straight Splice 5–34.5-kV 1/C Cross-Linked Polyethylene Insulated Concentric Neutral Type



LEGEND

1. Compression connector, see JJ 110.
2. Semiconducting shield tape, one half-lapped layer, M/C 656-69608.
3. Strand conductor.
4. Cable insulation, cross-linked polyethylene.
5. High-voltage insulating tape. Half-lapped layers, M/C 647-31102.
6. Semiconducting shielding tape, one half-lapped layer, M/C 656-69608.
7. Tinned copper shielding braid, two half-lapped layers, M/C 656-69202.
8. High-voltage insulating tape, two layers under wire, (see #9), and two layers over wire.
9. One concentric wire.
10. Splice jacketing tape, six half-lapped layers, M/C 646-72108.
11. Concentric neutral wires helically wrapped around splice. (Secure with plastic straps.)
12. Semiconducting insulation shield.
13. Plastic strap.
14. Concentric neutral wires twisted and connected together outside of splice.
15. Ground the splice.

Voltage		Dimensions (in) A	B	C	D
5 kV[1/] (90 mil)		3	1	1/2 Connector Length + 1/2	See Note 1
12/17-kV (220 mil)		6-1/4	2		See Note 2
17 kV (295 mil)		8-1/4	2		See Note 3
34.5 kV	420 mil	10	5		See Note 4
	345 mil	10	3		

[1/] Use 200 mil cable for 5 kV.

Note(s):
1. Diameter over connector and semiconducting tape plus 3/8 inches.
2. Diameter over connector and semiconducting tape plus 5/8 inches.
3. Diameter over connector and semiconducting tape plus 3/4 inches.
4. Diameter over connector and semiconducting tape plus 1-1/4 inches.

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JJ 506 34.5 kV Raychem Straight Splice Instructions

Scope JJ 506.1 Application and Installation of Raychem HVS-3510E Series Permanent Cable Splice for 34.5 kV Class

1.0 Application

The Raychem HVS-3510E series permanent cable splices are applicable for use to join two 1/C cross-linked polyethylene insulated cables in a fully shielded 34.5 kV splice.

The Raychem heat-shrinkable rubber splice is preferred over the taped splice.

2.0 Instructions

2.1 Measure and Cut Cables

Form the cables as nearly as possible into their final position, allowing the ends to overlap. Avoid all sharp bends, using a minimum bending radius of 12 times the cable diameter. Determine the location of the vertical centerline of the joint, and cut the cables so that one end extends at least 30 inches beyond the centerline. Cut the other end at the centerline. Use plastic strap to secure concentric wires on cable. Make sure the concentric wires from one cable are long enough to connect to the concentric wires of the other cable. Unwrap the concentric wires and spread away from the cable. On one end of cable, make sure enough concentric wires are unwrapped (30 inches) to allow the smaller tubing to rest prior to final positioning. Cut off excess cable at joint center.

2.2 Remove Insulation and Semiconducting Jacket

Remove the semiconducting jacket and cable insulation (one process) for a distance of “B” inches. Remove the semiconducting jacket for a distance of “A” inches from the end. **Take care when removing the jacket so that the factory insulation is not nicked or damaged.**

2.3 Slide Splice Tubings

Make sure the cables are clean. Slide the largest (red/black) splice tubing on one side of cable and the other splice tubings on the other cable. The smaller tubings (black stress control tubing and red insulating tubing) should be on the side where the concentric wires were pulled back.

2.4 Apply Connector and Clean the Insulator

Wire brush and clean the bare aluminum conductors. Slip the proper size and type compression connector into place, making sure the conductors are in as far as possible. Using appropriate compression tool and die (see JJ 700), install circular crimps on each end of the connector. Deburr and smooth any resulting sharp edges on the installed connector. Remove excess compound and loose particles from the connector, taking care to prevent contamination of the cable insulation. Clean the exposed insulation.

2.5 Apply Stress Relief Material (SRM) on Semicon Cutbacks

Remove release paper from the short, angle-cut piece of stress relief material (SRM) and place three to four tight wraps at each semicon cutback. SRM should be tapered to overlap the semicon and insulation by approximately 1/4 inch.

2.6 Apply Stress Relief Material (SRM) Around Connector

Remove release paper from one side of the long strip of SRM. Using half-laps, tightly wrap the SRM around the connector and exposed conductor filling all voids. Tightly fill all gaps up to the level of the cable insulation. The SRM should overlap onto the cable insulation at least 1/4 inch but not more than 1/2 inch

2.7 Apply Stress Control Tubing

Center the black stress control tubing over the splice. Begin shrinking at the center of the tubing working the propane torch with a smooth brushing motion around the entire circumference of the tube. Heat evenly, making sure enough heat is applied to the back side. After the center portion shrinks, work torch toward one end, then to the opposite end. Do not point the flame at the cable semicon layer.

2.8 Apply Moisture Sealant Strips

Remove release paper from the red sealant strip and place two wraps around the cable butted up to the edge of the stress control tubing on each end.

2.9 Apply Protective Foil

Wrap the protective foil shield around the cable semicon layer butted up to each end of the red sealant on each end. The outer tubing will overlap onto the foil when shrunk. Do not remove foil.

2.10 Apply Red Insulating Tubing

Center the red insulating tubing evenly over the black stress control tubing. Shrink in place in the same manner as the black tubing was previously shrunk.

2.11 Apply Dual-Layer Insulating-Shielding Tubing

Center the dual-layer insulating-shielding tubing over the red insulating tubing, evenly overlapping the foil shield. Begin shrinking at the center. Shrink toward one end and stop about 3 inches short of the end of the tubing. Begin shrinking toward the second end. Stop shrinking 3 inches from this end and finish shrinking the first end. Complete shrinking the opposite end. Post head the tubing for 45 seconds to be sure of even heating. Do not remove foil shield.

2.12 Apply Concentric Wires Over Splice

Place one wrap of the grounding spring around the outer tubing 1 inch from the end. Spread out the neutral wires and lay them over the spring. Finish wrapping the spring completely over the wires and itself. Bundle the neutral wires together and install the neutral wire connector. Connect the concentrics to ground. The joint is now complete. **Allow to cool before moving or energizing.**

Scope JJ 506.2 **Raychem HVS-3510E Straight Splice 34.5 kV 1/C Cross-Linked Polyethylene Insulated Concentric Neutral Type**

Figure JJ 506–1: Raychem HVS-3510E Straight Splice 34.5 kV 1/C Cross-Linked Polyethylene Insulated Concentric Neutral Type

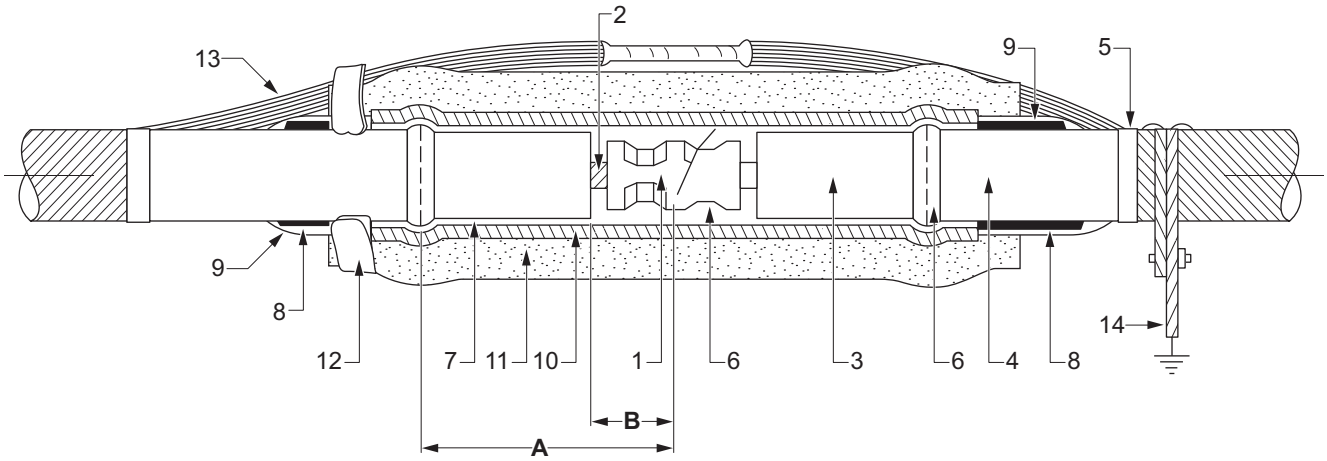

Table JJ 506–1: Raychem HVS-3510E Straight Splice 34.5 kV 1/C Cross-Linked Polyethylene Insulated Concentric Neutral Type

SAP Number	Catalog No.	Conductor Size	Insulating Thickness	Connector Size		Dimensions (in)	
				MAX L	MAX O.D.	A	B
10117834	HVS-3511S-1/0	1/0 Al	420 mil	3.75	1.00	6.5	1/2 Connector Length + 1/2
10117835	HVS-3512S-4/0	4/0 Al	420 mil	5.50	1.35	7.5	
10117836	HVS-3513S-750	750 kcmil Al	420 mil	8.00	1.50	8.5	
10117837	HVS-3513S-1500	1,500 kcmil Al	345 mil	8.00	2.25	8.5	

Legend

1. Compression connector (refer to JJ 110)
2. Strand conductor
3. Cable insulation, cross-linked polyethylene
4. Semiconducting insulation shield
5. Plastic strap
6. Semiconducting stress relief tap (SRM)
7. Black heat-shrinkable stress control tubing
8. Red moisture sealant strip
9. Protective aluminum foil
10. Red heat-shrinkable insulating tubing
11. Dual-layer, heat-shrinkable EPR insulating-shielding tubing
12. Grounding spring clamp
13. Concentric neutral wires twisted and connected together outside of splice
14. Ground the splice

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JJ 507 Splicing 3/C EPR Compact Cu Cable

Scope JJ 507.1 3/C EPR Cable Splices for use when Replacing 3/C PILC Cable

The preferred 3/C EPR cable straight splice is the Raychem heat shrink with breakout boots. The material codes provided below are for a single conductor splice, except for the 3/C EPR to 3/C PILC splice kits which contain 3 splices. Three units of the material codes listed below must be ordered for each splice along with the appropriate number of breakout boots and grounding kits (if applicable).

1.0 3/C EPR Cable Breakout Boot (M/C 655-01686)

Heat-shrink breakout boot has 6 openings and is required to convert one 3/C cable into three 1/C cables.

Table JJ 507–1: 12/16-kV Splice Kits (For 220 mil 3/C EPR)

Conductor Size		SAP Number	Raychem Part Number	Maximum Connector Size (in)	
EPR (Cu)	EPR (Cu)			Length	DIA
1/0	1/0	10117919	HVS-1521S-SCE	4-1/4	0.90
4/0	1/0	10117829	HVS-1521S-SCE	4-1/4	0.90
4/0	4/0	10117905	HVS-1521S-SCE	4-1/4	0.90
350 kcmil	4/0	10117945	HVS-1522S-SCE	5-1/2	1.15
350 kcmil	350 kcmil	10117922	HVS-1522S-SCE	5-1/2	1.15
500 kcmil	350 kcmil	10117944	HVS-1522S-SCE	5-1/2	1.15
500 kcmil	500 kcmil	10117923	HVS-1522S-SCE	5-1/2	1.15
EPR (Cu)	**CLP (Al)**				
1/0	1/0	10117919	HVS-1521S-SCE	4-1/4	0.90
4/0	1/0	10117829	HVS-1521S-SCE	4-1/4	0.90
4/0	350 kcmil	10117945	HVS-1522S-SCE	5-1/2	1.15
350 kcmil	350 kcmil	10117922	HVS-1522S-SCE	5-1/2	1.15
350 kcmil	750 kcmil	10117954	HVS-1523S-SCE	8	1.60
500 kcmil	750 kcmil	10117953	HVS-1523S-SCE	8	1.60
EPR (Cu)	**PILC (Cu)**				
4/0	4/0	10117862	HVS-T-1581S	4-1/2	0.90
350 kcmil	4/0	10117869	HVS-T-1582S	5-1/2	1.15
350 kcmil	350 kcmil	10117955	HVS-T-1582S	5-1/2	1.15
500 kcmil	350 kcmil	10117956	HVSR-T-1583S	7	1.60
500 kcmil	500 kcmil	10117957	HVS-T-1583S	7	1.60
500 kcmil	750 kcmil	10117866	HVS-T-1583S	7	1.60

Note(s):
1. External shield grounding braid with solder block for attaching to the structure is included with splice kits.
2. For installation instructions refer to JJ 508 and the manufacturers' instructions found in the splice kit.

Table JJ 507–2: 4 kV 3/C EPR Splice Kit (For 115 mil EPR)[a]

Cable Size	SAP Number	Raychem[1/] Part Number	Maximum Connector Size (in)	
			Length	DIA
1/0	10117958	HVS-822S-1/0	4-1/4	3/4
4/0	10117901	HVS-822S-4/0	4-1/4	3/4
250	10117902	HVS-822S-250	4-1/4	3/4
350	10117903	HVS-8235-350	6	1.10
500	11017904	HVS-823S-500	6	1.10

[1/] 4 kV 3/C EPR cable is for special applications only, contact engineer responsible for distribution cable for its use.

Note(s):
1. External shield grounding kit for attaching to the structure ground is included with splice kits.
2. For installation instructions refer to JJ 508 and the manufacturers' instructions found in the splice kit.

For splices requiring one or more phases to be tapped off (for example, to feed a transformer) use premolded splices and standard aluminum CLP cable from the splice to the tapped destination. If a premolded splice is required for 5 kV or 12/16-kV 1/0 cables, use a straight receptacle and plug (M/C 656-01122 and 656-01114 for 5 kV and 656-32408 and 656-14901 for 12/16-kV), all other cable sizes should use the 600A components listed in the tables below

Table JJ 507–3: 600A Cable Adapters

System Voltage (kV)	Insulation Thickness (mil)	Cable Size	SAP Number
4	115	1/0	Not Available
4	115	4/0	10117439
4	115	250	10117337
4	115	350	10117292
4	115	500	10117292
12/16	220	1/0	10117337
12/16	220	4/0	10117292
12/16	220	250	10117292
12/16	220	350	10117293
12/16	220	500	10117293

Note(s):
1. These cable adapters are to be used with the 600A elbow receptacle (“T-Body”), M/C 656-34008, and are to be grounded to the structure ground by using an external shield ground kit.

Table JJ 507–4: Spade Terminal for Compacted Cable

Conductor Size	SAP Number
1/0	10117446
4/0	10117447
250	10117444
350	10117448
500	10117445

Table JJ 507–5: 600 A External Shield Ground Kit

System Voltage (kV)	Conductor Size (AWG/kcmil)	Insulation Thickness (mils)	SAP Number
4 kV	1/0	115	10117937
	4/0		
	250		
	350		
	500		
12/16 kV	1/0	220	10117937
	4/0		
	250		
	350	220	10117938
	500		

JJ 508 Installation of Raychem Heat-Shrink Splices for 3/C EPR Cable

Scope JJ 508.1 Installation of Raychem Heat-Shrink Splices for 3/C EPR Cable

Table JJ 508–1: 12/16-kV Splice Requirements (for 220 mil 3/C EPR)

Conductor Size		Raychem Part Number	Cable Cutback Dimensions (in)			
EPR (Cu)	EPR (Cu)		A	B	C	D
1/0	1/0	HVS-1521S-SCE	9-1/2	8	4-/12	1/2 Connector Length + 1/4"
4/0	1/0	HVS-1521S-SCE	9-1/2	8	4-1/2	1/2 Connector Length + 1/4"
4/0	4/0	HVS-1521S-SCE	9-1/2	8	4-1/2	1/2 Connector Length + 1/4"
350 kcmil	4/0	HVS-1522S-SCE	10-1/2	9	5	1/2 Connector Length + 1/4"
350 kcmil	350 kcmil	HVS-1522S-SCE	10-1/2	9	5	1/2 Connector Length + 1/4"
500 kcmil	350 kcmil	HVS-1522S-SCE	10-1/2	9	5	1/2 Connector Length + 1/4"
500 kcmil	500 kcmil	HVS-1522S-SCE	10-1/2	9	5	1/2 Connector Length + 1/4"
EPR (Cu)	CLP (Al)					
1/0	1/0	HVS-1521S-SCE	9-1/2	8	4-1/2	1/2 Connector Length + 1/4"
4/0	1/0	HVS-1521S-SCE	9-1/2	8	4-1/2	1/2 Connector Length + 1/4"
4/0	350 kcmil	HVS-1522S-SCE	10-1/2	9	5	1/2 Connector Length + 1/4"
350 kcmil	350 kcmil	HVS-1522S-SCE	10-1/2	9	5	1/2 Connector Length + 1/4"
350 kcmil	750 kcmil	HVS-1523S-SCE	11-1/2	10	6-1/2	1/2 Connector Length + 1/2"
500 kcmil	750 kcmil	HVS-1523S-SCE	11-1/2	10	6-1/2	1/2 Connector Length + 1/2"
EPR (Cu)	PILC (Cu)					
4/0	4/0	HVS-T-1581S	10	8-1/2	5-1/2	1/2 Connector Length + 1/4"
350 kcmil	4/0	HVS-T-1582S	11	9-1/2	6	1/2 Connector Length + 1/4"
350 kcmil	350 kcmil	HVS-T-1582S	11	9-1/2	6	1/2 Connector Length + 1/4"
500 kcmil	350 kcmil	HVSR-T-1583S	12	10-1/2	7	1/2 Connector Length + 1/2"
500 kcmil	500 kcmil	HVS-T-1583S	12	10-1/2	7	1/2 Connector Length + 1/2"
500 kcmil	750 kcmil	HVS-T-1583S	12	10-/12	7	1/2 Connector Length + 1/2"

Figure JJ 508–1: 12/16-kV Splice Requirements (for 220 mil 3/C EPR)

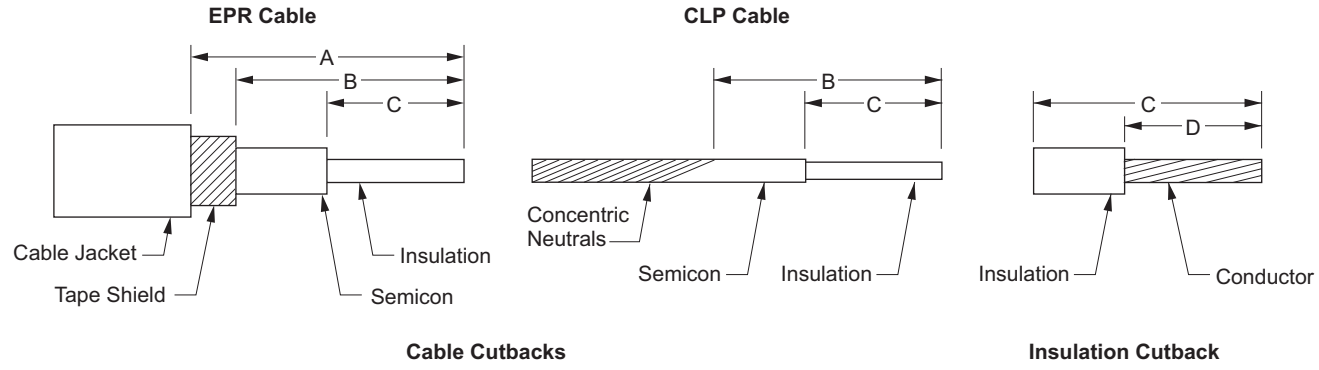
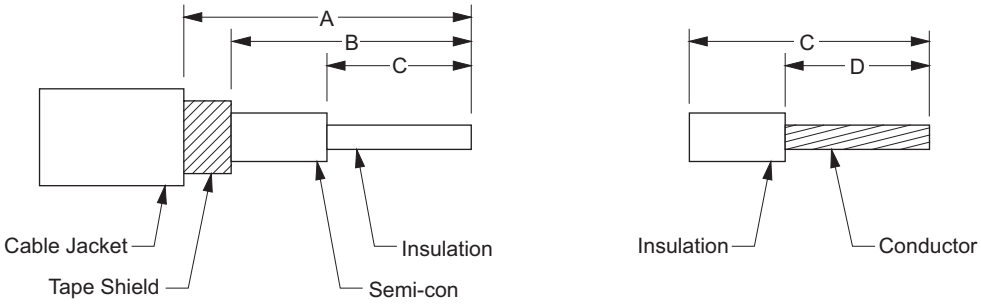


Table JJ 508–2: 5 kV 3/C Splice Requirements (for 115 mil 3/C EPR)

Cable Size	Raychem Part Number	Cable Cutback Dimensions (in)			
		A	B	C	D
1/0	HVS-822S-1/0	8-1/2	7	4	1/2 Connector Length + 1/4"
4/0	HVS-822S-4/0	8-1/2	7	4	1/2 Connector Length + 1/4"
250	HVS-822S-250	8-1/2	7	4	1/2 Connector Length + 1/4"
350	HVS-823-350	9-1/2	8	5	1/2 Connector Length + 1/2"
500	HVS-823S-500	9-1/2	8	5	1/2 Connector Length + 1/2"

Figure JJ 508–2: 5 kV 3/C Splice Requirements (for 115 mil 3/C EPR)

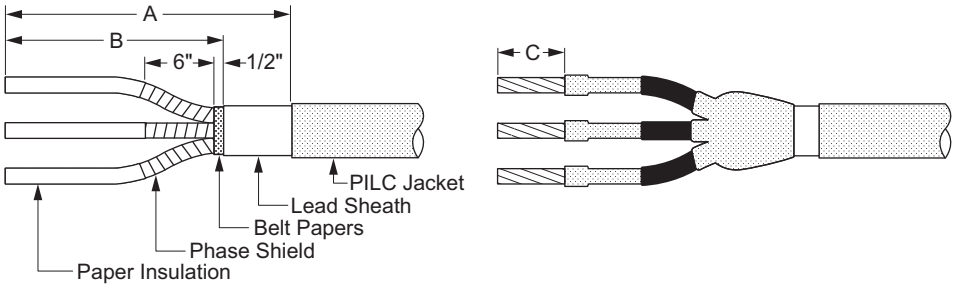


Cable Cutbacks **Insulation Cutback**

Table JJ 508–3: 12/16 kV Splice Requirements (for PILC)

Cable Size	Raychem Part Number	Cable Cutback Dimensions (in)		
		A	B	C
4/0 AWG	HVS-T-1581s	19	14	1/2 Connector Length + 1/4"
4/0 AWG	HVS-T-1582s	20	15	1/2 Connector Length + 1/4"
350 kcmil	HVS-T-1582s	20	15	1/2 Connector Length + 1/4"
350 kcmil	HVSR-T-1583s	22	16	1/2 Connector Length + 1/2"
500 kcmil	HVS-T-1583s	22	16	1/2 Connector Length + 1/2"

Figure JJ 508–3: 12/16 kV Splice Requirements (for PILC)



PILC Cable Cutbacks **Connector Cutback**

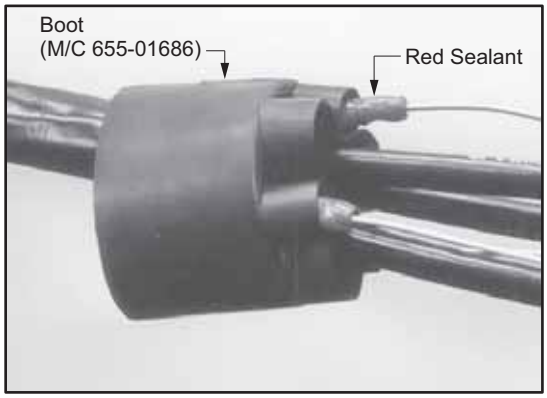
Scope JJ 508.2 General Application of Heat Shrink Break-Out Boots and Splices for 3/C EPR Cable

1.0 Application

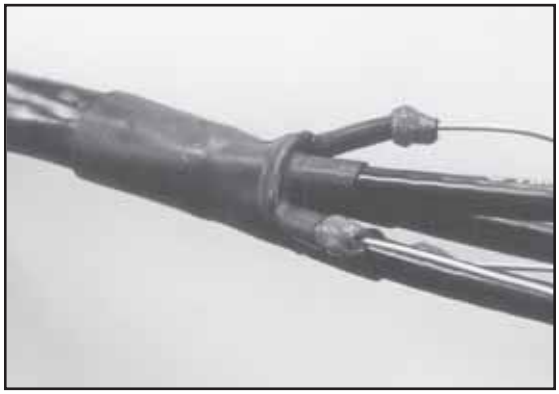
Raychem heat-shrink splices to be used with EPR cable.

2.0 General Instruction Illustrations

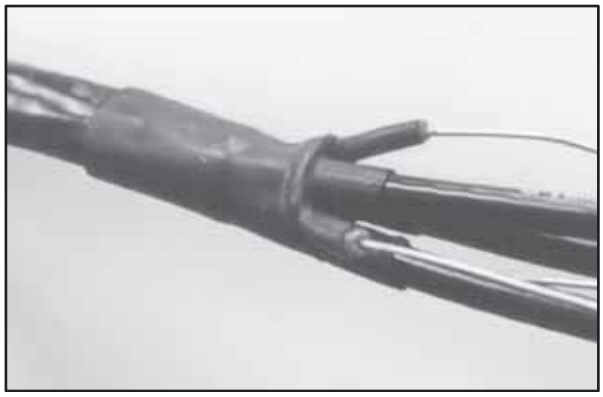
2.1 Strip away outer jacket of 3/C EPR cable a minimum of 36 inches on one side of the EPR and 24 inches minimum on the other. Apply 1 wrap of red sealant over neutral conductors. Remove release paper from breakout boot before installing. Slide breakout boot over cable. The breakout boot cutback dimensions may vary based on the actual job or structure particulars. For example, size of structure, location of equipment, and so forth.



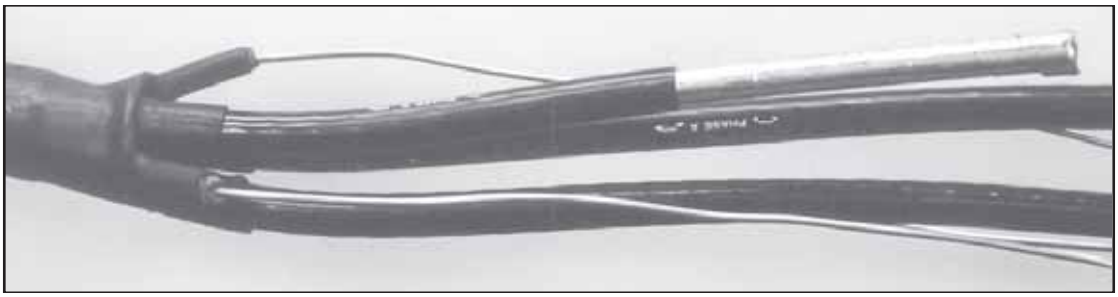
2.2 Apply heat to shrink boot and seal cable.



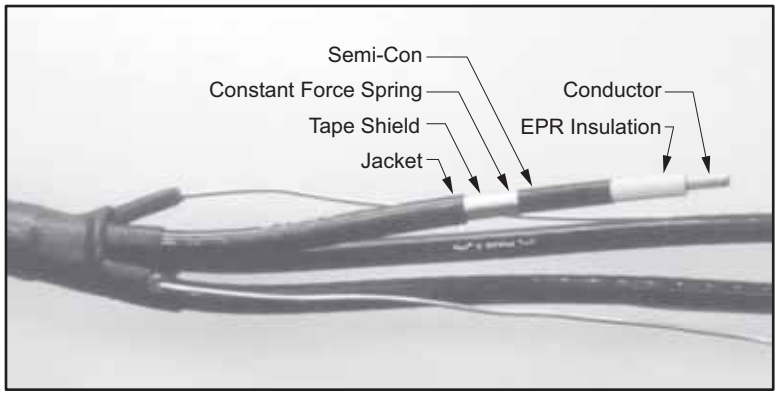
2.3 Remove excess red sealant.



2.4 Remove jacket of single conductor exposing tape shield.



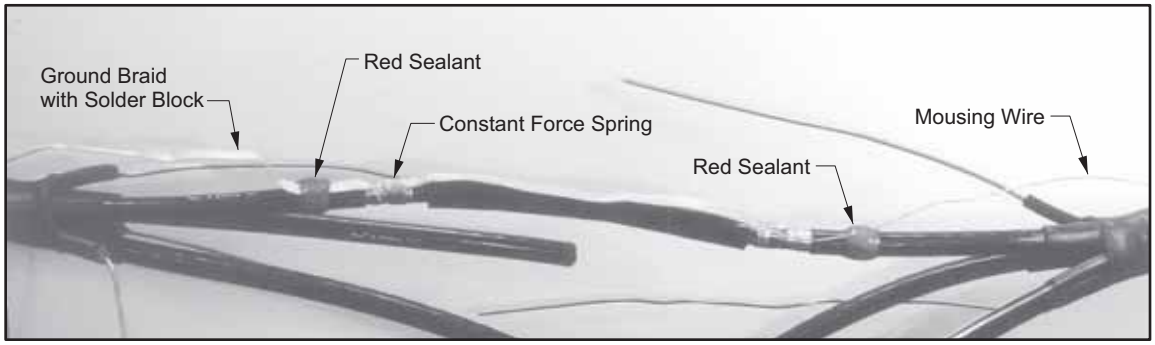
2.5 Follow instructions to create proper cutbacks. Apply constant force spring on tape shield. Cutback semicon to expose EPR insulation. Cutback insulation to expose conductor.



2.6 Slide splicing tubes over conductor. Apply and crimp connector splicing both conductors. Fill gaps between connector and EPR with stress relief material. Wrap connector with stress relief material. Apply stress relief material at semicon cutback. Apply one layer of red sealant over semicon.

2.7 Apply heat to center of tube and shrink unto red sealant.

2.8 Attach ground braid to tape shield over tube. Attach ground braid or mousing wire to tape shield and wrap 1 layer of red sealant over 1/C jacket and then 1 layer over ground braid or mousing wire.



2.9 Wrap copper shielding mesh over grounding braid over tube and tie off.

2.10 Position wrap-around sleeve and heat shrink it over splice after sliding metal retention clip onto the butted rails. Crimp connector over neutral conductors and ground along with ground braid or mousing wire.

JJ 600 Straight Splice — 12/16-kV #2 and 1/0 — ESNA

Scope JJ 600.1 Application and Installation of Elastimold Permanent Splice for 12/16-kV

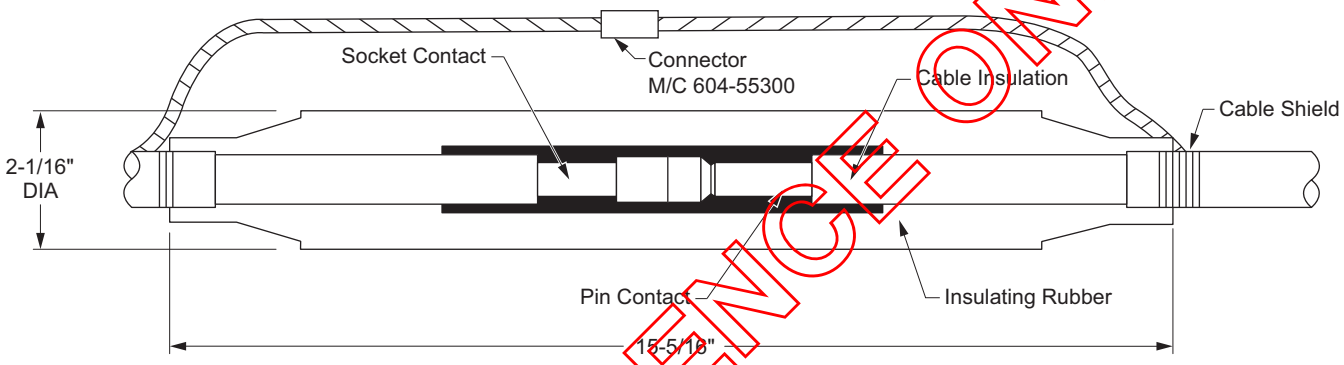
1.0 Application

For joining two 1/C aluminum polyethylene-insulated cables in a permanent fully shielded splice.

Table JJ 600–1: Straight Splice — 12/16-kV #2 and 1/0 — ESNA

Material Code	Slice Description	Catalog No.
656-53602	Splice, Straight, Permanent, Elastimold No. 2 Al, 220 mil, Polyethylene Cable See JJ 601.1,.2	25-S-FG-1 AX
656-53701	Splice, Straight, Permanent, Elastimold No. 2 Al, 295 and 320 mils Polyethylene Cable	25-S-GB-1 AX
656-53909	Splice, Straight, Permanent, Elastimold No. 1/0 Al, 220 mil Polyethylene Cable	25-S-GAB-1 0AX

Figure JJ 600–1: Straight Splice — 12/16-kV #2 and 1/0 — ESNA



FOR REFERENCE ONLY

2.0 Instructions

2.1 Determine splice location and allow for 4 inches of concentric neutral beyond that point. Measure back 8 inches bind and unwrap the concentric neutral wires. See Figure JJ 600–1.1 (Page JJ-2).

2.2 Remove 1 inch (1-13/16 inches far #1/0) of cable insulation from cable end. **Cut squarely. Do not pencil. See Figure JJ 600–1.1 (Page JJ-2).**

2.3 Wirebrush bare aluminum conductor. Crimp pin contact on bared conductor, holding the crimp barrel against the cable insulation. See Figure JJ 600–1.2 (Page JJ-2). Use MD-6 compression tool and install three crimps ("X" groove for No. 2 conductor and the "BG" groove for No. 1/0 conductor). Rotate the crimps 120 degrees. Wipe off excess inhibitor.

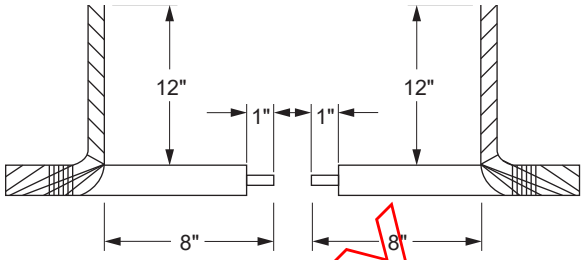


Figure JJ 600–1.1

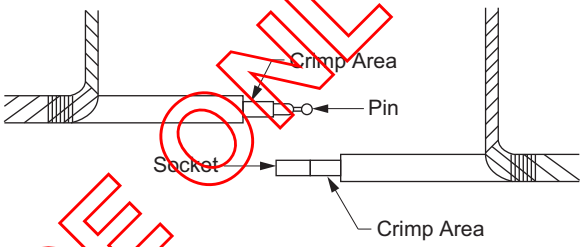
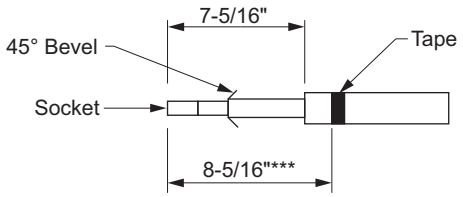


Figure JJ 600–1.2

FOR REFERENCE ONLY

2.4 **Socket side and pin side of cable end.** Remove the conductive jacket 7-5/16 inches back from the front end of the socket and pin with a smooth, straight cut. **Do not cut or nick the insulation.** Bevel the insulation no more than 1/8 inch back at 45 degrees. At a point 8-5/16 inches back from the far end of the socket and pin, put on a turn of jacketing tape as an indicator on the cable shield. See Figure JJ 600–1.3 (Page JJ-3).



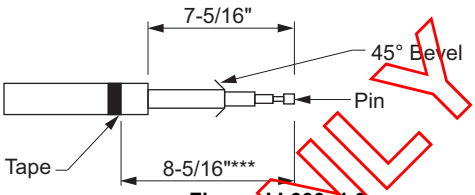


Figure JJ 600–1.3

2.5 Remove the protective caps from the splice housing and lubricate the inside of the housing with the lubricating grease supplied. (Use silicone grease that is supplied. **Do not substitute**).

2.6 Examine the splice housing and note that one side is engraved with a “P” (pin contact), and the other side with an “S” (socket contact). Slip the “S” side of the housing over the socket end. Twist the housing and push the socket end into the housing until the tape indicator lines up with the end of the housing. Insert the nylon rod approximately half way into “P” side of the splice housing. See Figure JJ 600–1.4 (Page JJ-3).

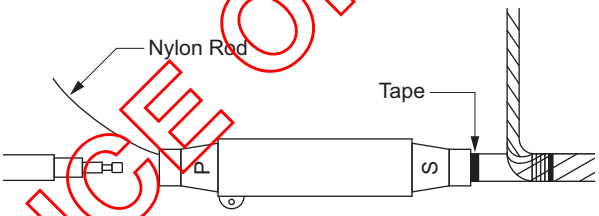


Figure JJ 600–1.4

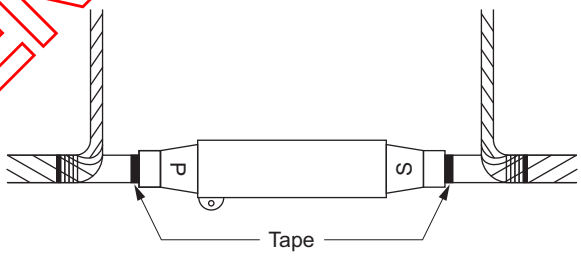


Figure JJ 600–1.5

2.7 Slip the pin end of the cable into the “P” side of the housing. Twist or rotate the housing until the tape indicator on the cable shield is approximately 1 inch away from the housing. Remove the nylon rod from the housing. Continue to push the pin end into the housing until the tape indicator lines up with the end of the splice housing. (This indicator tape may be as far as 1/6 inch from the splice housing depending upon cable insulation size. The housing shrinks slightly as cables are installed.) Check splice by pulling both ends of cable. Key located in socket will prevent splice from pulling apart, if properly connected. See Figure JJ 600–1.5 (Page JJ-3).

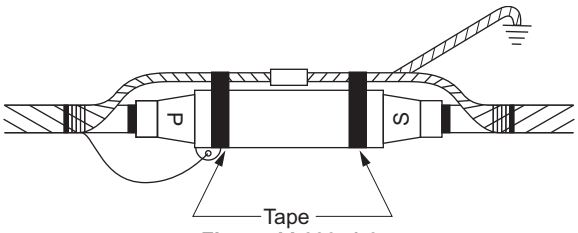


Figure JJ 600–1.6

2.8 Connect one strand of concentric wires to grounding eye. Train remaining concentric wires over the splice housing and crimp together with appropriate connector. Tape the concentric neutral wires to housing. See Figure JJ 600–1.6 (Page JJ-3).

FOR REFERENCE ONLY

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JJ 601 Application and Installation of Elastimold Permanent Splice for 12/16 kV

Scope JJ 601.1 Application and Installation of Elastimold Permanent Splice for 12/16 kV

1.0 Application

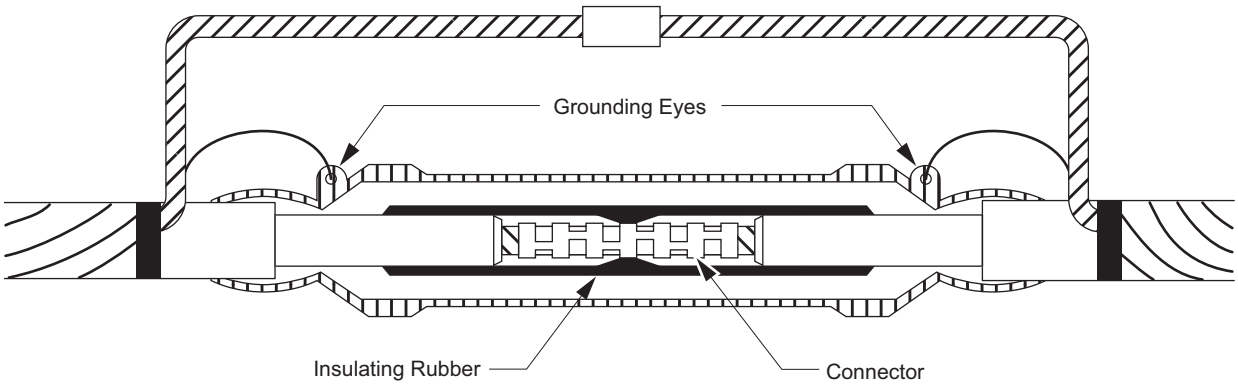
For joining two 1/C aluminum polyethylene insulated cables in a permanent fully shielded splice.

Table JJ 601–1: Application and Installation of Elastimold Permanent Splice for 12/16 kV

SAP Number	Straight Splice Description Conductor Size — Insulation Thickness	Cataloging
10118099	#2 Str Al — 220 mil	15PCJ1F1220

= For Reference Only

Figure JJ 601–1: Application and Installation of Elastimold Permanent Splice for 12/16 kV



2.0 Instructions

2.1 Mark the location of the splice centerline on both cables and allow for a minimum of 6 inches of the concentric neutral wires to extend beyond these marks. Temporarily bind the concentric wires of cable “A”. Permanently bind the concentric wires of cable “B”. Unwrap the concentric wires as shown in Figure JJ 601–1.1 (Sheet 1). Note the difference in dimensions on each cable.

2.2 Remove insulation and semiconductive semicon shield as shown. Bevel edge of insulation at 45 degree angle. **DO NOT EXCEED 1/8 INCH. DO NOT USE PENCILLING TOOL.** See Figure JJ 601–1.1 (Sheet 1).

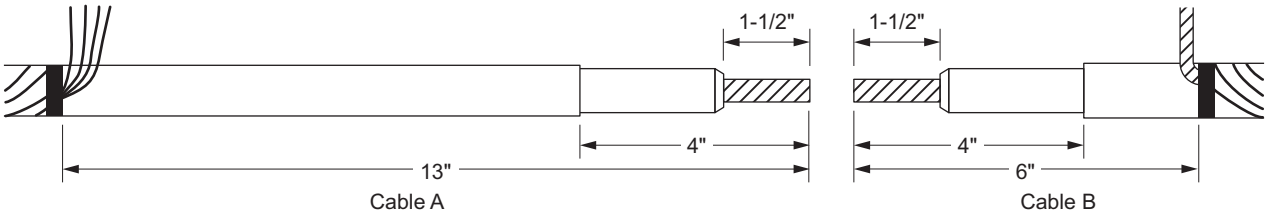


Figure JJ 601–1.1

2.3 Clean the semiconducting semicon shield of Cable A to remove any loose particles of semiconducting material. Wrap two layers of vinyl tape over the conductor strands of Cable A. Lubricate both ends of splice housing, insulation, and semiconducting semicon shield of Cable A with the silicone grease supplied or silicone grease SAP 10154115. **Do not substitute.** See Figure JJ 601–1.2 (Sheet 2).

2.4 Slide the splice housing onto Cable A until the bare strands are completely exposed, as shown in Figure JJ 601–1.2 (Sheet 2). Remove vinyl tape from conductor strands of Cable A. Wire brush the aluminum conductors. Before crimping connector, make sure the wires are in the connector as far as possible. Use the BG groove of the MD-6 compression tool and make three crimps on each end of the connector. Rotate the crimps 120 degrees. **Remove any sharp points on the connector.** Wipe off excess inhibitor.

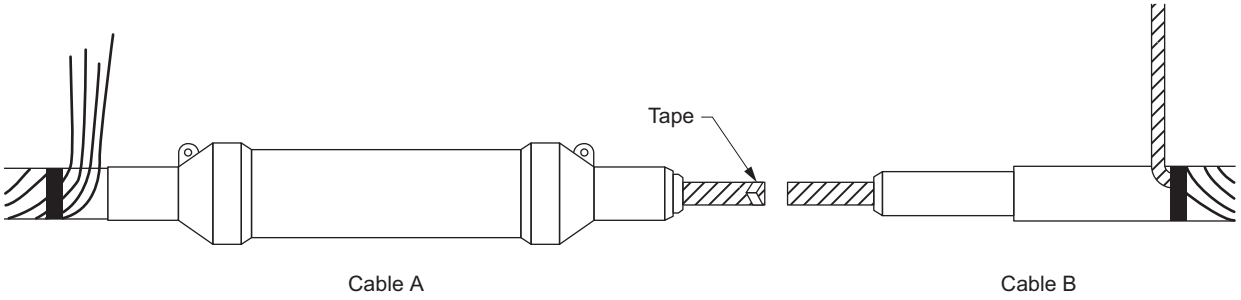


Figure JJ 601–1.2

2.5 Lubricate the insulation of Cable B, Figure JJ 601–1.2 (Sheet 2), and slide splice housing into final position. Use the bumps at each cable entrance to center the splice housing over the connector as shown in Figure JJ 601–1.3 (Sheet 2).

2.6 Rewrap the concentric wires on Cable A. Run one concentric wire to each grounding eye. Train the concentric wires over the splice housing and crimp together with appropriate connector. Connect the concentric wires to ground. (See Figure JJ 601–1.3 [Sheet 2].)

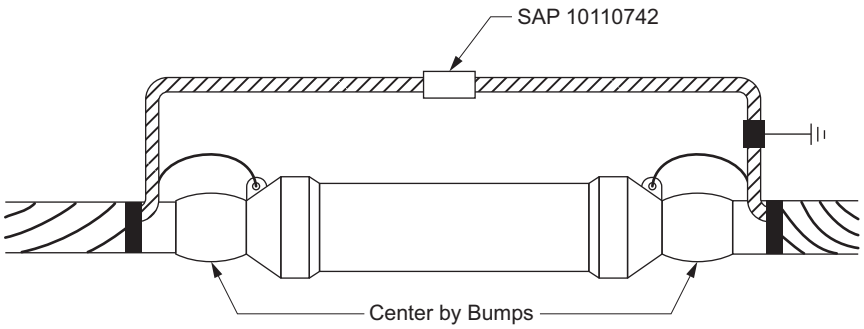


Figure JJ 601–1.3

JJ 602 Application and Installation of Burndy Permanent Splice for 12/16-kV

Scope JJ 602.1 Application and Installation of Burndy Permanent Splice for 12/16-kV

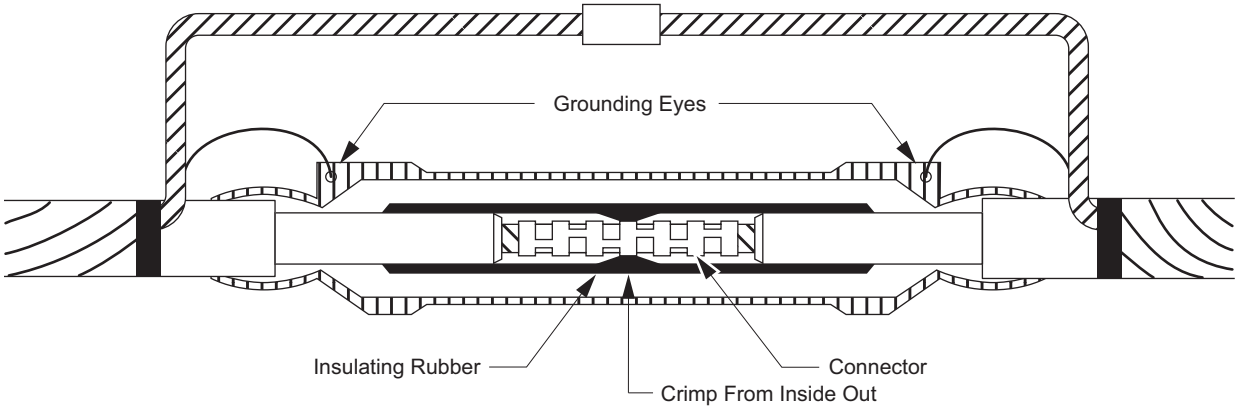
1.0 Application

For joining two 1/C aluminum polyethylene insulated cables in a permanent fully-shielded splice.

Table JJ 602–1: Application and Installation of Burndy Permanent Splice for 12/16-kV

Material Code	Straight Splice Description Code Conductor Size — Insulation Thickness	Catalog No.
656-53602	#2 str Al — 220 mil	PMS152-A2

Figure JJ 602–1: Application and Installation of Burndy Permanent Splice for 12/16-kV



2.0 Instructions

2.1 Mark the location of the splice centerline on both cables and allow for a minimum of 6 inches of the concentric neutral wires to extend beyond these marks. Temporarily bind the concentric wires of cable “A”. Permanently bind the concentric wires of cable “B”. Unwrap the concentric wires as shown in Figure JJ 602–1.1 (Sheet 2). Note the difference in dimensions on each cable.

2.2 Remove insulation and semiconductive jacket as shown. Bevel edge of insulation at a 45 degree angle. **DO NOT EXCEED 1/8 INCH. DO NOT USE PENCILING TOOL.** See Figure JJ 602–1.2 (Sheet 2). Install marker tape as shown.

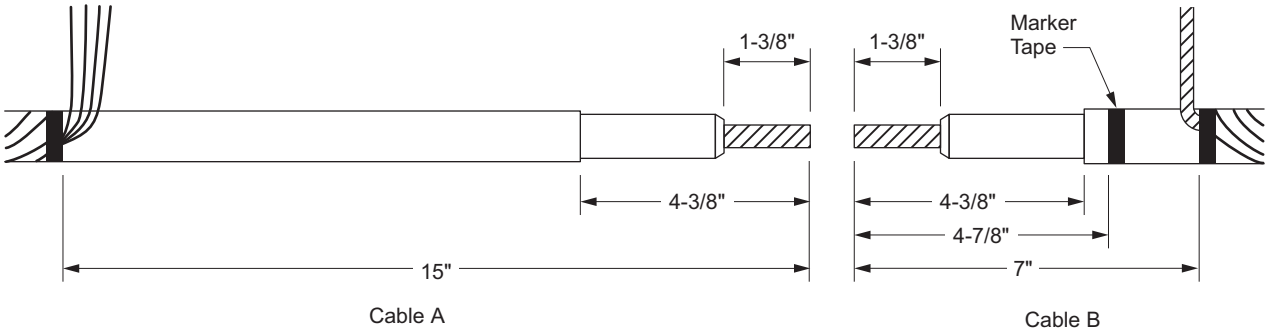


Figure JJ 602–1.1

2.3 Clean semiconducting jacket of Cable A to remove any loose particles of semiconducting material. Wrap two layers of vinyl tape over the conductor strands of Cable A. Lubricate both ends of splice housing, the insulation, and semiconducting jacket of Cable A with the silicone grease supplied or silicone grease M/C 904-00615. **Do not substitute.** See Figure JJ 602–1.2 (Sheet 2).

2.4 Slide the splice housing onto Cable A until the bare strands are completely exposed as shown in Figure JJ 602–1.2 (Sheet 2). Remove vinyl tape from conductor strands of Cable A. Wire brush the aluminum conductors. Before crimping connectors, make sure the wires are in the connector as far as possible. Use the BG groove of the MD-6 compression tool and make three crimps on each end of connector. Rotate the crimps 120 degrees. **Remove any sharp points on the connector.** Wipe off excess inhibitor.

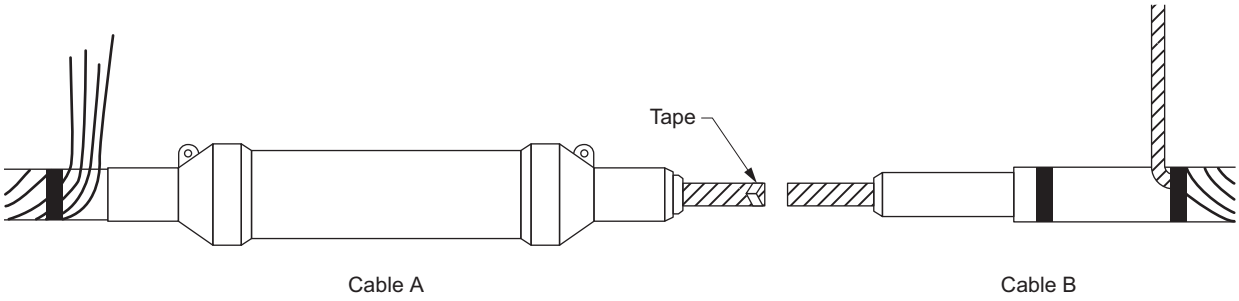


Figure JJ 602–1.2

2.5 Lubricate the insulation of Cable B, Figure JJ 602–1.2 (Sheet 2), and slide the splice housing into final position with the end even with marker tape. Remove marker tape.

2.6 Rewrap the concentric wires on Cable A. Run one concentric wire to each grounding eye. Train the concentric wires over the splice housing and crimp together with the appropriate connector. Connect the concentric wires to ground. See Figure JJ 602–1.3 (Sheet 3).

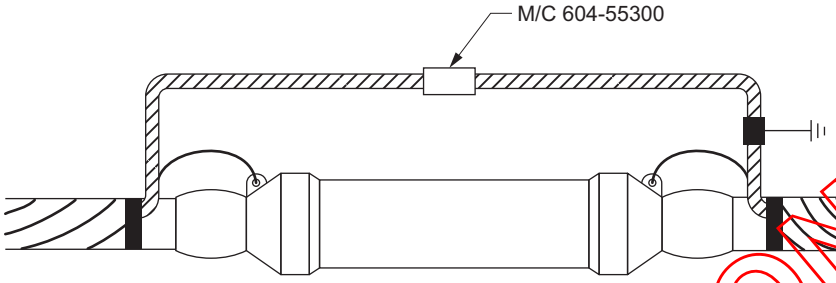


Figure JJ 602–1.3

FOR REFERENCE ONLY

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JJ 603 Application and Installation of General Electric Permanent Splice for 12/16-kV

Scope JJ 603.1 Application and Installation of General Electric Permanent Splice for 12/16-kV

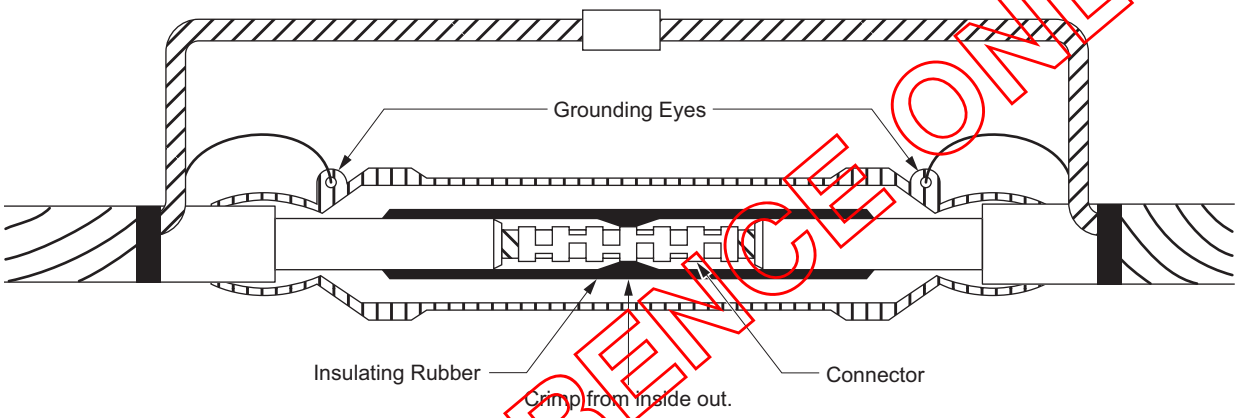
1.0 Application

For joining two 1/C aluminum polyethylene insulated cables in a permanent fully-shielded splice.

Table JJ 603–1: Application and Installation of General Electric Permanent Splice for 12/16-kV

Material Code	Straight Splice Description Conductor Size — Insulation Thickness	Catalog No.
656-53602	#2 str Al — 220 mil	9U16AYC100

Figure JJ 603–1: Application and Installation of General Electric Permanent Splice for 12/16-kV



FOR REFERENCE ONLY

2.0 Instructions

2.1 Mark the location of the splice centerline on both cables and allow for a minimum of 6 inches of the concentric neutral wires to extend beyond these marks. Temporarily bind the concentric wires of cable “A”. Permanently bind the concentric wires of cable “B”. Unwrap the concentric wires as shown in Figure JJ 603–1.1 (Sheet 1). Note the difference in dimensions on each cable.

2.2 Remove insulation and semiconductive jacket as shown. Bevel edge of insulation at a 45 degree angle. **DO NOT EXCEED 1/8 INCH. DO NOT USE PENCILING TOOL.** See Figure JJ 603–1.1 (Sheet 1).

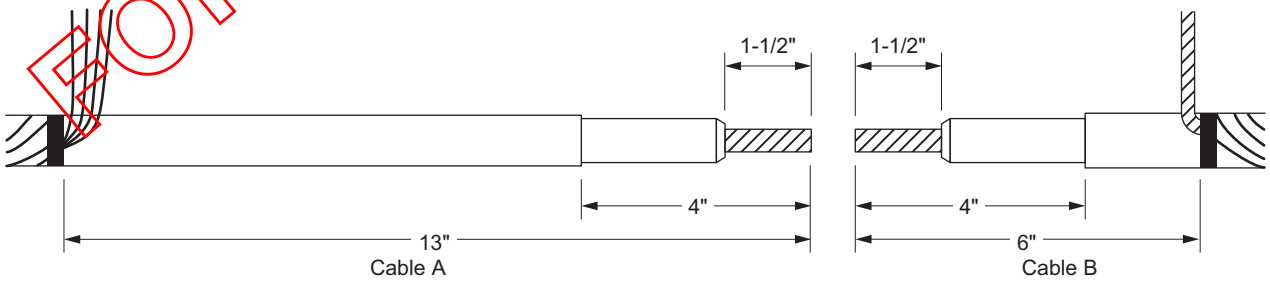


Figure JJ 603–1.1

2.3 Clean the semiconducting jacket of Cable A to remove any loose particles of semiconducting material. Wrap two layers of vinyl tape over the conductor strands of Cable A. Lubricate both ends of splice housing, insulation, and semiconducting jacket of Cable A with the silicone grease supplied or silicone grease M/C 904-00615. **Do not substitute.** See Figure JJ 603–1.2 (Sheet 2).

2.4 Slide the splice housing onto Cable A until the bare strands are completely exposed as shown in Figure JJ 603–1.2 (Sheet 2). Remove vinyl tape from the conductor strands of Cable A. Wire brush the aluminum conductors. Before crimping connector, make sure the wires are in the connector as far as possible. Use the BG groove of the MD-6 compression tool and make three crimps on each end of the connector. Rotate the crimps 120 degrees. **Remove any sharp points on the connector.** Wipe off excess inhibitor.

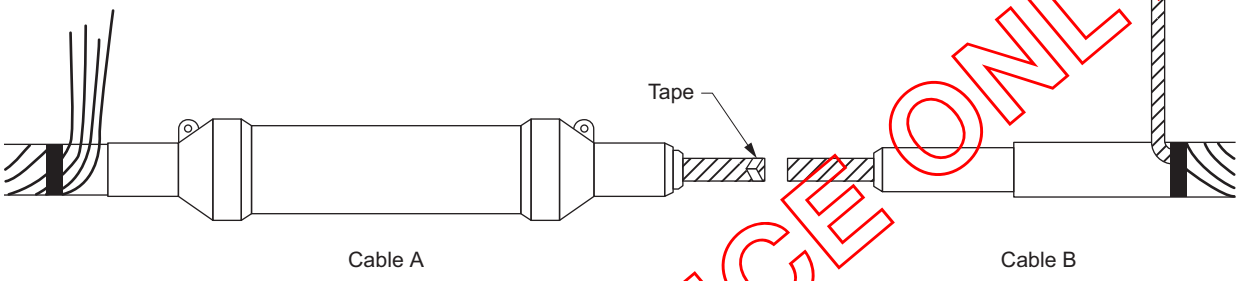


Figure JJ 603–1.2

2.5 Place a marker tape five inches from the center of the crimp connector on the semiconductive jacket of Cable B. See Figure JJ 603–1.3 (Sheet 2). Lubricate the insulation of Cable B. Slide the housing into final position with the end even with marker tape. Remove marker tape.

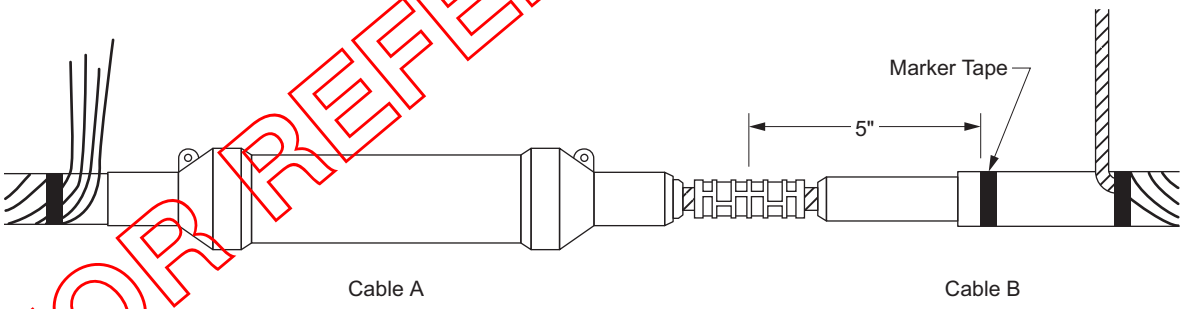


Figure JJ 603–1.3

FOR REFERENCE ONLY

2.6 Rewrap the concentric wires on Cable A. Run one concentric wire to each grounding eye. Train the concentric wires over the splice housing and crimp together with appropriate connector. Connect the concentric wires to ground. See Figure JJ 603–1.4 (Sheet 3).

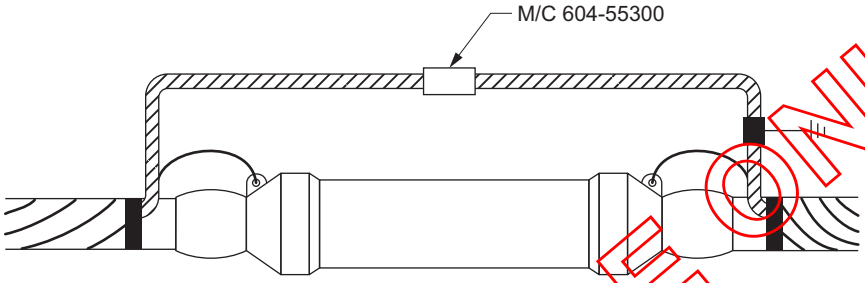


Figure JJ 603–1.4

FOR REFERENCE ONLY

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JJ 605 Straight Splice — 5–16-kV #2 through 1,000 kcmil — General Electric

Scope JJ 605.1 Typical Application and Installation of General Electric Permanent Splice for 5–16-kV

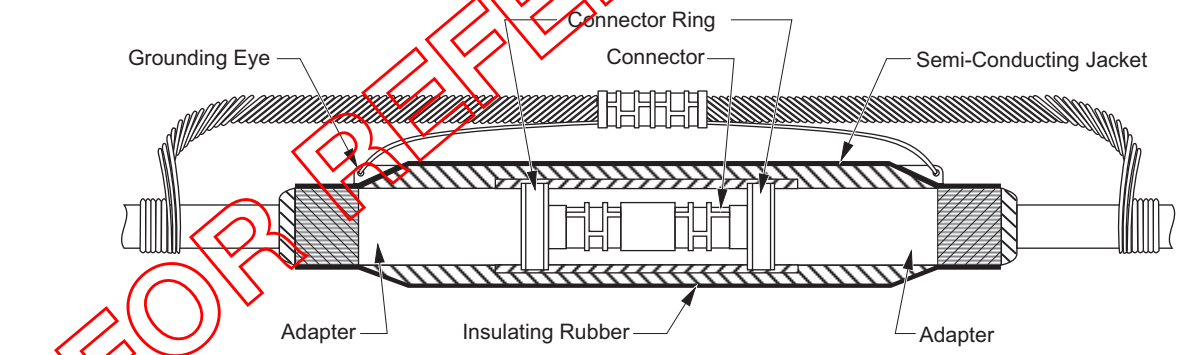
1.0 Application

For joining two 1/C Aluminum Polyethylene cables in a permanent fully-shielded splice.

Table JJ 605–1: Straight Splice — 5–16-kV #2 through 1,000 kcmil — General Electric

Material Code	Straight Splice Description		Catalog No.
	Conductor Size	Insulation Thickness	
656-53602	#2 Al	220 mil	A1511315113
656-53701	#2 Al	295 mil	A1611316113
656-53909	#1/0 Al	220 mil	A1611616116
656-54709	350 kcmil Al	90 mil	9U06CHN100
656-54808	750 kcmil Al	90 mil	9U06CKU100
656-54907	350 kcmil Al	220 mil	9U06CKN100
656-55003	750 kcmil Al	220 mil	9U06CNV100
656-55102	1,000 kcmil Al	220 mil	9U06CRY100
Reducing Splice			
656-55508	1,000 kcmil Al to 220 mil 750 kcmil Alto220 mil		9U06CNV111YR

Figure JJ 605–1: Straight Splice — 5–16-kV #2 through 1,000 kcmil — General Electric



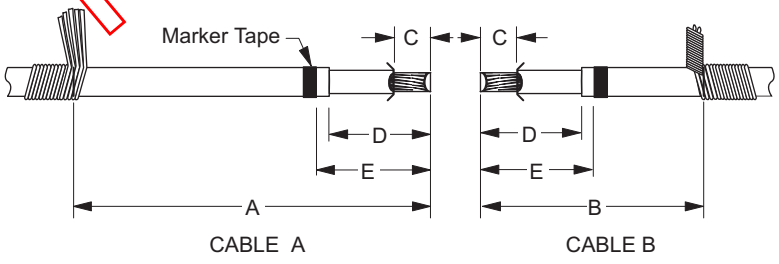


Figure JJ 605–1.1

Conductor Size	Dimension (in)				
	A	B	C	D	E
#2	20	7	1-3/4	5	5-3/4
1/0	20	7	1-3/4	5	5-3/4
350	32	12	4-5/8	9	9-3/4
750	32	12	4-5/8	9	9-3/4
1,000	32	12	4-5/8	9	9-3/4

FOR REFERENCE ONLY

2.0 Instructions

2.1 Determine splice location and allow for 6 inches of concentric neutral beyond that point. Temporarily bind and unwrap the concentric neutral wires as shown in Figure JJ 605–1.1 (Sheet 1). Note the differences in dimensions on each Cable A and Cable B.

2.2 Remove insulation and conductive jacket and install marker tape as shown. See Figure JJ 605–1.1 (Sheet 1).

2.3 Lubricate the inside of the splice housing with the silicone grease supplied or silicone grease approved for use on pre-molded rubber components and accessories. **Do not substitute.** Slide the splice housing on the cable that has the concentric wires temporarily bound at 20 inches. See Figure JJ 605–1.2 (Sheet 2).

2.4 Lubricate the cable insulation and the inside of the adapters with the silicone grease and slide one adapter on each cable back to the marker tape. See Figure JJ 605–1.3 (Sheet 2).

2.5 Wire brush the aluminum conductor. Place the connector on the conductor. Before crimping the connector, make sure the wires are in as far as possible and that the rings do not extend beyond the end of the connector. Use the proper compression tool and die and install crimps on each end of the connector. Rotate the crimps 120 degrees on #2 and 1/0 conductor only. Wipe off excess inhibitor. See Figure JJ 605–1.4 (Sheet 2).

2.6 Unscrew the rings until they are flush with the adapters. See Figure JJ 605–1.5 (Sheet 2).

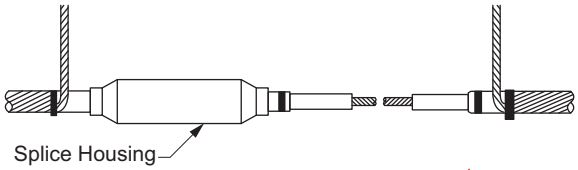


Figure JJ 605–1.2

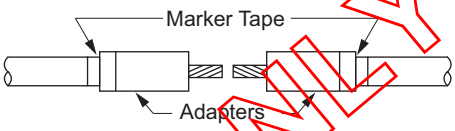


Figure JJ 605–1.3

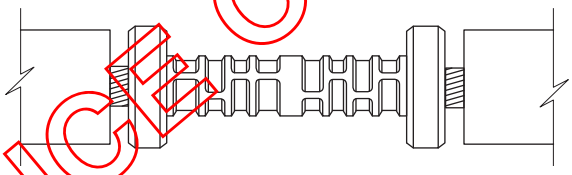


Figure JJ 605–1.4

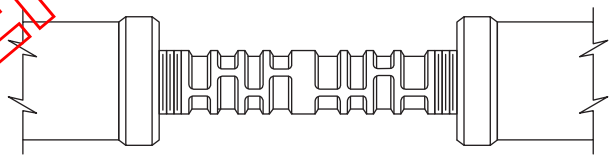


Figure JJ 605–1.5

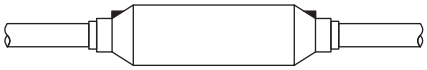


Figure JJ 605–1.6

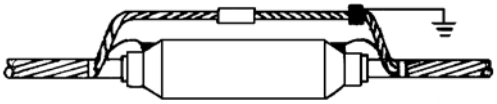


Figure JJ 605–1.7

Table JJ 605–2: Installation Data

Conductor	Circular Crimps Per End					
	MD-6		UT-15		Y-39	
	Die	No.	Die	No.	Die	No.
#2 Str	BG	3				
350 kcmil			15C96R	3	15CA96R[1/]	3
750 kcmil			15C140R	3		
1,000 kcmil			15C161R[2/] 15C150R	3		

[1/] Will fit in UT-15 with adapter die M/C 851-25102.
[2/] The preferred die.

FOR REFERENCE ONLY

2.7 Lubricate the outside of the adapters with the silicone grease supplied. Slide the splice housing into place and center it on the adapters. **Remove the marker tapes.** See Figure JJ 605–1.6 (Sheet 2). Wipe off excess grease from splice assembly and cable.

2.8 Rewrap the concentric wires around the cable. Connect one concentric wire to each grounding eye. Train the concentric neutral wires over the splice housing and crimp together with appropriate connector. See Figure JJ 605–1.7 (Sheet 2). Attach concentric wires to ground.

FOR REFERENCE ONLY

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JJ 610 Straight Splice — 5–16-kV — 350–1,000 kcmil — Elastimold (ESNA)

Scope JJ 610.1 Application and Installation of Elastimold 650S Permanent Splice for 5 kV, 12 kV, and 16 kV

1.0 Application

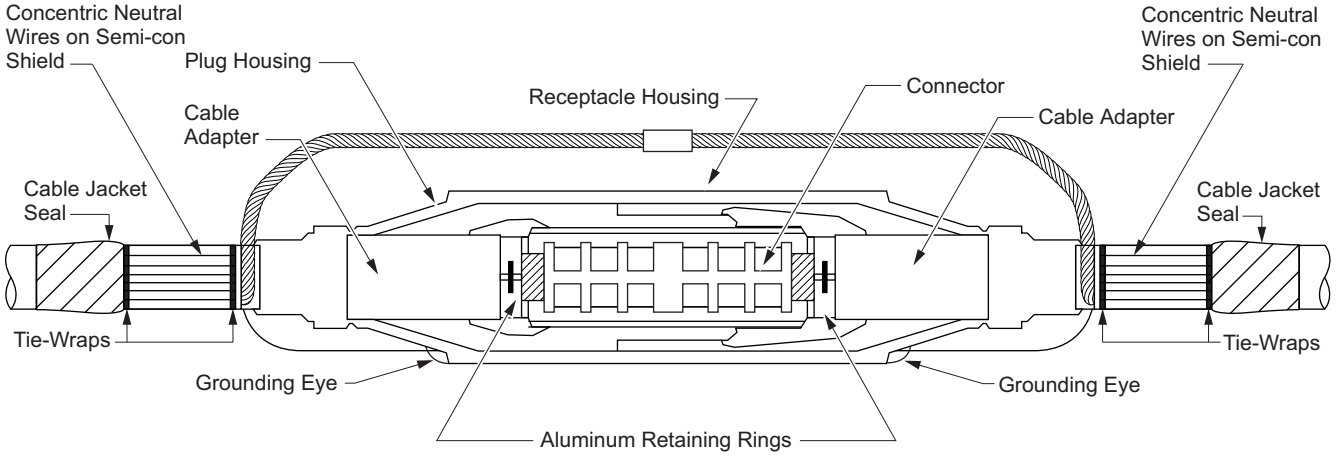
For joining two 1/C aluminum cross-linked polyethylene insulated cables in a fully shielded splice.

Table JJ 610–1: Straight Splice — 5–16-kV — 350–1,000 kcmil

Material Code	Straight Splice Description		Catalog No.
	Conductor Size	Insulation Thickness	
656-54709	350 kcmil Al	90 mil	650S-GH350-GH350
656-54808	750 kcmil Al	90 mil	650S-JA750-JA750
656-54907	350 kcmil Al	220 mil	650S-HJ350-HJ350
656-55003	750 kcmil Al	220 mil	650S-KA750-KA750
656-55102	1,000 kcmil Al	220 mil	650S-KB1000-KB1000
656-55201	350 kcmil Al	295 mil	650S-JAB350-JAB350
656-55300	750 kcmil Al	295 mil	650S-KB750-KB750
Reducing Splice			
656-55508	1,000 kcmil Al To 750 kcmil Al	220 mil 220 mil	K650S-N0410-M0380

=For Reference Only

Figure JJ 610–1: Straight Splice — 5–16-kV — 350–1,000 kcmil



2.0 Instructions

For Jacketed Concentric Neutral (JCN) cable follow steps 2.1 to 2.14; if nonjacketed CN cable, skip steps 2.1 and 2.3.

2.1 Determine splice location on each cable and mark each cable jacket at a point 8 inches beyond the splice location. Measure 41 inches back from these marks and remove the cable jackets from both cables. See Figure JJ 610–1.1 (Sheet 2)

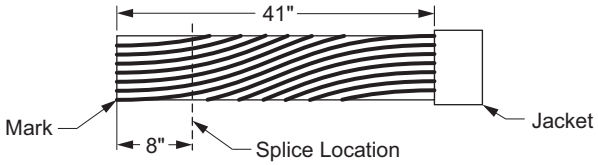


Figure JJ 610–1.1

2.2 Cut each cable to desired length as shown in Figure JJ 610–1.2 (Sheet 2) and allow for 8 inches of concentric neutral wires beyond the cut (splice) location.

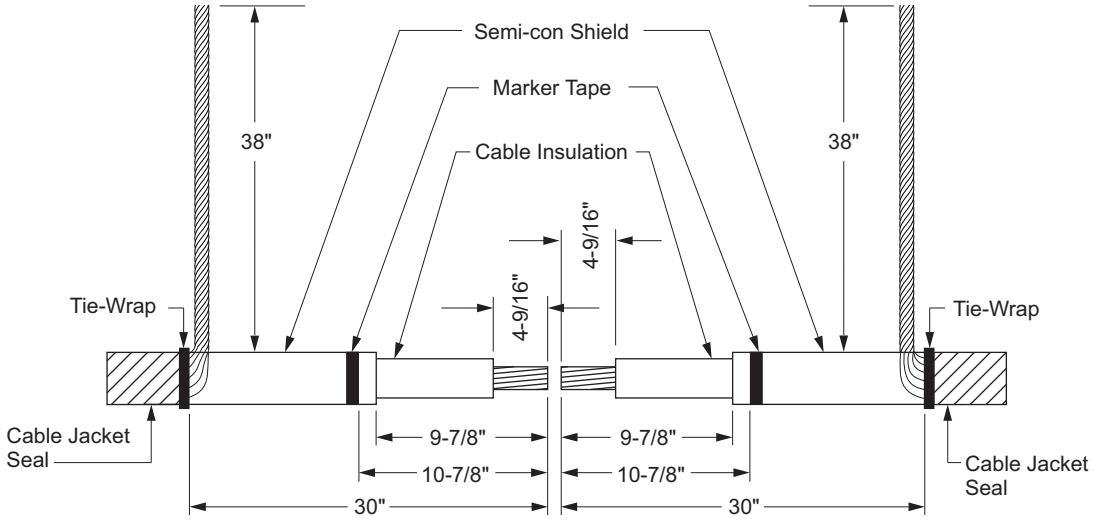


Figure JJ 610–1.2

2.3 Seal the concentric neutral jacket from moisture intrusion following the jacket sealing procedure shown in IC 230.

2.4 Bend the concentric neutral wires back to the tie-wrap bind of the jacket seal at approximately 30 inches from cable end cut.

2.5 Prepare cables as shown in Figure JJ 610–1.2 (Sheet 2). (Not to scale). At a point 10-7/8 inches back from the cable end cut, apply marker tape as an indicator for correct location of the cable adapters.

2.6 Use the diameter measuring tape, included with the kit, to measure the cable insulation. Check this dimension with the diameter range of the adapter.

2.7 Make sure the cable's semicon is clean. Slide splice housings back to the concentric wires on each cable end, See Figure JJ 610–1.3 (Sheet 3).

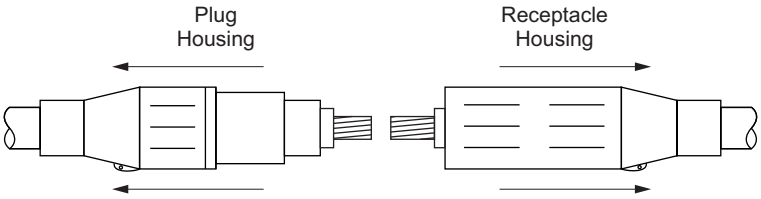


Figure JJ 610–1.3

2.8 Lubricate the cable insulation and inside surface of adapters. Use the lubricant that is supplied or silicone grease M/C 904-00615. **Do not substitute.** Slide adapters on cable back to marker tape, see Figure JJ 610–1.4 (Sheet 3). If cable insulation protrudes beyond cable adapters, remove it by cutting even with cable adapters. **Do not cut or nick the conductor.**

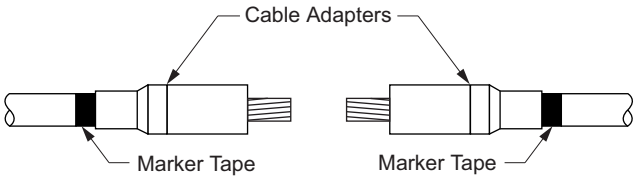


Figure JJ 610–1.4

Table JJ 610–2: Cable Adapter

Material Code	Conductor & Insulation
655-00217	350 kcmil w/90 mil
655-00217	750 kcmil w/90 mil
655-00209	350 kcmil w/220 mil
655-00225	750 kcmil w/220 mil
655-00233	1,000 kcmil w/220 mil
655-00308	350 kcmil w/295 mil
655-00233	750 kcmil w/295 mil

=For Reference Only

2.9 Wire brush the bare aluminum conductor. Place connector in position for crimping but do not crimp. Measure distance between the two cable adapters. This distance should be 9 inches to 9-5/8 inches. If not, do not proceed. Recheck all dimensions. Be sure all parts are in position as shown in Figure JJ 610–1.5 (Sheet 4).

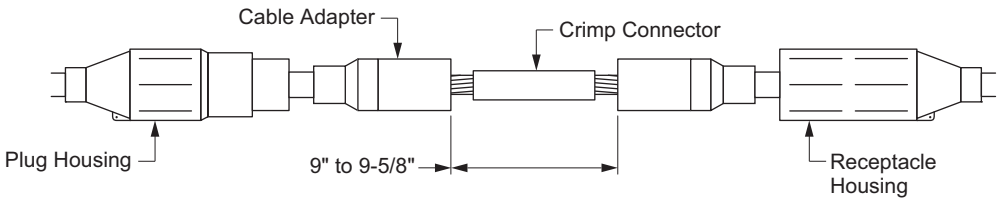


Figure JJ 610–1.5

Table JJ 610–3: Die Chart

Conductor	Connector O.D. (in)	Circular Crimps Per End UT-15	
		Die	No.
350 kcmil	1.125	15CA96R[1/]	3
750 kcmil	1.590	15C14OR	3
1,000 kcmil	1.840	15C161R	3

[1/] Will fit in UT-15 with adapter die M/C 851-25102.

=For Reference Only

2.10 Crimp connector using proper tool and die (see Table JJ 610–2 [Sheet 3]). Wipe off excess inhibitor. Assemble aluminum retaining rings over conductor at each end of crimp connector, see Figure JJ 610–4 (Sheet 4). Butt rings firmly against cable adapters and using the hex wrench provided, tighten socket head cap screws so that the rings compress the conductor. The wrench will twist before the rings are damaged. Measure and record distance “A” between rings for determining assemble position of housing in step 2.11.

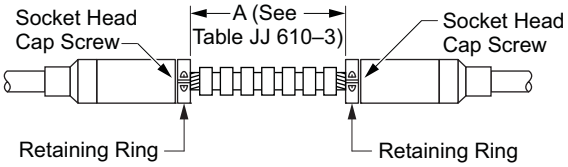


Figure JJ 610–1.6

Table JJ 610–4: Assemble Position of Housing

A	B
8"	0"
8-1/2"	1/4"
9"	1/2"
9-1/2"	3/4"

2.11 Using the lubricant supplied, lubricate the cable adapter as shown in Figure JJ 610–1.7 (Sheet 5). Slide the plug housing over the adapter with a twisting motion until it is in position indicated by the detail drawing. Lubricate the mating surface of the plug housing and the cable adapter as shown in Figure JJ 610–1.8 (Sheet 5).

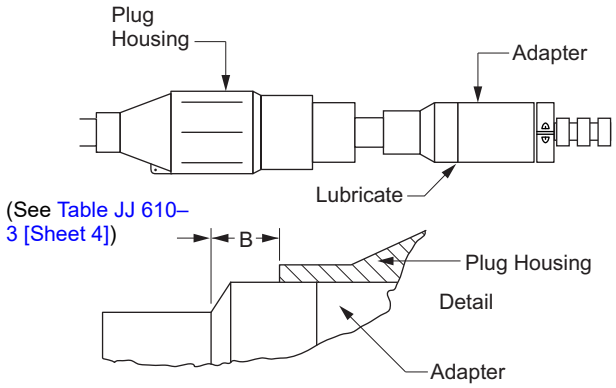


Figure JJ 610–1.7

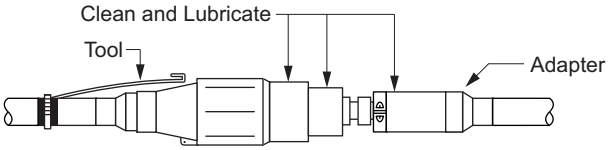


Figure JJ 610–1.8

2.12 Place the assembly tool (M/C 843-25901) in position as shown in Figure JJ 610–1.9 (Sheet 5). Insert nylon venting rod. While holding the plug housing in position, raise the assembly tool handle to slide the receptacle housing into position. After the splice housings are in the final position, remove the nylon rod. **Remove the marker tapes applied to the cable jacket in step 2.5 (Sheet 2).**

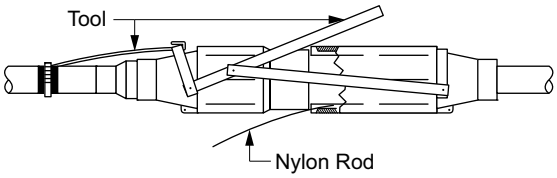


Figure JJ 610–1.9

2.13 The molded splice housing must be centered over the connector. To assure this condition, verify that the cable adapters extend an equal distance from the housing at both the plug and receptacle end. The cable adapter should not extend more than 7/8 inches beyond the housing.

2.14 Re-wrap the concentric neutral back to within 1 inch of the cable adapter and secure it with a plastic cable tie. Take one concentric wire and attach it through each grounding eye. Train the concentric wires over the splice and crimp together with the appropriate connector, see Figure JJ 610–1.10 (Sheet 6). Connect the concentric wires to ground.

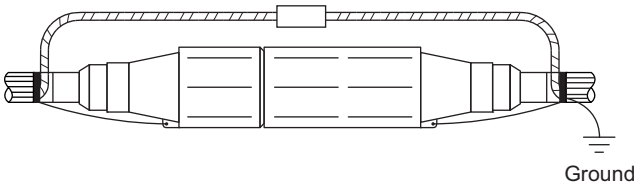


Figure JJ 610–1.10

JJ 611 Straight Splice — 5–16 kV — #2 — 1,000 kcmil — Elastimold

Scope JJ 611.1 Application and Installation of Elastimold 15PCJ1 Permanent Cable Splice for 5 kV, 12 kV, and 16 kV

1.0 Application

The Elastimold 15PCJ series permanent cable splices are applicable for use to join two 1/C cross-linked polyethylene insulated cables in a fully-shielded splice.

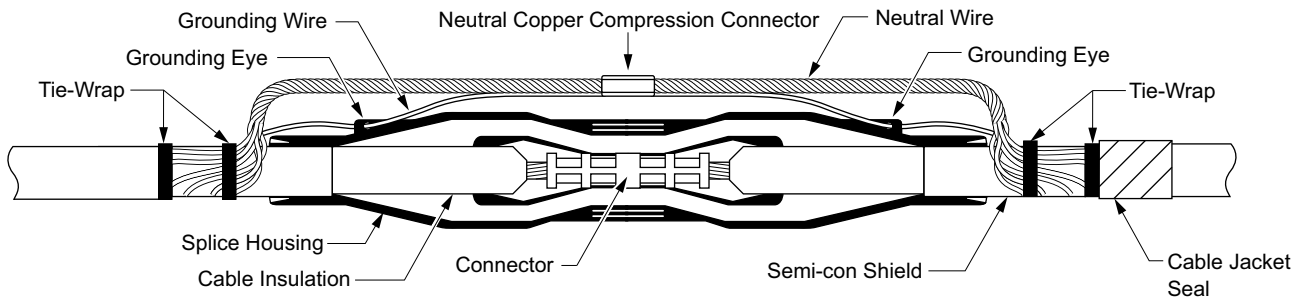
Table JJ 611–1: Straight Splice — 5–16 kV — #2 Through 1,000 kcmil

SAP	Straight Splice Description		Catalog Number
	Conductor Size	Insulation Thickness	
10118099	#2 Al	220 mil	15PCJ1F1220
10118104	1/0 Al	220 mil	15PCJ1G1240
10118108	350 kcmil Al	220 mil	15PCJ1K1300-CS-820
10118109	750 kcmil Al	220 mil	15PCJ1M1380-CS-820
10118110[1/]	1,000 kcmil Al	220 mil	15PCJ1N1410-CS-820
10182736[2/]	1,000 kcmil Cu	220 mil	15PCJ1N2410-CS-820

[1/] For Al conductor only.
[2/] For Cu conductor only.

= For Reference Only

Figure JJ 611–1: Straight Splice — 5–16 kV — #2 Through 1,000 kcmil



2.0 Instructions

For Jacketed Concentric Neutral (JCN) cable follow steps 2.1–2.11; if nonjacketed CN cable skip steps 2.1 and 2.2.

2.1 Determine the splice location and mark the cable jacket where the desired cable end cut will be on the cable. From this mark, measure a dimension of A + 6 inches for Cable A and B + 6 inches for Cable B (See Table JJ 611–2 [Sheet 2]). Remove the cable jacket to these measured points (See Figure JJ 611–1.1 [Sheet 2]).

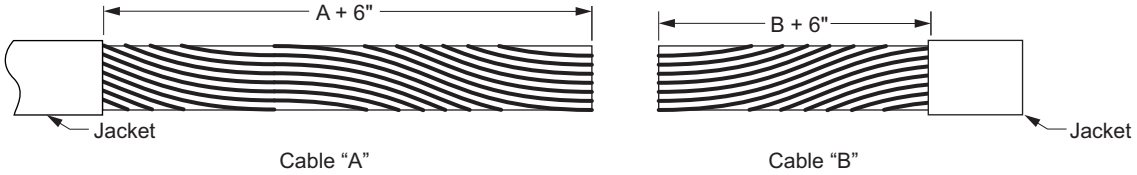


Figure JJ 611–1.1

2.2 Seal the concentric neutral jacket from moisture/water intrusion following the jacket sealing procedure shown inIC 230.

2.3 Allowing for a minimum of 6 inches of the concentric neutral wires to extend beyond the determined splice location, cut the cable. (If nonjacketed cable, temporarily bind the concentric wires of Cable A and permanently bind the concentric wires of Cable B as shown in Figure JJ 611–1.2 [Sheet 2]). Unwrap the concentric wires as shown in Figure JJ 611–1.2 (Sheet 2). Note the difference in dimensions on each cable.

2.4 Remove insulation and semiconducting insulation shield as shown in Figure JJ 611–1.2 (Sheet 2). Bevel edge of insulation at 45 degree angle. **Do not exceed 1/2 inch. Do not use penciling tool.**

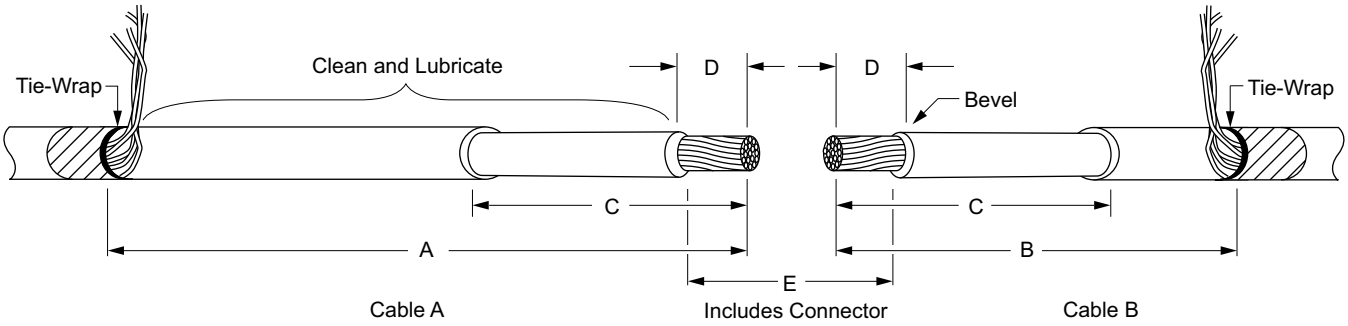


Figure JJ 611–1.2

Table JJ 611–2: Cable Preparation Dimensions

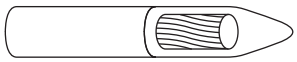
Conductor Size	Dimension (inches)					
	A	B	C	D	E (MAX) Before Crimping	E (MAX) After Crimping
#2 Al	16	6	4	1-3/4	4	4-1/4
1/0 Al	16	6	4	1-3/4	4	4-1/4
350 Al	22	8	6	2	5	5-1/4
750 Al	22	8	6	2-1/4	5-1/4	5-1/2
1,000 Al, Cu	25	9	6-1/2	2-3/4	6-1/2	6-3/4

= For Reference Only

2.5 Clean the insulation and semiconducting insulation shield of Cable A to remove any loose particles of semiconducting material. Wrap two layers of vinyl tape over the conductor strands of Cable A. Lubricate both ends of the splice housing and semiconducting insulation shield of Cable A with the silicone grease supplied or silicone grease (SAP 10154115). **Do not substitute.** See Figure JJ 611–1.2 (Sheet 2).

2.6 Place the cone-shaped cable assembly ramp tool (provided) on the end of Cable A. (See Figure JJ 611–1.3 [Sheet 3]). Slide the splice housing onto Cable A until ramp tool is completely exposed. Remove the assembly ramp tool.

NOTE Cone-shaped assembly ramp tools are sized according to the cable. The proper size assembly ramp tool should not extend beyond the cable diameter.



Assembly Ramp Tool
Figure JJ 611–1.3

2.7 Remove the vinyl tape from the conductor strands and immediately insert into the compression connector provided, making sure the conductors are in as far as possible.

CAUTION Use aluminum compression connector with aluminum conductor, and use copper compression connector with copper conductor to prevent a splice failure.

2.8 Check the distance between cable insulations installed. If the distance exceeds the maximum “E” allowed, redo the connector assembly.

2.9 Using appropriate compression tool and die, install the required number of crimps on each end of the connector. Rotate the crimps 120 degrees, to prevent distortion. **Remove any sharp points on the connector.** Wipe off excess inhibitor.

NOTE Start the crimps just outside the centering marks of the connector and work outward.

To remove sharp points left by crimping, rotate the compression tool 90 degrees and re-crimp.

It is essential that the proper amount of crimps be made, as overcrimping may cause the connector to elongate and change the measurements of the splice.

Table JJ 611–3: Crimp Data

Conductor	Circular Crimps Per End			
	MD-6		UT-15 and Y-39	
	Die	No.	Die	No.
#2 and 1/0	BG	3		
350 kcmil			15C96R	3
350 kcmil			15CA96R[1/]	3
750 kcmil			15C140R	2
1,000 kcmil Al			15C140R[2/]	2
1,000 kcmil Cu			15CA125R[3/]	2

[1/] Will fit Y-39, and also UT w/adapter die M/C 851-25102.
[2/] Use die 15C140R for this Elastimold 1000 kcmil Al splice only.
[3/] Use die 15C125R for this Elastimold 1000 kciml Cu splice only.

= For Reference Only

2.10 Clean the exposed cable insulation and lubricate Cable B in the direction away from the connector to provide a build-up or ramp of lubricant at the edge of the insulation shield.

2.11 Slide the splice housing into final position. Proper positioning is insured by observing and equalizing the deformation (bumps) of the splice ends caused by the underlying cable insulation shield.

2.12 Permanently bind concentrics of Cable A at the end of the splice. Insert one of the concentric wires from Cable A through the splice grounding eye, repeat for Cable B. Reshape concentric wires as shown in Figure JJ 611–1 (Sheet 1). Connect splice grounding wires and remaining concentric wires, using a neutral copper compression connector, per DUG GR 100.

JJ 620 Straight Splice — 12/16 kV — 350–1,000 kcmil — 3M

Scope JJ 620.1 Application and Installation of 3M Permanent Splice for 12/16 kV

1.0 Application

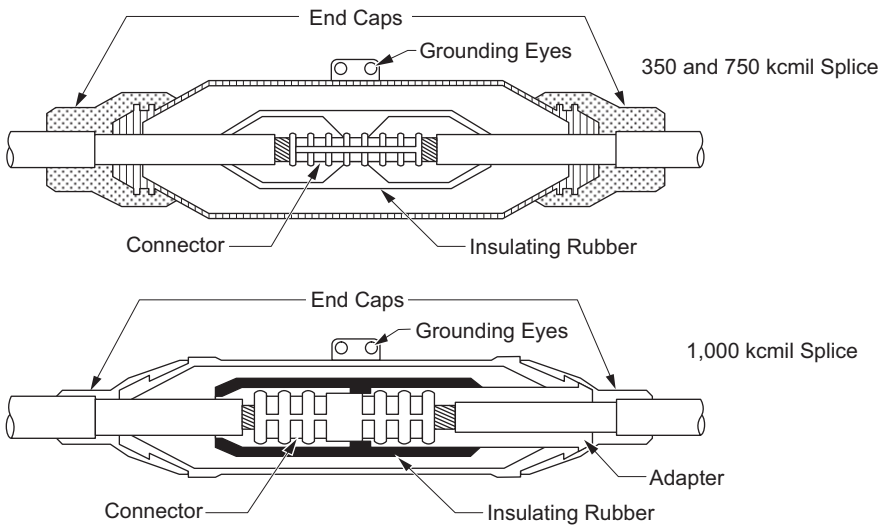
For joining two 1/C aluminum polyethylene-insulated cables in a permanent, fully-shielded splice.

Table JJ 620–1: Straight Splice — 12/16 kV — 350 — 1,000 kcmil — 3M

SAP Number	Straight Splice Description		Overall Length (in)
	Conductor Size	Insulation Thickness	
10118108	350 kcmil Al	220 mil	14-3/8
10118109	750 kcmil Al	220 mil	14-3/8
10118110	1,000 kcmil Al	220 mil	20-1/4

= For Reference Only

Figure JJ 620–1: Straight Splice — 12/16-kV — 350–1,000 kcmil — 3M



2.0 Instructions

2.1 Determine splice locations and allow for 6 inches of concentric neutral wires beyond that point. Temporarily bind and unwrap the concentric neutral wires as shown in Figure JJ 620–1.2 (Sheet 2). Note the differences in dimensions on each cable (Cable A and B).

2.2 Remove insulation and semiconductive semicon shield as shown. Bevel edges of cable insulation at a 45 degree angle. Do not exceed 1/8 inch, do not use pencilling tool. See Figure JJ 620–1.2 (Sheet 2).

2.3 Wrap a half-lapped layer of vinyl tape (supplied with splice kit) unto the semiconducting semicon shield of Cable A for distance E. Tape in direction of arrows shown in Figure JJ 620–1.2 (Sheet 2). Continue the layer of tape over the edge of the semiconductive semicon shield 1/4 inch. Wrap two layers of vinyl tape over the conductor strands of the cable. See Figure JJ 620–1.2 (Sheet 2).

2.4 Lubricate exposed cable insulations and vinyl tape with the silicone grease SAP 10154115. Do not substitute. Slide one splice end cap back out of the way on each cable. Slide cable adapter (1,000 kcmil splice only) onto cable B until the cable insulation is butted up against the cable adapter end. See Figure JJ 620–1.3 (Sheet 2).

2.5 Relubricate the tape and insulation and slide the splice housing onto the cable over the vinyl tape until the conductor has been entirely exposed. See Figure JJ 620–1.4 (Sheet 2). Use assembly tool if necessary.

2.6 Remove vinyl tape from conductor strands. Wire brush the aluminum conductor. Before crimping the connector, make sure the wires are in the connector as far as possible. Use the proper compression tool and die and install crimps on each end of the connector. Remove any sharp points on the connector. Wipe off excess inhibitor.

2.7 Lubricate the insulation and slide the splice housing over the connector until the housing locks in place. Use assembly tool if necessary. See Figure JJ 620–1.8 (Sheet 3). The cable semiconducting semicon shield must not extend inside the splice housing. A minimum of 1/16 inch to a maximum of 5/8 inches for 350 and 750 kcmil or a minimum of 1/8 inch to a maximum of 3/4 inches for 1,000 kcmil of cable insulation should be exposed. See Figure JJ 620–1.5 (Sheet 2).

2.8 Remove vinyl tape from semiconductive semicon jacket of cable. Apply a ring of lubricant over the exposed insulation between splice housing and semiconductive jacket at both ends of splice. See Figure JJ 620–1.5 (Sheet 2).

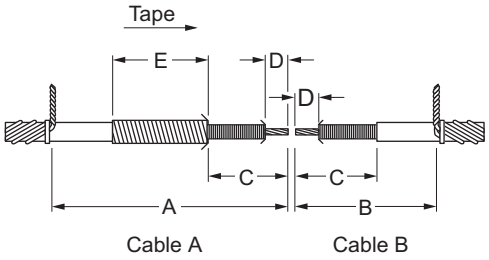


Figure JJ 620–1.1

Conductor Size	Dimension (in)				
	A	B	C	D	E
350	17	10	5-3/4	2	9
750	17	10	5-3/4	2-1/2	9
1,000	26	13-1/2	8-1/4	3-3/4	14

= For Reference Only

Figure JJ 620–1.2

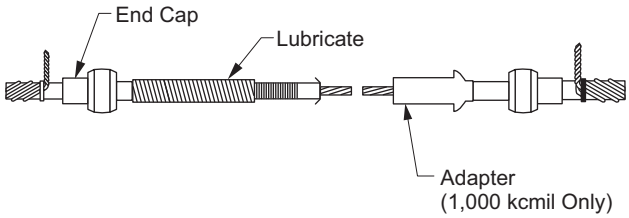


Figure JJ 620–1.3

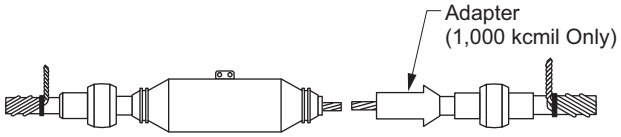


Figure JJ 620–1.4

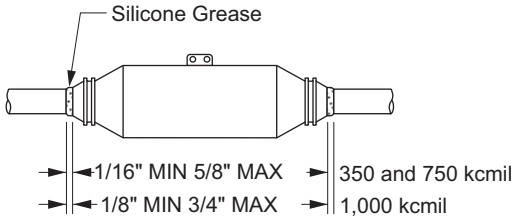


Figure JJ 620–1.5

2.9 Slide both end caps into position on the splice housing until they snap in place. There are locking grooves on each end of the splice. See Figure JJ 620–1.6 (Sheet 3).

2.10 Rewrap the concentric wires around the cable. Run one concentric wire to each grounding eye. Train the concentric neutral wires over the splice housing and crimp together with appropriate connector. Connect the concentric wires to ground. See Figure JJ 620–1.7 (Sheet 3).

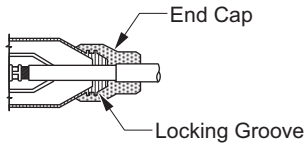


Figure JJ 620–1.6

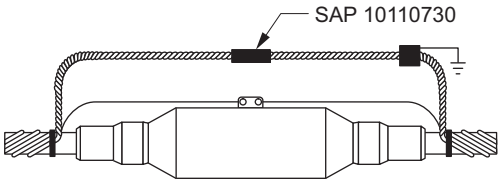


Figure JJ 620–1.7

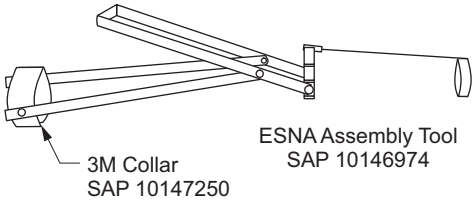


Figure JJ 620–1.8

Table JJ 620–2: Connector Installation Data

Conductor Size	Circular Crimps Per End	
	UT-15 and Y-39	
	Die	No.
350 kcmil	15CA96R[1/] 15C96R	3
750 kcmil	15C140R	3
1,000	15C161R[2/] 15C150R	3

[1/] Will fit UT-15 with adapter die (SAP 10148852) and will fit Y-39 without adapter die.
[2/] Alternate die for 1,000 kcmil is 15C150R.

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JJ 621 Straight Splice — 5–16-kV — #2–1/0 — 3M

Scope JJ 621.1 Application and Installation of 3M Permanent Splice for 5–16-kV

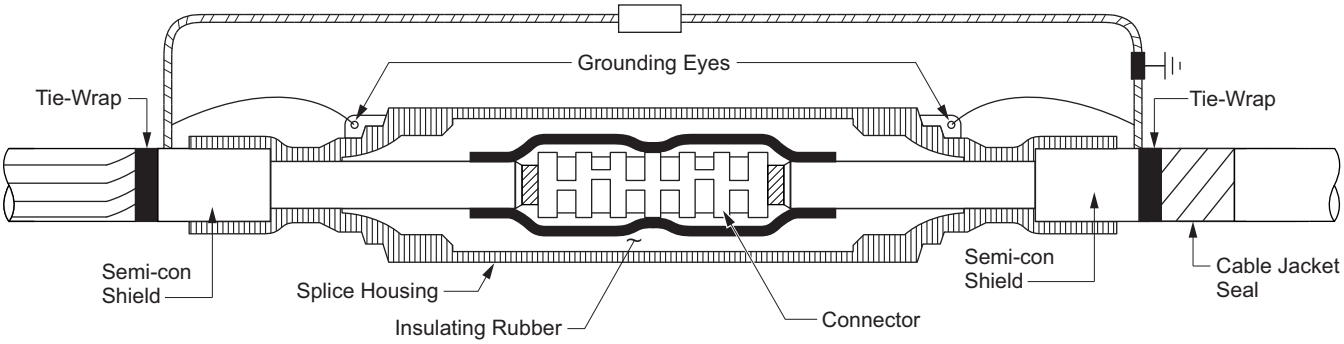
1.0 Application

The 3M CI series permanent cables splices are applicable for use to join two 1/C cross-linked polyethylene insulated aluminum and copper cables in a fully-shielded splice.

Table JJ 621–1: Straight Splice — 5–16-kV — #2–1/0

SAP	Straight Splice Description	
	Conductor Size	Insulation Thickness
10118099	#2	220 mil
10118104	1/0	220 mil
10200759	#2 to 1/0	220 mil

Figure JJ 621–1: Straight Splice — 5–16-kV — #2–1/0



2.0 Instructions

For Jacketed Concentric Neutral (JCN) cable follow steps 2.1–2.8; if nonjacketed CN cable ignore cable jacket instructions in step 2.1 and 2.2.

2.1 Determine splice location on each cable. Mark each cable jacket at a point 6 inches beyond splice location. Measure 21 inches for Cable “A” and 15 inches for Cable “B” from these marks and remove the cable jackets from both cables. See Figure JJ 621–1.1 (Sheet 1) and note the difference in dimensions for each cable. Unwrap the concentric neutral wires back to he cable jacket.

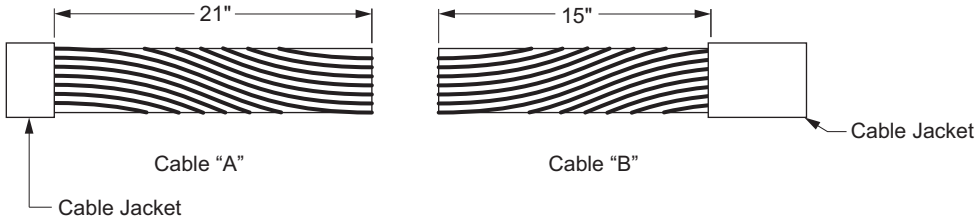


Figure JJ 621–1.1

2.2 Seal the concentric neutral jacket from moisture/water intrusion following the jacket sealing procedure described in IC 230. After sealing the jacket leave the concentric neutral wires unwrapped back to the jacket seal bind tie-wrap as shown in Figure JJ 621–1.2 (Sheet 2).

2.3 Allowing for a minimum of 6 inches of the concentric neutral wires to extend beyond the determined splice location, cut cables to desired lengths. (If the cable is nonjacketed cable temporarily bind the concentric wires of Cable "A" and permanently bind the concentric wires of Cable "B" as shown in Figure JJ 621–1.2 (Sheet 2)).

2.4 Remove insulation and semiconducting insulation shield as shown. Bevel edge of insulation at 45 degree angle. **Do not exceed 1/8 inch bevel. Do not use pencilling tool.** *See Figure JJ 621–1.3 (Sheet 2).*

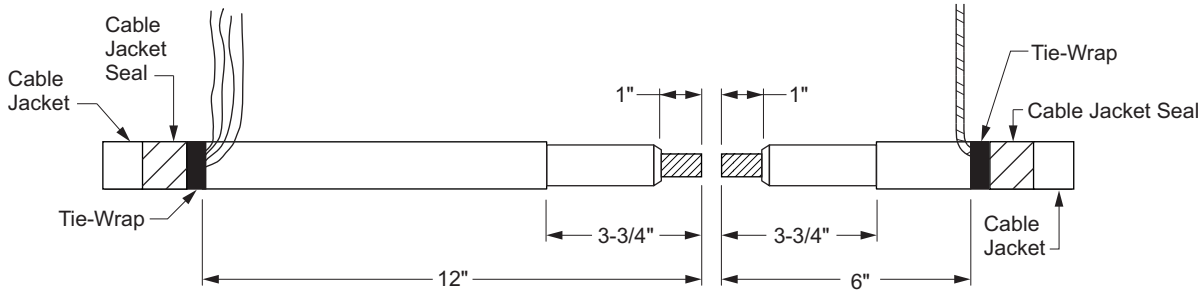


Figure JJ 621–1.2

2.5 Clean the semiconducting insulation shield of Cable "A" to remove any loose particles of semiconducting material. Wrap two layers of vinyl tape over the conductor strands of Cable "A." Lubricate both ends of the splice housing and the insulation, and semiconducting insulation shield of Cable "A" with the silicone grease supplied or silicone grease SAP 10154115. **Do not substitute.** See Figure JJ 621–1.3 (Sheet 2).

2.6 Slide splice housing onto Cable "A" until the bare strands are completely exposed, as shown in Figure JJ 621–1.3 (Sheet 2). Remove vinyl tape from conductor strands of Cable "A." Wire brush the aluminum conductors. Before crimping the connector, make sure the wires are in the connector as far as possible. Use the BG groove of the MD-6 compression tool and make three crimps on each end of the connector. Rotate the crimps 120 degrees. **Remove any sharp points on the connector.** Wipe off excess inhibitor.

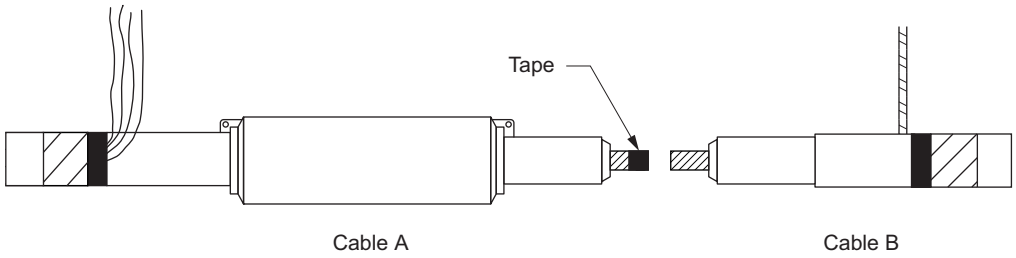


Figure JJ 621–1.3

2.7 Lubricate the insulation of Cable “B” (Figure JJ 621–1.3 [Sheet 2]) and slide the splice housing into final position. Use the indents shown on Figure JJ 621–1.4 (Sheet 3) to center splice housing over connector.

2.8 Rewrap concentric wires on Cable “A.” Run one concentric wire to each grounding eye. Train the concentric wires over splice housing, permanently bind, and crimp together with appropriate connector. Connect the concentric wires to ground. See Figure JJ 621–1.4 (Sheet 3).

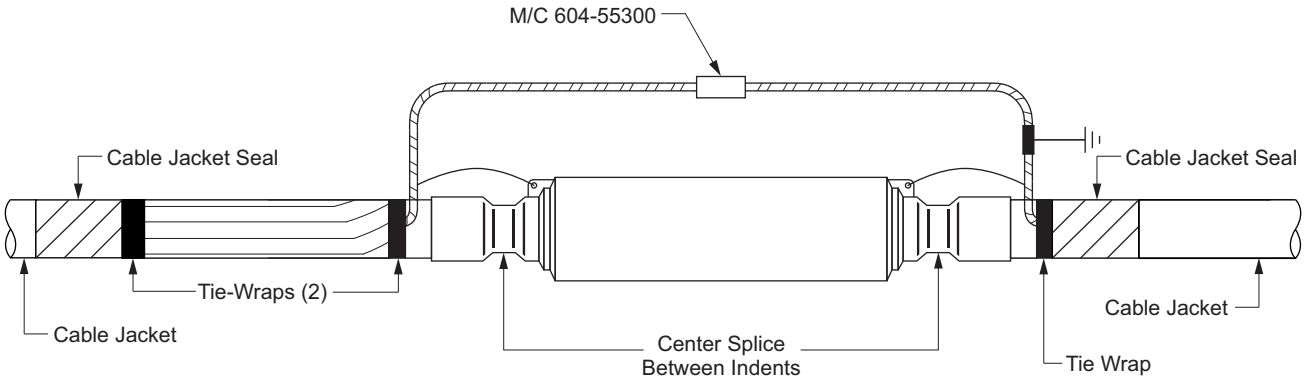


Figure JJ 621–1.4

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JJ 624 Straight Splice — 12/16-kV — #2–1/0 AWG

Scope JJ 624.1 Application and Installation of Permanent Splice for 12/16-kV

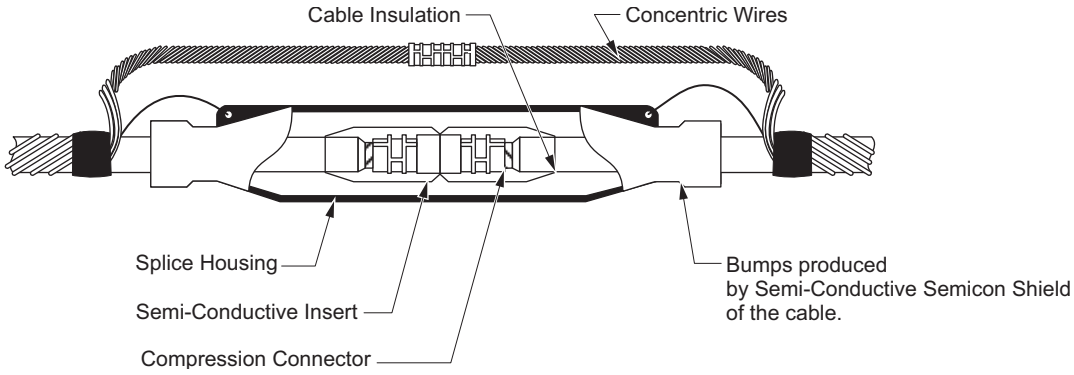
1.0 Application

For joining two 1/C aluminum polyethylene-insulated cables in a permanent, fully-shielded splice.

Table JJ 624–1: Straight Splice — 12/16-kV — #2–1/0 AWG

SAP Number	Straight Splice Description	
	Conductor Size	Insulation Thickness
10118099	#2 Al	220 mil
10118104	1/0 Al	220 mil

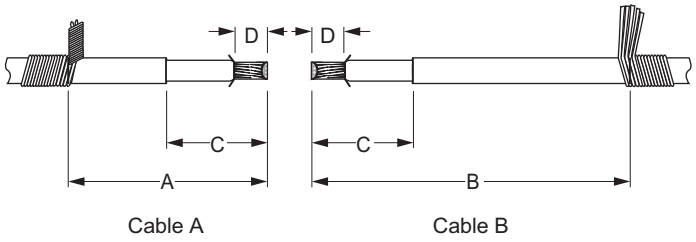
Figure JJ 624–1: Cooper 200 A Z Splice for #2 and 1/0



2.0 Instructions

2.1 Determine splice location and allow for 6 inches of concentric neutral beyond that point. Unwrap the concentric neutral wires as shown in Figure JJ 624–1.1 (Sheet 1). Note the differences in dimensions on each cable.

2.2 Remove insulation and semiconductive semicon shield as shown. Bevel edge of insulation. **Do not exceed 1/8 inch. Do not use pencilling tool.** See Figure JJ 624–1.1 (Sheet 1).



Conductor Size	Dimension (in)			
	A	B	C	D
#2	6	12	3-3/4	1
1/0	6	12	3-3/4	1

Figure JJ 624–1.1

2.3 Clean semiconductive jacket of Cable B to remove any loose particles of semiconductive material. Lubricate insulation and semiconductive semicon shield of Cable B with the silicone grease supplied or silicone grease (M/C 904-00615). **Do not substitute.**

2.4 Tape conductor on Cable B to prevent damage to the splice bore. Slide splice onto Cable B until conductor is exposed; remove tape. See Figure JJ 624–1.2 (Sheet 2).

2.5 Wire brush the aluminum conductors. Slide the connector onto both cables until firmly seated, making sure that the wires are in the connector as far as possible. Using the proper tool and die, start crimping 1/8 inch from center of connector on alternating sides from the center. Leave the center 1/4 inch uncrimped. Rotate each successive crimp 120 degrees from the last. Make a total of 6 crimps (3 per side). Do not overlap crimps. Remove any sharp points on the connector and any excessive lubricant. See Figure JJ 624–1.3 (Sheet 2).

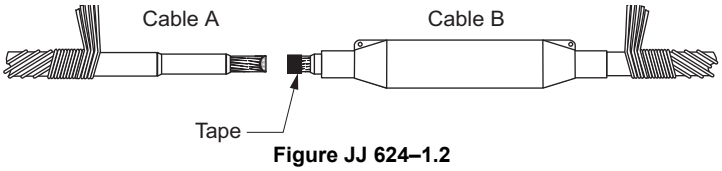


Figure JJ 624–1.2

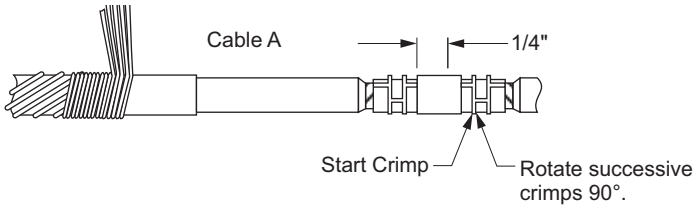


Figure JJ 624–1.3

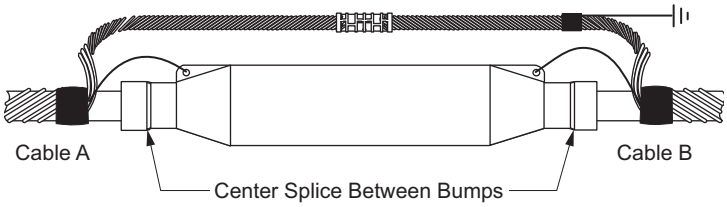


Figure JJ 624–1.4

Table JJ 624–2: Connector Installation Data

Conductor	Circular Crimps Per End	
	MD-6	
	DIA	No.
#2 str	BG	3
1/0 str	BG	3

2.6 Clean semiconductive semicon shield of Cable A to remove any loose particles of semiconductive materials. Lubricate insulation and semiconductive semicon shield of Cable A with the silicone lubricant supplied or silicone grease M/C 904-00615. **Do not substitute.**

2.7 Slide the splice housing into position over Cable A and connector. Use the bumps formed on the splice as a centering device. Rewrap the concentric wires on both Cable A and B. Run one concentric wire to each grounding eye. Train the concentric wires over the splice housing and crimp together with the appropriate connector. Connect the concentric wires to ground. See Figure JJ 624–1.4 (Sheet 2).

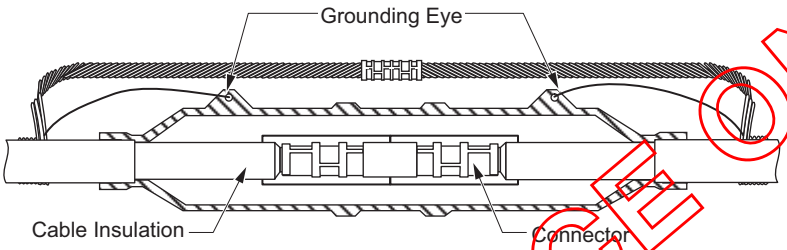
JJ 625 Straight Splice — 12/16-kV — 350–750 kcmil Cooper

Scope JJ 625.1 Typical Applications and Installation of Cooper Permanent Straight Splice for 12/16-kV — 350–750 kcmil Cable

Table JJ 625–1: Straight Splice — 12/16-kV — 350–750 kcmil Cooper

Material Code	Straight Splice Description		Catalog Number
	Conductor Size	Insulation Thickness	
656-54907	350 kcmil	220 mil	2602877B16SC
656-55003	750 kcmil	220 mil	2602877B15

Figure JJ 625–1: RTE 600 A Splice for 350 kcmil and 750 kcmil



FOR REFERENCE ONLY

1.0 Instructions

1.1 Determine splice location and allow for 6 inches of concentric neutral beyond that point. Temporarily bind Cable A; permanently bind Cable B and unwrap the concentric neutral wires as shown in Figure JJ 625–1.1 (Sheet 1). Note the differences in dimensions on each cable.

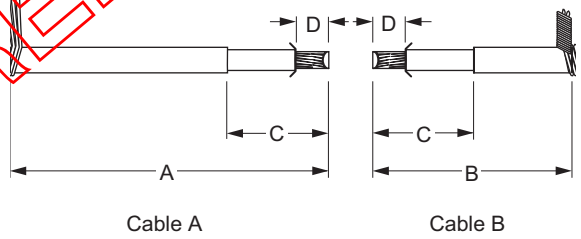


Table JJ 625–2: Cable Cut-Back Dimensions

Conductor Size	Dimension (in)			
	A	B	C	D
350	20	9	6-3/4	3-1/4
750	20	9	6-3/4	3-1/4

Figure JJ 625–1.1

1.2 Remove insulation and conductive jacket as shown. Bevel edge of insulation at a 45 degree angle for 350 kcmil and larger cables. **Do not exceed 1/8 inch. Do not use pencilling tool.** See Figure JJ 625–1.1 (Sheet 1).

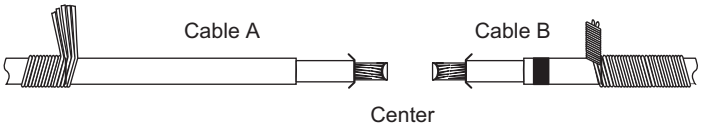


Figure JJ 625–1.2

1.3 Clean semiconducting jacket of Cable A to remove any loose particles of semiconducting material. Lubricate insulation and semiconducting jacket of cable A

with the silicone grease supplied or silicone grease (M/C 904-00615). **Do not substitute.**

1.4 Wire brush the aluminum conductors. Wrap two layers of vinyl tape over the strands of Cable A.

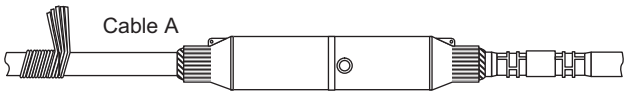


Figure JJ 625–1.3

1.5 Slide the splice housing onto the lubricated cable approximately 4 inches. Remove the splice housing and relubricate the cable. Insert the lubricated cable into the unlubricated end of the splice housing. Turn the splice housing onto the cable, rotating the housing in one direction only, while applying pressure in the direction of travel. Continue until the cable insulation is exposed at the other end of the housing. See Figure JJ 625–1.3 (Sheet 2).

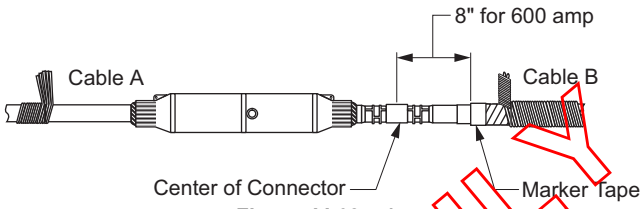


Figure JJ 625–1.4

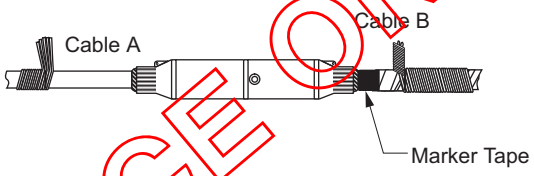


Figure JJ 625–1.5

1.6 **Remove vinyl tape from the conductor strands of Cable A.** Using the proper tool and die, install the compression connector, making sure the wires are in the connector as far as possible. Rotate each successive crimp 120 degrees from the last. Make a total of 6 crimps (3 per side). Do not overlap crimps. **Remove any sharp points on the connector. Wipe off excess inhibitor.**

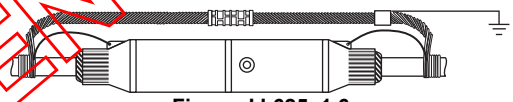


Figure JJ 625–1.6

Table JJ 625–3: Connector Installation Data

Conductor	Circular Crimps Per End			
	UT-15		Y-39	
	Die	No.	Die	No.
350 kcmil	15C96R	3	15CA96R[1/]	3
750 kcmil	15C140R	3		

[1/] Will fit in UT-15 with adapter die M/C 851-25102.

1.7 Install a marker tape on Cable B back from the center of the compression connector as shown in Figure JJ 625–1.4 (Sheet 2).

1.8 Lubricate the cable insulation and slide the splice housing back over the connector until the housing meets the marker tape. See Figure JJ 625–1.5 (Sheet 2). Remove the marker tape.

1.9 Rewrap the concentric wires on Cable A. Run one concentric wire to each grounding eye. Train the concentric wires over the splice housing and crimp together with appropriate connector. Connect the concentric wires to ground. See Figure JJ 625–1.6 (Sheet 2).

FOR REFERENCE ONLY

JJ 640 Straight Splice — 35-kV — 750 kcmil — AMPACT

Scope JJ 640.1 Application and Installation of AMPACT UD Permanent Splice for 34.5-kV

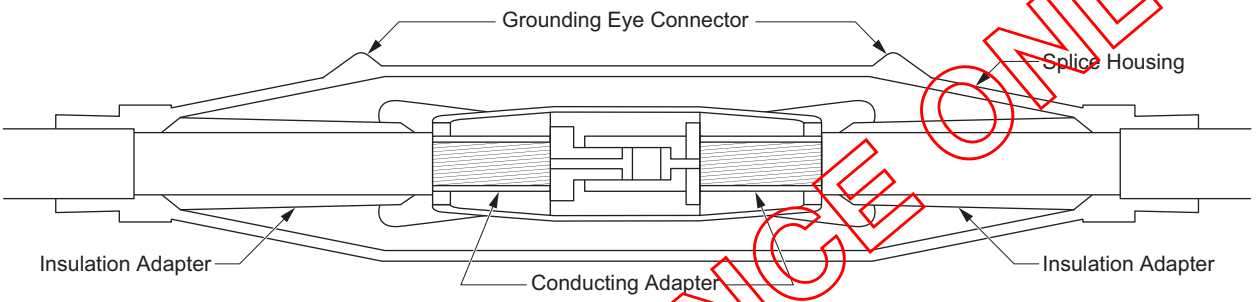
1.0 Application

For joining two 1/C aluminum polyethylene-insulated cables in a fully-shielded splice.

Table JJ 640–1: Straight Splice — 35-kV — 750 kcmil — AMPACT

Material Code	Straight Splice Description		Catalog No.
	Conductor Size	Insulation Thickness	
656-55607	750 kcmil	420 mil	SCE8-7-28K

Figure JJ 640–1: Straight Splice — 35-kV — 750 kcmil — AMPACT



2.0 Instructions

2.1 Prepare cables as shown in Figure JJ 640–1.1 (Sheet 1). Use a hacksaw to cut the cables squarely. **Do not nick the insulation.**

2.2 Lubricate the cable insulation, the inside surface of the cable adapters and the ignition wire tubes with the silicone grease supplied or silicone grease M/C 898-41407. **Do not substitute.**

2.3 Position the ignition tape inside the cable adapter with the tagged end extending beyond the semiconductive end of the adapter and the foil end extending beyond the insulation end. See Figure JJ 640–1.2 (Sheet 1).

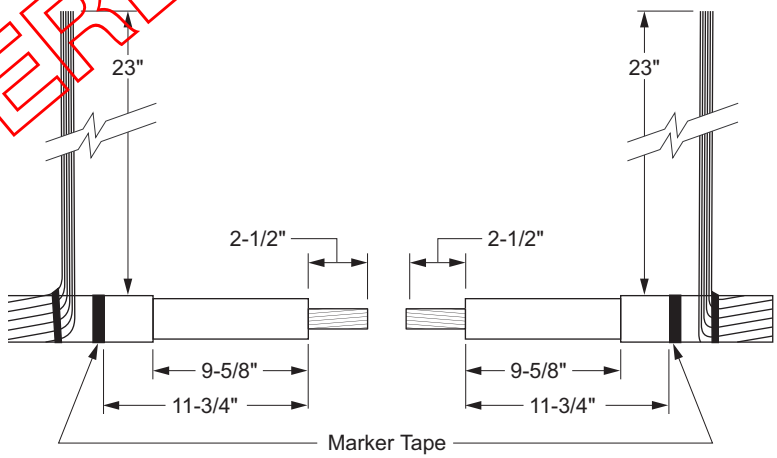


Figure JJ 640–1.1

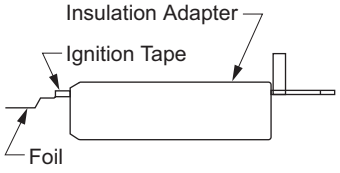


Figure JJ 640–1.2

FOR REFERENCE ONLY

2.4 Hold the ignition tape in place and slide the cable adapter onto cable. The end of the cable adapter must be flush with the marker tape. See Figure JJ 640–1.3 (Sheet 2).

2.5 Straighten and adjust the ignition so that the insulation is just exposed beyond the insulation end of the insulation adapter. Bend exposed ignition tape foil at cable conductor end over cable insulation and onto the conductor, positioning bent ignition tape foil against the outer strands of the conductor. See Figure JJ 640–1.4 (Sheet 2).

2.6 Carefully slide the conductor adapter, with the beveled end out, over the conductor end ignition wire foil. The ignition wire foil must be kept between the conductor strands and the adapter. See Figure JJ 640–1.5 (Sheet 2).

2.7 Lubricate the cable adapters and the inside of the splice housing with the silicone grease provided or silicone grease (M/C 898-41407). **Do not substitute.**

2.8 Insert a vent tube along the inside surface of the splice housing to the depth indicated on the tag attached to the tube. See Figure JJ 640–1.6 (Sheet 2).

2.9 Slide the splice housing into the internal jaws. When properly aligned, the conductor will enter the jaws with minimum resistance. The cable is fully inserted when 1-1/4 inches to 1-1/2 inches of the black portion of the insulation adapter end is still exposed. When not properly aligned, the conductor will jam at the jaw opening. This will occur when all of the black portion, plus 1/2 inch to 3/4 inches of the gray portion of this insulation adapter is

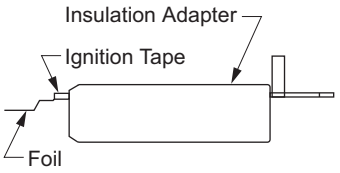


Figure JJ 640–1.3

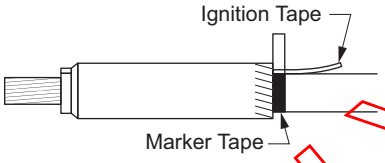


Figure JJ 640–1.4

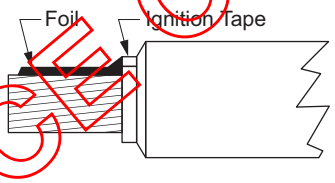


Figure JJ 640–1.5

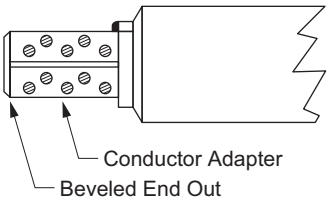


Figure JJ 640–1.6

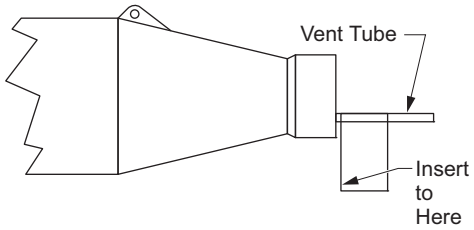


Figure JJ 640–1.7

FOR REFERENCE ONLY

still exposed. Do not force cable beyond this point or conductor and/or conductor adapter may be damaged. Pull cable out approximately 1/2 inch, readjust alignment and reinsert cable. Repeat, if necessary.

2.10 Prepare other cable end and insert into opposite end of splice housing in the same manner as described in Step 2.9. After cable ends are fully inserted into splice housing, readjust vent tubes, if necessary, so that correct depth is not exceeded.

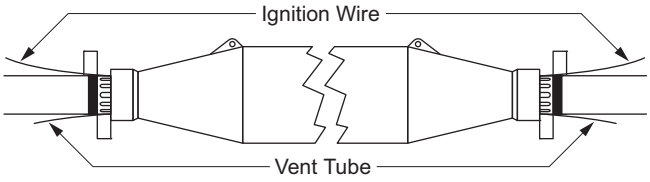


Figure JJ 640–1.8

2.11 After both cable ends have been fully inserted into the splice housing, apply an appropriate power source to the ignition wires to fire the connector. A 6-volt battery is satisfactory. See Figure JJ 640–1.8 (Sheet 3). If the splice does not fire, the cable ends probably have not been fully inserted in tot he splice housing. Disconnect battery leads, then push cables in until they bottom and establish contact with the splice ignition circuit. A continuity check (with a Volt Meter VOM) across ignition tapes, prior to connection of the battery, will verify that the required contacts have been made. Apply power to the ignition wires again. Remove battery connections immediately after firing, but do not remove ignition wires at this time.

2.12 Adapters must be adjusted if the ends are not flush with the marker tapes. **Important:** Adjust the adapters, if necessary, before removing ignition wires and vent tubes.

2.13 Remove each ignition wire, ignition wire tubes, and vent tubes using a pair of pliers and apply a constant pull. Remove marker tapes.

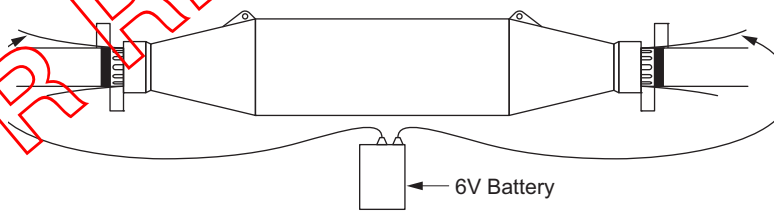


Figure JJ 640–1.9

2.14 Rewrap the concentric wires around the cable. Run one concentric wire to each grounding eye. Train the concentric wires over the splice housing and crimp together with appropriate connector. Connect the concentric wires to ground. See Figure JJ 640–1.9 (Sheet 3).

FOR REFERENCE ONLY

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JJ 650 Y-Splice — 12 kV and 16 kV — #2 and 1/0 — Elastimold (ESNA)

Scope JJ 650.1 Application and Installation of Elastimold Permanent Y-Splice for #2 and 1/0 12 and 16 kV

1.0 Application

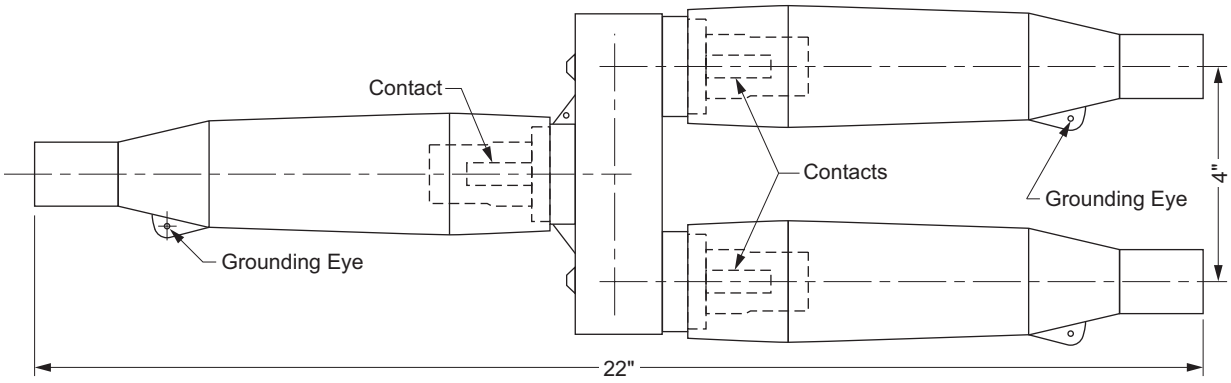
For joining three 1/C-#2 AWG or three 1/C-1/0 AWG aluminum polyethylene-insulated cables in a permanent fully-shielded Y-splice.

Table JJ 650–1: Y-Splice — 12 kV and 16 kV — #2 and 1/0

SAP	Splice Description	Catalog No.
10118101	Splice, "Y", permanent, Elastimold, for three #2 Al 220 mil, polyethylene cables	K151LYFG1220
10118102	Splice, "Y", permanent, Elastimold, for three #2 Al 295 or 320 mil, polyethylene cables	25-Y-GB-1AX
10118103	Splice, "Y", permanent, Elastimold, for three 1/0 Al 220 mil, polyethylene cables	K151LYGAB1240

= For Reference Only

Figure JJ 650–1: Y-Splice — 12 kV and 16 kV — #2 and 1/0



2.0 Instructions

For Jacketed Concentric Neutral (JCN) cable follow steps 2.1–2.11; if nonjacketed CN cable skip steps 2.1 and 2.2.

2.1 Determine splice location. Mark cable where the desired cable end cut will be on the cable. Measure 11 inches back from this mark and remove the cable jacket back to this point on the cable. See Figure JJ 650–1.1 (Sheet 1).

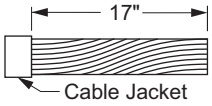


Figure JJ 650–1.1

2.2 Seal the cable's concentric neutral jacket from moisture/water intrusion following the jacket sealing procedure shown in IC 230.

2.3 Allow for at least 6 inches of concentric neutral beyond the determined splice location, cut the cable. Measure back at least 8 inches from cable end cut. Bind the concentric neutral wires for nonjacketed cable. See Figure JJ 650–1.2 (Sheet 2).

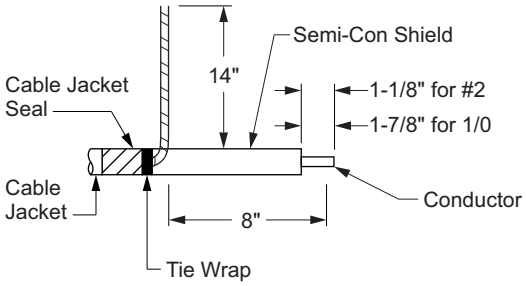


Figure JJ 650–1.2

2.4 For #2 cable, remove 1-1/8 inch (1-7/8 inch for 1/0) of cable insulation from cable end. **Cut squarely. Do not pencil. S**ee Figure JJ 650–1.2 (Sheet 2).

2.5 Wire brush bare aluminum conductor. Crimp pin contact on bared conductor, holding the crimp barrel against the cable insulation. See Figure JJ 650–1.3 (Sheet 2). Use MD-6 compression tool, ("X" groove for #2 conductor and "BG" groove for 1/0 conductor.) Install three crimps. Rotate the crimps 120 degrees. Wipe off excess inhibitor.

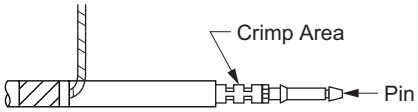


Figure JJ 650–1.3

2.6 Remove the semiconducting shield to 7-5/8 inches back from the front end of the pin contact with a smooth, straight cut. **Do not cut or nick the insulation.** Bevel the insulation no more than 1/8 inch back at 45 degrees. See Figure JJ 650–1.4 (Sheet 2).

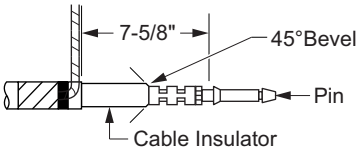


Figure JJ 650–1.4

2.7 Clean the outer jacket and thoroughly clean the insulation to remove all traces of semiconducting residue. This may be done by wiping with a rag soaked with an approved solvent. Always wipe from the end of the cable toward the outer jacket.

2.8 Lubricate inside of cable entrance, crimp area of pin contact, and cable insulation with the silicone grease supplied or silicone grease (SAP 10154115). See Figure JJ 650–1.5 (Sheet 3). **Do not substitute any other grease.**

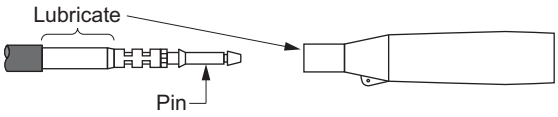


Figure JJ 650–1.5

2.9 Push cable into housing until the base of the pin chamfer is flush with the inside face of the receptacle. See Figure JJ 650–1.6 (Sheet 3).

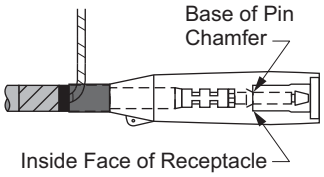


Figure JJ 650–1.6

2.10 Repeat steps 2.1 to 2.9 for the other two cables.

2.11 Lubricate splice bushing with silicone grease. See Figure JJ 650–1.7 (Sheet 3).

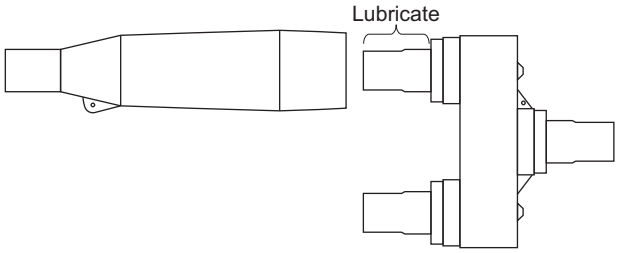


Figure JJ 650–1.7

2.12 Place nylon venting rod into receptacle face until it bottoms (approximately 1-3/4"). See Figure JJ 650–1.8 (Sheet 3).

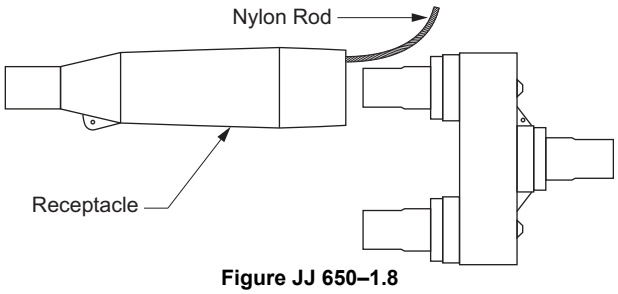


Figure JJ 650–1.8

2.13 Insert K151LY assembly into receptacle as far as possible. See Figure JJ 650–1.9 (Sheet 4).

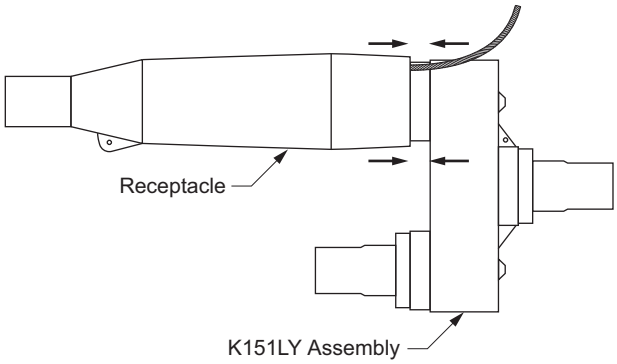


Figure JJ 650–1.9

2.14 Test locking contacts for proper connection by pulling the cable (NOT the housings) with a force of approximately 100 pounds. If the parts separate, repeat step 2.13.

2.15 Pull out nylon venting rod. See Figure JJ 650–1.10 (Sheet 4).

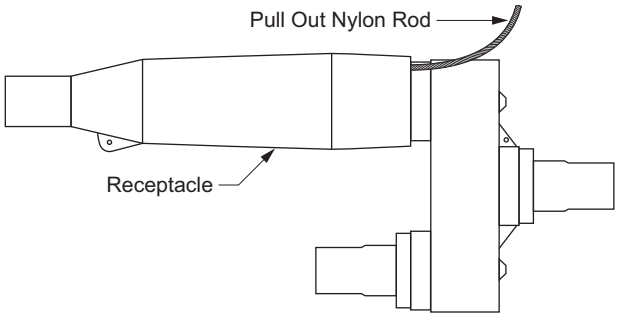


Figure JJ 650–1.10

2.16 Repeat steps 2.11 — 2.15 for the remaining two interfaces.

2.17 Connect one concentric neutral wire to the grounding eye for each cable receptacle assembly and the K151LY assembly. Train remaining concentric neutral wires for each cable receptacle assembly over the splice housing and merge and crimp together with appropriate connectors. Tape the concentric neutral wires to the housing. Connect cable concentric wires at splice with #2 bare copper to system ground. See Figure JJ 650–1.11 (Sheet 5).

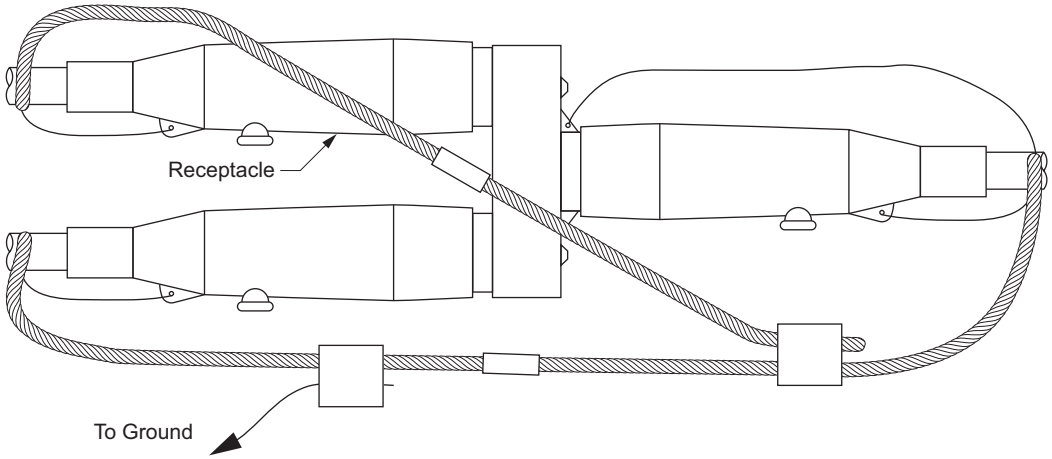


Figure JJ 650–1.11

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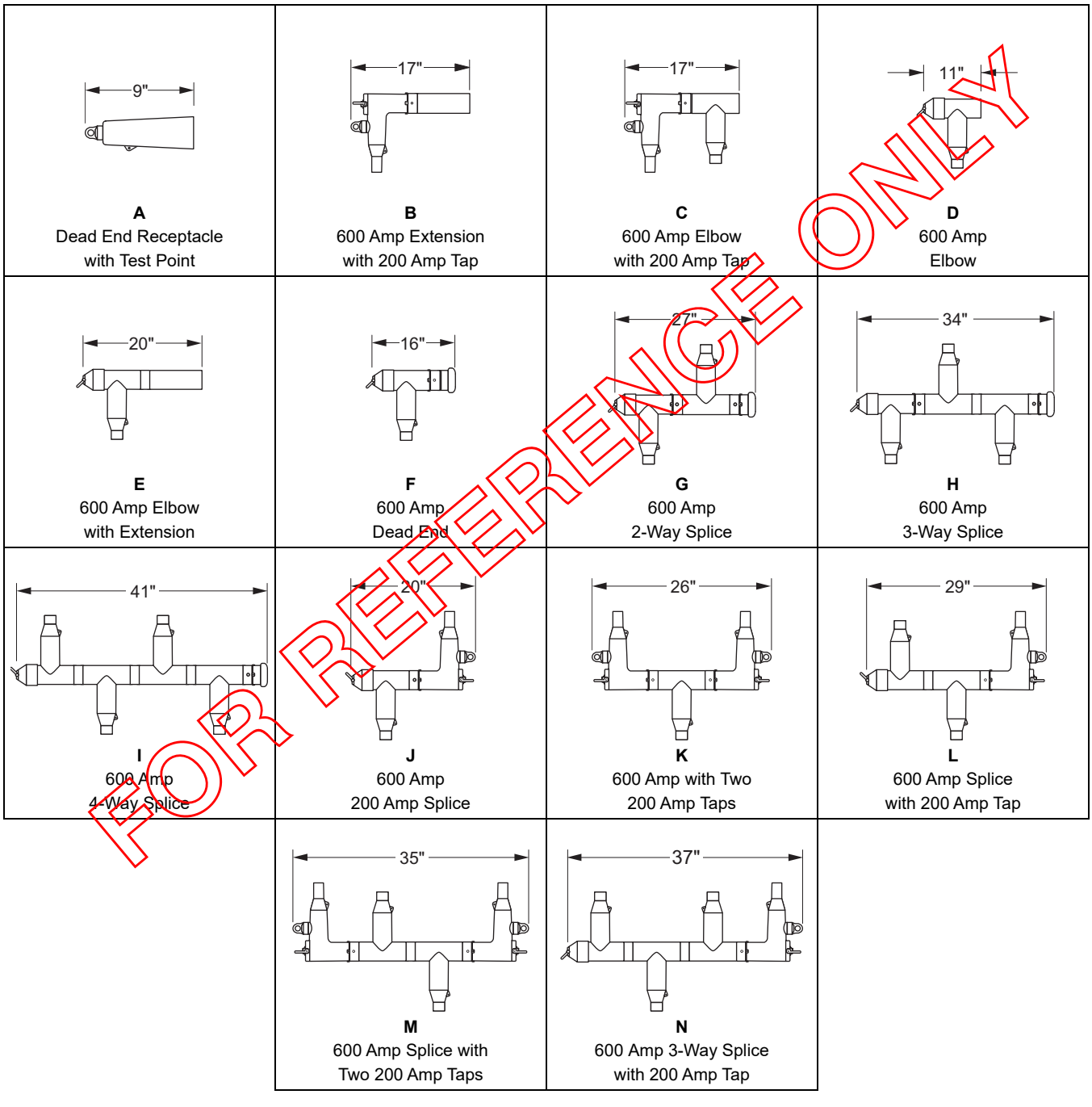
JJ 655 Application for 5–16 kV, 600 A Premolded Rubber Separable Connectors

Scope JJ 655.1 Application Guide for 5–16 kV, 600 A Premolded Rubber Separable Connectors

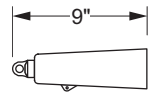
Select the splice or "T" tap configuration desired (A through N on JJ 625.2) from the figures below. The quantities of individual components required for that particular configuration are shown in the column directly below the letter.

Figure JJ 655–1: Application Guide for 5–16 kV, 600 A Premolded Rubber Separable Connectors (Dead-Break Elbow)

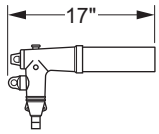


FOR REFERENCE ONLY

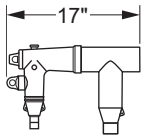
Figure JJ 655–2: Application Guide for 5–16 kV, 600 A Premolded Rubber Separable Connectors (Includes 200 A Load-Break Elbow)



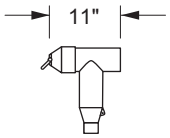
A
Dead End Receptacle
with Test Point



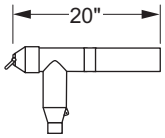
B
600 Amp Extension
with 200 Amp Tap



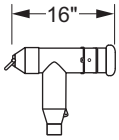
C
600 Amp Elbow
with 200 Amp Tap



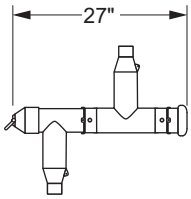
D
600 Amp
Elbow



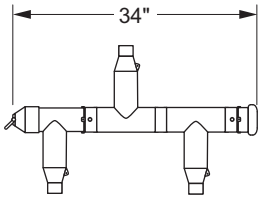
E
600 Amp Elbow
with Extension



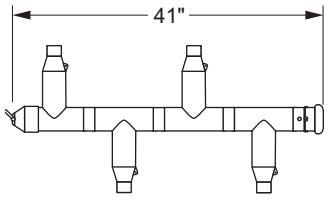
F
600 Amp
Dead End



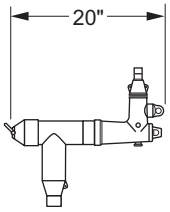
G
600 Amp
2-Way Splice



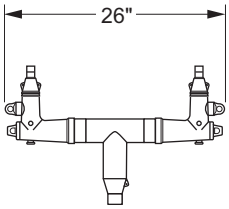
H
600 Amp
3-Way Splice



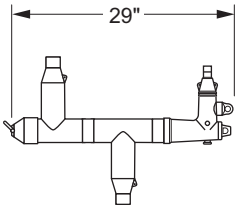
I
600 Amp
4-Way Splice



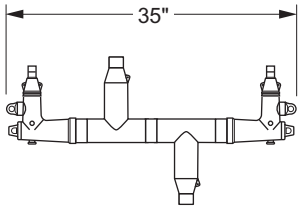
J
600 Amp
200 Amp Splice



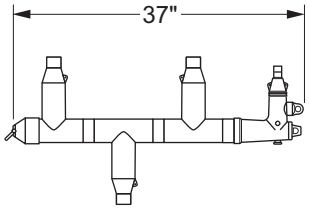
K
600 Amp with Two
200 Amp Taps



L
600 Amp Splice
with 200 Amp Tap



M
600 Amp Splice with
Two 200 Amp Taps

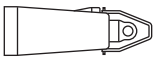
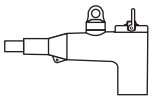
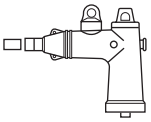
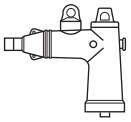
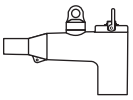


N
600 Amp 3-Way Splice
with 200 Amp Tap

Table JJ 655–1: Application Guide for 5–16 kV, 600/200 A Premolded Rubber Separable Connectors

Components Are Required in the Quantities Shown Below															
Component	A	B	C	D	E	F	G	H	I	J	K	L	M	N
600 A Dead-Break Cable Adapter[a/] #2 AWG (SAP 10117439) 1/0 AWG (SAP 10117337) 350 kcmil 90 mil (SAP 10117292) 750 kcmil 90 mil (SAP 10117294) 350 kcmil 220 mil (SAP 10117293) 750 kcmil 220 mil (SAP 10117295) 1,000 kcmil 220 mil (SAP 10117296) 350 kcmil 295 mil (SAP 10117303) 750 kcmil 295 mil (SAP 10117296)			1	1	1	1	2	3	4	1	1	2	2	3
600 A Dead-Break Spade Terminal[a/] #2 AWG (SAP 10117440) 1/0 AWG (SAP 10117338) 350 kcmil (SAP 10117650) 750 kcmil (SAP 10117651) 1,000 kcmil (SAP 10117652)			1	1	1	1	2	3	4	1	1	2	2	3
600 A Dead-Break Basic Elbow Receptacle w/Stud (SAP 10118051)			1	1	1	1	2	3	4	1	1	2	2	3
600 A Dead-Break Basic Insulating Plug (SAP 10118025)				1	1	1	1	1	1	1		1		1
200 A Load-Break Elbow ETP SAP 10117932 (15 kV); 10117931 (25 kV)		1	1			1	1	1	1	1	2	1	2	
600/200 Amp Dead-Break Tap Plug (SAP 10118028)		1	1			1	1	1	1	1	2	1	2	
600 A Dead-Break Removable Stud[b/] (SAP 10118030)	1	1			1									
600 A Dead-Break Connector Plug (SAP 10118026)					1		1	2	3			1	1	2
Dead-End Plug w/Stud (SAP 10118027)														
600/200 Amp Tap Plug w/Stud														
600 A Dead-Break Bushing Extension (SAP 10118052)		1			1									

Table JJ 655–1: Application Guide for 5–16 kV, 600/200 A Premolded Rubber Separable Connectors

Components Are Required in the Quantities Shown Below														
Component	A	B	C	D	E	F	G	H	I	J	K	L	M	N
200 Amp Load-Break Insulator Cap SAP 10117350 (15 kV); 10117349 (25 kV) 						1	1	1	1					
or 200 Amp Elbow w/Insulating Plug Elbow (SAP 10118047) Insulating Plug (SAP 10118024) 														
600 Amp Dead-End Receptacle w/Test Point (SAP 10118053)	1													
200 Amp Load-Break Elbow w/ Insulating Plug Load Break Elbow (SAP 10117360 [1/0 15 kV]) (SAP 10117358 [1/0 25 kV]) Insulating Plug (SAP 10118024) 						1	1	1	1					
200 Amp Load-Break Elbow SAP 10117361 (#2 15 kV); 10117359 (#2 25 kV) SAP 10117360 (1/0 15 kV); 10117358 (1/0 25 kV) 		1	1							1	2	1	2	1
200 Amp Dead-Break Elbow [a/] #2 220 mil (SAP 10118047) 1/0 220 mil (SAP 10118050) 600 A Dead-Break #2 295 mil (SAP 10118048) 		1	1							1	2	1	2	1
Spanner Wrench (SAP 10147698)	Two wrenches are required for the assembly of most configurations.													

[a/] These components must be sized for the cable.
[b/] One stud is included with SAP 10118051. Install removable stud to component with 50 to 60 foot-pounds of torque.

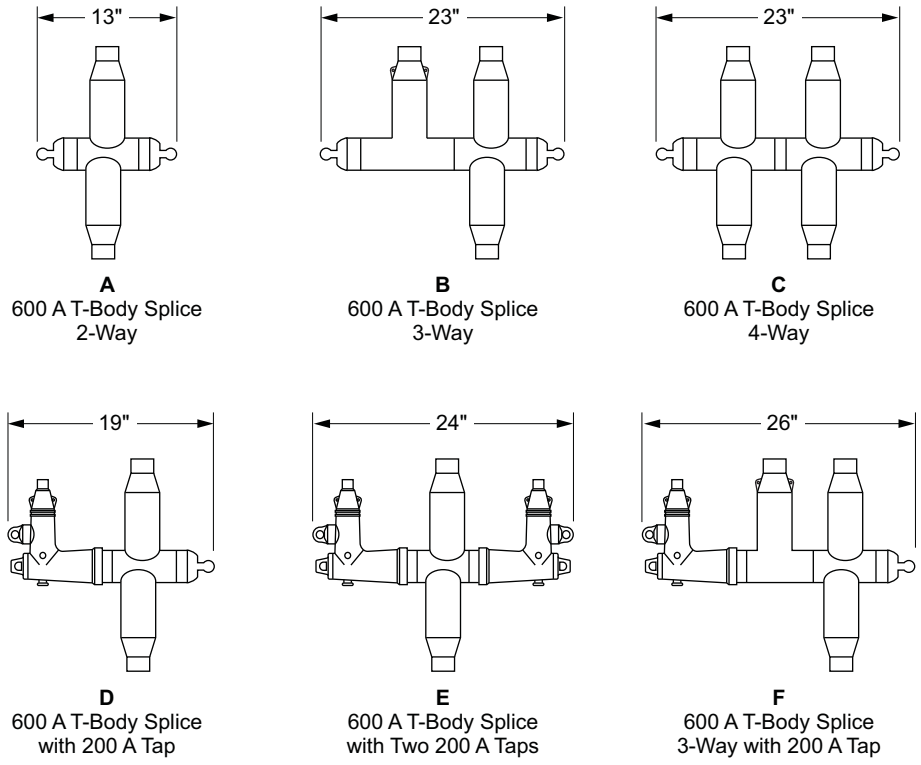
= For Reference Only

JJ 657 600 A T-Body Splice – 4 kV-17 kV – #2 AWG to 1,000 kcmil – Elastimold

Scope JJ 657.1 Application Guide for the 15/25 kV 600 A T-Body Splice

Select the splice or "T" tap configuration desired (A through F). Refer to Figure JJ 657–1 (Sheet 1) for configuration selection. The quantities of individual components required for each particular configuration are shown in the column directly below the letter, in Table JJ 657–1 (Sheet 2).

Figure JJ 657–1: Splice and T-Tap Configurations for the 15/25 kV 600 A T-Body



A
600 A T-Body Splice
2-Way

B
600 A T-Body Splice
3-Way

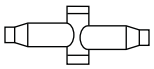
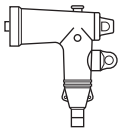
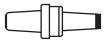
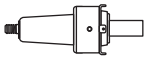
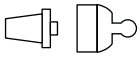
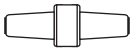
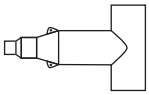
C
600 A T-Body Splice
4-Way

D
600 A T-Body Splice
with 200 A Tap

E
600 A T-Body Splice
with Two 200 A Taps

F
600 A T-Body Splice
3-Way with 200 A Tap

Table JJ 657–1: Configuration Component Quantities for the 15/25 kV 600 A T-Body Splice

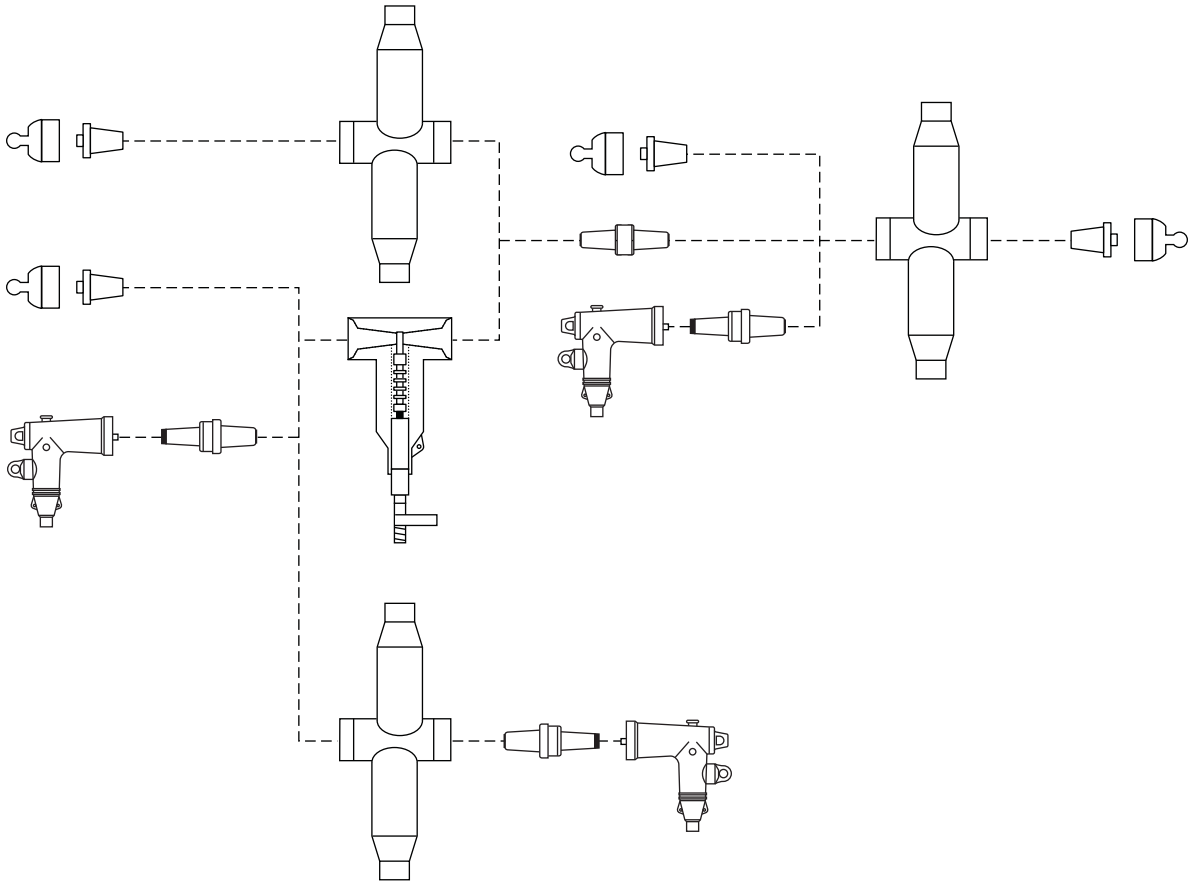
Component	SAP Number	A	B	C	D	E	F
600 Amp T-Body Splice [a/] 	10174589	1	1	2	1	1	1
200 Amp Load-Break Elbow 							
#2 AWG (15 kV)	10117361						
1/0 AWG (15 kV)	10117360				1	2	1
#2 AWG (25 kV)	10117359						
1/0 AWG (25 kV)	10117358						
600/200 Amp Reducing Tap Plug (Load-Break Interface) 							
15 kV	10117932				1	2	1
25 kV	10117931						
600/200 Amp Reducing Tap Plug (Dead-Break Interface) 	10118028						
Removable Stud [b/]	10118030						
Basic insulating Plug (with cap) 	10118025	2	2	2	1		1
Connector Plug 	10118026		1	1			1
Basic Elbow Receptable 	10118051		1				1
Spade terminal [c/]							
#2 AWG	10117440						
1/0 AWG	10117338						
350 kcmil	10117650	2	3	4	2	2	3
750 kcmil	10117651						
1000 kcmil	10117652						
Cable Adapter [c/]							
#2 AWG	10117439						
1/0 AWG	10117337						
350 kcmil	10117293	2	3	4	2	2	3
750 kcmil	10117295						
1000 kcmil	10117296						
200 Amp Load-Break Insulating Cap							
15 kV	10117350						
25 kV	10117349						

[a/] A special stud is included with the 600 Amp T-Body Splice, 15/25 kV Stud SAP 10200061
[b/] The removable stud is shown for information only. It is included in the 200 Amp and 600 Amp elbow kits as needed. It is not a replacement for the special stud used with the 600 Amp T-Body Splice.
[c/] These cable components must be sized for the cable.

1.0 Application

For joining two or more single conductor polyethylene-insulated cables in a disconnectable splice or tee tap and connecting single-conductor polyethylene-insulated cables to high-voltage apparatus, refer to Figure JJ 657–2 (Sheet 3).

Figure JJ 657–2: 600 A T-Body Splice 4 kV-17 kV – #2 AWG to 1,000 kcmil



Scope JJ 657.2 Installation of the 15/25 kV 600 A T-Body Splice

1.0 General Information

This standard shows the approved method for using the 600 A T-Body Splice as an alternative to the 2-way 600 A T-Body Splice which stacks 600 A T-Body Elbows (Basic Elbow Receptacles) to splice concentric neutral cables.

2.0 Installation

For Unjacketed Concentric Neutral cables, ignore cable jacket reference in step 2.1.

2.1 Train the cables that are being spliced so that they are located in their final assembled position with required amount of slack. Mark and cut the cables so that there will be 3 1/2-inches between the two cables. See Figure JJ 657–3 (Sheet 4). Measure 16 inches back from this cut on each cable and remove the cable jackets back to this point. See Figure JJ 657–4 (Sheet 4).

Figure JJ 657–3: Cable Orientation and Cutback

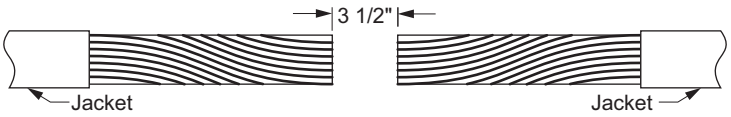
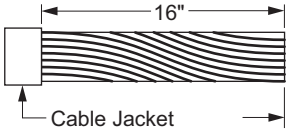


Figure JJ 657–4: Cable Jacket Removal

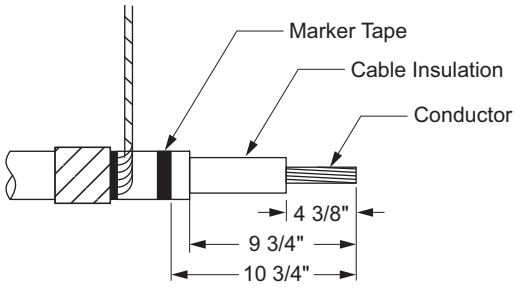


2.2 Seal the concentric neutral jackets from moisture/water intrusion by following the jacket sealing procedure shown in DUG IC 230.

2.3 Leave enough concentric neutral wires for connection to ground.

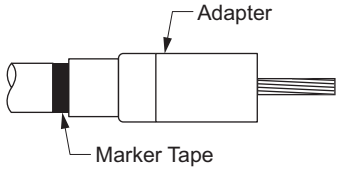
2.4 Prepare the cables as shown in Figure JJ 657–5 (Sheet 4). DO NOT CUT OR NICK THE CABLE INSULATION.

Figure JJ 657–5: Cable Preparation



2.5 Thoroughly clean the cable insulation on each cable, wiping in one direction only from the conductor to the insulation, and to the semicon, thus avoiding wiping semiconducting material onto the insulation. See Figure JJ 657–5 (Sheet 4). Lubricate the cable insulation and inside surface of the cable adapters with the grease supplied or silicone grease (SAP 10154115). Do not substitute any other grease. Slide the cable adapters into position, small end first, until they are flush with the end of the marker tape, on each cable as shown in Figure JJ 657–6 (Sheet 5).

Figure JJ 657–6: Cable Adapter Installation



Remove the protruding cable insulation by cutting it even with the large end of the cable adapter. DO NOT CUT OR NICK THE CABLE ADAPTER OR THE CONDUCTOR.

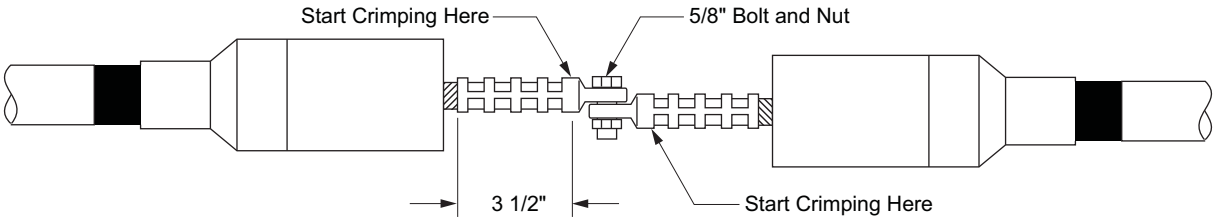
2.6 Wire brush the bare conductor and immediately insert it into the compression connector. Select the proper tool, die, and number of crimps for crimping in accordance with the die chart shown in DUG JJ 700, Table JJ 700–7 (Sheet 7).

NOTE

If oxide inhibitor is not visually detected when the compression connector (called crimp terminals, crimp connectors, or spade terminals) is pushed onto the bare conductor, SCE approved oxide inhibitor should be applied to the bare conductor in the field, prior to crimping.

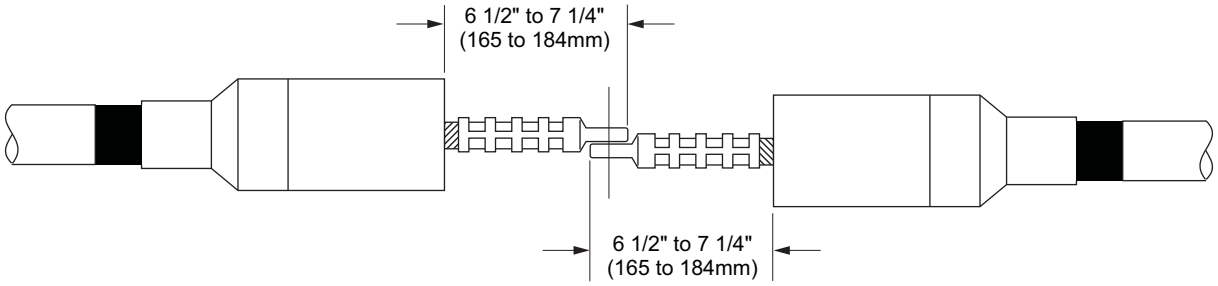
2.7 Before making the first crimp, align the flat portions of the compression connectors by using a 5/8-inch bolt and nut as a temporary locater. Hold the compression connectors in the proper position and start the first crimp 3 1/2-inches from the open end of the compression connector at the mark indicated on the connector. See Figure JJ 657–7 (Sheet 5)

Figure JJ 657–7: Temporary Bolt Installation Prior to Crimping



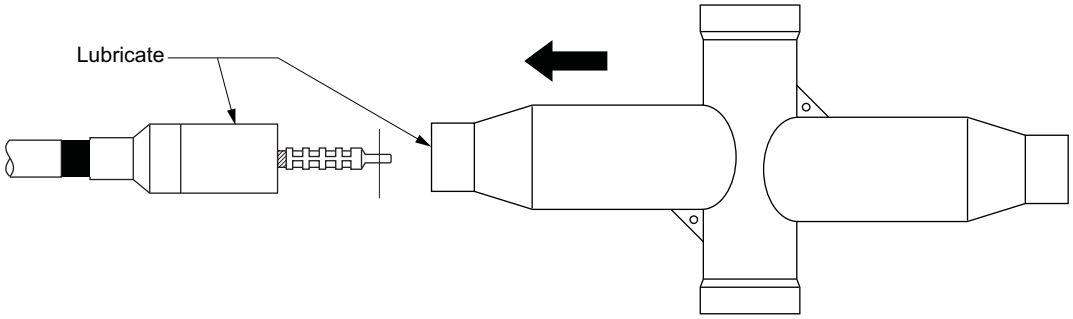
2.8 Rotate each successive crimp 180 degrees to prevent bowing. After both compression connectors have been crimped, carefully wipe excess inhibitor from the outside of the connectors and from the cable insulation. Check to ensure that the end of the connectors is 6 1/2 to 7 1/4 inches from the large end of the cable adapters. Remove the 5/8-inch bolt and nut used as a temporary locater, and remove sharp flash, if any, from the crimped connectors. See Figure JJ 657–8 (Sheet 6)

Figure JJ 657–8: Crimp Connector Check Dimensions



2.9 Lubricate the inside of the 600 A T-Body Splice housing, and lubricate the outside of both cable adapters with grease supplied or silicone grease (SAP 10154115). Do not substitute any other grease. Slide one cable into the 600 A T-Body Splice housing until it cannot advance any further, and the hole in the crimped connector is centered in the housing when viewed through the tap hole. The base of the cable adapter should still be aligned with the marking tape. See Figure JJ 657–9 (Sheet 6)

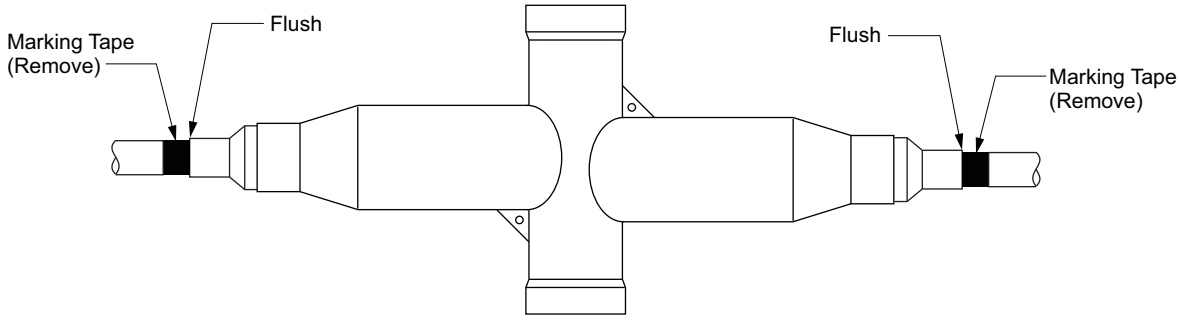
Figure JJ 657–9: Installation of 600 A T-Body Splice Housing



2.10 To install the other cable on the other side, push the 600 A T-Body Splice housing sideways until the cable enters the open end of the housing.

2.11 Slowly push both cables toward their normal alignment, making sure that the second cable adapter is sliding into its proper position. The hole in the second crimped connector should be centered in the housing when viewed through the tap hole. When the crimped connector is fully seated, make sure that the base of both cable adapters are still in their proper position flush against the marking tape. If not, reposition cable adapters. Remove the marker tape. See Figure JJ 657–10 (Sheet 7).

Figure JJ 657–10: Check Proper Alignment of 600 A T-Body Splice Housing



2.12 Remove the protective caps from the 600 A T-Body Splice and the mating parts. Hand tighten the specially-designed 2 5/8-inch stud supplied with the 15/25 kV 600 A T-Body Splice into the first mating part.

NOTE The special/longer stud (Elastimold 650VSA, SAP 10200061) supplied with the 15/25 kV 600 A T-Body Splice is 1/2 inch longer than the standard stud and must be used with the 15/25 kV 600 A T-Body Splice only.

WARNING DO NOT connect or disconnect mating products while energized.

WARNING DO NOT energize while disconnected.

Clean and lubricate both the 600 A T-Body Splice and the first mating part with the lubricant supplied. Keep both mating surfaces clean. Insert the first mating part.

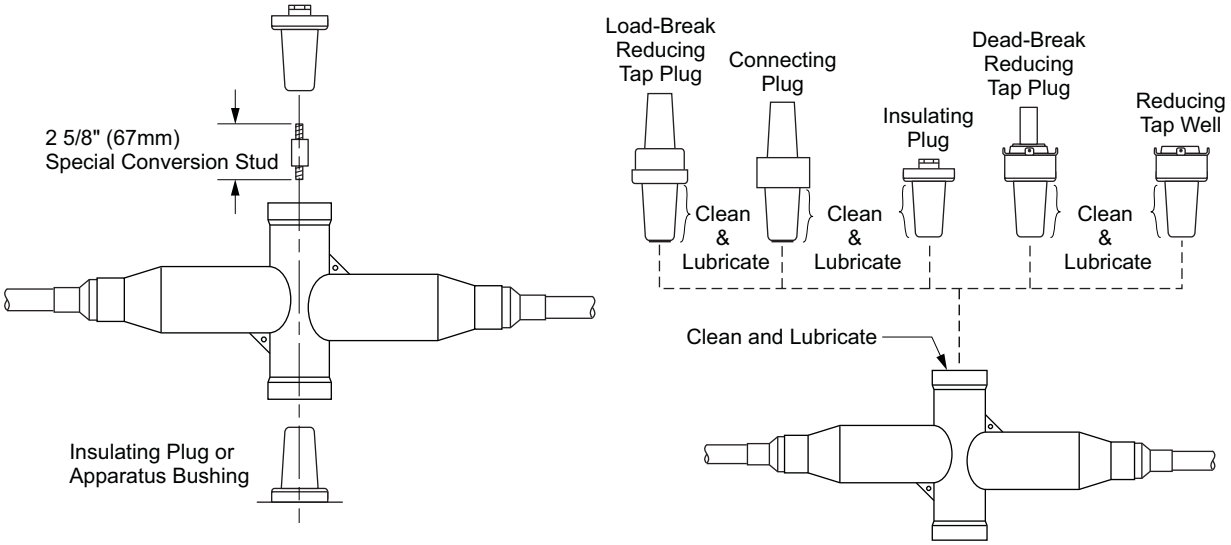
2.13 Clean and lubricate the mating part for the opposite end of the 600 A T-Body Splice. Insert the mating part into the elbow. Engage the threads and hand tighten. See Figure JJ 657–11 (Sheet 8).

CAUTION Cable should be racked into its final position before tightening so that cable movement will not affect the connection. Cable should extend straight out of the 600 A T- Body Splice at least 6 inches before starting a bend to prevent distortion of the 600 A T-Body splice and compromising of the cable seal.

Torque mating part according to the instructions supplied with the mating part.

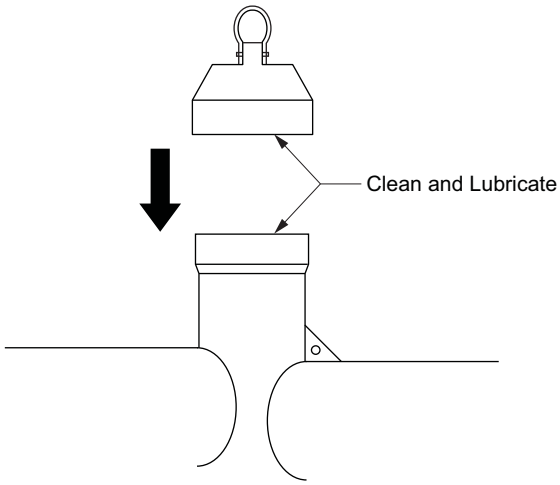
NOTE All mating parts must be operated in accordance with their operating instruction.

Figure JJ 657–11: Mating Parts of the 600 A T-Body Splice



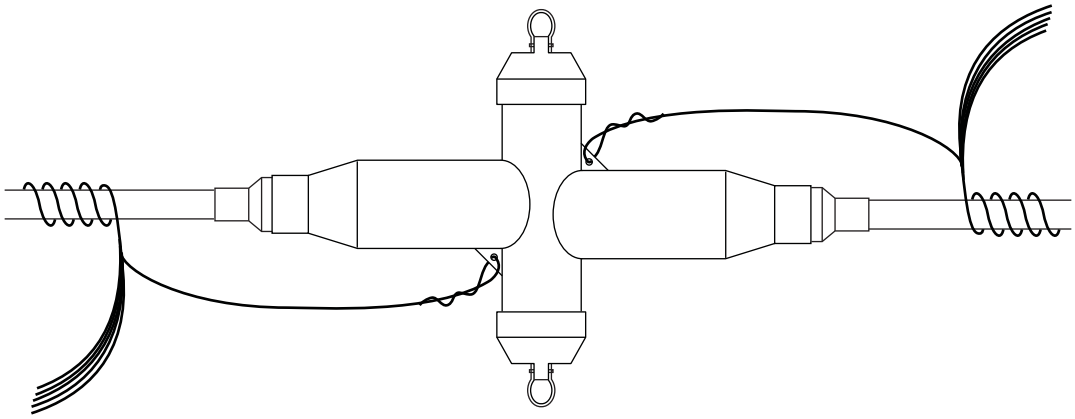
2.14 If a basic insulating plug (BIP) is used as a mating part, clean and lubricate the inside of the voltage detection cap and place on the 600 A T-Body Splice, to cover the BIP. Push down hard on the insulating cap until it snaps into place. See Figure JJ 657–12 (Sheet 8).

Figure JJ 657–12: Installation of BIPs and Caps



2.15 All pre-molded 200 A and 600 A cable components with grounding eyes shall be bonded to ground with a #14 AWG copper wire or equivalent. It is recommended that a primary concentric neutral wire be utilized. Connect the remaining neutral wires to system ground as required. See Figure JJ 657–13 (Sheet 9).

Figure JJ 657–13: Ground Wire Installation



CAUTION Failure could occur if the components are not properly bonded and grounded.

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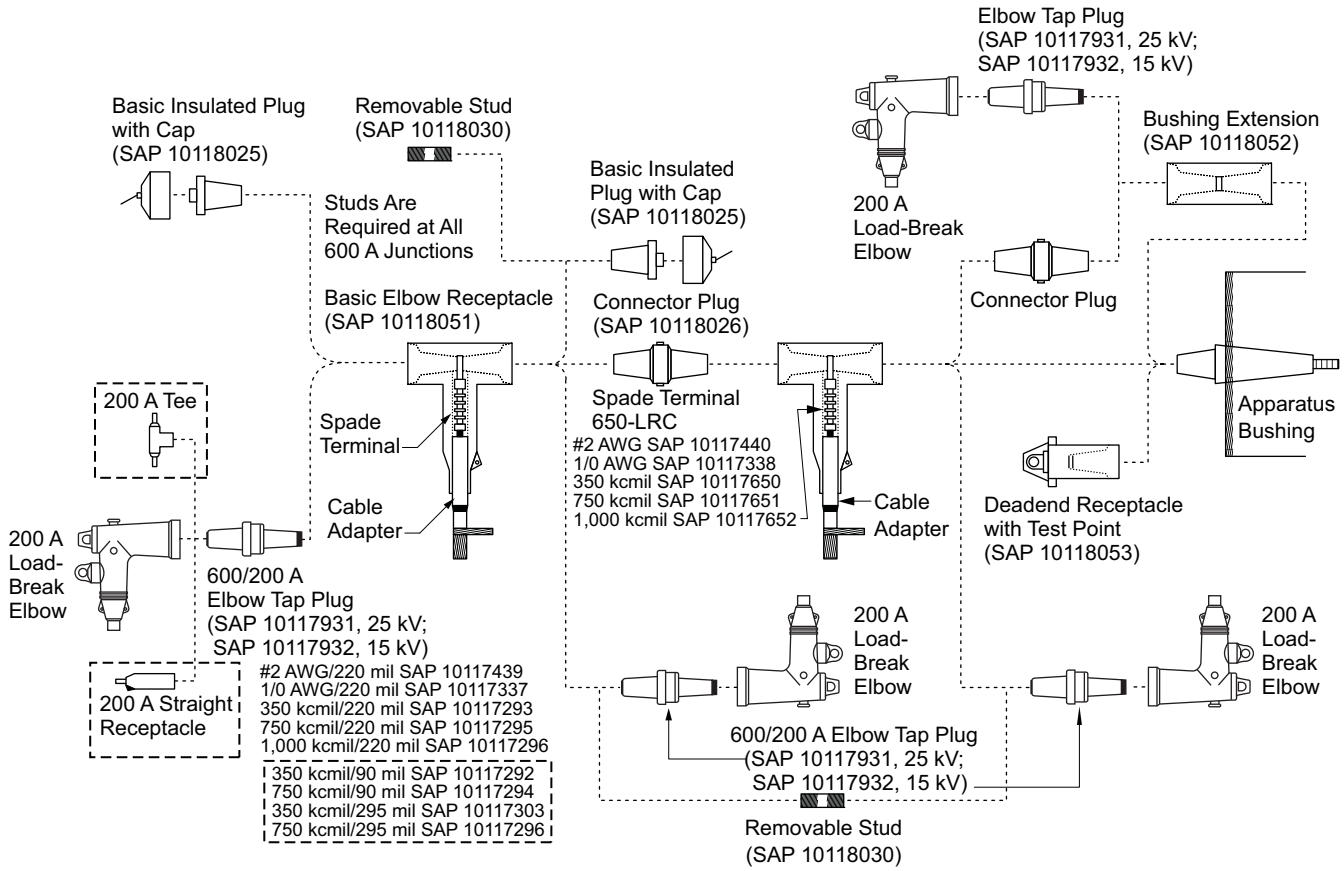
JJ 660 600 A Elbow 4 kV–17 kV — #2 AWG to 1,000 kcmil

Scope JJ 660.1 Application and Installation of 25 kV Class Premolded Rubber Separable Connectors

1.0 Application

For joining two or more single-conductor polyethylene-insulated cables in a disconnectable splice or tee tap and connecting single-conductor polyethylene-insulated cables to high-voltage apparatus.

Figure JJ 660–1: 600 A Elbow 4 kV–17 kV — #2 AWG to 1,000 kcmil



2.0 Basic Elbow

For Jacketed Concentric Neutral (JCN) cable follow steps 2.1–2.8; if nonjacketed CN cable ignore cable jacket reference in step 2.1 and skip step 2.2.

2.1 Train the cable so that it is located in the final assembled position with required amount of slack. Mark the cable jacket 1-3/4 inches short from the center line of the apparatus bushing or connecting plugs. See Figure JJ 660–1.1 (Sheet 2). Measure 16 inches back from this mark and remove the cable jacket back to this point. See Figure JJ 660–1.1 (Sheet 2).

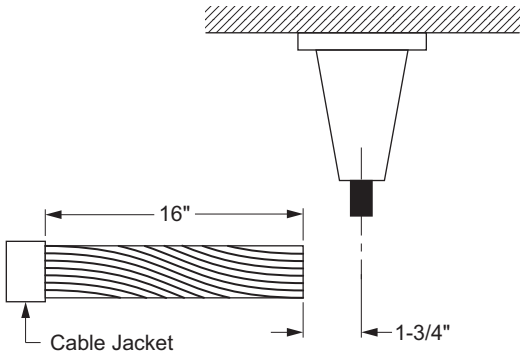


Figure JJ 660–1.1: Jacket Removal

2.2 Seal the concentric neutral jacket from moisture/water intrusion following the jacket sealing procedure shown in IC 230.

2.3 Leaving enough concentric neutral wires for connection to ground, cut the cable 1-3/4 inches short from the centerline of the apparatus bushing of connector plug. See Figure JJ 660–1.1 (Sheet 2).

2.4 Prepare cable as shown in Figure JJ 660–1.2 (Sheet 2). Do not cut or nick the insulation.

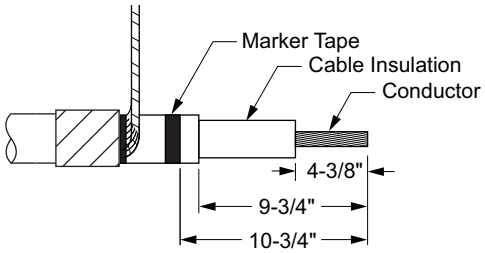


Figure JJ 660–1.2: Cable Preparation

2.5 Thoroughly clean cable installation, always wiping from the conductor to the insulation semicon, thus avoiding wiping semiconducting material on to the insulation. See Figure JJ 660–1.2 (Sheet 2). Lubricate the cable insulation and inside surface of the cable adapter with the grease supplied or silicone grease (SAP 10154115). **Do not substitute any other grease.** Slide the cable adapter into position as shown in Figure JJ 660–1.3 (Sheet 2).

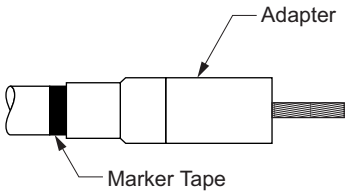


Figure JJ 660–1.3: 600 A Cable Adapter

2.6 Wire brush bare aluminum conductor and immediately insert into spade terminal. Before crimping, position the spade terminal on the conductor so that the flat contact area faces the apparatus bushing or connecting plugs.

2.7 Crimp the terminal using the proper tool and die. Select the proper die and number of crimps in accordance with the die chart shown in DUG JJ 700, Table JJ 700–7 (Sheet 7). Wipe off all excess manufacture installed inhibitor from the spade terminal and cable adapter after crimping.

Note: If oxide inhibitor is not visually detected when the compression connector (called crimp terminals, crimp connectors, or spade terminals) is pushed onto the bare conductor, SCE approved oxide inhibitor should be applied to the bare conductor in the field, prior to crimping.

2.8 Lubricate the outside of cable adapter and inside of basic elbow receptacle cable entrance with silicone grease supplied or silicone grease (SAP 10154115). Do not substitute any other grease. Slide the cable into the elbow until the hole in the spade terminal is centered in the elbow. See Figure JJ 660–1.4 (Sheet 3). Make sure cable adapter is still flush with marker tape. If not, reposition cable adapter. Remove marker tape.

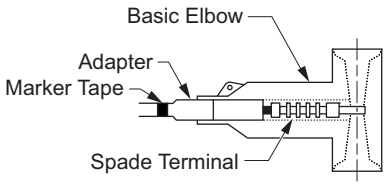


Figure JJ 660–1.4: 600 A Basic Elbow

3.0 Elbow Assembled on Apparatus Bushing

Hand tighten the removable stud all the way into the 600 A Basic Insulated Plug to “chase” the threads, then remove the stud. Next, insert the removable stud all the way into the 600 A Apparatus Bushing and hand tighten to “chase” the bushing threads; then, back off half way. Clean and lubricate the Basic Elbow Receptacle and Apparatus Bushing with the silicone grease supplied or silicone grease (SAP 10154115). **Do not substitute any other grease**. Place the elbow on the bushing, being careful to line up hole in spade terminal with stud in bushing. See Figure JJ 660–1.5 (Sheet 4). Clean and lubricate Basic Insulated Plug, insert into elbow, and hand tighten.

CAUTION

Cable should be racked in final position before tightening so that cable movement will not affect the connection. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising of the cable seal.

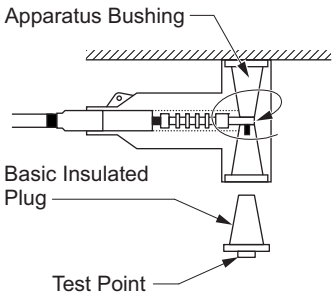


Figure JJ 660–1.5: 600 A Basic Elbow Installed on Apparatus Bushing

3.1 Use a torque wrench to tighten the Basic Insulated Plug, exerting 50 to 60 foot-pounds of torque. See Figure JJ 660–1.6 (Sheet 4). Clean and lubricate inner surface of test point cap with silicone grease supplied or silicone grease (SAP 10154115) and install on elbow. **Do not substitute any other grease**. Remove marker tape.

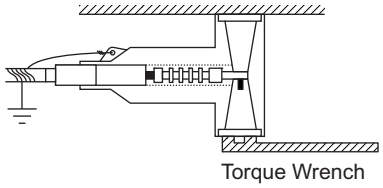


Figure JJ 660–1.6: Torque Wrench Installation

3.2 All premolded rubber 200 and 600 A components with grounding eyes shall be bonded to ground with a #14 AWG copper wire or equivalent. It is recommended a primary concentric neutral wire be utilized. Connect remaining concentric wires to ground as required. See Figure JJ 660–1.6 (Sheet 4).

4.0 Bushing Extensions

No more than two bushing extensions should be used on apparatus bushings. Be sure cable is adequately secured and supported.

5.0 Elbow Assembled as a Splice with 200 A Tap

Hand tighten the removable studs all the way into all mating 600 A connector plugs to “chase” the threads, then remove the stud. Next, insert the removable stud all the way into the 600/200 A tap plug and hand tighten to “chase” the threads; then, back off half way. Start assembly of splice from one end lubricating all elbows and plugs before they are assembled with the silicone grease supplied or silicone grease (SAP 10154115). **Do not substitute any other grease**. See Figure JJ 660–1.7 (Sheet 5). Hand tighten all plugs.

CAUTION

Cable should be racked in final position before tightening so that cable movement will not affect the connection. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising of the cable seal.

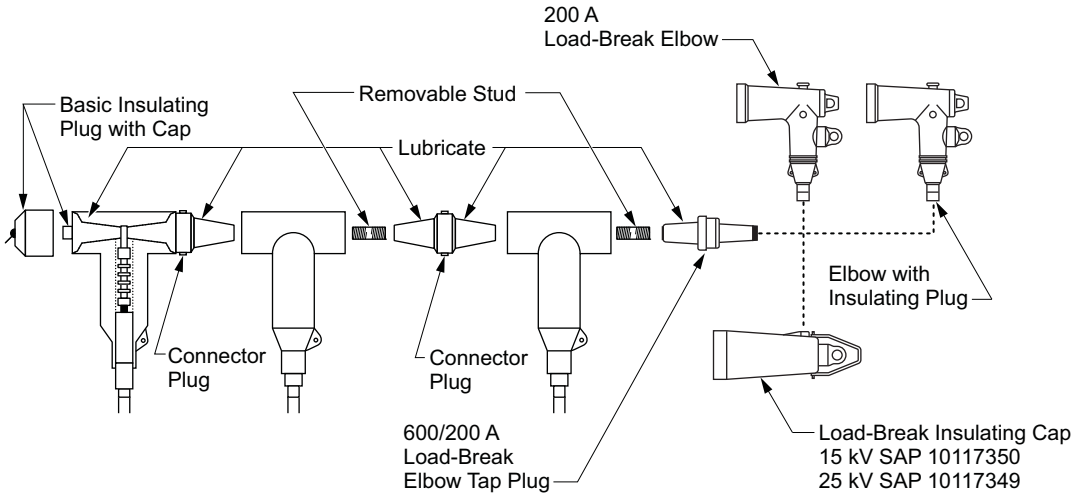


Figure JJ 660–1.7: 4 kV – 17 kV Component Assembly

5.1 Start at one end and tighten assembly using a wrench on the Basic Insulating Plug and a 1/2 inch torque wrench with a spanner wrench adapter (SAP 10147537 or SAP 10147547) on the connector plug and tap plug.

Note: When using the spanner wrench adapter with the torque wrench attached, the torque setting exceeds the actual torque applied to the stud. The indicated torque should be 45 foot-pounds, while keeping the torque wrench inline with the spanner wrench handle.

For the rubber molded connector plug, use a 1/2 inch torque wrench with a hex adapter socket (SAP 10158037). Tighten each joint exerting 50 to 60 foot-pounds of torque.

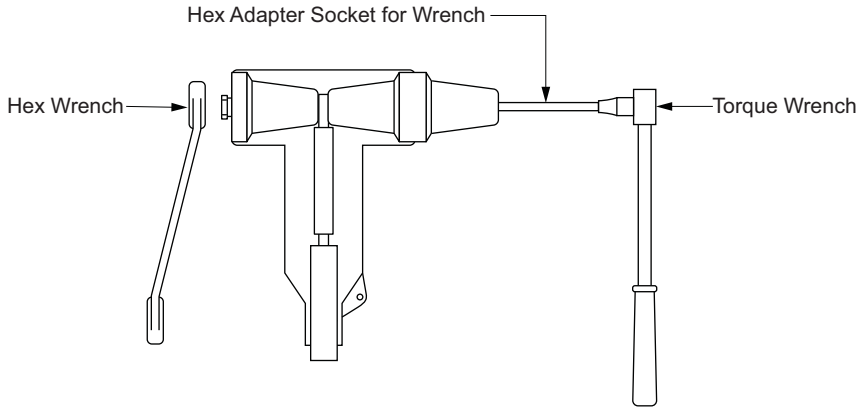


Figure JJ 660–1.8: 600 A Rubber Connector Plug Installation, Using a Hex Adapter Socket

5.2 Lubricate inner surface of insulating plug cap with silicone grease supplied or silicone grease (SAP 10154115) and install on elbow. **Do not substitute any other grease**. Lubricate tap plug bushing and install dead-end receptacle or 200 A elbow. Remove marker tapes.

5.3 All premolded rubber 200 A and 600 A components with grounding eyes shall be bonded to ground with a #14 AWG copper wire or equivalent. It is recommended a primary concentric neutral wire be utilized. Connect remaining concentric wires to ground as required. See Figure JJ 660–1.9 (Sheet 6).

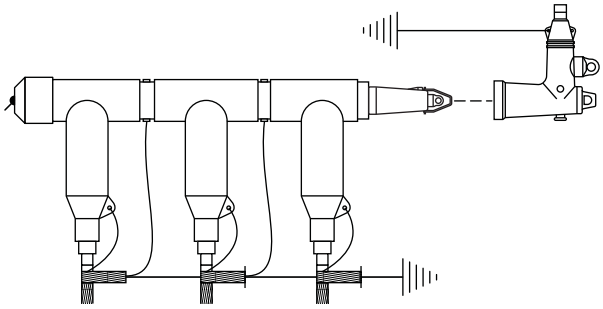


Figure JJ 660–1.9: 600 A Basic Elbow Grounding

CAUTION Failure could occur if the components are not properly bonded and grounded.

Scope JJ 660.2 Instructions for Safe-Ending 1/C 350 kcmil–1,000 kcmil 5–16 kV Cross-Linked Polyethylene-Insulated Cable with 600 A Premolded Rubber Components

1.0 Application

These instructions cover the preferred procedure for safe ending single-conductor cables with cross-linked polyethylene insulation, semiconducting shield, and concentric neutral wires.

2.0 Instructions

2.1 Prepare cable and assemble basic elbow, adapter, and spade terminal as shown in Figure JJ 660–2.1 (Sheet 7). See Scope JJ 660.1 (Sheet 1) for assembly procedure. Leave enough concentric wires for connection to ground.

Figure JJ 660–2: Safe Ending 1/C 350 kcmil–1,000 kcmil 4–17 kV Cross-Linked Polyethylene-Insulated Cable with 600A Premolded Rubber Components

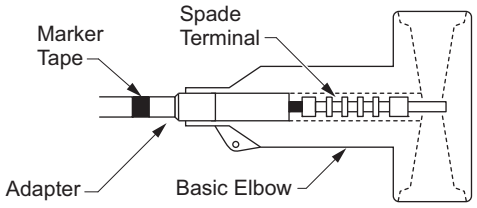


Figure JJ 660–2.1: 600 A Basic Elbow

2.2 Hand tighten a removable stud all the way into one 600 A Basic Insulated Plug to “chase” the threads, then remove the stud. Next, insert the removable stud all the way into the other 600 A Basic Insulated Plug, hand tighten to “chase” the threads, and back out half way. Assemble the end bell as shown in Figure JJ 660–2.2 (Sheet 8). Tighten the Basic Insulated Plug by exerting 50 to 60 foot-pounds of torque to each.

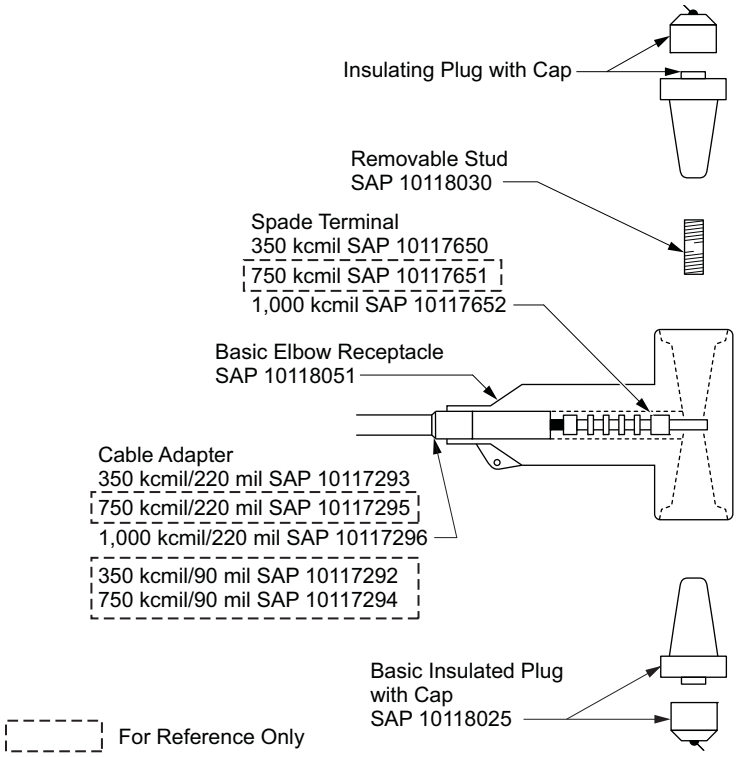


Figure JJ 660–2.2: 4 kV–17 kV Safe End Assembly

2.3 Lubricate inner surfaces of insulating plug caps and install on plugs. See Figure JJ 660–2.3 (Sheet 8).

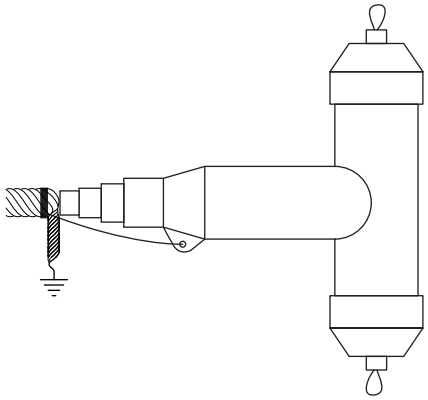


Figure JJ 660–2.3: Complete Safe End Assembly

2.4 All premolded rubber 600 A components with grounding eyes shall be bonded to ground with a wire. It is recommended a primary concentric neutral wire be utilized for grounding. Connect remaining concentric wires to ground as shown in Figure JJ 660–2.3 (Sheet 8).

JJ 661 600 A Elbow — 35 kV — 1/0, 4/0, 750, and 1,500 kcmil

Scope JJ 661.1 Application Guide for 35 kV Premolded Rubber Separable Connectors

Select the configuration desired (A through D) from the figures below. The quantities of individual components required for that particular configuration are shown in the column directly below the letter. Component quantities, marked with an "[a/]" must be sized for each individual cable.

Figure JJ 661–1: 600 A Elbow — 35 kV — Configuration

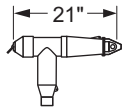
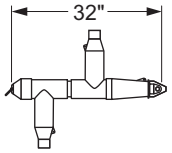
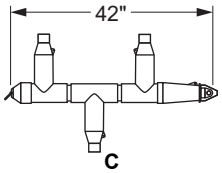
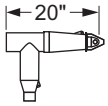
			
A 600 Amp Dead End	**B** 600 Amp 2-Way Splice	**C** 600 Amp 3-Way Splice	**D** 600 Amp Termination

Table JJ 661–1: Application Guide for 35 kV Premolded Rubber Separable Connectors

Components Are Required in the Quantities Shown Below					
Component		A	B	C	D
Cable Adapter 1/0 / 420 mil SAP 10117429 4/0 / 420 mil SAP 10117429 750 kcmil / 420 mil SAP 10117386 1,500 kcmil / 345 mil SAP 10117381		1[1/]	2[1/]	3[1/]	1[1/]
Spade Terminal 1/0 SAP 10117338 4/0 SAP 10117430 750 kcmil SAP 10117651 Unjacketed 1500 kcmil SAP 10117393 Jacketed 1500 kcmil SAP 10207288		1[1/]	2[1/]	3[1/]	1[1/]
600/200 Amp Reducing Tap Plug (Load-Break Interface) SAP 10117873		1[2/]	1[2/]	1[2/]	1[2/]
Insulating Cap (Load-Break Interface) SAP 10117401		1[3/]	1[3/]	1[3/]	1[3/]
Removable Stud SAP 10117892		1[4/]	2[4/]	3[4/]	1[4/]
Connector Plug SAP 10117859		0	1	2	0
Basic Elbow Receptacle SAP 10117861 (includes stud)		1	2	3	1
Basic Insulating Plug SAP 10117858		1 or 2	1 or 2	1 or 2	1 or 2
Bushing Extension SAP 10117882		N/A	N/A	N/A	N/A

= For Reference Only

1/ These components must be sized for the cable.
2/ See Note 1.
3/ Use with 600/200 A reducing tap plug (SAP 10117873).
4/ Shown for information only. One stud is included with each elbow (SAP 10117861).

Note(s):

1. The 600/200 A tap plug with 200 A load-break interface is used for grounding purposes only. Use load-break grounding elbow SAP 10117347 when **any one or all of the following are present:**
   - The available fault duty is 9 kA or less
   - The line conductor to be grounded is copper and smaller than #2 AWG
   - The line conductor is aluminum and smaller than 1/0 AWG

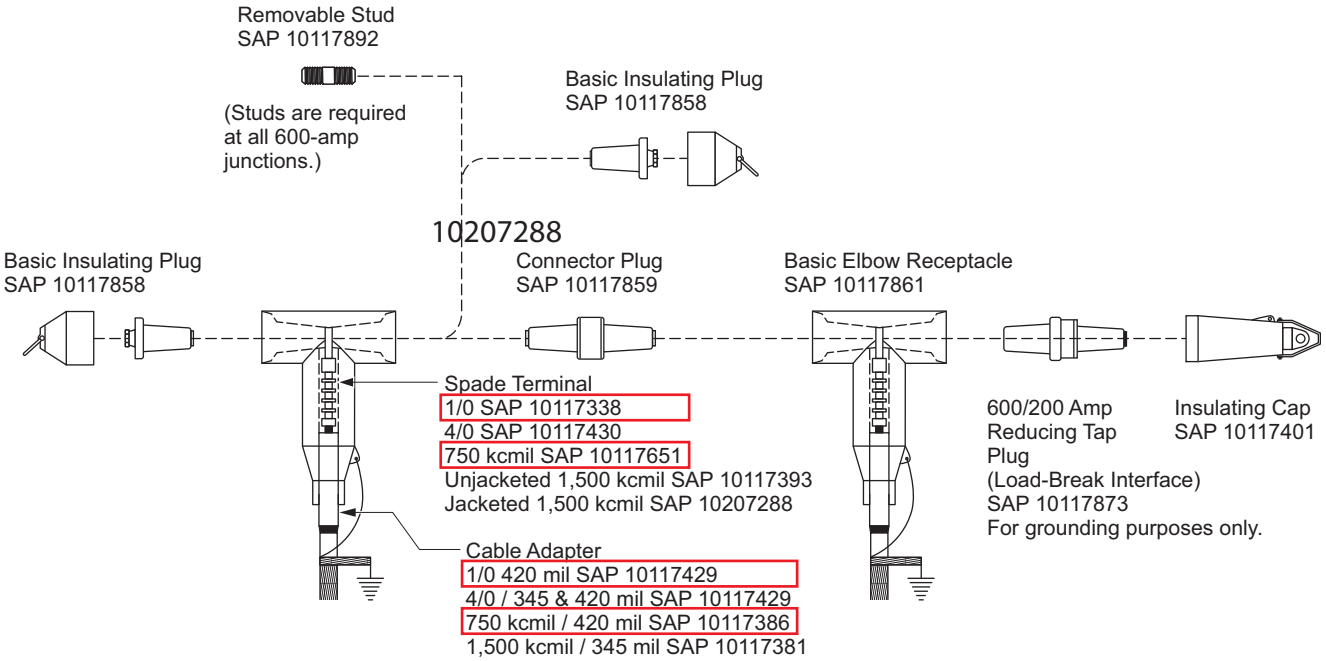
   Crews must verify that Table 1 of the Underground Grounding Manual allows for the size and configuration chosen.

These connectors are designed to provide a fully shielded, submersible joint for splicing 35 kV Jacketed Concentric Neutral (JCN) cables. Applications include splicing two 750 kcmil cables with a 1,500 kcmil cable using the three-way configuration, splicing two 750- or 1,500 kcmil cables using the two-way configuration, and terminating cables on deadfront equipment. These connectors can also be used to join two different size cables (for example, 1/0 to 4/0).

1.0 Application

For joining or terminating 35 kV polyethylene-insulated cables in a disconnectable configuration.

Figure JJ 661–2: 35 kV — 1/0–1,500 kcmil Premolded Rubber Separable Connectors



2.0 Basic Elbow

For Jacketed CN (JCN) cable follow steps 1–8; if unjacketed CN cable skip Steps 2 and 3.

STEP 1. Train the cable so it is located in the final assembled position with required amount of slack.

STEP 2. From the cut end of the cable remove 17 inches of the cable jacket, see Figure JJ 661–2.1.

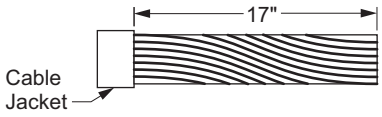


Figure JJ 661–2.1: Jacket Removal

STEP 3. Seal the concentric neutral jacket from moisture/water intrusion following the jacket sealing procedure shown in IC 230.

STEP 4. Prepare cable as shown in Figure JJ 661–2.2. Do not cut or nick the insulation.

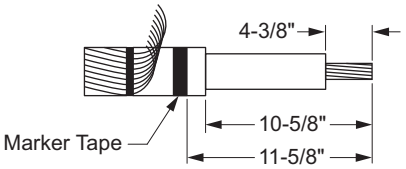


Figure JJ 661–2.2: Cable Preparation

STEP 5. Lubricate the cable insulation and inside surface of the cable adapter with the grease supplied or silicone grease SAP 10154115. **Do not substitute any other lubricating grease.** Slide the cable adapter into position as shown in Figure JJ 661–2.3.

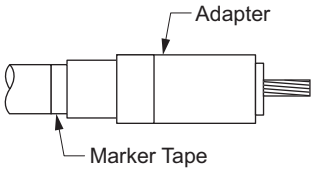


Figure JJ 661–2.3: 600 A Cable Adapter

STEP 6. Wire brush bare aluminum conductor and immediately insert into spade terminal. Before crimping, position the spade terminal on the conductor so that the flat contact area faces the apparatus bushing or connecting plugs.

STEP 7. Crimp the terminal using the proper tool and die. Select the proper die and number of crimps in accordance with the die chart shown in DUG JJ 700, Table JJ 700–7. Wipe off excess inhibitor.

NOTE

If oxide inhibitor is not visually detected when the compression connector (called crimp terminals, crimp connectors, or spade terminals) is pushed onto the bare conductor, SCE approved oxide inhibitor should be applied to the bare conductor in the field, prior to crimping.

STEP 8. Lubricate the outside of cable adapter and inside of basic elbow receptacle. Slide the cable into the elbow until the hole in the spade terminal is centered in the elbow.

3.0 Elbow Assembled as a Splice

STEP 1. First insert the removable stud all the way into all the mating 600 A connector plugs, hand tighten to chase the threads, and remove. Next insert the removable stud all the way into the 600/200 A tap plug, hand tighten to chase the threads, and then back off half way.

NOTE

The 600/200 A tap plug has a 200 A load-break interface and is used for grounding purposes only. Use load-break grounding elbow SAP 10117347.

STEP 2. Start assembly of splice from one end lubricating all elbows and plugs before they are assembled. See Figure JJ 661–2.4. Hand tighten all plugs. Rack cables so that cable movement due to expansion and contraction will not affect the connections. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow.

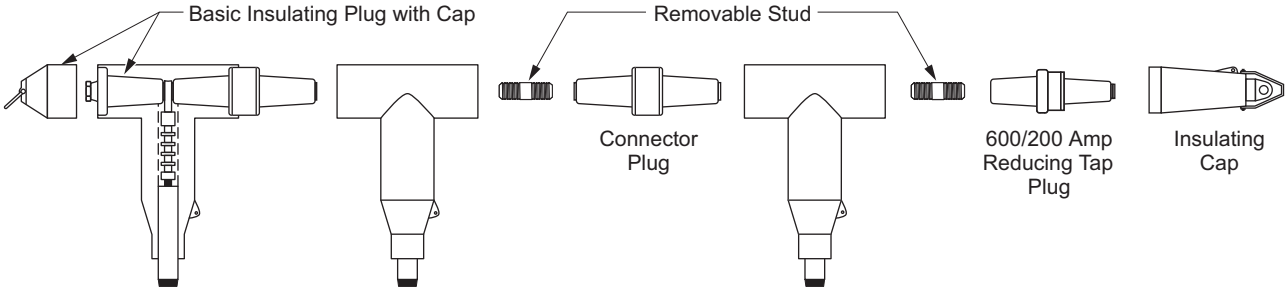


Figure JJ 661–2.4: 35 kV Component Assembly

NOTE

35 kV CONNECTOR PLUG AND REDUCING TAP PLUGS will not accept the spanner wrench adapter, but may be torqued by using a Hex Adapter (preferred) or by using an an extra INSULATING PLUG as a tool (alternate). Use a spacer (extra spade terminal) between components when using the extra INSULATING PLUG. Tighten each joint exerting 50 to 60 foot-pounds of torque. See Figure JJ 661–2.5, Figure JJ 661–2.6, and Figure JJ 661–2.7.

STEP 3. Using a hex adapter, start at one end and tighten assembly using a 1/2 inch torque wrench (preferred method).

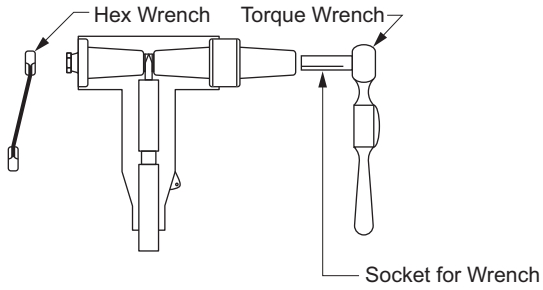


Figure JJ 661–2.5: Torque 600 A Components Using a Hex Adapter, One Joint at a Time (Preferred Method)

STEP 4. Using an extra insulating plug as a tool, start at one end and tighten assembly using a 1/2 inch torque wrench (alternate method).

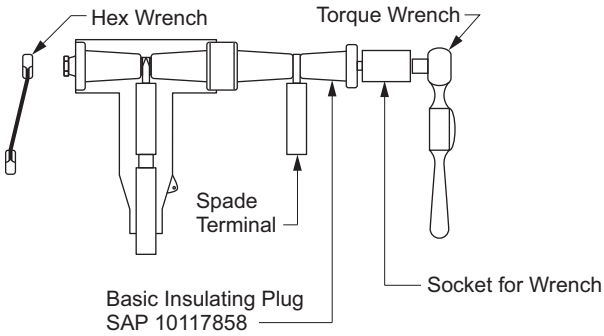


Figure JJ 661–2.6: Torque the First 600 A Component Using an Insulation Plug and a Spade Terminal (Alternate Method)

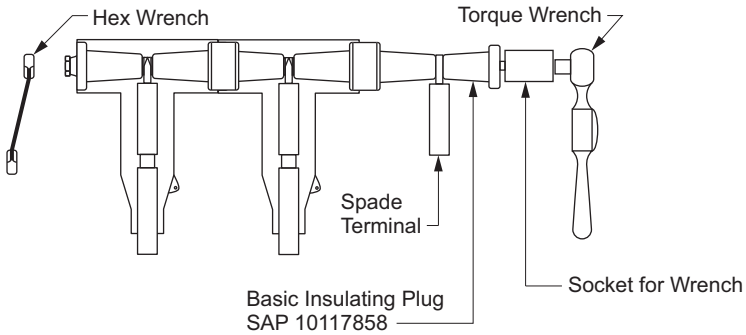


Figure JJ 661–2.7: Then Torque the Second 600 A Component Using an Insulation Plug and a Spade Terminal (Alternate Method)

STEP 5. Lubricate inner surface of test point cap and install on elbow.

STEP 6. All premolded rubber 35 kV 600 A components with grounding eyes shall be bonded to ground with #14 AWG copper wire or equivalent. It is recommended a primary concentric neutral wire be utilized for grounding. Connect remaining concentric wires to ground as required. See Figure JJ 661–2.8.

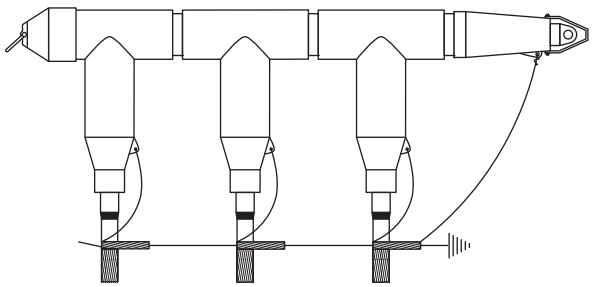


Figure JJ 661–2.8: 600 A Grounding

CAUTION Failure could occur if the components are not properly bonded and grounded.

JJ 662P 600 A Cold-Shrink Dead-Break Elbow Pilot — 4-17 kV — 350 to 1000 kcmil Cable

Scope JJ 662P.1 600 A Cold-Shrink Dead-Break Elbow

1.0 General Description

The purpose of the 600 A Cold-Shrink Elbow is to eliminate the need to install a cable adapter in order for the cable and elbow/hammerhead to interface. The removal of the cable adapter will also improve on installation time and ergonomics, as it will no longer require field personnel to utilize high amounts of force to make up the interface between the cable and cable adapter. The 600 A cold-shrink elbow is compatible with existing SCE-approved components and connectors, such as compression lugs, spade terminals, studs, connector plugs, and insulating plugs with caps and should be used with Jacketed Concentric Neutral (JCN) UG cable.

The 600 A Cold-Shrink Dead-Break Elbow is currently approved for use in the following districts: South Bay, Saddleback, Menifee, Ontario

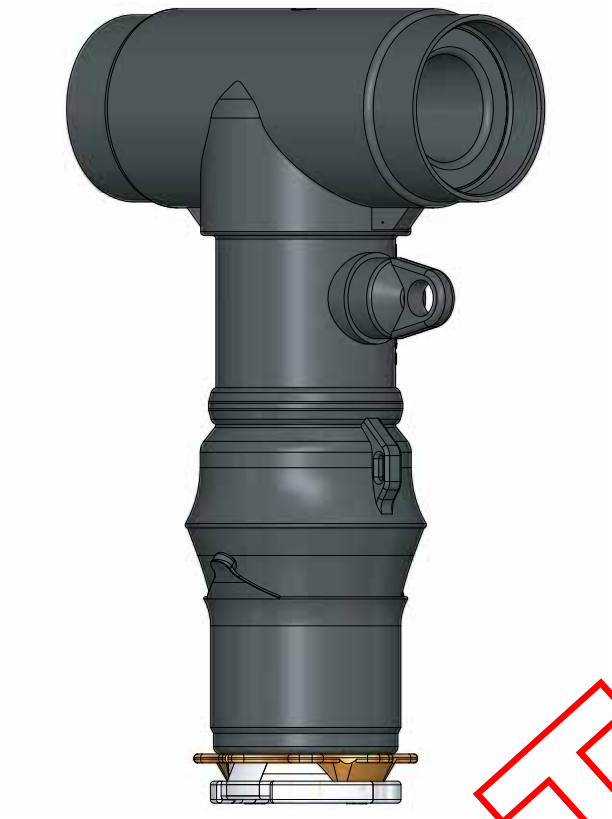
Table JJ 662P–1: 600 A Cold-Shrink Elbow Dead-Break Elbow Sizes

Voltage (kV)	Elbow Size (kcmil)	SAP Number
4 / 12/ 16	350-750 kcmil	10212380
	1000 kcmil	10212379

Contact the Center of Excellence for Underground Cable for questions regarding application, installation, and work methods.

PILOT

Figure JJ 662P–1: 600 A Cold-Shrink Dead-Break Elbow



2.0 Kit Contents

The 600A Cold-Shrink Elbow kit will contain the following items:

- Cold-Shrink Elbow
- Silicone Lubricant
- Jacket Mastic
- Sealing Mastic
- Stress Control Mastic

PILOT

Scope JJ 662P.2 600 A Cold-Shrink Dead-Break Elbow Installation

1.0 Installation Instructions

STEP 1. Train the cable so that it is located in the final assembled position with the required amount of slack. Mark the cable jacket 1-3/4 inches short from the center line of the apparatus bushing or connecting plugs (see Figure JJ 662P–1.1. Clean cable jacket up to 15 inches from the end of the cable. Measure 11 inches back from this mark and remove the cable jacket back to this point. Abrade cable jacket 1-1/2 inches from exposed concentric (see Figure JJ 662P–1.2).

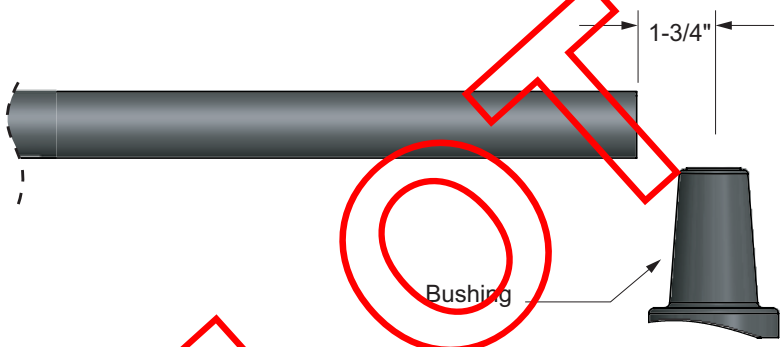


Figure JJ 662P–1.1 Correctly Positioned Cable

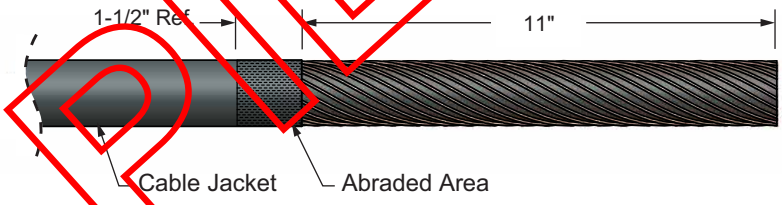
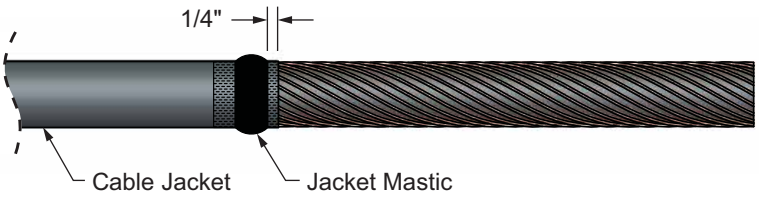


Figure JJ 662P–1.2 Removed Cable Jacket Dimensions

STEP 2. Apply one piece of jacket mastic by stretching and wrapping with light tension fully around outer jacket. The mastic is to be applied on the abrade area 1/4" away from the removed jacket. (See Figure JJ 662P–2.)

Figure JJ 662P–2: Jacket Mastic Installation



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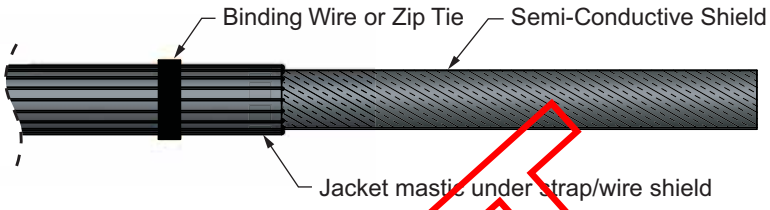
STEP 3. Fold back wire shields and press firmly into jacket mastic. Secure wire shields 3" back from jacket mastic with binding wire or zip ties as shown in figure 662P-3.

Figure JJ 662P–3: Concentric Neutral Fold Back



STEP 4. Prepare cable as shown in Figure JJ 662P-4 and Figure JJ 662P-5. Do not cut or nick the insulation.

Figure JJ 662P–4: Semi-Con Cutback Dimension

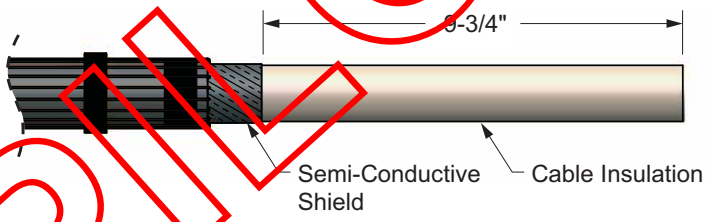
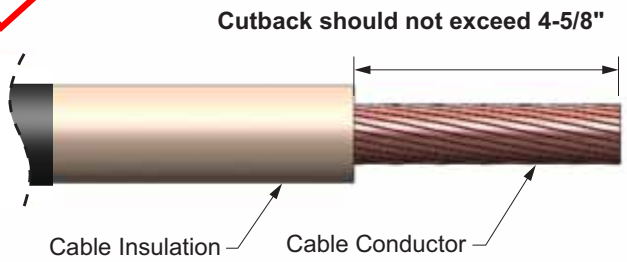


Figure JJ 662P–5: Insulation Cutback DImension



STEP 5. Wire brush the bare aluminum conductor and immediately insert the spade terminal. Before crimping, position the spade terminal on the conductor so that the flat contact area faces the apparatus bushing or connecting plugs.

STEP 6. Crimp the terminal using the proper tool and die. Select the proper die and number of crimps in accordance with the die chart shown in DUG JJ 700, Table JJ 700–7. Wipe off all excess manufacture installed inhibitor from the spade terminal and cable adapter after crimping.

Note: If oxide inhibitor is not visually detected when the compression connector (called crimp terminals, crimp connectors, or spade terminals) is pushed onto the bare conductor, SCE approved oxide inhibitor should be applied to the bare conductor in the field, prior to crimping.

PILOT

STEP 7. Thoroughly clean cable insulation, always wiping from the conductor to the insulation semicon, thus avoiding wiping semiconducting material on to the insulation (see Figure JJ 662P-6). Apply supplied stress control mastic centered over edge of semi-conductive shield cutback. Apply the mastic with light tension so it slightly stretches and completely wraps the cable (see Figure JJ 662P-7).

Figure JJ 662P–6: Proper Cable Cleaning

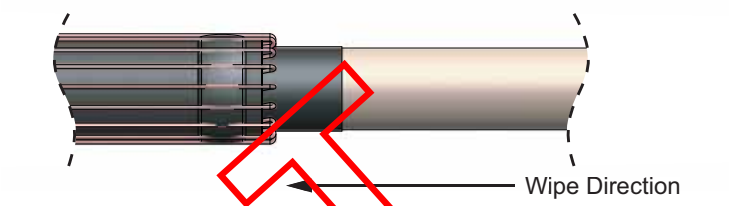
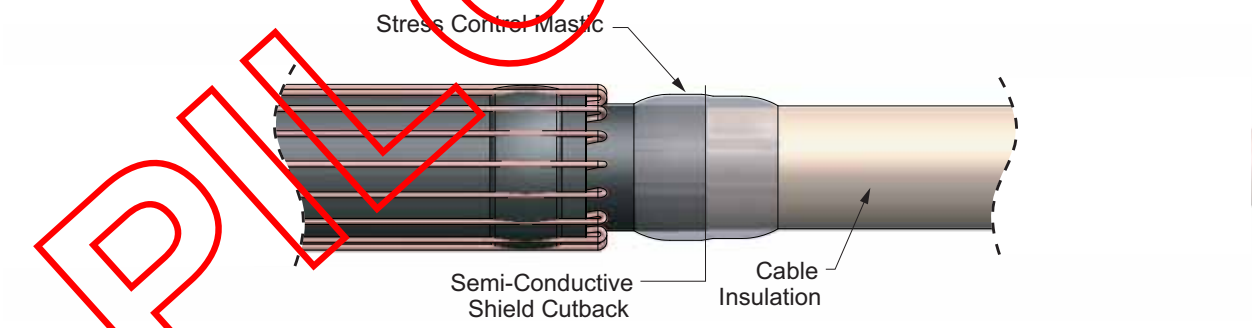


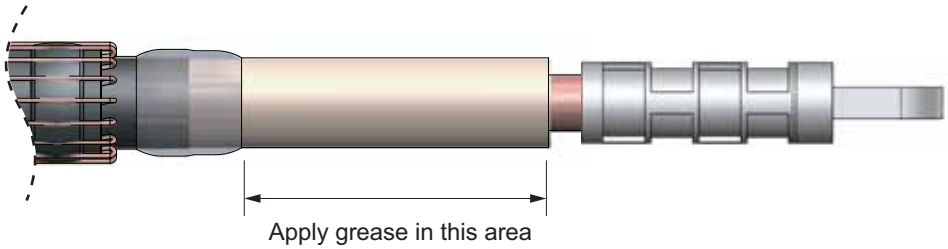
Figure JJ 662P–7: Application of Stress Control Mastic



PILOT

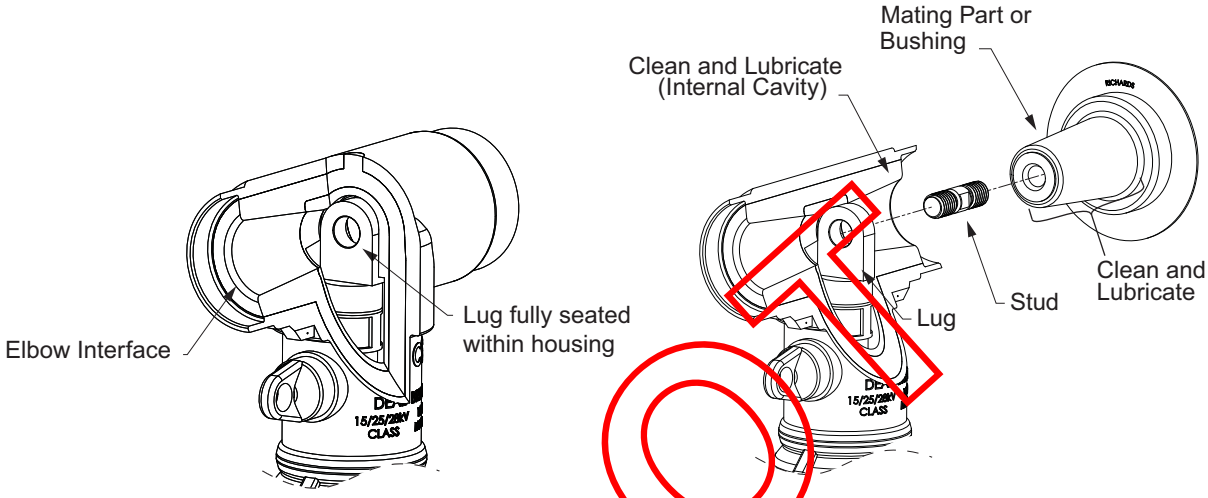
STEP 8. Apply grease up to stress control mastic covering entire area of exposed cable insulation as shown in Figure JJ 660-8. Avoid applying grease on stress control mastic; this may prevent adhesion to sealing mastic in Step 13.

Figure JJ 662P–8: Grease Application Area



STEP 9. Install cold-shrink elbow onto cable until the lug is fully seated inside the housing. Hand-tighten stud into the appropriate mating part or bushing. Clean and lubricate (using supplied or approved silicone grease) elbow interface and mating part interface as shown in Figure JJ 662P-9. Push cold-shrink elbow onto mating part, lining up the hole in the lug with the stud on the mating part.

Figure JJ 662P–9: Cold-Shrink Elbow Installed on Lug



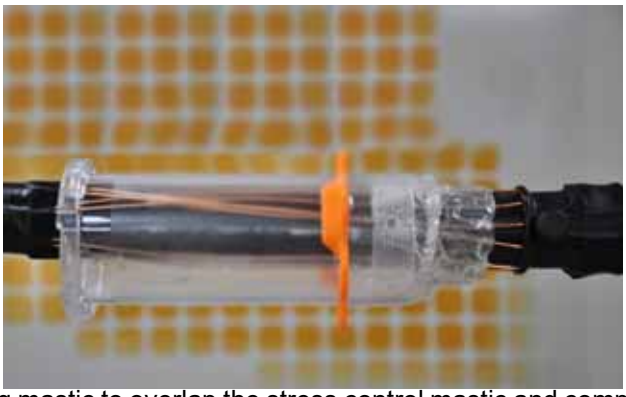
PILOT

STEP 10. Clean and lubricate (using supplied or approved silicone grease) the remaining elbow interface and mating part interface. Insert mating part, engage threads, and hand-tighten. For Insulating Plugs: Engage hex nut and tighten to 50-60 ft lbs using appropriate tool. Lubricate interior of insulating plug cap and push on to install. For all other mating parts: Install mating part per manufacturer instructions.

STEP 11. For removal of the cold shrink core grasp the removal ring. Push ring against core flange and twist so that cutting teeth breaks the tape on both sides. Check that tape is broken (See figure JJ 662P-10). Completely remove core from rubber housing by hand. DO NOT twist core while removing. Separate core into two halves and clip any plastic rings that remain on cable (see figure JJ 662P-11).

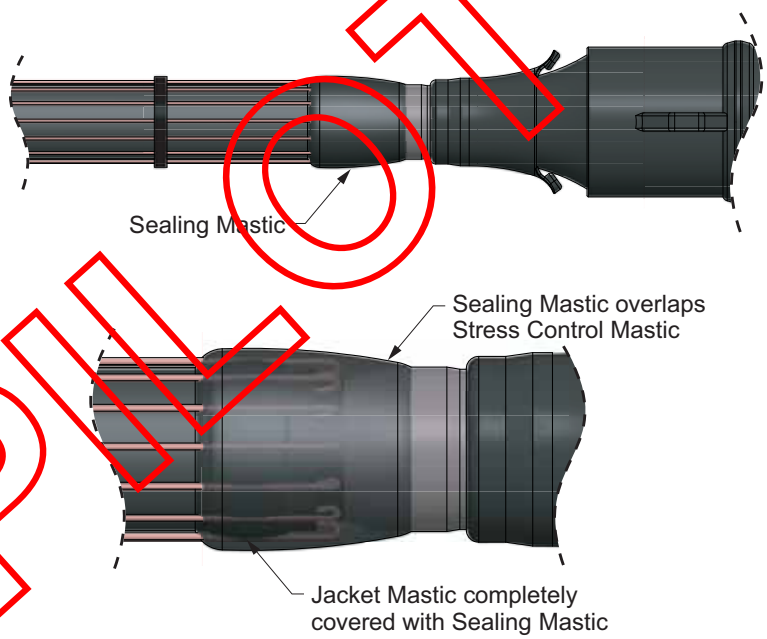
Figure JJ 662P–10: Removal of Core Flange Ring

Figure JJ 662P–11: Removal of Core



STEP 12. Apply sealing mastic to overlap the stress control mastic and completely overlap jacket mastic as shown in Figure JJ 662P-12. Compress sealing mastic to create a smooth transition to stress control mastic; this will assist during jacket seal application.

Figure JJ 662P–12: Sealing Mastic Installation



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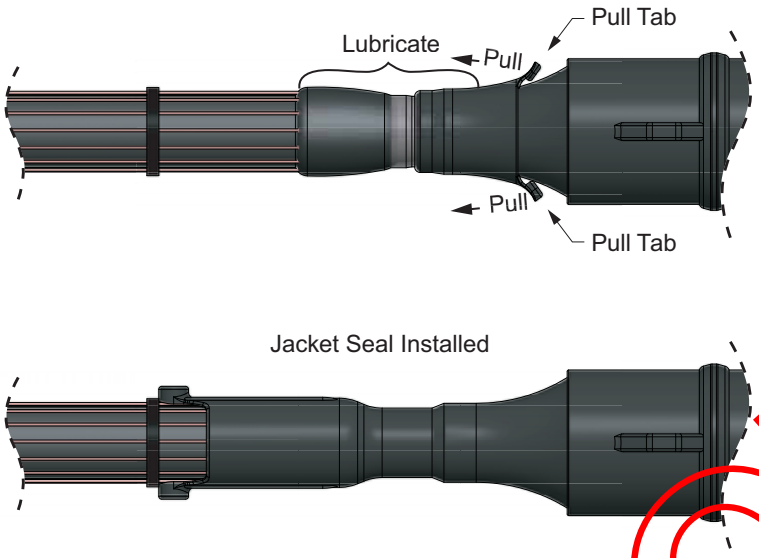
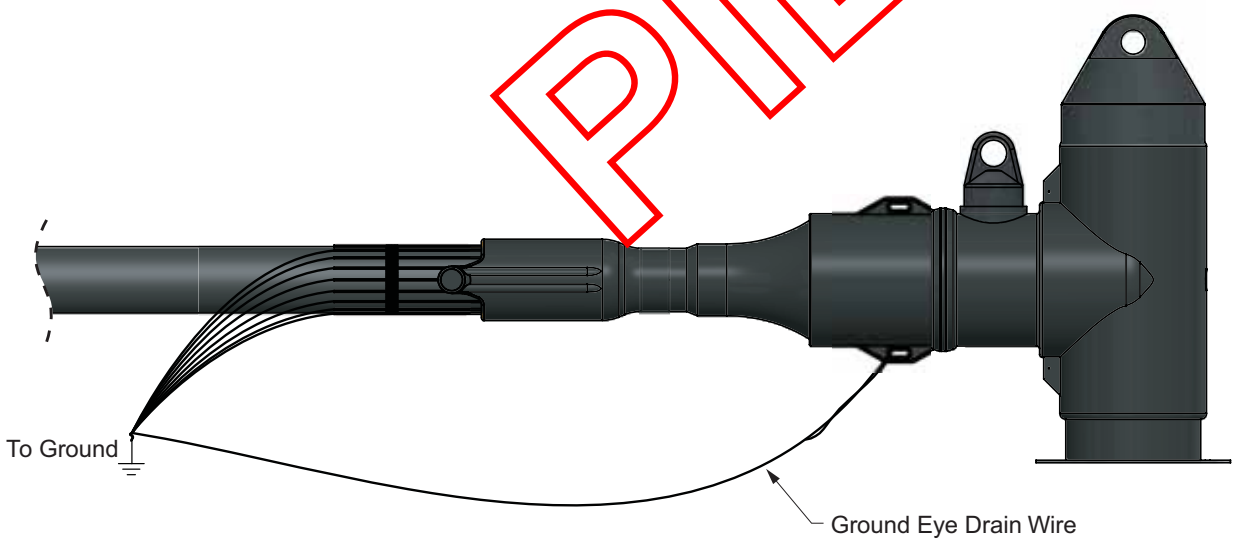
STEP 13. Apply grease over area as shown in Figure JJ 662P-13. Only use grease supplied with kit or approved silicone grease. Hold both tabs and pull out to completely cover sealing mastics as shown below. Ensure sealing mastic is not dislodged when unfolding seal.

Figure JJ 662P–13: Silicone Grease and Jacket Seal Installation



STEP 14. Insert one end of a piece of wire (#14 AWG copper or larger) through one of the available grounding eyes and twist to make a small loop. Be sure not to damage grounding eye. Connect other end of wire to shield wires.

Figure JJ 662P–14: Complete Installation



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JJ 663 600 A Elbow 5 kV–16 kV — 1/0 AWG to 500 kcmil — EPR

Scope JJ 663.1 Installation of Premolded Rubber Separable Connectors for 5 kV–16 kV

1.0 Application

Figure JJ 663–1: 600 A Elbow 5 kV–16 kV — 1/0 AWG to 500 kcmil

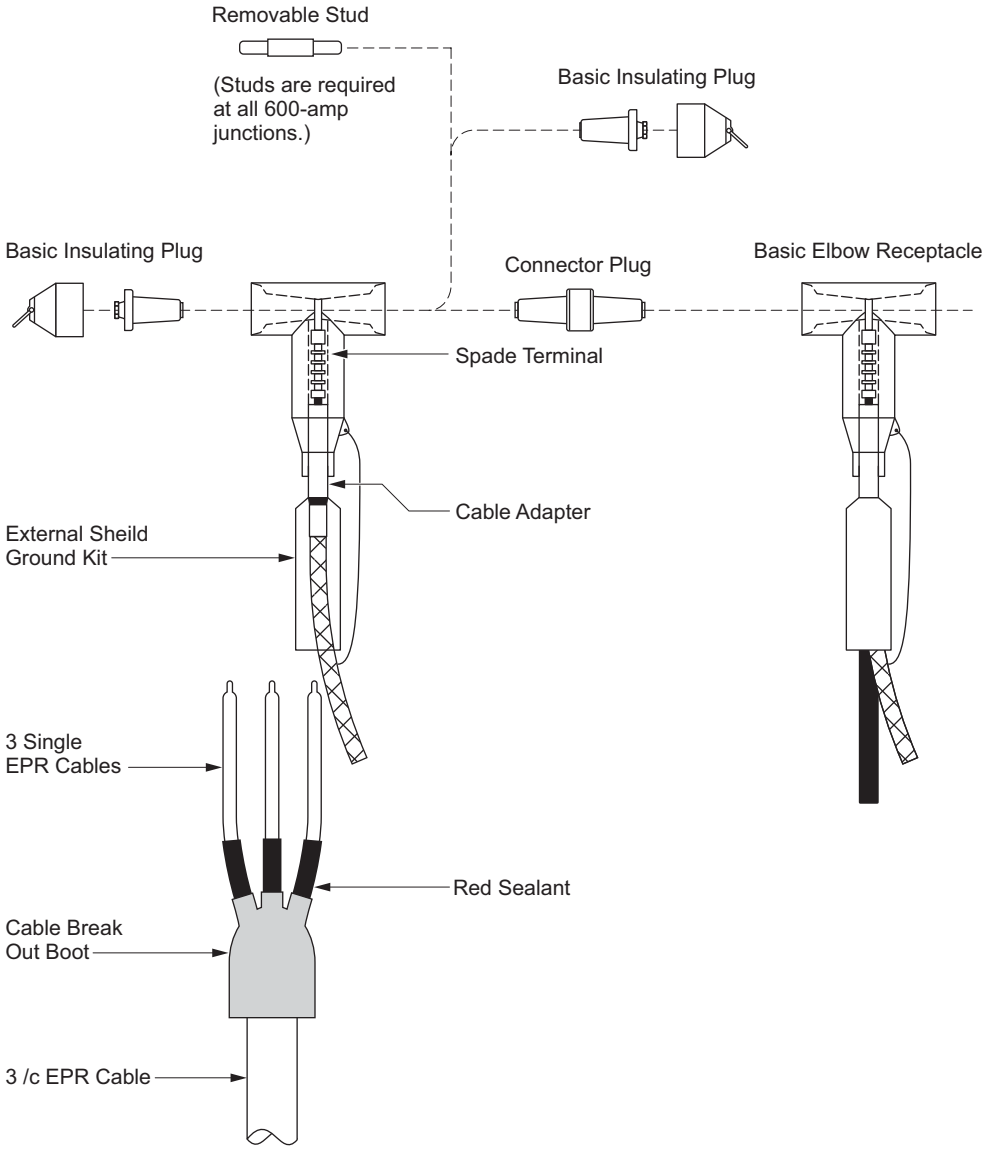


Table JJ 663–1: Premolded Rubber Separable Connectors for Installation on 5 kV–16 kV EPR Cable

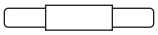
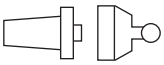
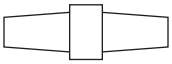
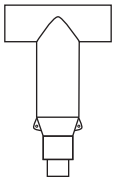
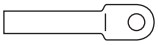
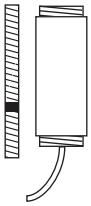
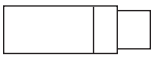
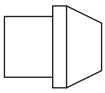
Component	SAP Number
Removable Stud 	10118030
Basic Insulating plug 	10118025
Connector Plug 	10118026
Basic Elbow Receptacle 	10118051
Spade Terminal	
1/0 AWG 	10117446
4/0 AWG	10117447
250 kcmil	10117430
350 kcmil	10117448
500kcmil	10117445
Cold Shrink Grounding and Elbow Sealing Kit 	
<u>12/16 kV</u>	
1/0 AWG/220 mil	10117937
4/0 AWG/220 mil	10117937
250 kcmil/220 mil	10117937
350 kcmil/220 mil	10117938
500 kcmil/220 mil	10117938
<u>4 kV</u>	
1/0 AWG/115 mil	10117937
4/0 AWG/115 mil	10117937
250 kcmil/115 mil	10117937
350 kcmil/115 mil	10117937
500 kcmil/115 mil	10117937

Table JJ 663–1: Premolded Rubber Separable Connectors for Installation on 5 kV–16 kV EPR Cable

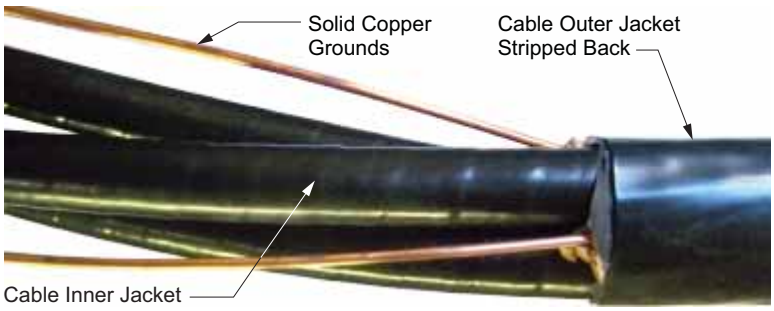
Component	SAP Number
Cacle Adapter 	
12/16 kV	
1/0 AWG/220 mil	10117337
4/0 AWG/220 mil	10117292
250 kcmil/220 mil	10117292
350 kcmil/220 mil	10117293
500 kcmil/220 mil	10117293
4 kV	
1/0 AWG/115 mil	N/A
4/0 AWG/115 mil	10117439
250 kcmil/115 mil	10117337
350 kcmil/115 mil	10117292
500 kcmil/115 mil	10117292
Cable Break Out Boot	10117441
Silicone Grease	10154115
Dead End Receptacle 	10118046
Spanner Wrench Adapter	
Adjustable	10147537
Modified	10147547
Hex Adapter Socket	10158037
Red Sealant	10116874
Heat Shrink Grounding and Elbow Sealing Kit	10178071

2.0 Basic Elbow Instructions

2.1 The heat-shrink breakout boot with 6 openings is required to convert one 3-conductor cable into three 1-conductor cables and three solid copper grounds.

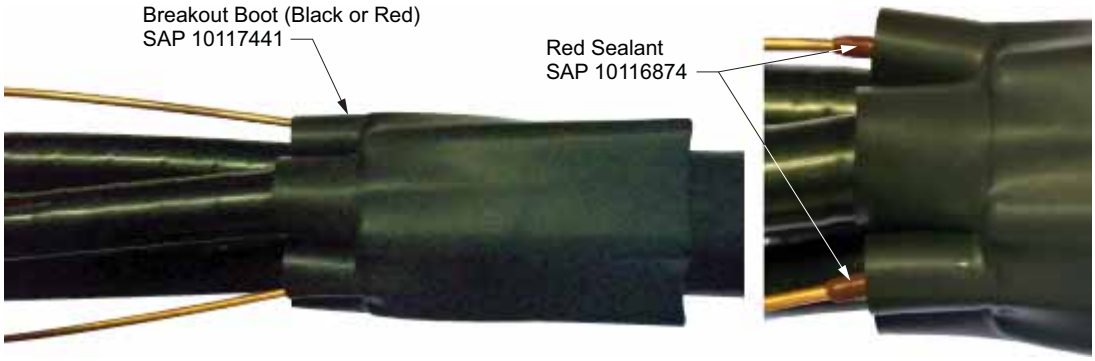
2.2 Strip away outer jacket of 3/C EPR cable a minimum of 36 inches. The cable outer jacket cutback dimensions may vary based on the actual job or structure particulars. For example, size of structure, location of equipment, and so forth.

Figure JJ 663–2: 3/C EPR Cable with Outer Jacket Stripped Away



2.3 Clean the cable jacket before sliding the breakout boot over cable. Remove release paper from breakout boot before installing. Field craft personnel can shorten or stagger the length of the three solid copper grounds for ease of sliding the breakout boot on. Apply 1 wrap of red sealant over each of the three solid copper grounds. Slide breakout boot over cable.

Figure JJ 663–3: Breakout Boot Installation



2.4 Apply heat to shrink boot that seals cable using a propane flame torch.

Figure JJ 663–4: Heat Shrink Boot after Heat was Applied

2.5 Remove excess red sealant, if necessary.

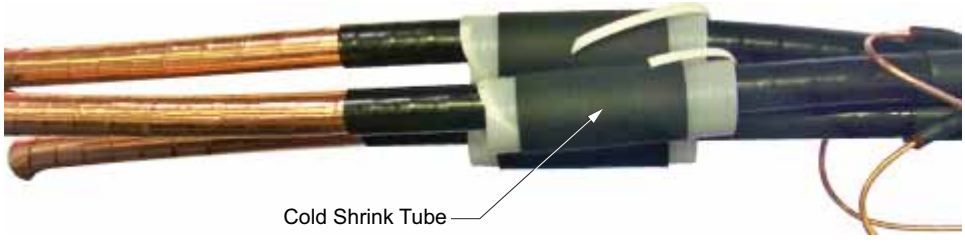
2.6 Train the cable so that it is located in the final assembled position with the required amount of slack. Cut the cable 1-3/4 inches short of the center line of the apparatus bushing or connecting plugs. Measure 13-3/4 inches back from the cut end of the cable and remove the cable jacket back to this point. See Figure JJ 663–5 (Sheet 5)

Figure JJ 663–5: Jacket Removal

2.7 Clean the outer surface of the cable jacket a distance of 30 inches.

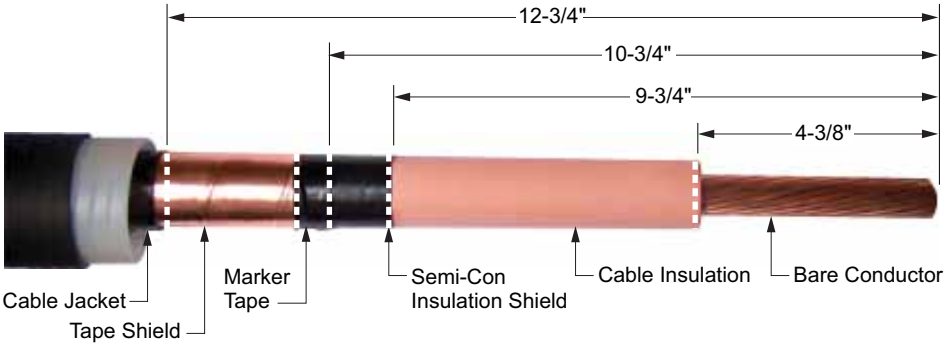
2.8 Park the cold shrink or heat shrink tube over the cable. For cold shrink, the tube shall be positioned such that the pull string can be pulled in the opposite direction of the elbow assembly.

Figure JJ 663–6: Position Cold Shrink Tube onto Cable



2.9 Prepare cable as shown in Figure JJ 663–7 (Sheet 6). Do not cut or nick the insulation.

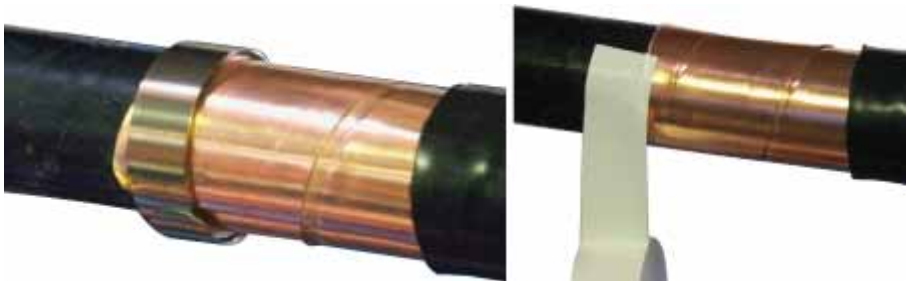
Figure JJ 663–7: Cable Preparation



NOTE

The coil spring or vinyl tape can be used to hold the copper tape shield in place after the copper tape shield is cut back as shown in Figure JJ 663–8 (Sheet 6).

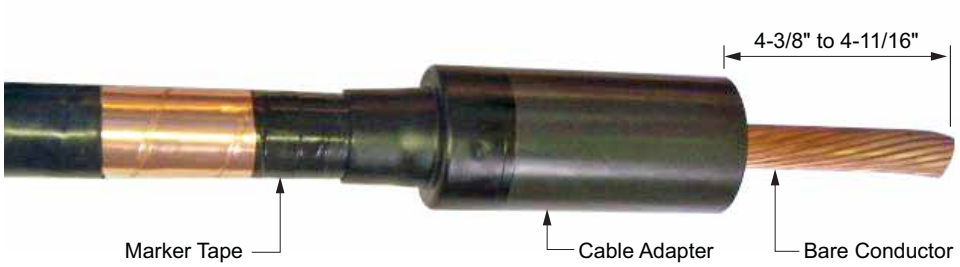
Figure JJ 663–8: Coil Spring (left) or Vinyl Tape (right) on Copper Tape Shield Cutback



2.10 Bevel the end of the cable insulation at a 45° angle, approximately 1/4 inch back. Thoroughly clean and lubricate the cable insulation and inside surface of the cable adapter with the grease supplied or SCE-approved silicone grease (SAP 10154115). Do not substitute. Slide the cable adapter onto the cable until the end of the cable adapter is flush with the marker tape.

2.11 Remove excess cable insulation by cutting it even with the end of the cable adapter. Do not cut or nick the cable adapter or the conductor. The length of exposed conductor should be in the range from 4-3/8 inches to 4-11/16 inches, as shown in Figure JJ 663–9 (Sheet 7).

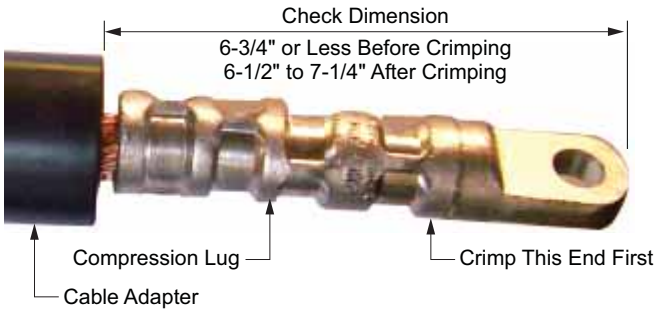
Figure JJ 663–9: 600 A Cable Adapter



2.12 Fully insert conductor into spade terminal. Measure the “Check Dimension” before crimping; see Figure JJ 663–10 (Sheet 7). This dimension shall be less than 6-3/4 inches, otherwise redo assembly. Before crimping, position the spade terminal on the conductor so that the flat contact area faces the apparatus bushing or connecting plugs.

After crimping, the "Check Dimension" should be between 6-1/2 to 7-1/4 inches, otherwise redo assembly; see Figure JJ 663–10 (Sheet 7).

Figure JJ 663–10: 600 A Spade Terminal Installation



2.13 Crimp the terminal using the proper tool and die. See Table JJ 663–2 (Sheet 8). Rotate the crimps by 90 degrees. Wipe off excess inhibitor.

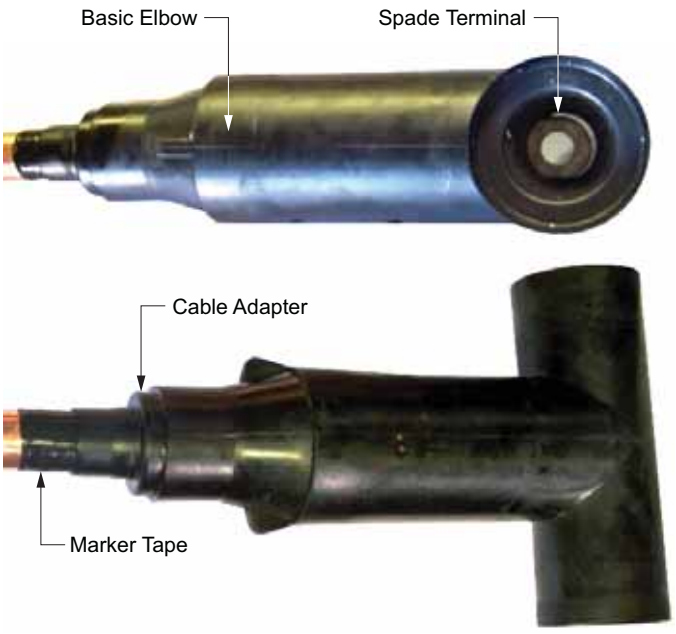
Table JJ 663–2: Spade Terminal Installation Data

Spade Terminal SAP Number	Conductor Size (Compact)	Connector O.D. (inches)	Y-35, Y-39, UT-15			
			Burndy (SAP No.)	Crimps[a/]	Homac Die (SAP No.)	Crimps[a/]
10117446	1/0 AWG	0.850	U28ART (298) (N/A)	3	15CA71R[b/] (10148902)	4
10117447	4/0 AWG	0.850				
10117430	250 kcmil	0.850			15CA66R[b/] (N/A)	4
10117448	350 kcmil	1.152	U31AR (299) (10148891)	2	15CA96R or 15CA94R[b/] (10148900)	5
10117445	500 kcmil	1.320	U34ART (300) (10148774)	4	15C106R (10148995)	6

[a/] Number of crimps per side without overlapping. Rotate crimps by 90 degrees to prevent distortion.
[b/] Will fit UT-15 with adapter die SAP 10148852.

2.14 Lubricate the outside of the cable adapter and inside of basic elbow receptacle cable entrance. Slide the cable into the elbow until the hole in the spade terminal is centered in the elbow. See Figure JJ 663–11 (Sheet 8). Make sure cable adapter is still flush with marker tape. If not, reposition cable adapter.

Figure JJ 663–11: 600 A Basic Elbow



2.15 For the heat shrink option, apply two wraps of red mastic, as shown in Figure JJ 663–12 (Sheet 9).

For the cold shrink option, apply one wrap of black mastic, as shown in Figure JJ 663–13 (Sheet 9).

Figure JJ 663–12: Copper Tape Shield Preparation, Heart Shrink Option

2.16 Slightly flare the end of the braid with the solder block that was supplied with the kit and place it on the copper shield, flush against the cable jacket.

Wrap the coil spring around the braid and cable, two complete turns. See Figure JJ 663–13 (Sheet 9).

NOTE

Use caution when working with the coil spring. Use proper Personal Protective Equipment (PPE). Do not wrap the stainless steel coil spring directly onto the copper tape shield.

Figure JJ 663–13: Grounding Coil Spring Installation, Cold Shrink Option (top —black mastic), and Heat Shrink Option (bottom — red mastic)

2.17 Apply #14 AWG copper mousing wire (SAP 10109303) under coil spring in a looped fashion. Bend braid back over the spring. Be sure the solder block of braid is centered on top of the mastic tape, and wrap the remainder of the coil spring around the braid and cable. Tighten the coil spring with fingers and secure the end of the coil spring and mousing wire with copper or vinyl tape. See Figure JJ 663–14 (Sheet 10).

Figure JJ 663–14: #14 AWG Copper Wire Installation, Cold Shrink Option (top – black mastic), and Heat Shrink Option (bottom – red mastic)

2.18 For cold shrink, apply black mastic over the braid. Then wrap two half-lapped layers of vinyl tape over mastic. Wrap black mastic around the end of the cable adapter. Then wrap two half-lapped layers of vinyl tape over mastic. See Figure JJ 663–15 (Sheet 10).

Figure JJ 663–15: Jacket Seal Mastic Installation, Cold Shrink Option

2.19 For heat shrink, apply red mastic over the braid and wrap red mastic around the end of the cable adapter, as shown in Figure JJ 663–16 (Sheet 11). DO NOT wrap vinyl tape over the red mastic.

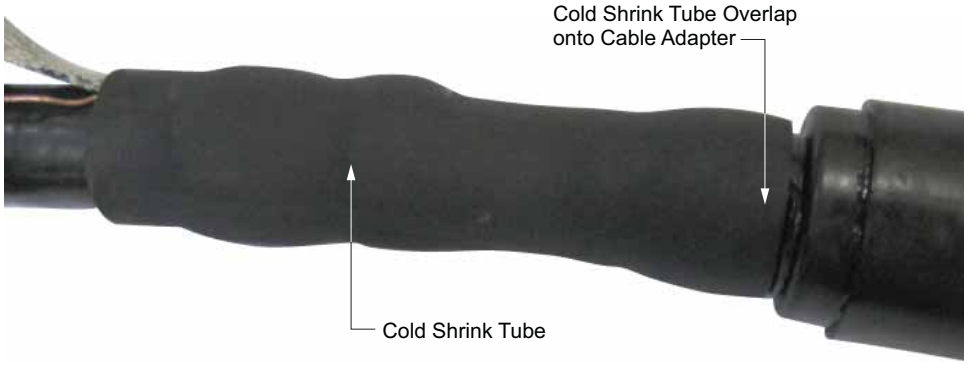
Figure JJ 663–16: Jacket Seal Mastic Installation, Heat Shrink Option

NOTE

If installing a cold shrink sealing tube follow step 2.15, if installing a heat shrink sealing tube follow step 2.16.

2.20 For cold shrink, pull loose end from the back of the cold shrink tube to unwind cord in a clockwise direction until the plastic core is flush with the end of cold shrink tube. Slide the cold shrink tube flush against the basic elbow and continue to unwind cord in a clockwise direction. The cold shrink tube will collapse at the elbow end first. The cold shrink tube must overlap the cable adapter and butt against the basic elbow for a proper seal that will prevent moisture/water intrusion. See Figure JJ 663–17 (Sheet 11). After installing cold shrink go to step 2.17.

Figure JJ 663–17: Jacket Seal Installation, Cold Shrink Option



2.21 For heat shrink, position black heat shrink tube to overlap red mastic applied to cable jacket and the cable adapter. Shrink the tube in place by beginning at the elbow end of the heat shrink tube and working toward the cable jacket end. Apply the torch with a smooth, brushing motion around all sides of the heat shrink tube. The heat shrink tube must overlap the cable adapter and butt against the basic elbow for a proper seal that will prevent moisture/water intrusion. See Figure JJ 663–18 (Sheet 12). After installing heat shrink go to step 2.17.

Figure JJ 663–18: Jacket Seal Installation, Heat Shrink Option

2.22 For cold shrink option and heat shrink option:

Using a two-bolt or vise type copper connector, connect the braided ground to the 4/0 AWG copper ground/neutral bus using a #2 AWG stranded copper wire and connect the #14 AWG copper mousing wire (SAP 10109303) to the bonding eye located on the basic elbow. See Figure JJ 663–19 (Sheet 12).

Figure JJ 663–19: 600 A EPR Elbow Grounding, Cold Shrink Option Shown

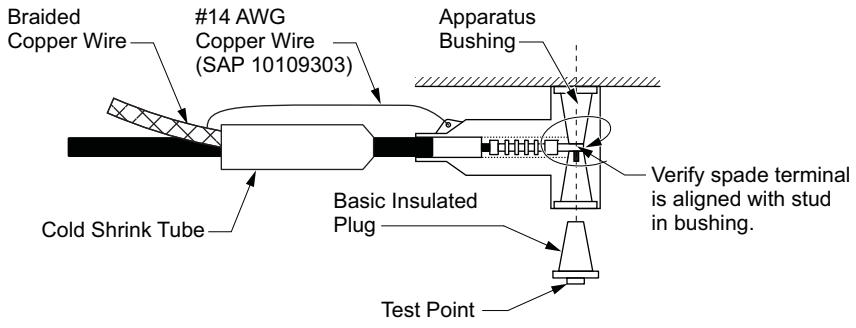
3.0 Elbow Assembled on Apparatus Bushing

3.1 Hand tighten the removable stud all the way into the 600 A Basic Insulated Plug to "chase" the threads, and then remove the stud. Next, insert the removable stud all the way into the 600 A Apparatus Bushing and hand tighten to "chase" the bushing threads; then, back off half way. Lubricate the Basic Elbow Receptacle and Apparatus Bushing. Place the elbow on the bushing, being careful to line up hole in spade terminal with stud in bushing. See Figure JJ 663–20 (Sheet 13). Lubricate Basic Insulated Plug, insert into elbow, and hand tighten.

CAUTION

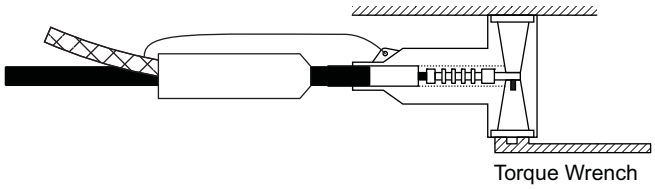
Cable should be racked in final position before tightening so that cable movement will not affect the connection. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising the cable seal.

Figure JJ 663–20: 600 A Basic Elbow Installed on Apparatus Bushing
(Remove curved arrow shown at apparatus bushing connection)



3.2 Use a torque wrench to tighten the Basic Insulated Plug, exerting 50 to 60 foot-pounds of torque. See Figure JJ 663–21 (Sheet 13). Lubricate inner surface of test point cap and install on elbow.

Figure JJ 663–21: Torque Wrench Installation
(Replace the torque wrench in this figure with the torque wrench depicted in DUG Figure JJ 660–1.8)



3.3 All premolded rubber 200 A and 600 A components with grounding eyes shall be bonded to ground with a #14 AWG copper mousing wire (SAP 10109303). Connect all the ground braids and the three solid copper grounds to the 4/0 AWG copper ground/neutral bus in the vault as required.

4.0 Bushing Extensions

No more than two bushing extensions should be used on apparatus bushings. Be sure cable is adequately secured and supported.

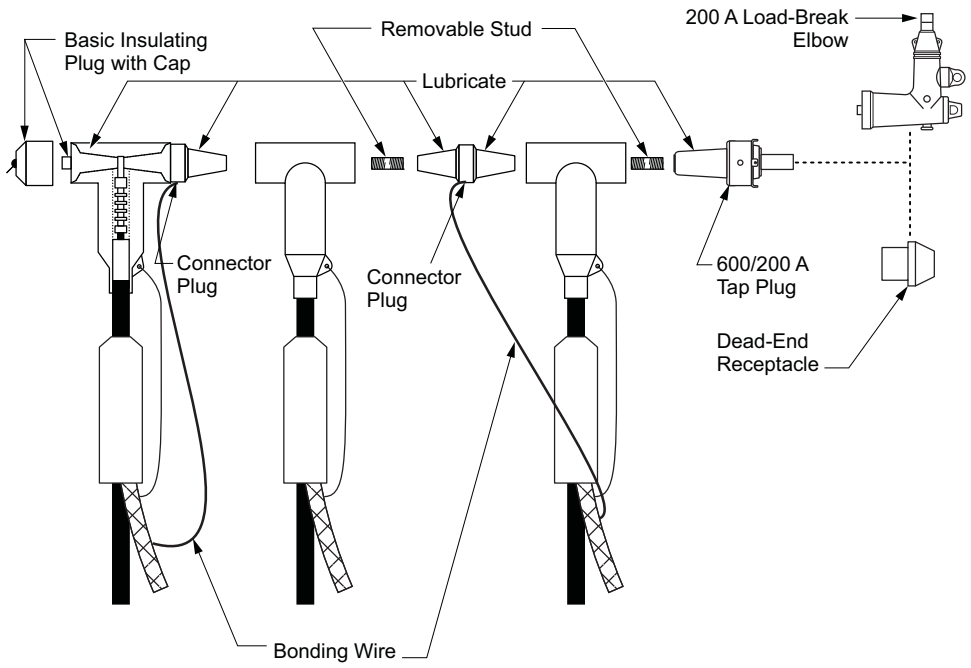
5.0 Elbow Assembled as a Splice with 200 A Tap

5.1 Hand tighten the removable studs all the way into all mating 600 A connector plugs to “chase” the threads, and then remove the stud. Next, insert the removable stud all the way into the 600/200 A tap plug and hand tighten to “chase” the threads; then, back off half way. Start assembly of splice from one end lubricating all elbows and plugs before they are assembled. See Figure JJ 663–22 (Sheet 14). Hand tighten all plugs.

CAUTION

Cable should be racked in final position before tightening so that cable movement will not affect the connection. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising the cable seal.

Figure JJ 663–22: 5 kV — 16 kV Component Assembly
(Update the connector plugs in this figure to look like the connector plugs in DUG Figure JJ 660–1.7)



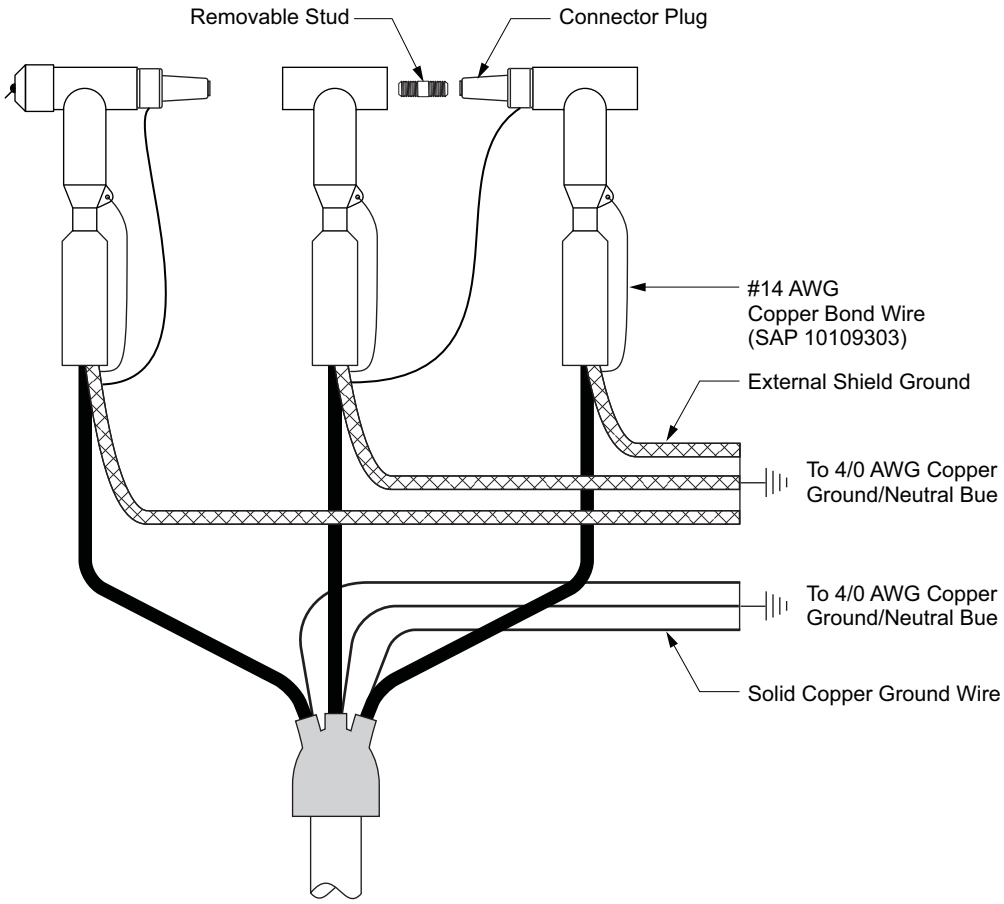
5.2 Start at one end and tighten assembly using a 1/2 inch torque wrench on the Basic Insulating Plug and a 1/2 inch torque wrench with a spanner wrench adapter (SAP 10147537 or 10147547) on the connector plug and tap plug. For the rubber molded connector plug, use a 1/2 inch torque wrench with a hex adapter socket (SAP 10158037). Tighten each joint exerting 50 to 60 foot-pounds of torque.

NOTE When using the spanner wrench adapter with the torque wrench attached, the setting exceeds the actual torque applied to the stud. The indicated torque should be from 45 foot-pounds while keeping the torque wrench inline with the spanner wrench handle.

5.3 Lubricate inner surface of insulating plug cap and install on elbow. Lubricate tap plug bushing and install insulating cap or 200 A elbows. Remove marker tapes.

5.4 All premolded rubber 200 A and 600 A components with grounding eyes shall be bonded to ground with a #14 AWG copper mousing wire (SAP 10109303). See Figure JJ 663–23 (Sheet 15). Connect all the ground braids and the three solid copper grounds to the 4/0 AWG copper ground/neutral bus in the vault as required.

Figure JJ 663–23: 600 A EPR Basic Elbow Grounding



CAUTION Failure could occur if the components are not properly bonded and grounded.

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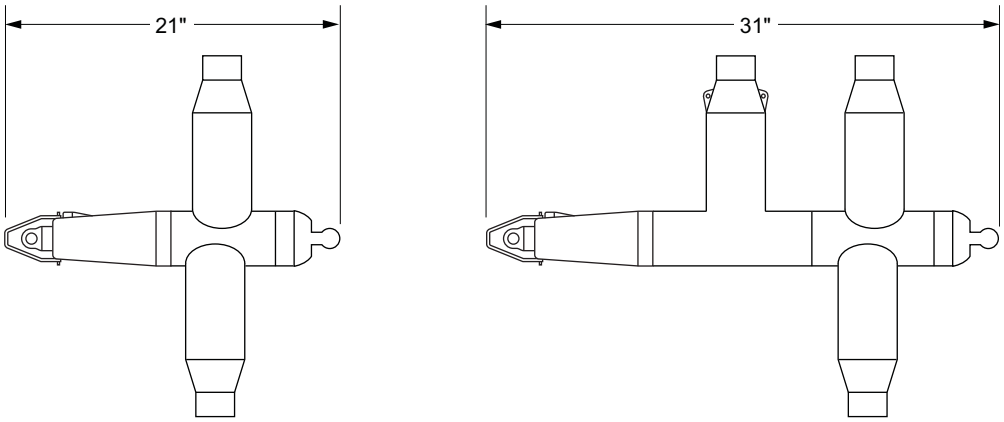
JJ 667 600 A T-Body Splice — 35 kV — 4/0, 750, and 1,500 kcmil — Elastimold

Scope JJ 667.1 Application Guide for the 35 kV 600 A T-Body Splice

Select the splice configuration desired (A or B). See Figure JJ 667–1 for configuration selection. The quantities of individual components required for that particular configuration are shown in the column directly below the letter, in Table JJ 667–1.

Figure JJ 667–1: Application Guide for the 35 kV 600 A T-Body Splice



A
600 A T-Body Splice
2-Way

B
600 A T-Body Splice
3-Way

Table JJ 667–1: Application Guide for the 35 kV 600 A T-Body Splice

Component	SAP	A	B
600 Amp T-Body Splice[a/]	10174590	1	1
600/200 Amp Reducing Tap Plug[b/] (Load-Break Interface)	10117873	1	1
Removable Stud[c/]	10117892		
Basic insulating Plug (with cap)	10117858	1	1
Connector Plug	10117859		1
Basic Elbow Receptable	10117861		1
Spade terminal[d/]		2	3
4/0 AWG	10117430		
750 kcmil	10117651		
1500 kcmil	10117393		
Cable Adapter[d/]		2	3
4/0 AWG — 420 mil	10117429		
750 kcmil — 420 mil	10117386		
1500 kcmil — 345 mil	10117381		
200 Amp Load-Break Insulating Cap[e/]	10117401	1	1

[a/] A special stud is included with the 600 Amp T-Body Splice, 35 kV Stud (SAP 10200062).
[b/] See Note 1.
[c/] The removable stud is shown for information only. It is included in the 600 Amp elbow kits (SAP 10117861) as needed. It is not a replacement for the special stud used with the 600 Amp T-Body Splice. Removable stud for 35 kV has a machined groove in the center.
[d/] These cable components must be sized for the cable.
[e/] Use with 600/200 Amp reducing tap plug (SAP 10117873).

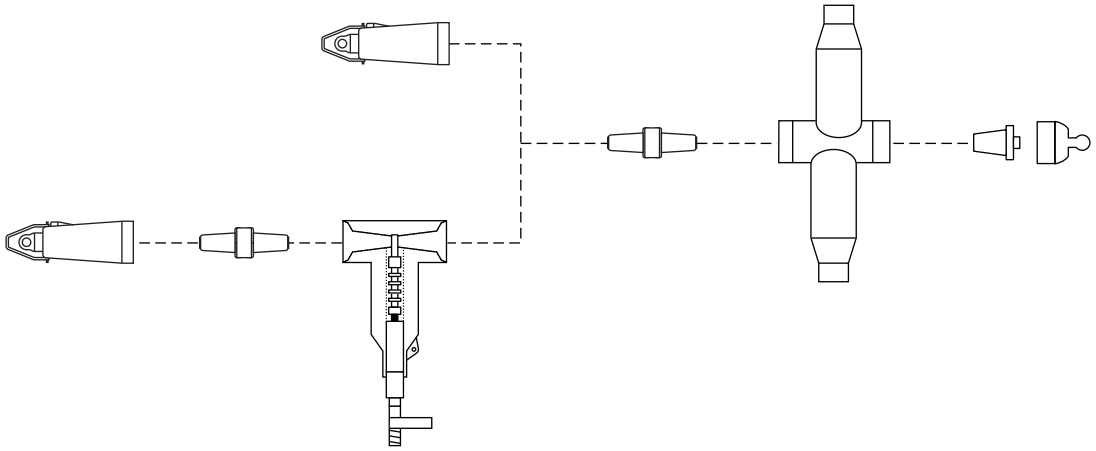
Note(s):

1. The 600/200 Amp tap plug with 200 Amp load-break interface is used for grounding purposes only. Use loadbreak grounding elbow (SAP 10117347) when any one or all of the following are present:
   - The available fault duty is 9 kA or less
   - The line conductor to be grounded is copper and smaller than #2 AWG
   - The line conductor is aluminum and smaller than 1/0 AWG
2. Crews must verify that Table 1 of the Underground Grounding Manual allows for the size and configuration chosen.

1.0 Application

For joining or terminating 35 kV polyethylene-insulated cables in a disconnectable configuration refer to Figure JJ 667–2

Figure JJ 667–2: 35 kV — 1/0 — 1,500 kcmil Premolded Rubber Separable



Scope JJ 667.2 Installation of the 35 kV 600 A T-Body Splice

1.0 General Information

This standard shows the approved method for using the 600 A T-Body Splice as an alternative to the 2-way 600 A T-Body Splice which stacks 600 A T-Body Elbows (Basic Elbow Receptacles) to splice concentric neutral cables for high-voltage apparatus applications.

2.0 Installation

For Unjacketed Concentric Neutral cables, ignore cable jacket reference in Step 1.

STEP 1. Train the cables that are being spliced so that they are located in their final assembled position with required amount of slack. Mark and cut the cables so that there will be 3-1/2 inches between the two cables. See Figure JJ 667–3. Measure 17 inches back from this cut on each cable and remove the cable jackets back to this point. See Figure JJ 667–4.

Figure JJ 667–3: Cable Orientation and Cutback

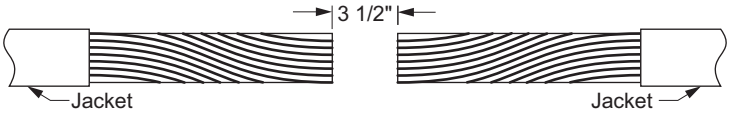
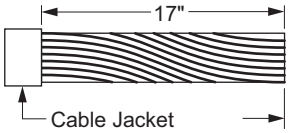


Figure JJ 667–4: Cable Jacket Removal

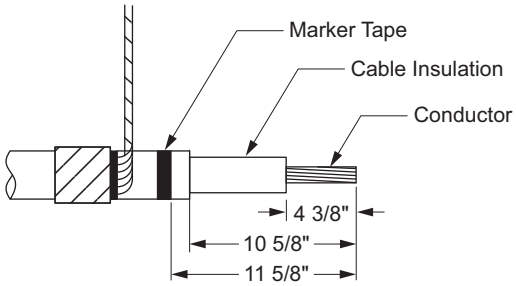


STEP 2. Seal the concentric neutral jackets from moisture/water intrusion by following the jacket sealing procedure shown in IC 230

STEP 3. Leave enough concentric neutral wires for connection to ground.

STEP 4. Prepare the cables as shown in Figure JJ 667–5. DO NOT CUT OR NICK THE CABLE INSULATION.

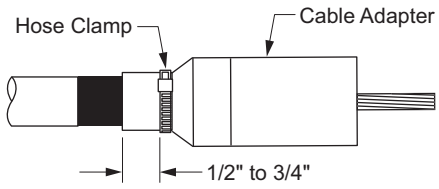
Figure JJ 667–5: Cable Preparation



STEP 5. Thoroughly clean the cable insulation on each cable, wiping in one direction only from the conductor to the insulation, and to the semicon, thus avoiding wiping semiconducting material onto the insulation. See Figure JJ 667–5. Lubricate the cable insulation and inside surface of the cable adapters with the grease supplied or silicone grease (SAP 10154115). Do not substitute any other grease. Slide the cable adapters into position, small end first, until they are flush with the end of the marker tape, on each cable as shown in Figure JJ 667–6.

Assemble hose clap 1/2 inch to 3/4 inch from the small end of the cable adapter on both cables.

Figure JJ 667–6: Cable Adapter Installation



Remove the protruding cable insulation by cutting it even with the large end of the cable adapter. DO NOT CUT OR NICK THE CABLE ADAPTER OR THE CONDUCTOR.

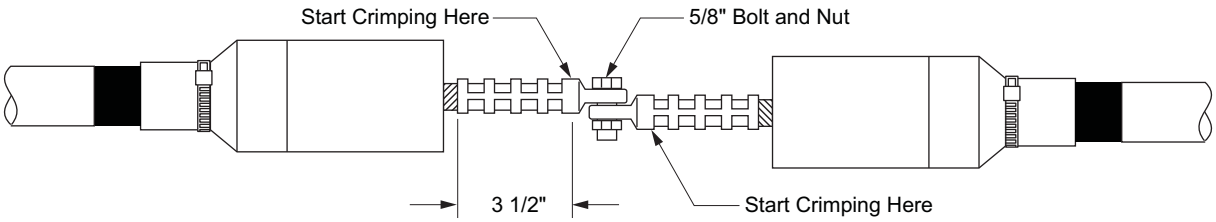
STEP 6. Wire brush the bare conductor and immediately insert it into the compression connector. Select the proper tool, die, and number of crimps for crimping in accordance with the die chart shown in DUG JJ 700, Table JJ 700–7.

NOTE

If oxide inhibitor is not visually detected when the compression connector (called crimp terminals, crimp connectors, or spade terminals) is pushed onto the bare conductor, SCE approved oxide inhibitor should be applied to the bare conductor in the field, prior to crimping.

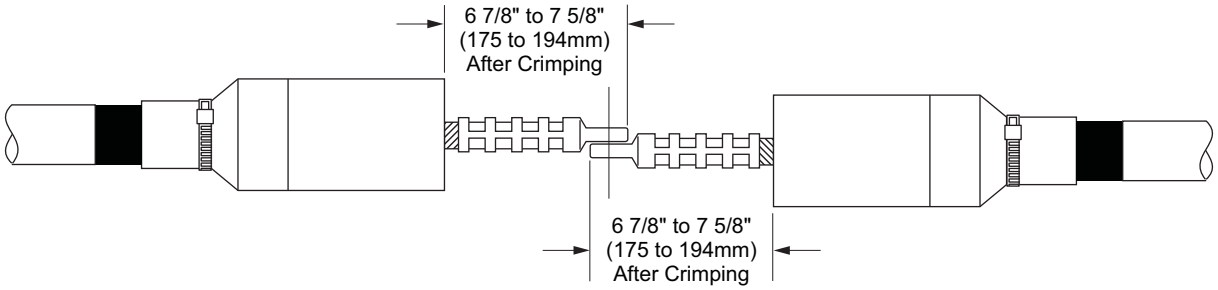
STEP 7. Before making the first crimp, align the flat portions of the compression connectors by using a 5/8-inch bolt and nut as a temporary locater. Hold the compression connectors in the proper position and start the first crimp 3-1/2 inches from the open end of the compression connector at the mark indicated on the connector. See Figure JJ 667–7.

Figure JJ 667–7: Temporary Bolt Installation Prior to Crimping



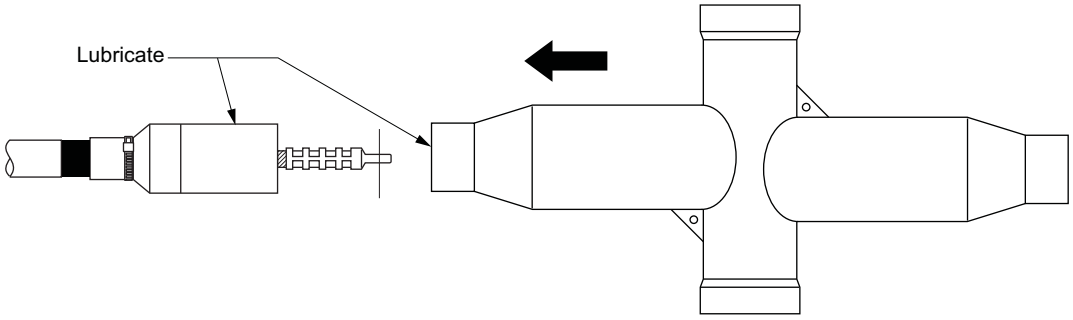
STEP 8. Rotate each successive crimp 180 degrees to prevent bowing. After both compression connectors have been crimped, carefully wipe excess inhibitor from the outside of the connectors and from the cable insulation. Check to ensure that the end of the connectors is 6-7/8 to 7-5/8 inches from the large end of the cable adapter. Remove the 5/8-inch bolt and nut used as a temporary locater, and remove sharp flash, if any, from the crimped connectors. See Figure JJ 667–8.

Figure JJ 667–8: Crimp Connector Check Dimensions



STEP 9. Lubricate the inside of the 600 A T-Body Splice housing, and lubricate the outside of both cable adapters with grease supplied or silicone grease (SAP 10154115). Do not substitute any other grease. Slide one cable into the 600 A T-Body Splice housing until it cannot advance any further, and the hole in the crimped connector is centered in the housing when viewed through the tap hole. The base of the cable adapter should still be aligned with the marking tape.
See Figure JJ 667–9.

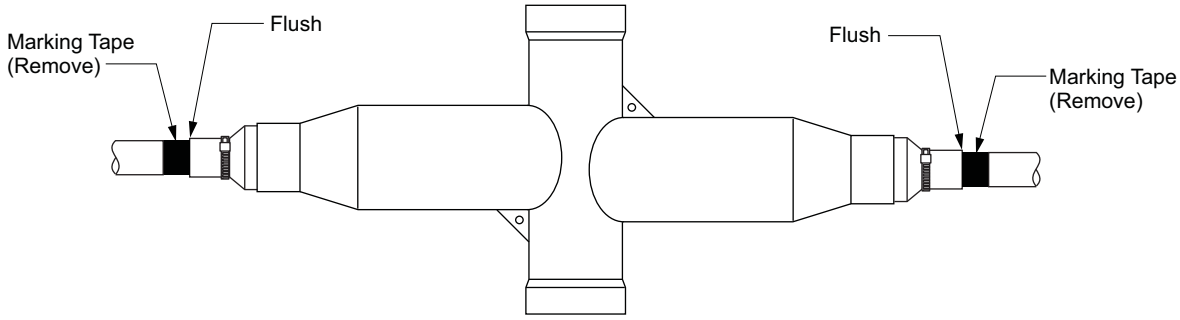
Figure JJ 667–9: Installation of 600 A T-Body Splice Housing



STEP 10. To install the other cable on the other side, push the 600 A T-Body Splice housing sideways until the cable enters the open end of the housing.

STEP 11. Slowly push both cables toward their normal alignment, making sure that the second cable adapter is sliding into its proper position. The hole in the second crimped connector should be centered in the housing when viewed through the tap hole. When the crimped connector is fully seated, make sure that the base of both cable adapters are still in their proper position flush against the marking tape. If not, reposition cable adapters. Remove the marker tape.
See Figure JJ 667–10.

Figure JJ 667–10: Check Proper Alignment of 600 A T-Body Splice Housing



STEP 12. Remove the protective caps from the 600 A T-Body Splice and the mating parts. Hand tighten the specially-designed 2-7/8-inch stud supplied with the 35 kV 600 A T-Body Splice into the first mating part.

NOTE The special/longer stud (Elastimold 750 VSA, SAP 10200062) supplied with the 35 kV 600 A T-Body Splice is 1/2 inch longer than the standard stud and must be used with the 35 kV 600 A T-Body Splice only.

WARNING DO NOT connect or disconnect mating products while energized.

WARNING DO NOT energize while disconnected.

Clean and lubricate both the 600 A T-Body Splice and the first mating part with the lubricant supplied. Keep both mating surfaces clean. Insert the first mating part.

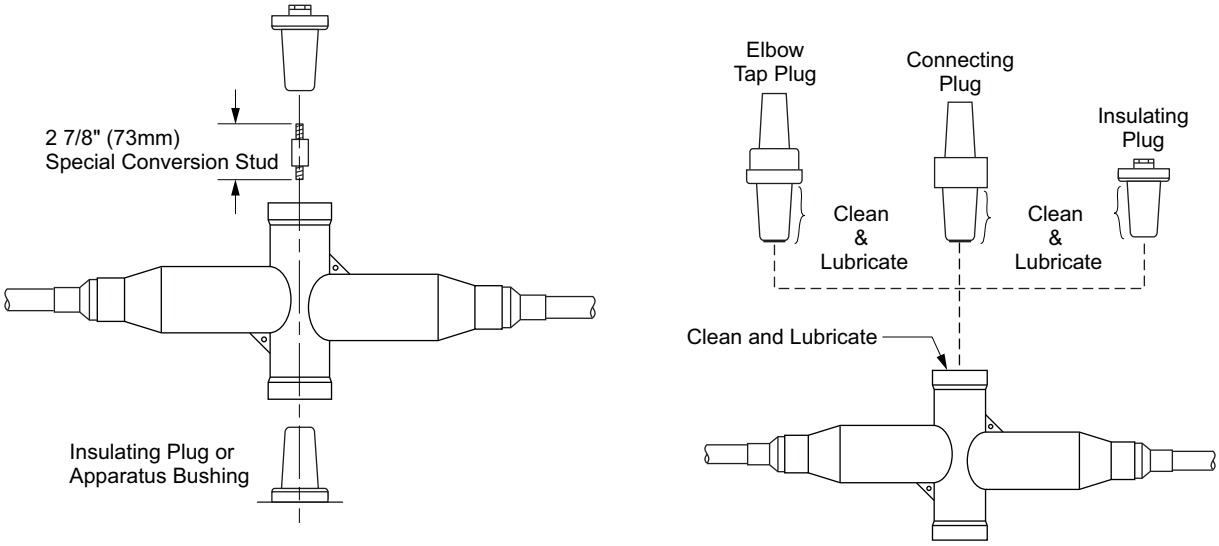
STEP 13. Clean and lubricate the mating part for the opposite end of the 600 A T-Body Splice. Insert the mating part into the elbow. Engage the threads and hand tighten. See Figure JJ 667–11.

CAUTION Cable should be racked into its final position before tightening so that cable movement will not affect the connection. Cable should extend straight out of the 600 A T- Body Splice at least 6 inches before starting a bend to prevent distortion of the 600 A T-Body splice and compromising of the cable seal.

Torque mating part according to the instructions supplied with the mating part.

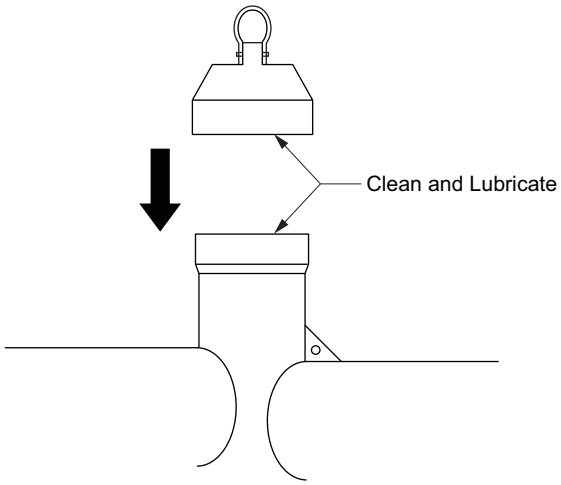
NOTE All mating parts must be operated in accordance with their operating instruction.

Figure JJ 667–11: Mating Parts of the 600 A T-Body Splice



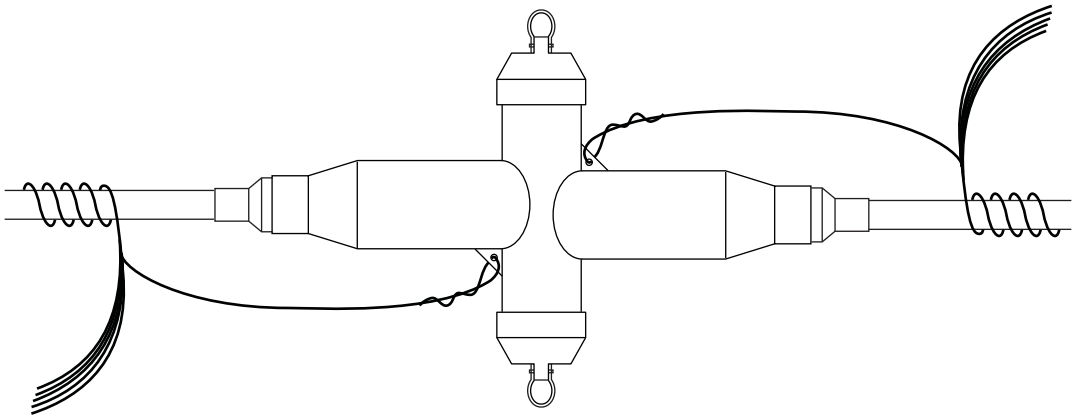
STEP 14. If a basic insulating plug (BIP) is used as a mating part, clean and lubricate the inside of the voltage detection cap and place on the 600 A T-Body Splice, to cover the BIP. Push down hard on the insulating cap until it snaps into place. See Figure JJ 667–12.

Figure JJ 667–12: Installation of BIPs and Caps



STEP 15. All pre-molded 200 A and 600 A cable components with grounding eyes shall be bonded to ground with a #14 AWG copper wire or equivalent. It is recommended that a primary concentric neutral wire be utilized. Connect the remaining neutral wires to system ground as required. See Figure JJ 667–13.

Figure JJ 667–13: Ground Wire Installation



CAUTION Failure could occur if the components are not properly bonded and grounded.

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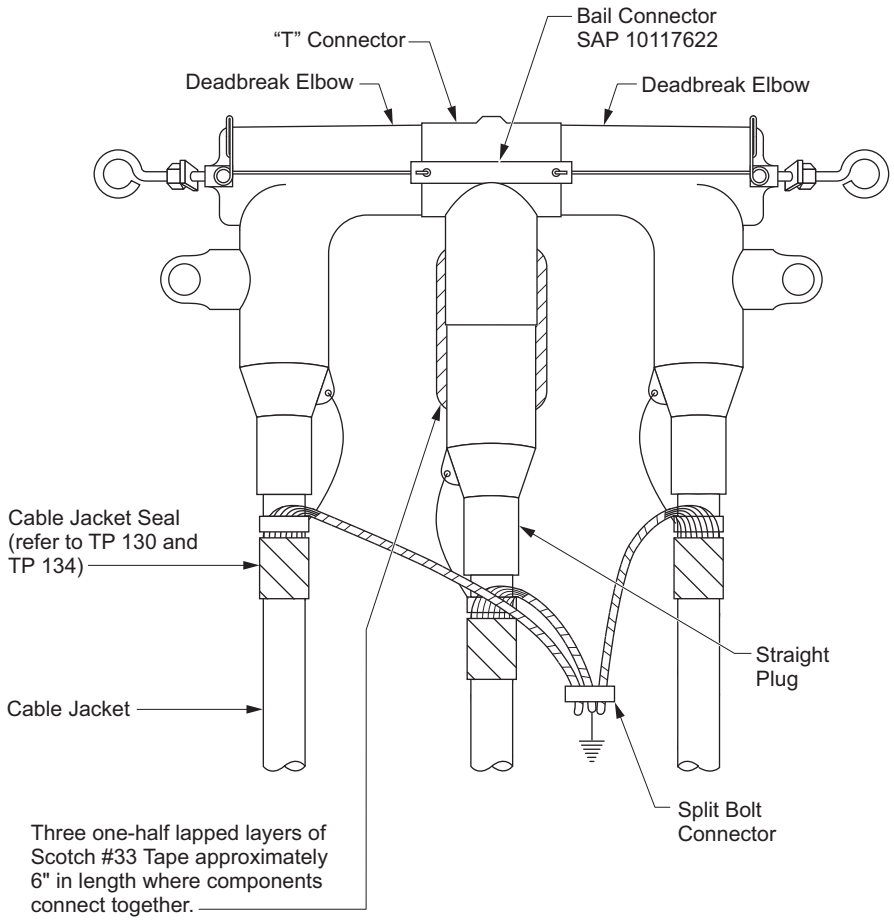
JJ 670 "T" Splice — 5–16 kV — #2–1/0 — Elastimold (ESNA)

Scope JJ 670.1 "T" Splice 5–16 kV, Single-Conductor Polyethylene Insulated Cable Premolded Rubber Components: "T", Straight Plug and Dead-Break Elbows

Figure JJ 670–1: "T" Splice — 5/16 kV — #2–1/0 AWG



Note(s):

1. The permanent "Y" splice is the preferred splice.

Table JJ 670–1: "T" Splice Components

Conductor Size	Insulation Thickness	SAP Number		
		Elbow	Straight Plug	"T" Connector
#2	220 mil	10118047	10118019	10117664
1/0	220 mil	10118050	10118018	10117664

= For Reference Only

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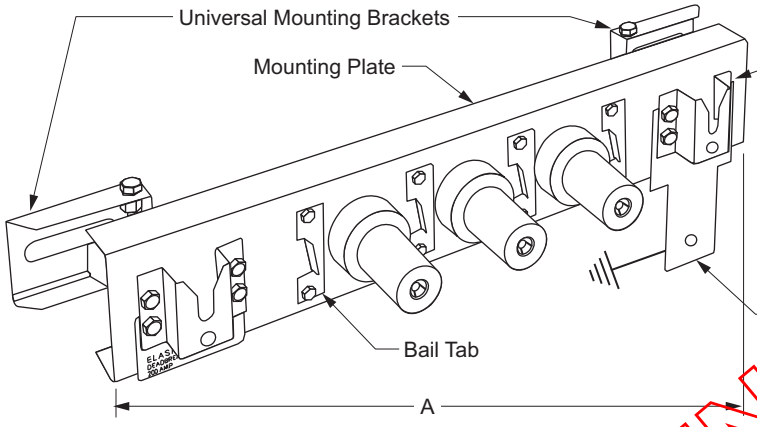
JJ 675 200 A Dead-Break Junctions

Scope JJ 675.1 Procedures for Installation of 3-Way and 4-Way 200 A Dead-Break Junctions

Figure JJ 675–1: Procedures for Installation of 3-Way and 4-Way 200 A Dead-Break Junctions



DEAD-BREAK JUNCTIONS	
200 Amp	**Material Code**
3-Way	655-62555
4-Way	655-00597

Figure JJ 675–1.1 (3-Way Shown)

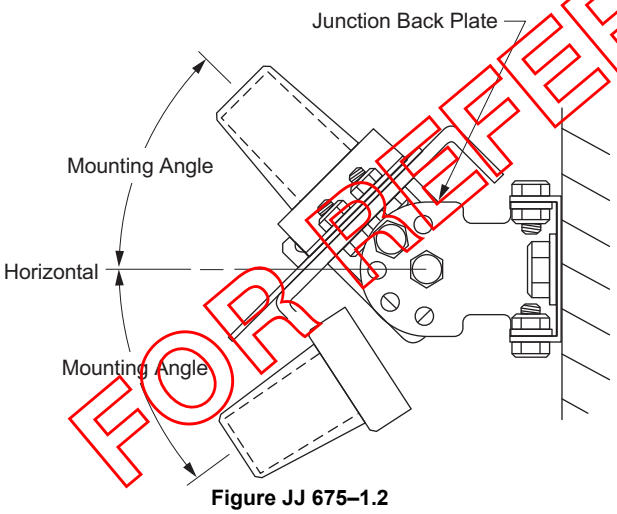


Figure JJ 675–1.2

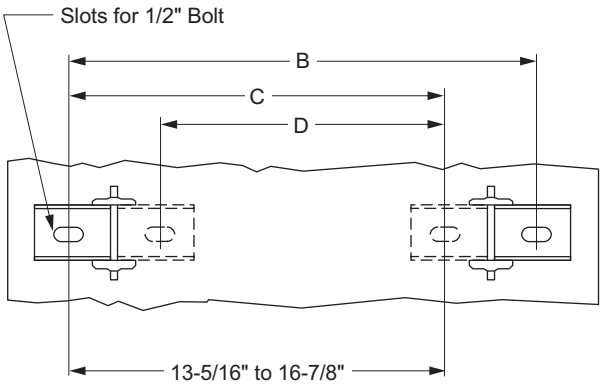


Figure JJ 675–1.3

FOR REFERENCE ONLY

Table JJ 675–1: Dead-Break Junction Dimensions

Dimensions	15/25 kV-Rated	
	3-Way	**4-Way**
A	18-1/4"	22-1/4"
B	12-3/8" to 17"	17-3/8" to 21"
C	11-1/2" to 13-5/16"	13-11/16" to 17-5/16"
D	6" to 9-5/8"	10" to 13-5/8"

1.0 Instructions

1.1 Assemble and attach universal mounting brackets to junction backplates. The mounting plate can be adjusted to a horizontal or angled position. (See Figure JJ 675–1.2 [Sheet 1]).

1.2 One or both of the mounting brackets can be reversed to change the distance required between bolt centers. (See Figure JJ 675–1.3 [Sheet 1]). The junction can also be adjusted for attachments to a curved or flat surface.

1.3 Attach to structure wall at slot locations with 1/2-inch wedge stud anchors as per RS 100.

1.4 The mounting plate must be solidly grounded. A hole in the copper grounding plate is provided for this purpose. (See Figure JJ 675–1.1 [Sheet 1]).

1.5 All premolded rubber 200 A components with grounding eyes shall be bonded to ground. It is recommended that a primary concentric neutral wire be used for grounding.

1.6 For older applications, where the existing universal mounting bracket is too short, an extended unviersal mounting bracket (M/C 655-03450) shall be used to increase the mounting length.

FOR REFERENCE ONLY

JJ 680 3-Way and 4-Way Load-break Junctions

Scope JJ 680.1 Installation of 3-Way and 4-Way 200 A 15 kV and 25 kV Rated Load-break Junctions

Table JJ 680–1: Load-Break Junction SAP Numbers

200A	15 kV-Rated		25 kV-Rated	
	with Bracket	without Bracket	with Bracket	without Bracket
3-Way	SAP 10117354	SAP 10117341	SAP 10117343	SAP 10117339
4-Way	SAP 10117344	SAP 10117340	SAP 10117342	SAP 10117364

Figure JJ 680–1: 3-Way and 4-Way Load-Break Junctions

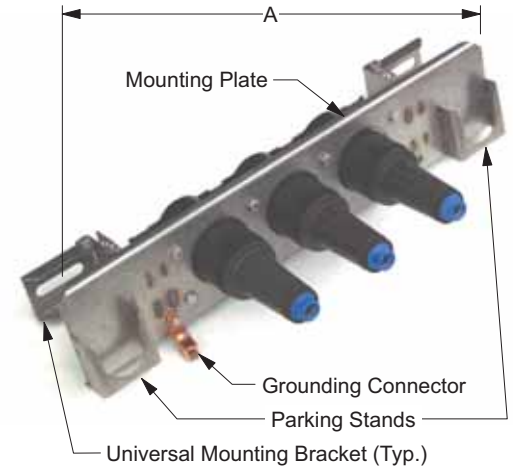


Figure JJ 680–1.1

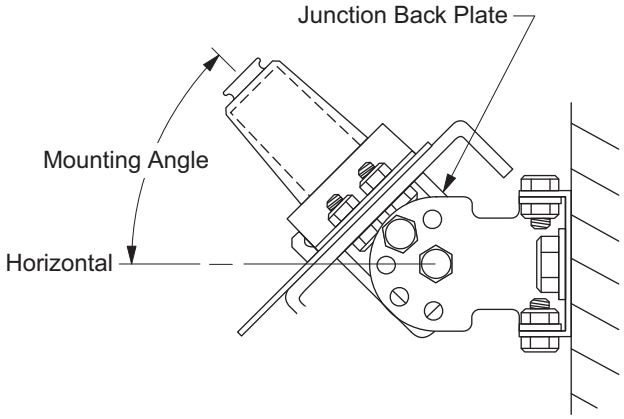


Figure JJ 680–1.2

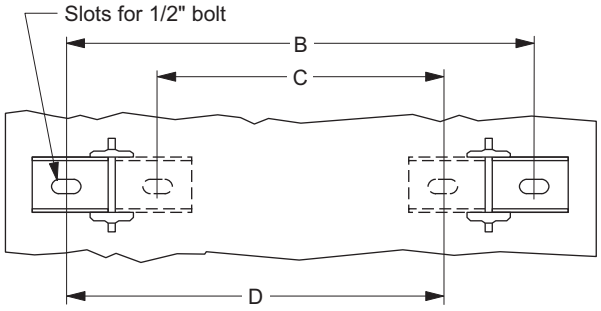


Figure JJ 680–1.3

Table JJ 680–2: Load-Break Junction Dimensions

Dimension	15 kV-Rated		25 kV-Rated	
	3-Way	4-Way	3-Way	4-Way
A	20-5/8"	23-3/4"	23"	27"
B	14" to 18-3/4"	17-7/8" to 21-7/8"	17-1/2" to 20-7/8"	21-1/2" to 24-7/8"
C	6-1/8" to 10-3/4"	9-1/8" to 13-7/8"	9-1/4" to 13-1/4"	13-1/4" to 17-1/4"
D	10" to 14-7/8"	13-3/8" to 17-7/8"	13-1/2" to 17-7/8"	17-1/2" to 21-1/8"

1.0 Instructions

1.1 Refer to Distribution Design Standards (DDS) for proper application and structure for junctions.

1.2 Assemble and attach universal mounting brackets to junction back plates. The mounting plate can be adjusted to a horizontal or angled position to facilitate operation of elbows from surface. See Figure JJ 680–1.2 (Sheet 1).

1.3 One or both of the mounting brackets can be reversed to change the distance required between bolt centers. See Figure JJ 680–1.3 (Sheet 1).

1.4 Attach to concrete (or RPM) structure wall at slot locations with 1/2 inch wedge stud anchors as per RS 100. If junction bars are mounted to wall bracket per DUG CW 401, wall bracket shall be attached to concrete structure wall at slot locations using 1/2-inch wedge stud anchors.

1.5 Attach to plastic (FRP) structure by bolting to manufacturer-installed inserts. Only 3-way junctions may be installed in plastic structures.

1.6 The mounting plate must be solidly grounded. A grounding connector is provided for this purpose. See Figure JJ 680–1.1 (Sheet 1).

1.7 All premolded rubber 200 A components with grounding eyes shall be bonded to ground. It is recommended a primary concentric neutral wire be utilized for grounding.

JJ 690 600A Dead-Break Junctions — 12/16-kV

Scope JJ 690.1 2-, 3-, and 4-Way 600A Dead-Break Junction — Elastimold

1.0 Installation

1.1 The 2-, 3-, and 4-way 600 A dead-break junctions are recommended for use in structures 5' X 8-1/2' and larger.

1.2 Mount junctions in a way which would avoid cables crossing over the same or other junction terminating positions, and/or junction parking stands. This mounting will allow access to each primary cable terminating component for voltage testing and grounding.

1.3 The junctions should normally be mounted in a horizontal position but may be mounted vertically. Alternatively, the junctions may be mounted on the stainles steel mounting bracket detailed in DUG CW 401.

Figure JJ 690–1: 2-, 3-, and 4-Way 600A Dead-Break Junction — Elastimold

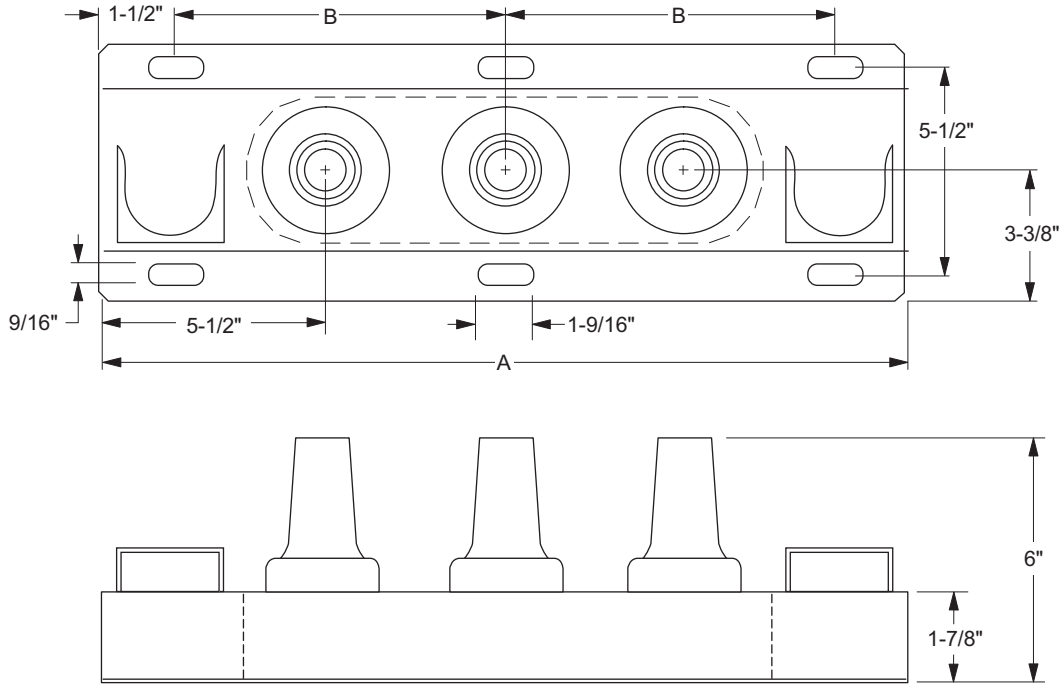


Table JJ 690–1: 2-, 3-, and 4-Way 600A Dead-Break Junction — Elastimold

Ways	SAP Number	"A" Dimension (in)	"B" Dimension (in)
2	10117335	15 ± 1/16	6 ± 1/16
3	10117331	19 ± 1/16	8 ± 1/16
4	10117334	23 ± 1/16	10 ± 1/16

2.0 Instructions

2.1 Determine the desired location of junction assembly on the structure wall. Using the base plate as a template, place the base plate on the surface that the junction is to be mounted and mark all slot locations. See Figure JJ 690–1.1 (Sheet 2).

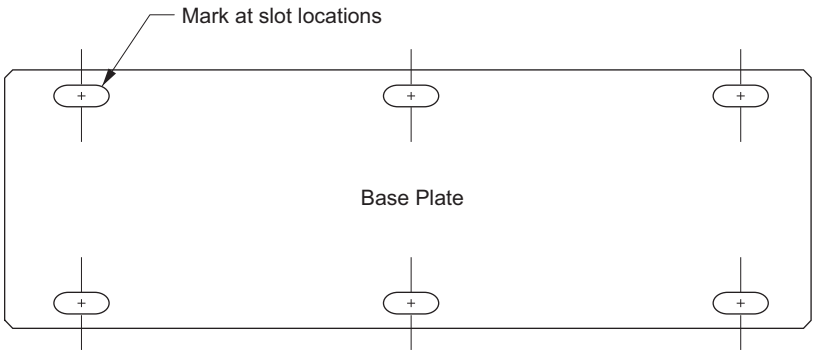


Figure JJ 690–1.1

2.2 Assemble dead-break junctions to base bracket assembly and base plate and attach securely to the structure wall at all slot locations with 1/2 inch wedge stud anchors as per RS 100 ensuring no movement during operation. See Figure JJ 690–1.2 (Sheet 2).

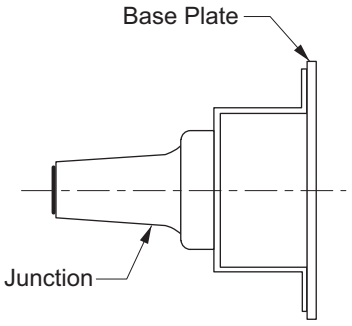


Figure JJ 690–1.2

2.3 Ground the junction assembly with #2 stranded bare copper. A grounding lug is provided on the base bracket for this purpose. See Figure JJ 690–1.3 (Sheet 2).

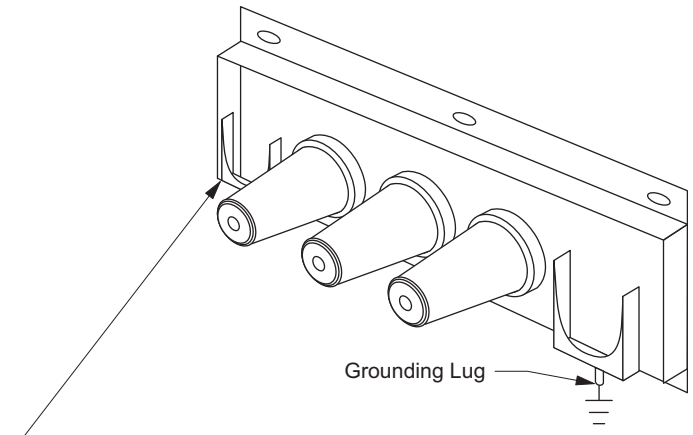


Figure JJ 690–1.3

Scope JJ 690.2 Instructions for the Installation of 2-, 3-, and 4-Way 600 A Dead-Break Junction — RTE

Figure JJ 690–2: 2-, 3-, and 4-Way 600 A Dead-Break Junction — RTE

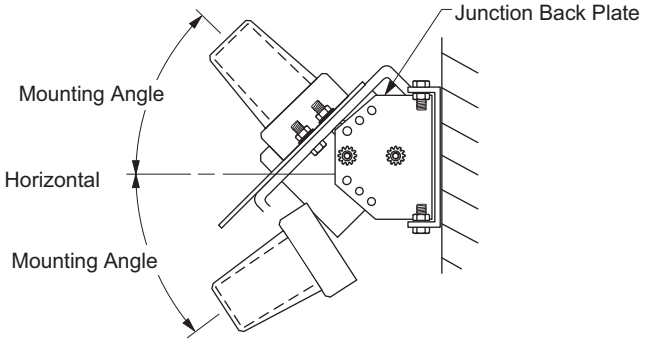


Figure JJ 690–2.1

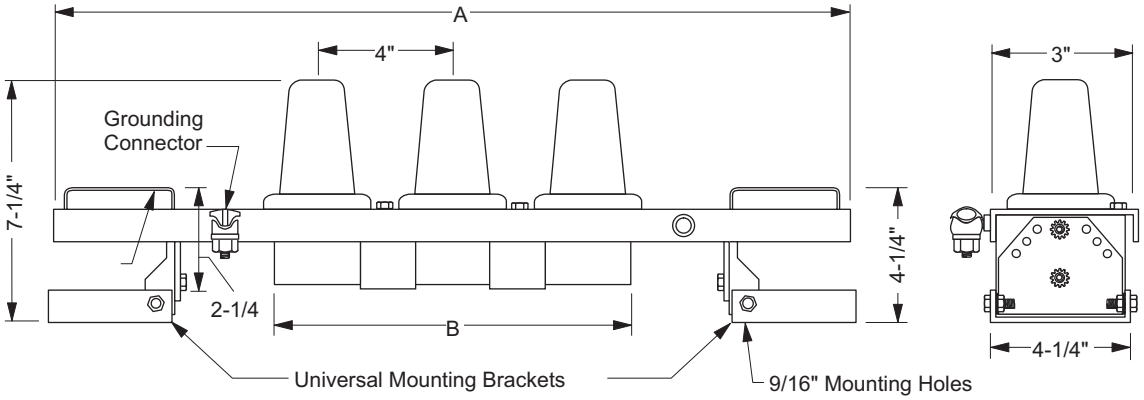


Figure JJ 690–2.2

Table JJ 690–2: 2-, 3-, and 4-Way 600 A Dead-Break Junction — RTE

Ways	SAP Number	"A" Dimension (in)	"B" Dimension (in)
2	10117335	14-1/4	6-3/4
3	10117331	23	10-3/4
4	10117334	27	14-3/4

1.0 Instructions

1.1 Attach universal mounting brackets to junction back plates as desired. The mounting back plate can be adjusted to a horizontal or angled position. See Figure JJ 690–2.1 (Sheet 3).

1.2 One or both of the mounting brackets can be reversed to change the distance required between mounting bolts. The junction can also be adjusted for attachments to a curved or flat surface.

1.3 Ground the junction assembly with #2 stranded bare copper. A grounding lug is provided on the junction for this purpose. See Figure JJ 690–2.2 (Sheet 3).

Note(s):
1. The 2-, 3-, and 4-way 600A dead-break junctions are recommended for use in structures 5' x 8-1/2' and larger.
2. Mount junctions in a way which would avoid cables crossing over the same or other junction terminating positions, and/or junction parking stands. This mounting will allow access to each primary cable terminating component for voltage testing and grounding.
3. The junctions should normally be mounted in a horizontal position but may be mounted vertically.
4. A parking stand adapter (SAP 10117394) is available for converting the parking stand to accept 200A dead-break grounding or insulating plugs.

JJ 700 Die Index for Al and Cu Compression Connectors for Underground Applications

Scope JJ 700.1 Cross Reference Die Index for Nontension Type Al and Cu Compression Connectors for Underground Applications

1.0 Instructions

1.1 Use circular crimps on all aluminum conductors. On smaller size conductors (#4-4/0) rotate the crimps. On larger size conductors (250-1,000 kcmil) no rotation is required.

1.2 When installing rubbermolded components use only the number of crimps specified on the standard.

1.3 When using insulated aluminum conductors for taped applications at 2.4 kV and above, use overlapping circular crimps.

1.4 These dies apply to all compression fittings, with the exception of aluminum connectors connected to service/secondary insulated bars for handhole and BURD transformers.

Table JJ 700–1: Dies – Circumferential (Al and Cu Conductors)

Dies — Circumferential (Al and Cu Conductors)				
Cable Size	Al Cable W/MD-6	Al Cable W/UT-15 W/Y-39	Cu Cable W/MD-6	Cu Cable W/UT-15 W/Y-39
6 str			W-161	
4 str	W-162 1/		2-161	
2 str	W-163 1/		2-161	
1/0 str	BG	15CA49R 2/		
2/0 str	W-245		2-241	
4/0 str	W-K840	15CA71R 2/	BG	15CA54R 2/
250 kcmil		15CA74R 2/		15CA60R 2/
300 kcmil		15CA96R 2/		
		15C96R 3/		
350 kcmil		15CA96R 2/		15CA71R 2/
		15C96R 3/		
500 kcmil		15C106R 3/		15CA87R 2/
750 kcmil		15C140R 3/		15C106R 3/
1,000 kcmil		15C161R 4/		

1/ Some connectors for #4 and #2 aluminum are manufactured to the same diameter as 1/0 connectors. These connectors are to be compressed with the “BG” die.
2/ Will fit UT-15 with adapter die SAP 10148852 and will fit Y-39 without adapter die.
3/ Will fit UT-15 without adapter die.
4/ An alternate die for 1,000 kcmil is 15C150R. Use 15C140R die on Elastimold 1,000 kcmil splice SAP10118110. SeeJJ 508.

Note(s):
1. Consult Scope JJ 700.2 (Sheet 2) and Scope JJ 700.3 (Sheet 4) for material code numbers of dies.
2. Decal GM-67 in die box shows dies for Hyplugs and so forth.

Scope JJ 700.2 Cross Reference Die Index for Nontension Type Al Compression Connectors for Underground Applications

Table JJ 700–2: Cross Reference Die Index for Nontension Type Al Compression Connectors for Underground Applications — Indent Type Compression

Conductor Aluminum Cable		Indent Type Compression			
		Y34A		Y48B	
		Nest	Indentor	Nest	Indentor
#4 str	Die No.	A1CD	Y34PA		
	SAP / M/C	861-22406	10148870		
#2 str	Die No.	A26D	6ERPA		
	SAP / M/C	861-22802	10148870		
1/0 str	Die No.	A27D	Y34PR-5		
	SAP / M/C	861-23206	10148871		
2/0 str	Die No.	A29D	Y34PR-5		
	SAP / M/C	861-23602	10148871		
4/0 str	Die No.	A31D	Y34PR-5		
	SAP / M/C	861-24006	10148871		
250 kcmil	Die No.				
	SAP / M/C				
300 kcmil	Die No.			C34D	Y48PR-1
	SAP / M/C			861-17604	10148873
350 kcmil	Die No.			C35D	Y48PR-1
	SAP / M/C			861-24601	10148873
500 kcmil	Die No.			C39D	Y48PR-1
	SAP / M/C			861-18404	10148873
700/750-kcmil	Die No.			C45D	Y48PR-1
	SAP / M/C			861-24709	10148873
1,000 kcmil	Die No.			C46D	Y48PR-1
	SAP / M/C			861-19600	10148873
1,500 kcmil	Die No.				
	SAP / M/C				
2,000 kcmil	Die No.				
	SAP / M/C				

Table JJ 700–3: Cross Reference Die Index for Nontension Type Al Compression Connectors for Underground Applications — Circumferential Type Compression

Conductor Aluminum Cable		Circumferential Type Compression						
		Y34A	Y35, Y39, and 12HA		Y48B	Y60	UT-15	MD-6[1/]
		Die Set	Die Set	Die Set	Die Set	Die Set	Die Set	Die Set
#4 str	Die No.		U-162					W-162-P
	SAP / M/C	851-65306						851-26100
#2 str	Die No.	A-163	U-163					W-163-X
	SAP / M/C	851-46009	10148876					851-26209
1/0 str	Die No.						15CA49R[2/]	W-BG
	SAP / M/C						851-57303	851-26019
2/0 str	Die No.		U-245					W-245
	SAP / M/C		851-66726					851-26282
4/0 str	Die No.			15CA71R			15CA71R[2/]	W-K840
	SAP / M/C			10148902			851-57709	851-26308
250 kcmil	Die No.	A-249	U-249	15CA74R			15CA74R[2/]	
	SAP / M/C	10148909	10148887	10148899			851-57402	
300 kcmil	Die No.			15CA96R[2/]			15C96R	
	SAP / M/C			10148796			851-57501	
350 kcmil	Die No.		U31ART	15CA96R[2/]			15C96R	
	SAP / M/C		10148891	10148796			851-57501	
500 kcmil	Die No.						15C106R	
	SAP / M/C						851-56909	
700/750-kcmil	Die No.				C39AR		15C140R	
	SAP / M/C				851-50001		851-57105	
1,000 kcmil	Die No.				C44AR		15C161R[3/]	
	SAP / M/C						851-57907	
	Die No.						15C150R	
	SAP / M/C				851-57006		851-57204	
1,500 kcmil	Die No.					L46ART		
	SAP / M/C					851-00238		
2,000 kcmil	Die No.					L489ART		
	SAP / M/C					851-50686		

= For Reference Only

1/ Has a fixed BG groove.
2/ Will fit in UT-15 with adapter die SAP 10148852.
3/ For Elastimold straight splice 1,000 kcmil Al (M/C 656-55102). Use die 15C140R. (See JJ 611).

Note(s):
1. Dark outline indicates standard dies.

Scope JJ 700.3 Cross Reference Die Index for Nontension Type Copper Compression Connectors for Underground Applications

Table JJ 700–4: Cross Reference Die Index for Nontension Type Copper Compression Connectors for Underground Applications — Indent Type Compression

Conductor Aluminum Cable		Indent Type Compression			
		Y34A		Y48B	
		Nest	Indentor	Nest	Indentor
#6 str	Die No.	A6CD	Y34PR		
	SAP	10148832	10148869		
#4 str	Die No.	A4CD	Y34PR		
	SAP	10148833	10148869		
#2 str	Die No.	A2CD	Y34PR		
	SAP	10148834	10148869		
1/0 str	Die No.	A25D	Y34PR		
	SAP	10148835	10148869		
2/0 str	Die No.	A26D	Y34PR		
	SAP	10148836	10148869		
4/0 str	Die No.	A28D	Y34PR		
	SAP	10148837	10148869		
250 kcmil	Die No.	A29D	A34PR	C29D	Y48PR
	SAP	10148838	10148869	10148841	10148872
300 kcmil	Die No.			C30D	Y48PR
	SAP / M/C			851-16804	10148872
350 kcmil	Die No.	A31D	Y34PR	C31D	Y48PR
	SAP	10148839	10148869	10148842	10148872
400 kcmil	Die No.				
	SAP				
500 kcmil	Die No.	A34D	Y34PR	C34D	Y48PR
	SAP	10148840	10148869	10148843	10148872
600 kcmil	Die No.			C36D	Y48PR
	SAP			10148844	10148872
750 kcmil	Die No.			C39D	Y48PR
	SAP			10148845	10148872
1,000 kcmil	Die No.			C44D	Y48PR
	SAP			10148846	10148872
1,250 kcmil	Die No.			C45D	Y48PR
	SAP			10148847	10148872
1,500 kcmil	Die No.			C46D	Y48PR
	SAP			10148848	10148872
1,750 kcmil	Die No.			C47D	Y48PR
	SAP				10148872
2,000 kcmil	Die No.			C48D	Y48PR
	SAP			10148849	10148872

Note(s):
1. Dark outline indicates standard dies.

Table JJ 700–5: Cross Reference Die Index for Nontension Type Cu Compression Connectors for Underground Applications — Circumferential Type Compression

Conductor Aluminum Cable		Circumferential Type Compression					
		Y34A	Y35, Y39, and 12HA			UT-15	MD-6
		Die Set	Die Set	Die Set	Die Set	Die Set	Die Set
#6 str	Die No.						W-161J
	SAP						10148858
#4 str	Die No.	A242	U242				W-161J
	SAP / M/C	851-53302	851-66692				10148858
#2 str	Die No.		U162				W-162P
	SAP		851-65306				10148861
1/0 str	Die No.	A163	U163	U25RT			W-163-X
	SAP / M/C	851-46009	10148876	851-47809			10148862
2/0 str	Die No.			U26RT	15CA45R	15CA45R[1/]	W-241
	SAP / M/C			851-48005	10148892	10148892	851-26290
4/0 str	Die No.	A243	A243	U28RT	15CA54R	15CA54R[1/]	W-BG[2/]
	SAP / M/C	851-53401	10148908	851-48500	10148893	851-56503	851-26019
250 kcmil	Die No.	A166	U166	U29RT	15CA60R	15CA60R[1/]	W-166
	SAP	10148874	10148878	851-48609	10148901	851-57600	10148863
300 kcmil	Die No.	A167	U167	U30RT			W-C
	SAP	10148879	10148879	851-48708			10148860
350 kcmil	Die No.	A168	U168	U31RT	15CA71R	15CA71R[1/]	
	SAP	10148875	10148880	10148891	10148902	851-57709	
400 kcmil	Die No.	A169	U169	U32RT			
	SAP / M/C	851-32108	851-34609	851-49300			
500 kcmil	Die No.			U34RT	15CA87R	15CA87R[1/]	
	SAP			10148888	10148894	851-56701	
600 kcmil	Die No.		U316				
	SAP		10148906				
750 kcmil	Die No.					16C106R	
	SAP					851-56909	
1,000 kcmil	Die No.						
	SAP						
1,250 kcmil	Die No.						
	SAP						
1,500 kcmil	Die No.						
	SAP						
1,750 kcmil	Die No.						
	SAP						
2,000 kcmil	Die No.						
	SAP						

= For Reference Only

[1/] Will fit in UT-15 adapter die SAP 10148852.
[2/] Has a fixed BG groove.

Note(s):
1. Dark outline indicates standard dies.

Scope JJ 700.4 Compression Connectors for 200 A Separable Connectors — Crimp Chart, Aluminum Compression Connectors

Table JJ 700–6: Compression Connectors for 200 A Separable Connectors

Cable	Conductor Type	Elastimold Crimp Connector			Burndy Die		No. of Presses	Total No. of Crimps
		Mfr. Part No. 02500XXX	SAP No.	O.D. (inches)	Mfr. Part No.	SAP No.		
#2 AWG	Compressed (XLP, JCN)	220	10117440	0.850	WBG[1/]	10148859	3	6
1/0 AWG		240	10117338	0.850	BG Nose[2/]	10148818	6	6

[1/] BG nose die makes 1 crimp per press
[2/] WBG die makes 2 crimps per press

Scope JJ 700.5 Compression Connectors for 600 A Separable Connectors — Crimp Chart, Aluminum Compression Connectors

Table JJ 700–7: Compression Connectors for 600 A Separable Connectors

Cable	Conductor Type	Elastimold Crimp Connector			Homac Die		No. of Crimps (See Note 2.)	Burndy Die		No. of Crimps (See Note 2.)
		Mfr. Part No. 03700XXX	SAP No.	O.D. (inches)	Mfr. Part No.	SAP No.		Mfr. Part No.	SAP No.	
#2 AWG	Compressed (XLP, JCN, 1/C PILC)	220	10117440	0.850	15CA71R	10148902	4	U28ART(298)	N/A	3
1/0 AWG		240	10117338	0.850	15CA71R	10148902	4	U28ART(298)	N/A	3
4/0 AWG		270	10117430	0.850	15CA66R	N/A	4	U28ART(298)	N/A	3
350 kcmil		300	10117650	1.152	15CA96R or 15CA94R	10148900	5	U31ART(299)	10148891	2
500 kcmil		330	10117532	1.320	15CA106R	10148895	4	U34ART(300)	10148774	4
750 kcmil		380	10117651	1.620	15CA125R	N/A	4	S39ART(301) or P39ART(301)	N/A	6 (See Note 1.)
1000 kcmil		410	10117652	1.840	15C150R	10148897	4	S44ART(302) or P44ART(302)	N/A	6 (See Note 1.)
1500 kcmil		470	10117393	2.250	N/A	N/A	N/A	C46ART(478) or L46AR(478)	10148788	2
1/0 AWG	Compact (EPR)	230	10117446	0.850	15CA71R	10148902	4	U28ART(298)	N/A	3
4/0 AWG		260	10117447	0.850	15CA71R	10148902	4	U28ART(298)	N/A	3
250 kcmil		270	10117430	0.850	15CA66R	N/A	4	U28ART(298)	N/A	3
350 kcmil		290	10117448	1.152	15CA96R or 15CA94R	10148900	5	U31ART(299)	10148891	2
500 kcmil		320	10117445	1.320	15C106R	10148995	6	U34ART(300)	10148774	4
750 kcmil		360	10117458	1.320	15C106R	10148995	6	U34ART(300)	10148774	4

Note(s):

1. Certain cable constructions may cause excessive conductor/connector growth. Check installation instructions for the acceptable “check dimension” range before crimping and after crimping.
2. Number of crimps (minimum) without overlapping.
3. Rotate each successive crimp 90° to prevent excessive distortion.
4. Wire brush bare aluminum conductor before inserting into conductor contact.
5. All dies contained in this document are recommended by Elastimold.
6. N/A = not available.
7. If there are burrs on the crimp connector after crimping, field craft personnel should smooth these edges with a file before inserting the crimp connector into an elbow.

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Protection Devices
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PD 100 Guidelines for Elimination of Ferroresonance

Scope PD 100.1 Signs for Ferroresonance

1.0 General

1.1 This construction standard identifies locations requiring ferroresonance signs.

1.2 A phenomenon, known as ferroresonance, can result when energizing or de-energizing one phase of primary cable and transformer that are connected in series and the primary cable capacitance is equal to or greater than the transformer's coil inductance. Ferroresonance can occur on transformers with phase-to-phase connected primaries or floating wye connected primaries when switched one phase at a time with no secondary load connected. Ferroresonance typically results in high primary phase to ground voltages and low energy capacitive current spikes accompanied by unusually loud transformer buzzing.

1.3 Ferroresonance is not a true resonance and will not produce high currents. Maximum current and energy are limited by the amount of charge the cable capacitance can store which is very small.

1.4 Despite the loud buzzing of transformers during ferroresonance, ferroresonance will not fail a distribution transformer with good insulation condition. However, the unusual operating conditions caused by ferroresonance can cause surge arresters to fail, and arcing when de-energizing with fuse cutouts, line taps, or load-break elbows. Also, in service transformers have unknown insulation condition and ferroresonant overvoltages could bring about failure of a weak transformer. For these reasons ferroresonance should be avoided. Refer to DOM Procedure TR-8 for identification of and operations in potentially ferroresonant situations.

2.0 Marking Ferroresonant Locations

2.1 Installations which require a gang switch for ferroresonance shall have a safety sign attached at points where single phase switching may occur. In addition, locations which do not require a switch but requires special switching sequence to avoid ferroresonance per DOM Standard TR-8, it should be clearly marked using a ferroresonance sign per this standard to assist crews switching in the future. The following should be signed:

A. Single-phase radials with less than three customers and more than 500 feet of cable from fuse cutouts or other single-phase means of isolating the radial. Sign any sectionalizing points.

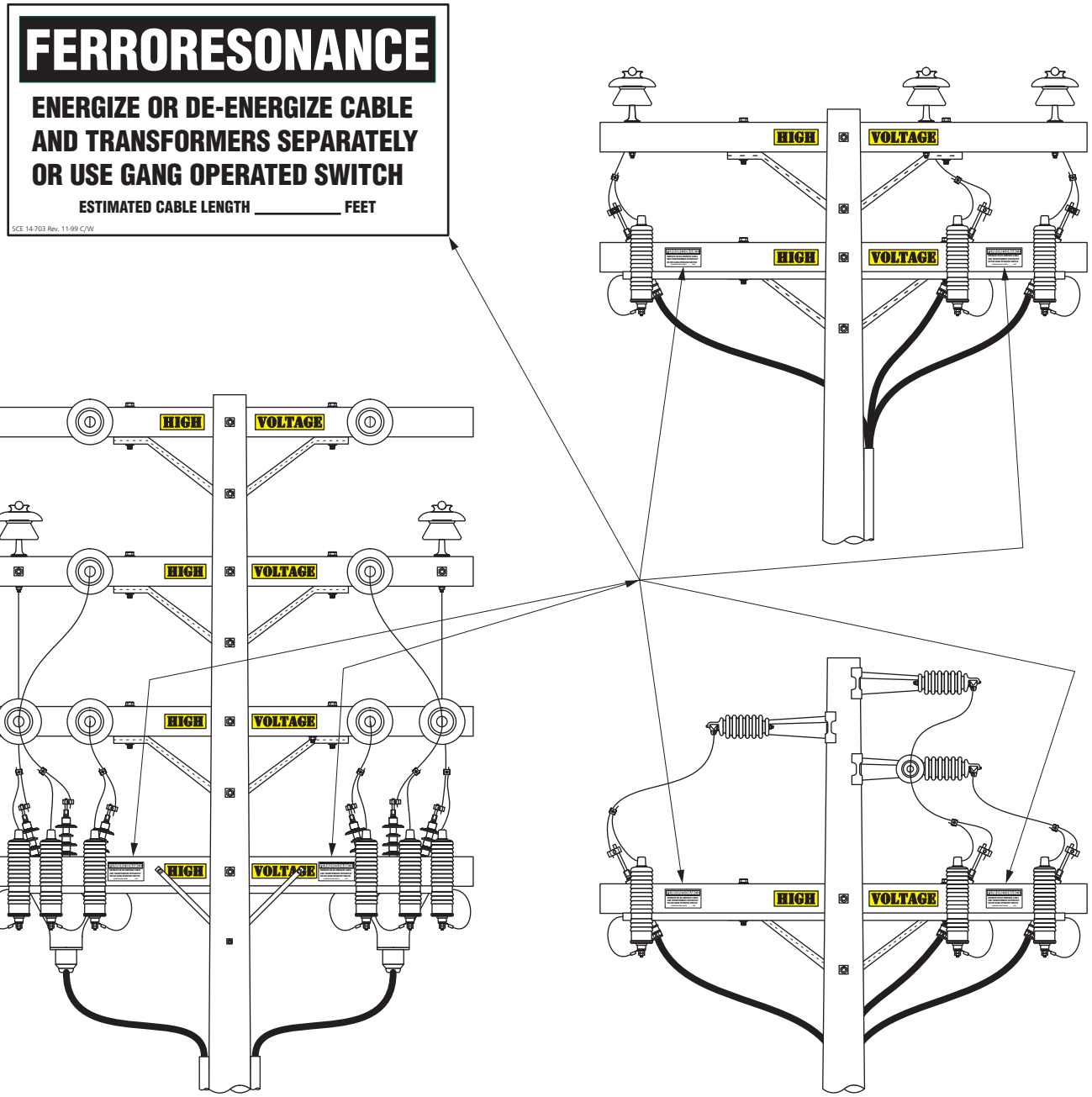
B. Commercial/Industrial (C/I) radials with live front pad-mounted transformers and which have cable lengths in excess of Table 1 (DOM, TR-8). Sign points where single-phase switching beyond Table 1 (DOM, TR-8) lengths may occur.

C. Other locations where single-phase switching may be done if customer load is present (except single phase radials which do not require a load check) should be signed and the estimated cable length beyond which would be sectionalized should be marked on the sign.

2.2 Signs should be located at dips on both sides of the pothead or fuseholder arm so as to be easily seen by anyone attempting to sectionalize at this point. If surface operable load-break junctions may be use to sectionalize C/I load it should have signs placed above the J-bar clearly visible by an operator. Plastic sign for overhead application is SAP 10135500. Sticker for cabinet application is SCE 14-703.

Scope PD 100.2 Suggested Location of Ferroresonance Safety Instruction Signs

Figure PD 100–1: Suggested Location of Ferroresonance Safety Instruction Signs



Note(s):

1. The ferroresonance signs shall be placed at the riser pole on both sides of the pothead arm (or the fuseholder arm where the pothead arm is not available) so that they will be seen by anyone who attempts to energize or de-energize a potentially ferroresonant system one phase at a time.

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PD 200 Fuse Tables 2,400 V/4,160 V Grounded Neutral

Scope PD 200.1 Table of Fuse Ratings for Transformers Connected to 2,400 V/4,160V 4-Wire Grounded Neutral Systems

Figure PD 200–1: G.E. "Universal" Fuse Link

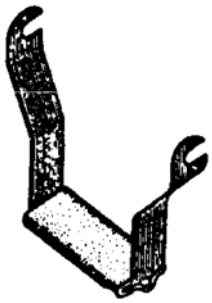
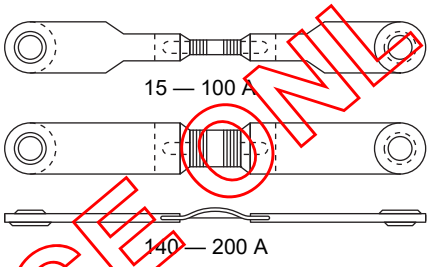


Figure PD 200–2: G&W — "FL" Type



FOR REFERENCE ONLY

Table PD 200–1: Fuse Ratings for Transformers Connected to 2,400 V/4,160 V 4-Wire Grounded Neutral Systems

Fuses for 2,400V 1Ø Transformers			
Trans Size	Full Load Amp	Fuse Size G.E.	Fuse Size G&W
10	4.2	6	6
15	6.3	10	8
25	10.4	20	12
37.5	15.7	25	20
50	21	30	25
75	31	50	40
100	42	65	50
167	70	125	100
250	104	150	140

Fuses for 4,160V 3Ø Transformers			
Trans Bank Size	Full Load Amp	Fuse Size G.E.	Fuse Size G&W
9	1.25	6	3
15	2.1	6	3
30	4.2	6	6
45	6.3	10	8
75	10.4	20	12
112.5	15.6	25	20
150	20.8	30	25
225	31.2	50	40
300	41.7	65	50
500	69.5	125	100

Fuse Ratings for 2.4 kV Constant Current Transformers		
Trans Size kW	Fuse Size G.E.	Fuse Size G&W
10	20	12
15	25	20
20	30	25
25	50	40
30	50	40

G.E. "Universal Type"			G&W Type "FL"		
Size	Catalog No.	Material Code	Size	Catalog No.	Material Code
6	9F57CAA006	570-75103	3	FL3	570-70203
10	9F57CAA010	570-75202	6	FL6	570-70401
20	9F57CAA020	570-75509	8	FL8	570-70609
25	9F57CAA025	570-75400	12	FL12	570-71003
30	9F57CAA030	570-75707	20	FL20	570-71409
50	9F57CAA050	570-75806	25	FL25	570-71607
65	9F57CAA065	570-76002	40	FL40	570-72001
125	9F57CAA125	570-76705	50	FL50	570-72209
150	9F57CAA150	570-76903	100	FL100	570-72605
			140	FL140	570-72803

Note(s):
1. Fuse links located in oil fuse cutout.

FOR REFERENCE ONLY

PD 205 Fuse Tables — 12/16 kV Type "SM" Refill Units

Scope PD 205.1 Fuse Ratings — 12/16 kV Type "SM" Refill Units or SMU-20 Fuses

Table PD 205–1: Three 1-Phase Transformers — Fusing

kVA	12 kV		16 kV	
Transformer Size	Full Load (Amp)	Fuse Rating	Full Load (Amp)	Fuse Rating
3-50	7.2	15E	5.4	15E
3-100	14.4	30E	10.8	25E
3-167	24.0	50E	18.0	40E
3-250	36.0	80E	27.0	65E
3-333	48.0	100E	36.0	80E
Refer to Field Engineering for fusing larger transformer sizes.				

Table PD 205–2: One 1-Phase Transformer — Fusing

kVA	12 kV		16 kV	
Transformer Size	Full Load (Amp)	Fuse Rating	Full Load (Amp)	Fuse Rating
50	4.2	10E or 10K[a/]	3.1	10E or 10K[a/]
100	8.3	25E	6.2	15E
167	14.0	30E	10.4	25E
250	21.0	50E	15.5	40E
333	28.0	65E	20.8	50E
Refer to Field Engineering for fusing larger transformer sizes.				

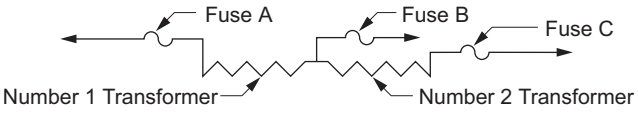
[a/] 10E for SM fuse. 10K for SMU-20 fuse.

Table PD 205–3: Open Delta Single-Phase Transformers — Fusing

kVA Size		12 kV		16 kV	
Number 1	Number 2	Fuse A	Fuse B or C	Fuse A	Fuse B or C
50	50	10E or 10K[a/]	10E or 10K[a/]	10E or 10K[a/]	10E or 10K[a/]
50	100	10E or 10K[a/]	25E	10E or 10K[a/]	15E
50	167	10E or 10K[a/]	30E	10E or 10K[a/]	25E
50	250	10E or 10K[a/]	50E	10E or 10 K[a/]	40E
100	100	25E	25E	15E	15E
100	167	25E	30E	15E	25E
100	250	25E	50E	15E	40E
100	333	25E	65E	15E	50E
167	167	30E	30E	25E	25E
167	250	30E	50E	25E	40E
167	333	30E	65E	25E	50E
250	250	50E	50E	40E	40E
250	333	50E	65E	40E	50E

[a/] 10E for SM fuse. 10K for SMU-20 fuse.

Figure PD 205–1: Open Delta Single-Phase Transformer Fuse Positions



Note(s):
1. For use with S&C Type SM 15 kV metal-clad power fuse units.
2. Material code numbers for SM-4/SM-5 refill units or SMU-20 fuses. See Table PD 205–4 (Sheet 3).

Scope PD 205.2 SAP Numbers for SM-4/SM-5 Refill Units and SMU-20 Fuses Listed in PD 205 Fusing Tables

Table PD 205–4: SAP Numbers for SM-4/SM-5 Refill Units and SMU-20 Fuses Listed in PD 205 Fusing Tables

Fuse Size	SM-4[a/]	SM-5	SMU-20
10E	10109006	10109032	—
10K	—	—	10108798
15E	10109014	10109042	10108800
25E	10109016	10109044	10108802
30E	10108988	10109045	10108807
40E	10109017	10109046	10108808
50E	10109018	10109047	10108813
65E	10109019	10109048	10108814
80E	10109020	10109049	10108815
100E	10109021	10109050	10108816
125E	10109022	10109051	10108817
150E	10109023	10109052	10108818
175E	10109024	10109053	10108804
175E[b/]	—	—	10108429
200E	10109025	10109054	10108803
200E[b/]	—	—	10108805
210[c/]	10109026	—	—
250E	—	10109055	—
300E	—	10109056	—
400E	—	10109057	—
410[c/]	—	10109059	—
420[c/]	—	10109061	—

[a/] SM-4 not for new design. Replacement fuses for existing SM-4 holder applications only.
[b/] Very slow speed.
[c/] Coordinating speed.

Note(s):
1. For 1500 kVA and above, coordinate with Field Engineering.

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PD 210 Current-Limiting Fuse Tables 6.9/9.4 kV and 12/16 kV, 1Ø and 3Ø Transformers

Scope PD 210.1 Current-Limiting Fuse Tables for 12/16 kV, 1Ø BURD Transformers, Pad Mounts, 3Ø Pad-Mounted Transformers, or Three 1Ø BURDs

Figure PD 210–1: 12/16 kV Current-Limiting Fuse

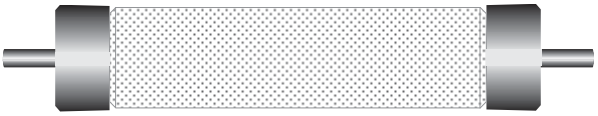


Table PD 210–1: 12 kV Transformer (Current-Limiting) Fusing

Trans Size	kVA	Single Phase					Three Phase						
		25	50	75	100		75	150	225	300	500	750	1,000
Fuse Size		6	10	18	20		10	18	25	30	50	2-40	2-50

Table PD 210–2: 16 kV Transformer (Current-Limiting) Fusing

Trans Size	kVA	Single Phase					Three Phase						
		25	50	75	100		75	150	225	300	500	750	1,000
Fuse Size		6	8	10	12		8	12	20	25	40	2-30	2-40

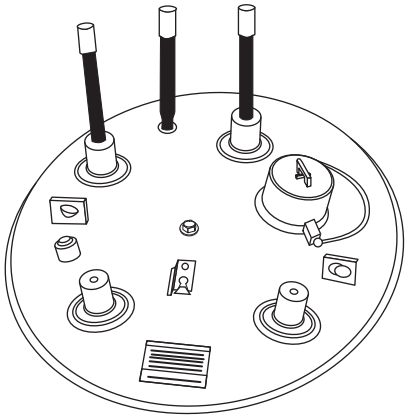
Table PD 210–3: Current-Limiting Fuse Table

Fuse Size	SAP Numbers for 15.5 kV Fuses
6	10108852
8	10108653
10	10108853
12	10108854
18	10108855
20	10108654
25	10108856
30	10108655
40	10108857
50	10108398

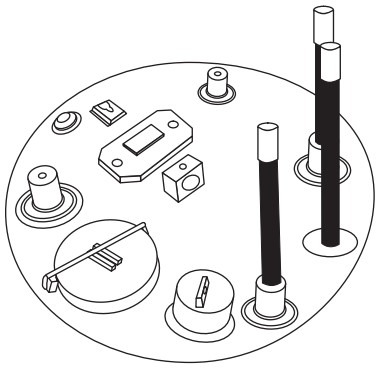
Note(s):
1. For Bay-O-Net fuse selection, refer to the Distribution Operations and Maintenance Policies and Procedures (DOM) Manual, TR-2.

Scope PD 210.2 Current-Limiting Fuses for 6.9 kV and 9.4 kV BURD Transformers

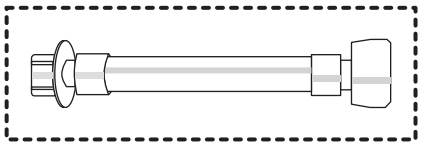
Figure PD 210–2: Current-Limiting Fuses for 6.9 kV and 9.4 kV BURD Transformers



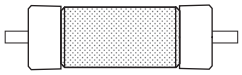
Type I Transformer
(Fuse and Switch Combined)



Type II Transformer
(Fuse and Switch Separate)



Type I Fuse
(Obsolete)



Type II Fuse

Table PD 210–4: Current-Limiting Fuses for 6.9 kV and 9.5 kV BURD Transformers

Application	6.9 kV				9.4 kV			
Transformer kVA	25	50	75	100	25	50	75	100
Fuse Size	12	15/18[a/]	25	30	8	12	15/18[a/]	25

[a/] Type I Transformers remaining in service will require replacement with Type II units when Type I fuse stock has been depleted.

Table PD 210–5: SAP Numbers for 8.3 kV Fuses

Fuse Size	Type I	Type II SAP Numbers
8	570-31601	10108847
12	570-31700	10108848
15	570-31809	–
18	–	10108849
25	570-31908	10108850
30	–	10108658

Note(s):
1. Type I Fuse stock depleted. Material Code for reference only.

= For Reference Only

PD 212 Fuse Tables — 6.9/9.4 kV and 12/16 kV Radial Laterals

Scope PD 212.1 Residential Pad-Mounted and BURD Systems Radial Lateral Fusing Tables

1.0 4-Wire (6.9/9.4 kV) Radial Laterals

1.1 Fuses for Fused BURD Switches, Fused Pad-Mounted Oil Switch, and Load-Break Fuse Cabinet (LBFC).

Fuse Size[a/]	SAP	Total Transformer Capacity	
		6.9 kV	9.4 kV
2-40	10108851	25–375 kVA	25–500 kVA

[a/] 8.3 kV current-limiting fuses.

Fuses for Pad-Mounted Fuse Cabinet (PFC), and PMH/PME CL Cabinets

Fuse Size[a/]	SAP	Total Transformer Capacity	
		6.9 kV	9.4 kV
80E	10108815	25–375 kVA	25–500 kVA
2-40	10108857		

[a/] 80E 14.4 kV SMU-20. Use 2-40 A, 15.5 kV CL fuses for fault duties above 10,000 A.

Pole-Mounted Fuses for Underground Dips (SMD-20 Fuseholder, SAP 10107506)

Fuse Size[a/]	SAP	Total Transformer Capacity	
		6.9 kV	9.4 kV
80E	10108815	25–375 kVA	25–500 kVA
80	10108474		

[a/] 80E 14.4 kV SMU-20. Use 80 A, X-Limiter CL fuses for fault duties above 10,000 A.

2.0 3-Wire (12/16 kV) Radial Laterals

2.1 Three-wire systems shall be installed only when it is not economical to install the neutral, or 16–9.4 kV or 12–6.9 kV step-down transformers. Check for possible ferroresonance condition before operating single blade fusing. See PD 100.

Fuses for Fused BURD Switches and Fused Pad-Mounted Oil Switch

Fuse Size[a/]	SAP	Total Transformer Capacity	
		12 kV	16 kV
40	10108857	25–325 kVA	25–450 kVA

[a/] 15.5 kV current-limiting fuses.

Fuses for PMH/PME CL Cabinets

Fuse Size[a/]	SAP	Total Transformer Capacity	
		12 kV	16 kV
80E	10108815	25–400 kVA	25–500 kVA
2-40	10108857		

a/ 80E 14.4 kV SMU-20. Use 2-40 A, 15.5 kV CL fuses for fault duties above 10,000 A.

Pole-Mounted Fuses for Underground Dips (SMD-20 Fuseholder, SAP 10107506)

Fuse Size[a/]	SAP	Total Transformer Capacity	
		12 kV	16 kV
80E	10108815	25–400 kVA	25–500 kVA
80	10108474		

a/ 80E 14.4 kV SMU-20. Use 80 A, X-Limiter CL fuses for fault duties above 10,000 A.

PD 215 Fuse Tables for 12/16 kV 3Ø Subsurface Transformer

Scope PD 215.1 3Ø Subsurface Transformers

Figure PD 215–1: Typical Subsurface Transformers

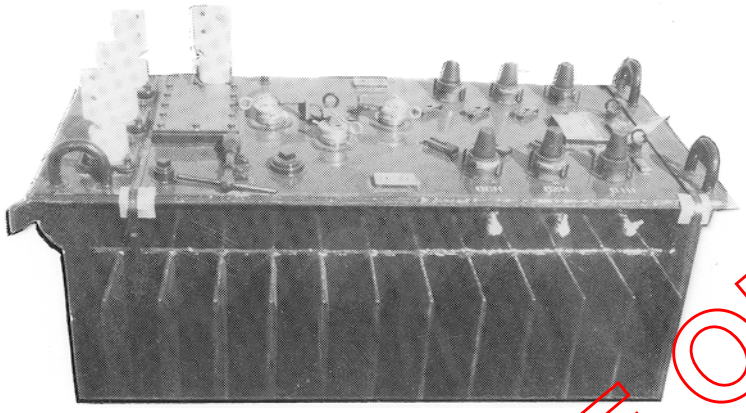


Figure PD 215–1.1: Typical Subsurface Transformer

FOR REFERENCE ONLY

Table PD 215–1: 12/16-kV 3Ø Subsurface Transformer — Fusing

12 kV Transformer Fusing								16 kV Transformer Fusing					
Xfrm Size	kVA	150	225	300	500	750	1,000	150	225	300	500	750	1,000
Fuse Size	Amp	18	25	30	50	2-40	2-50	12	20	25	40	2-30	2-40

Table PD 215–2: 12/16-kV 3Ø Subsurface Transformer — Fusing Table

Fuse Size	Material Code
12	570-32609
18	570-32708
20	570-02826
25	570-33003
30	570-02834
40	570-33300
50	570-00275

Table PD 215–3: 12/16-kV 3Ø Subsurface Transformer — Fusing Table

Fuse Size	Material Code
12	570-32609
18	570-32708
20	570-02826
25	570-33003
30	570-02834
40	570-33300
50	570-00275

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PD 217 Fuse Tables for 12/16-kV 3Ø Closed Delta Banks

Scope PD 217.1 Fuse Tables for 12/16-kV 3Ø Closed Delta Banks

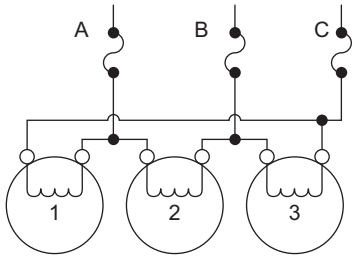
Fuse table for 12- and 16-kV closed delta banks with unequal transformer size 1-phase units, to serve combination 1-phase and 3-phase load.

Table PD 217–1: Modified, Subway, or Nonfused BURD Transformers

Transformer kVA			Normal Fuse Rating (Amp)[a/]			
			12 kV		16 kV	
1	2	3	A or B	C	A or B	C
25	50	25	12	8	10	6
25	75	25	18	8	12	6
25	100	25	20	8	18	6
50	75	50	20	18	18	12
50	100	50	25	18	18	12
75	100	75	30	25	20	18
100	167	100	40	30	30	25
100	250	100	50	30	40	25
167	250	167	50	50	50	40
167	333	167	50	50	50	40

[a/] Current-limiting fuses are 15.5 kV units. Installed in 3-pole fused BURD switches or in current-limiting fuse cabinets.

Figure PD 217–1: Transformer Fuse Positions



Note(s):

1. This type of bank should not be intentionally loaded over 100 percent for 1Ø loads. Consider the 3Ø rating as a bank of the smaller units. The 1Ø rating is to be taken as the difference between the large transformer and one of the smaller ones.
2. Do not use fused BURD transformers in closed delta banks.

Table PD 217–2: Fuse Table

Fuse Size[a/]	SAP Number
6	10108852
8	10108653
10	10108853
12	10108854
18	10108855
20	10108654
25	10108856
30	10108655
40	10108857
50	10108398

[a/] 15.5 kV Current-Limiting Fuses

PD 218 Fuse Tables for Bay-O-Net Fuse Links for 1Ø and 3Ø Pad-Mounted Transformers

Scope PD 218.1 Fuse Tables for Bay-O-Net Fuse Links for 1Ø and 3Ø Pad-Mounted Transformers

Table PD 218–1: Bay-O-Net Fuse Links for 2.4 kV, 1Ø Pad-Mounted Transformers

2.4 kV	Transformer Rating	Fuse Link Size/Type	Fuse Link Inscription	SAP Number
1-Phase	25 kVA	25 A/Current Sensing	RTE-353C10	10108458
	50 kVA	40 A/Current Sensing	RTE-353C12	10108459
	75 kVA	65 A/Current Sensing	RTE-353C14	10108495
	100 kVA	100 A/Current Sensing	RTE-353C16	10108497
	167 kVA	140 A/Current Sensing	RTE-353C17	10108496

Table PD 218–2: Bay-O-Net Fuse Links for 4.16 kV, 1Ø and 3Ø Pad-Mounted Transformers

4.16 kV	Transformer Rating	Fuse Link Size/Type	Fuse Link Inscription	SAP Number
1-Phase	25 kVA	15 A/Current Sensing	RTE-353C08	10108457
	50 kVA	25 A/Current Sensing	RTE-353C10	10108458
	75 kVA	40 A/Current Sensing	RTE-353C12	10108459
	100 kVA	40 A/Current Sensing	RTE-353C12	10108459
	167 kVA	100 A/Current Sensing	RTE-353C16	10108497
3-Phase	45 kVA	15 A/Current Sensing	RTE-353C08	10108457
	75 kVA	25 A/Current Sensing	RTE-353C10	10108458
	150 kVA	40 A/Current Sensing	RTE-353C12	10108459
	225 kVA	65 A/Current Sensing	RTE-353C14	10108495
	300 kVA	100 A/Current Sensing	RTE-353C16	10108497
	500 kVA	140 A/Current Sensing	RTE-353C17	10108496

Table PD 218–3: Bay-O-Net Fuse Links for 6.9 kV, 1Ø Pad-Mounted Transformers

6.9 kV	Transformer Rating	Fuse Link Size/Type	Fuse Link Inscription	SAP Number
1-Phase	25 kVA	15 A/Current Sensing	RTE-353C08	10108457
	50 kVA	25 A/Current Sensing	RTE-353C10	10108458
	75 kVA	25 A/Current Sensing	RTE-353C10	10108458
	100 kVA	40 A/Current Sensing	RTE-353C12	10108459
	167 kVA	40 A/Current Sensing	RTE-353C12	10108459

CAUTION

WARNING: DO NOT INTERCHANGE BON FUSE LINK SIZES. Bay-O-Net fuselinks were selected to coordinate with the non-field replaceable current-limiting fuse inside the transformer. Therefore, only the size and type specifically specified for the transformer rating shall be used

Table PD 218–4: Bay-O-Net Fuse Links for 9.4 kV, 1Ø Pad-Mounted Transformers

9.4 kV	Transformer Rating	Fuse Link Size/Type	Fuse Link Inscription	SAP Number
1-Phase	25 kVA	10 A/Current Sensing	RTE-353C06	10108456
	50 kVA	15 A/Current Sensing	RTE-353C08	10108457
	75 kVA	25 A/Current Sensing	RTE-353C10	10108458
	100 kVA	25 A/Current Sensing	RTE-353C10	10108458
	167 kVA	40 A/Current Sensing	RTE-353C12	10108459

Table PD 218–5: Bay-O-Net Fuse Links for 12 kV, 1Ø and 3Ø Pad-Mounted Transformers

12 kV	Transformer Rating	Fuse Link Size/Type	Fuse Link Inscription	SAP Number
1-Phase	25 kVA	6 A/Current Sensing	RTE-353C04	10108455
	50 kVA	15 A/Current Sensing	RTE-353C08	10108457
	75 kVA	15 A/Current Sensing	RTE-353C08	10108457
	100 kVA	25 A/Current Sensing	RTE-353C10	10108458
	167 kVA	25 A/Current Sensing	RTE-353C10	10108458
3-Phase	45 kVA	6 A/Current Sensing	RTE-353C04	10108455
	75 kVA	10 A/Current Sensing	RTE-353C06	10108456
	150 kVA	25 A/Dual Sensing	RTE-358C10	10108625
	225 kVA	25 A/Dual Sensing	RTE-358C10	10108625
	300 kVA	50 A/Dual Sensing	RTE-358C12	10108626
	500 kVA	50 A/Dual Sensing	RTE-358C12	10108626
	750 kVA	65 A/Dual Sensing	RTE-358C14	10108627
	1,000 kVA	65 A/Dual Sensing	RTE-358C14	10108627

Table PD 218–6: Bay-O-Net Fuse Links for 14.4 kV, 1Ø Pad-Mounted Transformers

14.4 kV	Transformer Rating	Fuse Link Size/Type	Fuse Link Inscription	SAP Number
1-Phase	25 kVA	6 A/Current Sensing	RTE-353C04	10108455
	50 kVA	10 A/Current Sensing	RTE-353C06	10108456
	75 kVA	15 A/Current Sensing	RTE-353C08	10108457
	100 kVA	15 A/Current Sensing	RTE-353C08	10108457
	167 kVA	25 A/Current Sensing	RTE-353C10	10108458

Table PD 218–7: Bay-O-Net Fuse Links for 16 kV, 1Ø and 3Ø Pad-Mounted Transformers

16 kV	Transformer Rating	Fuse Link Size/Type	Fuse Link Inscription	SAP Number
1-Phase	25 kVA	6 A/Current Sensing	RTE-353C04	10108455
	50 kVA	10 A/Current Sensing	RTE-353C06	10108456
	75 kVA	15 A/Current Sensing	RTE-353C08	10108457
	100 kVA	15 A/Current Sensing	RTE-353C08	10108457
	167 kVA	25 A/Current Sensing	RTE-353C10	10108458
3-Phase	45 kVA	6 A/Current Sensing	RTE-353C04	10108455
	75 kVA	10 A/Current Sensing	RTE-353C06	10108456
	150 kVA	15 A/Dual Sensing	RTE-358C08	10108592
	225 kVA	25 A/Dual Sensing	RTE-358C10	10108625
	300 kVA	25 A/Dual Sensing	RTE-358C10	10108625
	500 kVA	50 A/Dual Sensing	RTE-358C12	10108626
	750 kVA	50 A/Dual Sensing	RTE-358C12	10108626
	1,000 kVA	65 A/Dual Sensing	RTE-358C14	10108627

CAUTION

WARNING: DO NOT INTERCHANGE BON FUSE LINK SIZES. Bay-O-Net fuselinks were selected to coordinate with the non-field replaceable current-limiting fuse inside the transformer. Therefore, only the size and type specifically specified for the transformer rating shall be used

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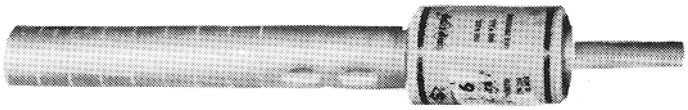
PD 220 Cable Protectors — 600 V

Scope PD 220.1 Cable Protectors — 600 V

Figure PD 220–1: Cable Protectors — 600 V



1.0 Application

Cable Protectors are to be used on single phase and three phase low voltage (or less) service cables in high-rise buildings when the service cables are furnished by the Edison Company.

2.0 Installation

2.1 Cable Protectors should be installed at each end of three or more parallel cables so that isolation of a faulted cable may be accomplished. See Figure PD 220–2 (Sheet 1).

2.2 Cable Protectors should be installed at only the source end when there is only one cable or no more than two paralleled cables. See Figure PD 220–3 (Sheet 1).

Figure PD 220–2: Cable Protector — 600 V Sketch 1

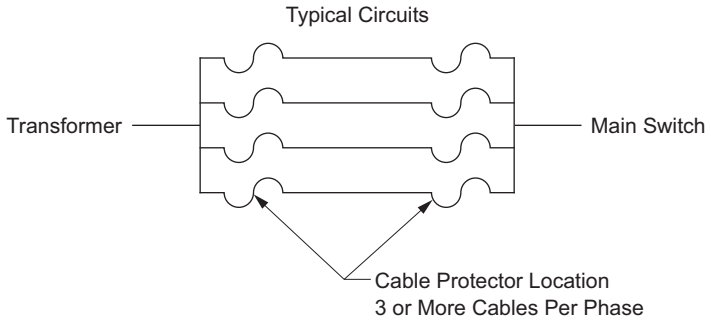


Figure PD 220–3: Cable Protector — 600 V Sketch 2

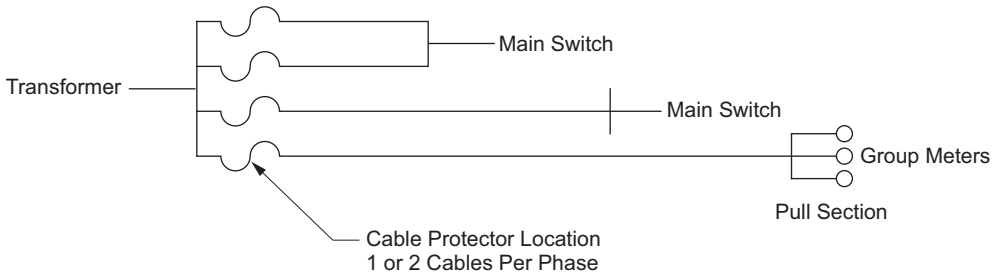


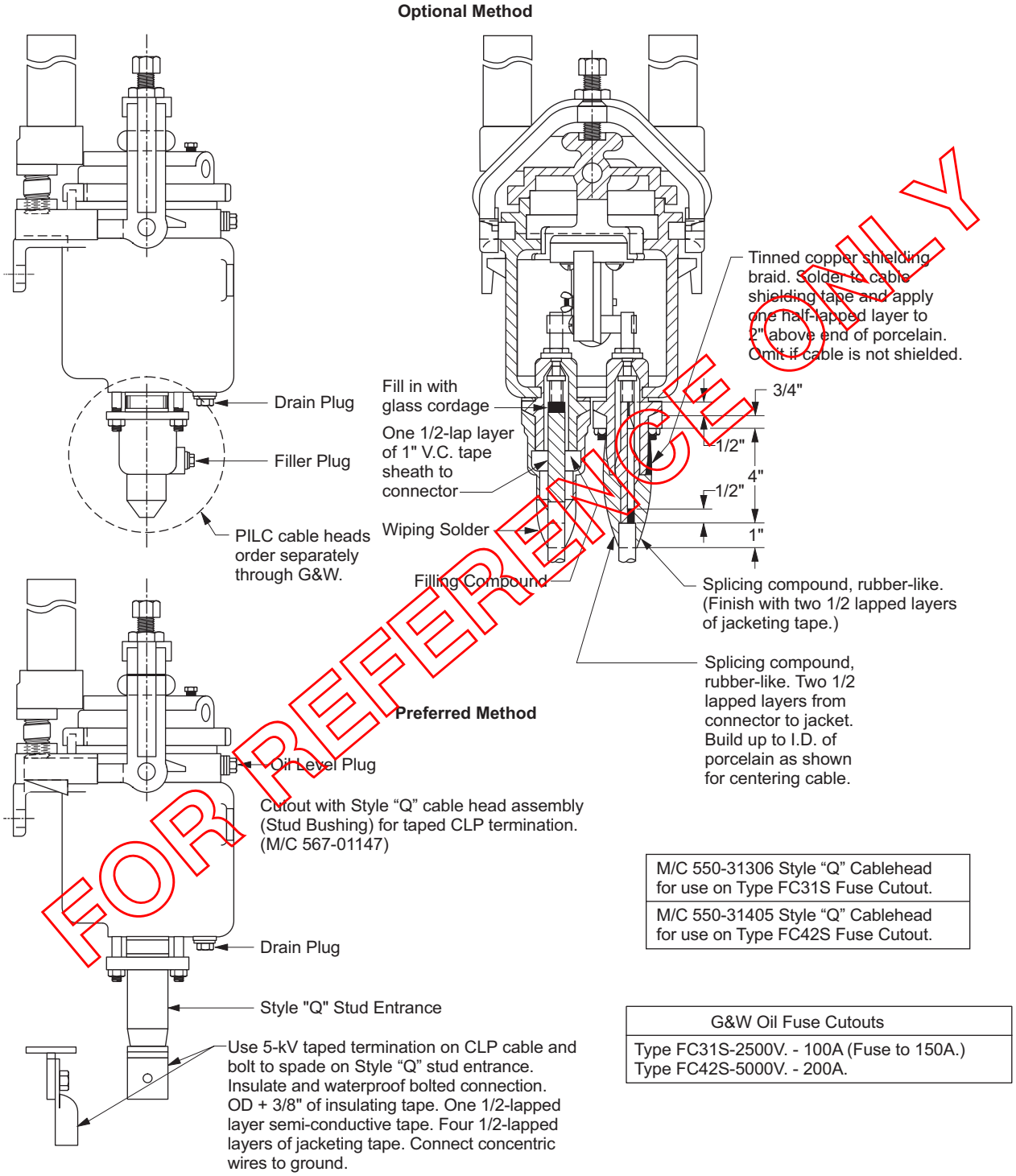
Table PD 220–1: Cable Protector — 600 V Data

Conductors Aluminum	Cable Protector Material Code	Installation Data			
		Circular Crimps per End			
		Y35 or 12HA		UT15	
		Die No.	No.	Die No.	No.
700 kcmil	655-70509	—	—	15C140R	3

PD 300 Subway Type Oil Fuse Cutout

Scope PD 300.1 PILC, Rubber-Like Cable and CLP Cable Termination

Figure PD 300–1: PILC, Rubber-Like Cable and CLP Cable Termination



M/C 550-31306 Style "Q" Cablehead for use on Type FC31S Fuse Cutout.
M/C 550-31405 Style "Q" Cablehead for use on Type FC42S Fuse Cutout.

G&W Oil Fuse Cutouts
Type FC31S-2500V. - 100A (Fuse to 150A.) Type FC42S-5000V. - 200A.

FOR REFERENCE ONLY

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PD 305 Replacement Equipment for Underground 4 kV Oil Fused Cutouts

Scope PD 305.1 Replacement Equipment for Underground 4 kV Oil Fused Cutouts

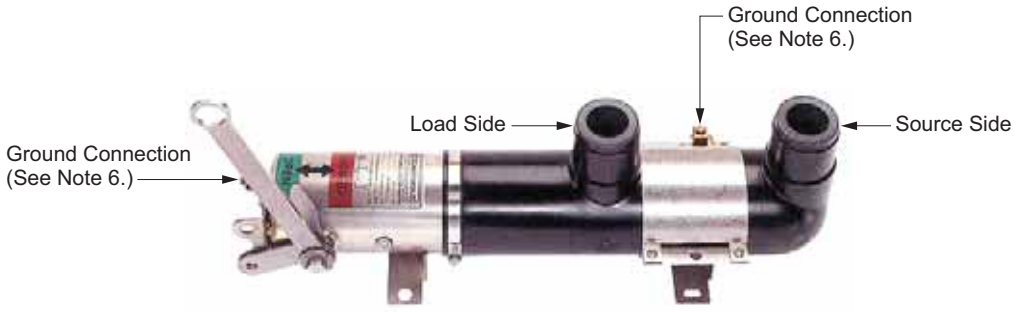
1.0 General

Existing 4 kV Oil Fuse Cutouts are no longer available and inventory of replacement fuse links are quickly being depleted. The replacement units to these obsolete Oil Fuse Cutouts consist of the Molded Vacuum Switch (MVS), Molded Canister Fuse (MCAN) for fusing requirements up to 80 Amps, and Molded Current-Limiting Fuse (MCLF) for 100-180 Amp applications. Current limiting fuses are applied in the MCAN and MCLF.

The replacement equipment is of dead-front construction, encapsulated with molded rubber that insulate, shield and eliminate any exposed live parts. They are compact, lightweight, sealed, submersible, and practically maintenance-free. Their modular construction and elbow connection via 200 Amp bushing wells accommodate wide varieties of mounting arrangements. The following switch and fusing equipment are the recommended replacement to the obsolete 4 kV Oil Fused Cutouts:

1. MVS - Molded Vacuum Switch: For all applications (Figure PD 305–1 [Sheet 1]).
2. MCAN - Molded Canister Fuse: For applications. ≤ 80 Amps (Figure PD 305–2 [Sheet 2]).
3. MCLF - Molded Current Limiting Fuse: For 100 -180 Amps applications (Figure PD 305–3 [Sheet 4]).

Figure PD 305–1: MVS Switch

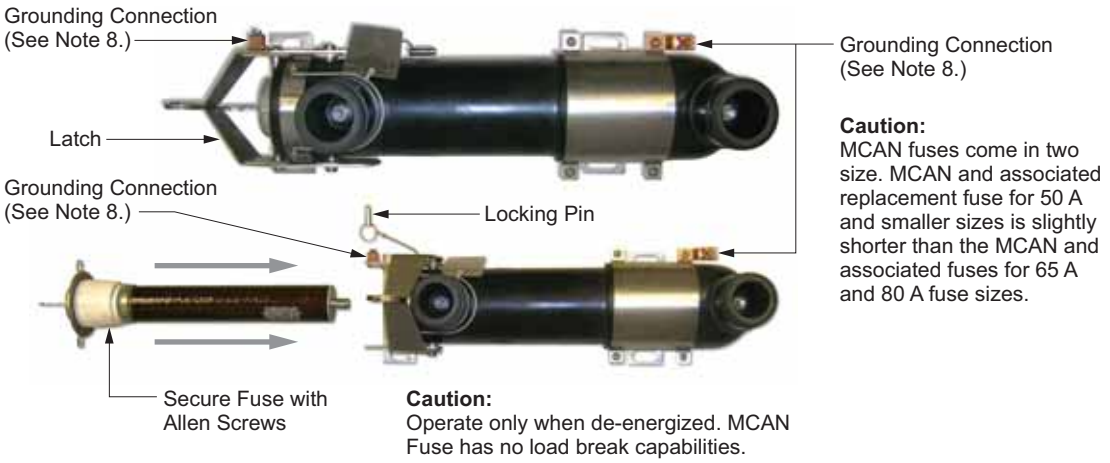


Note(s):
1. MVS switches are available in 1-Phase (shown above), 2-Phase and 3-Phase configurations.
2. It should be used in situations where loadbreak elbow operation is prohibited or in situations where gang operation of the switch is desired to prevent the creation of a ferroresonant condition.
3. The MVS switch can be mounted at convenient locations where switching and/or rigging can be performed easily and safely.
4. Connections to the MVS switches are made through the 200 Amp bushing wells. See DUG Section TP 140 for elbow installation with the paper-insulated, lead-covered (PILC) cable.
5. Alternately, in-line splice for transitioning from PILC to cross-linked polyethylene (CLP) cable can be made per DUG Section JJ 410. Standard elbow connection with the CLP cable can then be made to the 200-Amp bushing wells of the MVS per DUG Section TP 150.
6. Ground connection must be made on all provided ground lugs. For ground connection details refer to DUG GR 100.

Table PD 305–1: SAP Number for MVS Switch

MVS Switch	
Switch Type	**SAP Number**
1-Phase MVS	10106459
2-Phase MVS	10106492
3-Phase MVS	10106460

Figure PD 305–2: Molded Canister Fuse (MCAN) ≤ 80 Amps



Note(s):

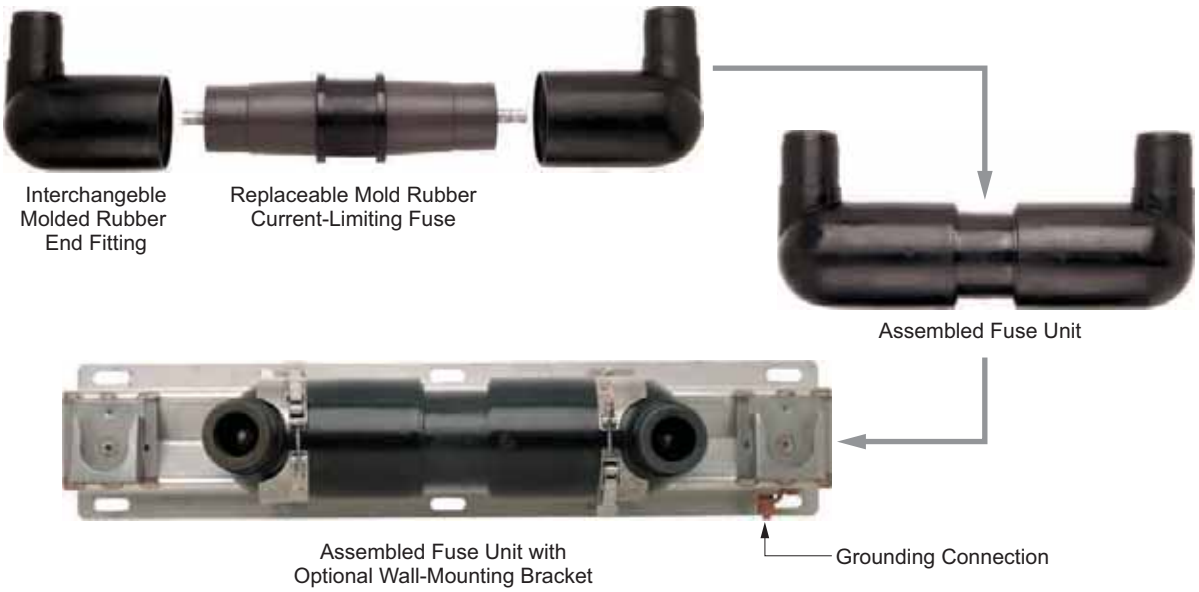
1. The MCAN fuse canisters are used in applications not exceeding 80 Amp fuse size.
2. Available in a 1-Phase configuration only.
3. Uses the common 8.3 kV underground current-limiting fuse.
4. Connections to the MCAN Fuse Canister are made through the 200 Amp bushing wells. See DUG Section TP 140 for elbow installation with the paper-insulated, lead-covered (PILC) cable.
5. Alternately, in-line splice for transitioning from PILC to cross-linked polyethylene (CLP) cable can be made per DUG Section JJ 410. Standard elbow connection with the CLP cable can then be made to the 200 Amp bushing wells of the MCAN per DUG Section TP 150.
6. MCAN can be mounted where it is convenient to perform the replacement of a blown fuse.
7. Once the fuse is secured to the end plug (cover) with Allen screws. Fuse replacement is a simple, drop, close and latch sequence.
8. Ground connection must be made on all provided ground lugs. For ground connection details refer to DUG GR 100.
9. The MCLF is not a load breaking device.

Table PD 305–2: SAP Number for MCAN Fuse Holder & Fuses

MCAN Replacement Fuse for 50 Amp & Below		
Fuse Size	**Fuse Holder SAP Number[a/]**	**Replacement CL Fuse SAP Number**
6	10108660	10108659
8	10108660	10108847
10	10108660	10108656
12	10108660	10108848
18	10108660	10108849
20	10108660	10108657
25	10108660	10108850
30	10108660	10108658
40	10108660	10108851
50	10108660	10108399
65	10108704	10108696
80	10108704	10108695

[a/] Complete with elbow parking stand (not shown)

Figure PD 305–3: MCLF Fuse (100 – 180 Amps)



Note(s):

1. The MCLF fuses are used in applications above the 80 Amp limitation of the MCAN.
2. Available in a 1-Phase configuration only.
3. Uses a special 5.5 kV rubber-encapsulated current-limiting fuse.
4. Connections to the MCLF fuse are made through the 200 Amp bushing wells. See DUG Section TP-140 for elbow installation with the paper-insulated, lead-covered (PILC) cable.
5. Alternately, in-line splice for transitioning from PILC to cross-linked polyethylene (CLP) cable can be made per DUG Section JJ 410. Standard elbow connection with the CLP cable can then be made to the 200 Amp bushing wells of the MCLF per DUG Section TP 150.
6. MCLF can be mounted where it is convenient to perform replacement of a blown fuse.
7. Fuse replacement is performed by completely removing the well stud and set screws inside the 200 Amp bushing well to separate the end fittings from the encapsulated fuse. Use 1/2” socket to remove stud. Then use 3/8” socket drive tool (supplied with replacement fuse) to remove set screw.
8. Ground connection must be made on all provided ground lugs. For ground connection details refer to DUG GR 100.
9. The MCLF is not a load breaking device.

Table PD 305–3: SAP Number for MCLF Fuse

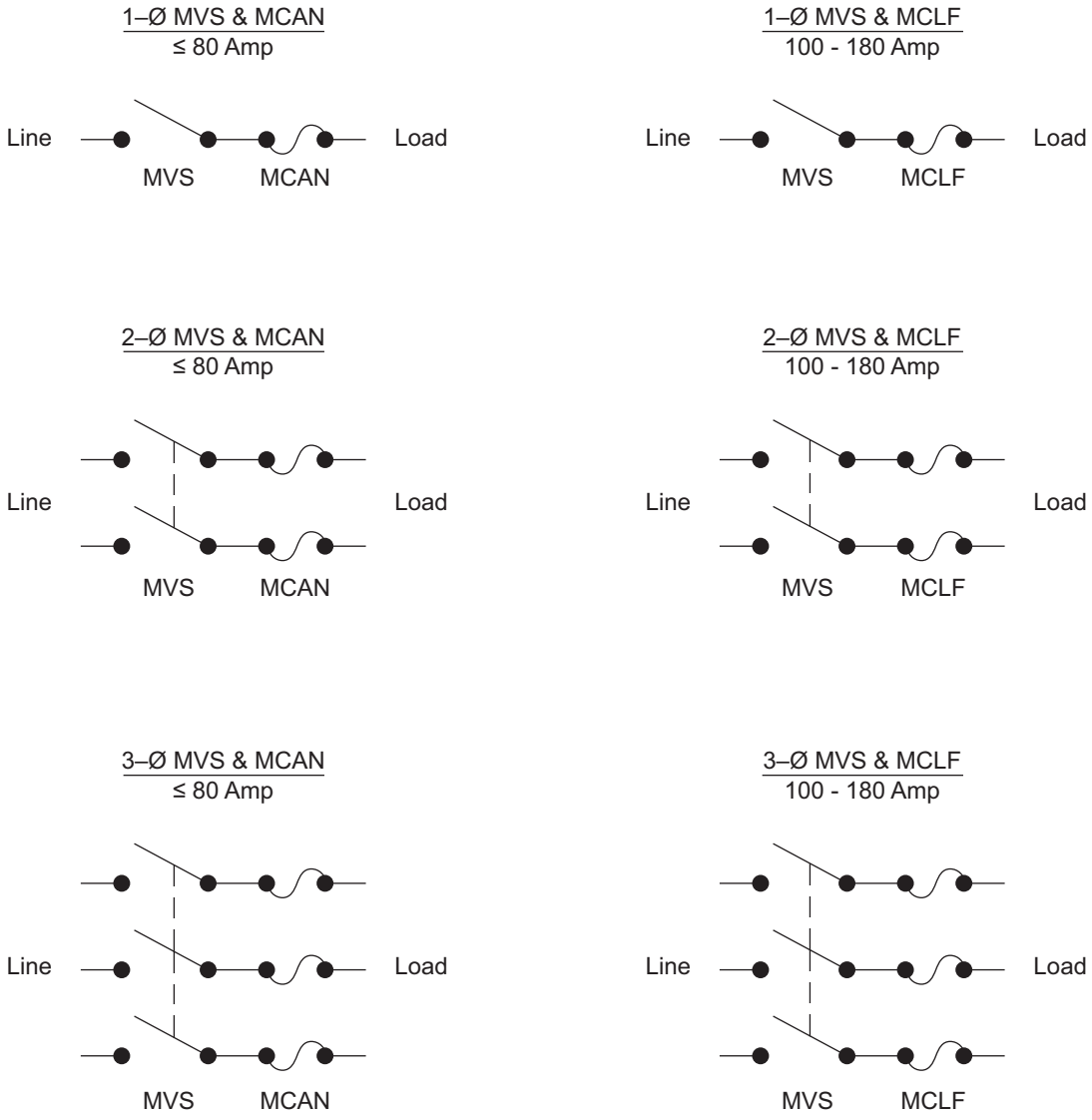
Amp Size	Fuseholder SAP Number	Replacement Fuse SAP Number
100 Amp	10108648 [a/]	10108697
125 Amp	10108649 [a/]	10108698
150 Amp	10108650 [a/]	10108699
180 Amp	10108651 [a/]	10108700

[a/] Complete Assembly, including the mounting bracket and replacement fuse

Table PD 305–4: Transformer Fuse Sizing Table

2.4 kV 1-Phase Transformer		
kVA Size	Fuse Size (Amps)	Fuse Type
10	10	MCAN
15	12	MCAN
25	20	MCAN
37.5	40	MCAN
50	50	MCAN
75	65	MCAN
100	80	MCAN
167	150	MCLF
250	180	MCLF
4.16 kV 3-Phase Transformer		
kVA Size	Fuse Size (Amps)	Fuse Type
9	6	MCAN
15	6	MCAN
30	8	MCAN
45	12	MCAN
75	20	MCAN
112.5	30	MCAN
150	40	MCAN
225	65	MCAN
300	80	MCAN
500	150	MCLF
2.4 kV Constant Current Transformer		
kW Size	Fuse Size (Amps)	Fuse Type
10	12	MCAN
15	20	MCAN
20	25	MCAN
25	30	MCAN
30	40	MCAN

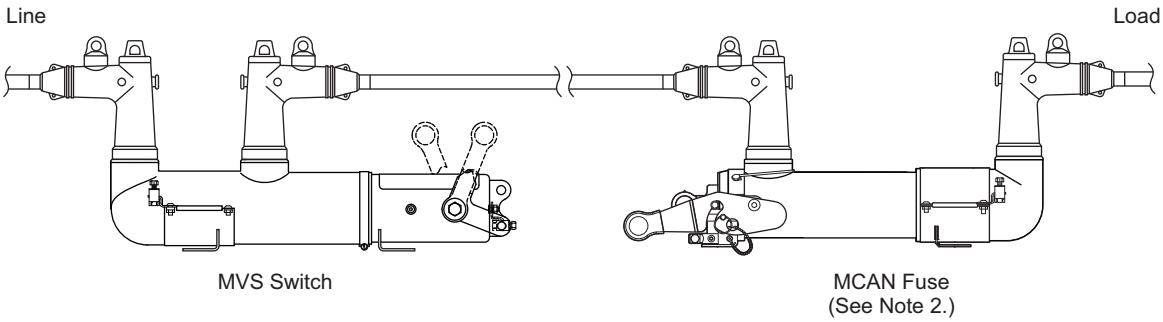
Figure PD 305–4: Typical Configuration for MVS Switch and MCAN Fuse



Note(s):

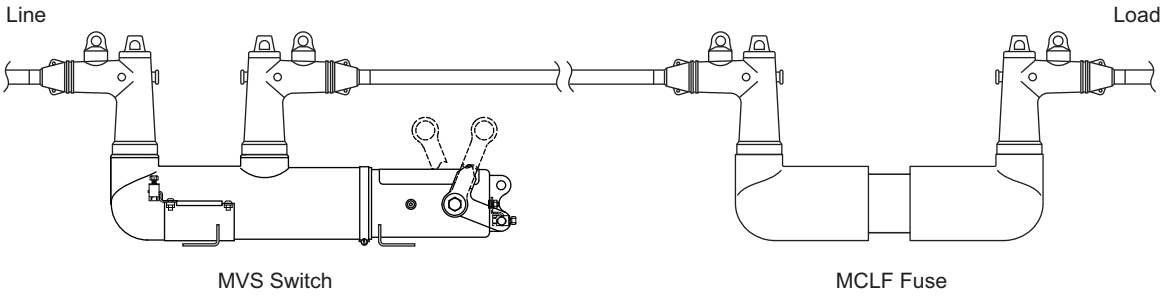
1. Replacement fuse for MCAN is the common underground current-limiting fuse, rated at 8.3 kV and up to 80 Amp fuse size. The 65 Amp and 80 Amp sizes have longer dimensions than 50 Amp size and smaller.
2. Replacement fuse for MCLF is a special rubber-encapsulated current-limiting fuse, rated at 5.5kV and available in sizes from 100 Amp to 180 Amp.

Figure PD 305–5: Typical Configuration of 1-, 2-, and 3-Phase MVS Switch and MCAN Fuse



Note(s):
1. The preferred loadbreak elbow connection is shown above. Deadbreak connection may also be used as appropriate.
2. For MCAN fuses, the line side and the load side termination could be interchangeable to allow convenient replacement of a blown fuse.
3. MVS switch and MCAN fuse can be mounted in any convenient location where they can be easily rigged or where fuse replacement can be easily performed.

Figure PD 305–6: Typical Configuration of 1-, 2-, and 3-Phase MVS Switch and MCLF Fuse



Note(s):
1. The preferred loadbreak elbow connection is shown above. Deadbreak connection may also be used as appropriate.
2. MVS switch and MCLF fuse can be mounted in any convenient location where they can be easily rigged or where fuse replacement can be easily performed.

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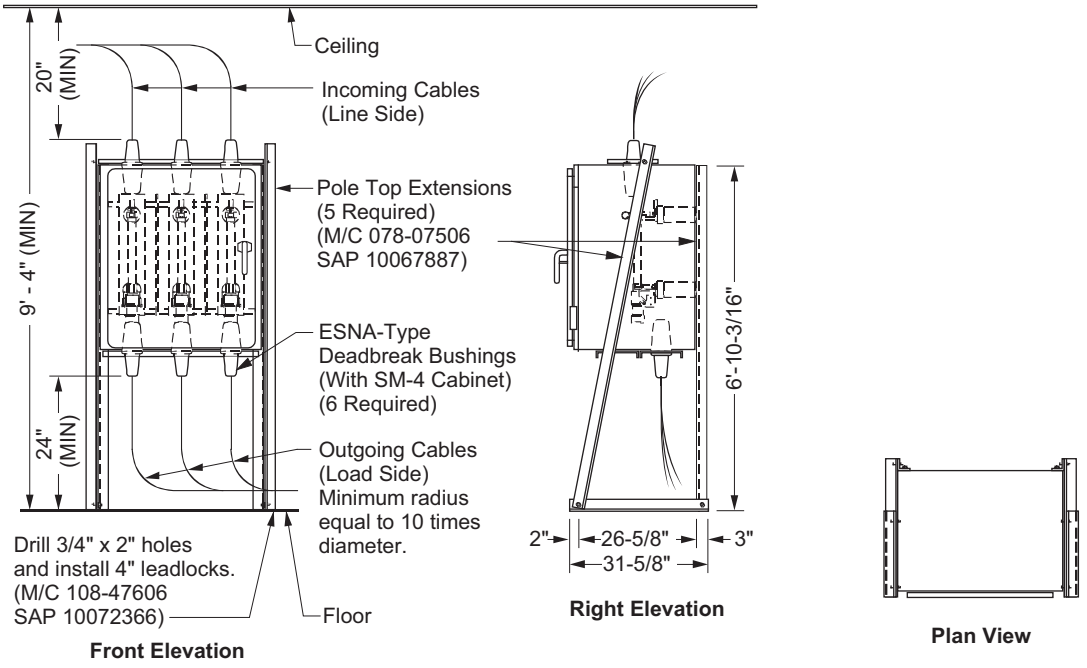
PD 310 Fuse Cabinet 15 kV SM-4, SM-5, and SML-20

Scope PD 310.1 Nonsubmersible Fuse Cabinet Installation Instructions (Floor-Mounted)

Figure PD 310–1: Nonsubmersible Fuse Cabinet Installation Diagram (Floor-Mounted)



1.0 General Information

Nonsubmersible fuse cabinets may be used for any indoor or outdoor above-ground applications where current-limiting or pad-mounted fuse cabinets cannot be used. Fuseholders are included with cabinet. Fuse cabinets with SML-20 or SM-5 fuse clips and live parts are available as follows:

SML-20 Cabinet: M/C 567-00404, SAP 10107329

SM-5 Cabinet: M/C 567-40905, SAP 10107527

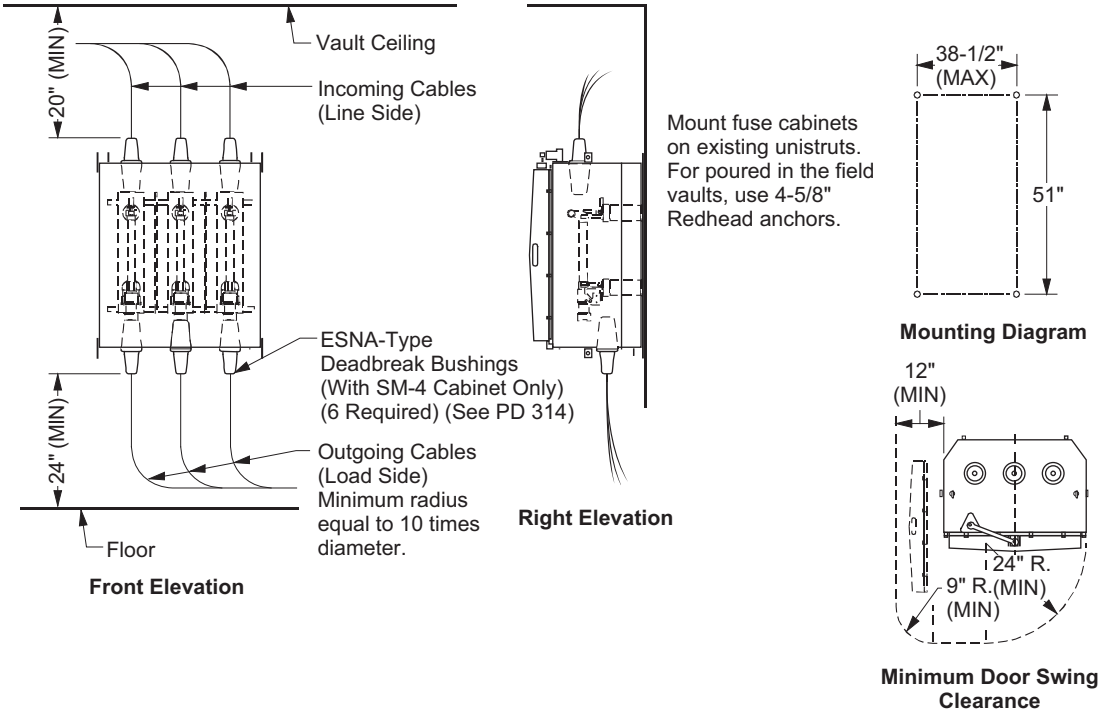
Table PD 310–1: Fuse Information

Fuseholder		12 kV Application		16 kV Application	
Type	SAP	MAX Fuse Rating	Interrupt Rating	MAX Fuse Rating	Interrupt Rating
SM-4[a/]	10107476	210E	260 MVA	210E	355 MVA
SML-20[b/]	10109108	200E	290 MVA	210E	400 MVA
SM-5S[c/]	10107478	420E	520 MVA	420E	715 MVA

[a/] SM-4 cabinet (M/C 567-40202) is obsolete and suitable for reuse only (Key 6).
[b/] SMU-20 fuses are used with end fittings supplied with cabinet. PD 315.
[c/] SM-5 fuse cabinets should only be used when fault duties exceed 14,000 A symmetrical and/or when the required fusing exceeds 200 A.

Scope PD 310.2 Submersible Fuse Cabinet Installation Instructions (Wall-Mounted)

Figure PD 310–2: Submersible Fuse Cabinet Installation Diagram (Wall-Mounted)



1.0 General Information

Submersible fuse cabinets are the only fuse cabinets approved for below-ground use. Fuseholders are included with cabinet. Fuse cabinets with SML-20 or SM-5 fuse clips and live parts are available as follows:

SML-20 Cabinet: M/C 567-00636, SAP 10107352

SM-5 Cabinet: M/C 567-00016, SAP 10107290

Table PD 310–2: Fuse Information

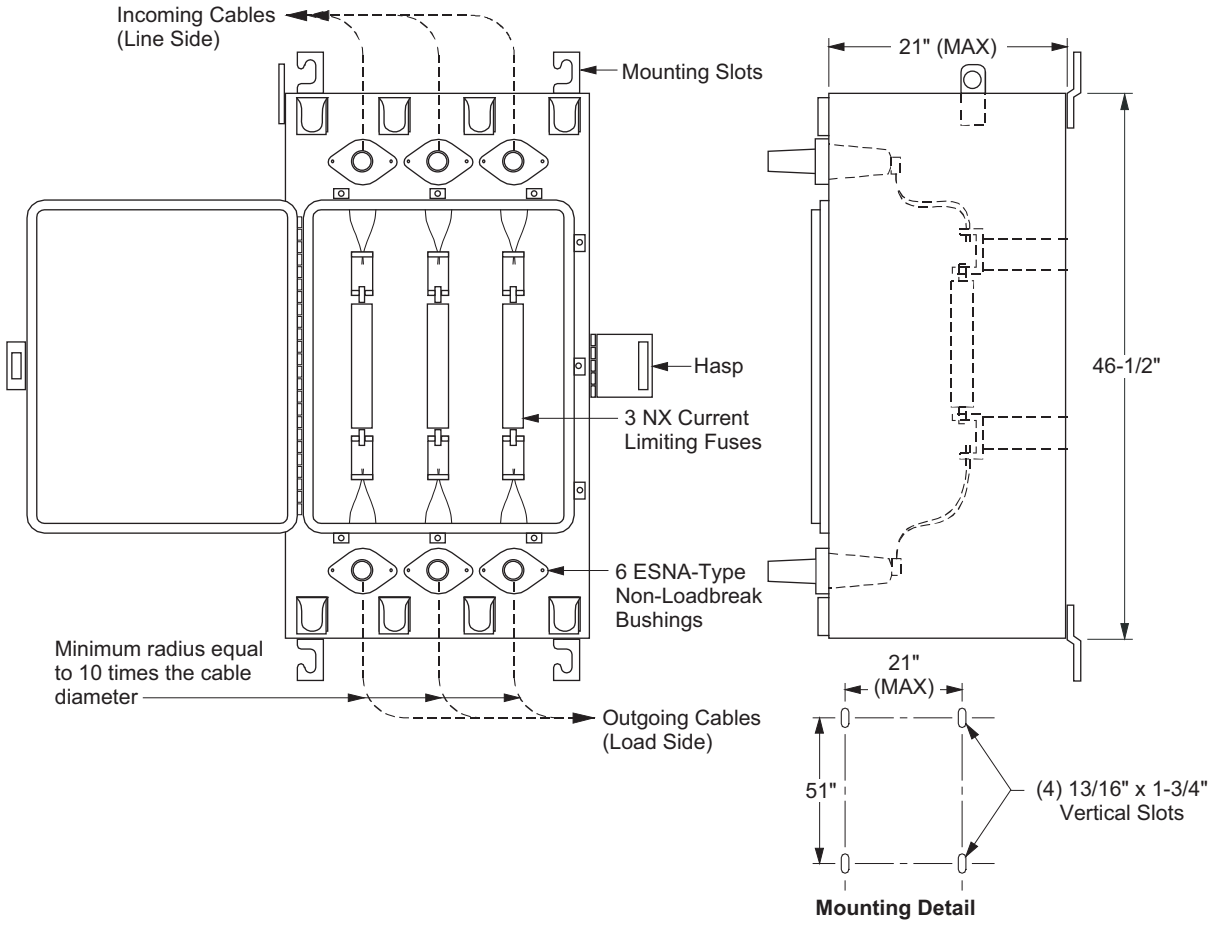
Fuseholder			12 kV Application		16 kV Application	
Type	M/C	SAP	MAX Fuse Rating	Interrupt Rating	MAX Fuse Rating	Interrupt Rating
SM-45[a/]	567-15600	10107476	210E	260 MVA	210E	355 MVA
SML-20[b/]	[b/]	[b/]	210E	290 MVA	210E	400 MVA
SM-5S[c/]	567-15808	10107478	420E	520 MVA	420E	715 MVA

[a/] SM-4 cabinet (M/C 567-40707) is obsolete and suitable for reuse only (Key 6).
[b/] SMU-20 fuses are used with end fittings supplied with switch. See PD 315.
[c/] SM-5 fuse cabinets should only be used when fault duties exceed 14,000 A symmetrical and/or when the required fusing exceeds 200 A.

PD 312 Fuse Cabinet 15 kV CL Fuse

Scope PD 312.1 15 kV Current-Limiting Fuse Cabinet (Wall Mounted) Non-Submersible

Figure PD 312–1: 15 kV Current-Limiting Fuse Cabinet (Wall Mounted) Non-Submersible



1.0 General Information

Current-limiting fuse cabinets (SAP 10107523) may be used for 12 kV and 16 kV indoor non-submersible (aboveground) installations where the total connected transformer load does not exceed 750 kVA. A hasp is provided for a padlock (not included).

2.0 Fuse Information

Fuse mounting complete with clips, are furnished with the cabinet, and will accept NX-type current limiting fuses up to and including 46 A.

3.0 Cable Terminations

Table PD 312–1: Cable Terminations

Cable Size and Type (220 MIL)	ESNA-Type Receptacle	SAP Number
#2 CLP	Elbow	10118047
#2 CLP	Straight	10118044
1/0 CLP	Elbow	10118050
1/0 CLP	Straight	10118043

= For Reference Only

PD 314 Fuse Cabinet 15 kV Cable Terminations

Scope PD 314.1 Cable Terminations for 15 kV Submersible and Nonsubmersible Fuse Cabinets

The following cable terminations are available with submersible (SAP 10107525 and SAP 10107526) and nonsubmersible (SAP 10107522 and SAP 10107527) fuse cabinets. Unless other terminations are specified on the requisition, 200 A apparatus bushing wells and bushing plug inserts will automatically be provided on each SM-4 cabinet, and 600 A apparatus bushings will be supplied with SM-5 cabinets.

Table PD 314–1: Cable Terminations for 15 kV Submersible and Nonsubmersible Fuse Cabinets

Cable Type	Conductor Size	Terminators Supplied[a/]
CLP	No. 2	Permali 200 A Bushing Well (Cat. No. WB252ES8.5) and ESNA Insert (Cat. No. K1501-A1)
CLP	1/0 Al	Permali 200 A Bushing Well (Cat. No. WB252ES8.5) and ESNA Insert (Cat. No. K1501-A1)
CLP	350-kcmil Al	ESNA 600 A Bushing (Cat. No. K600T BC)
CLP	750-kcmil Al	ESNA 600 A Bushing (Cat. No. K600T BC)
PILC	No. 4–250-kcmil Cu	G&W (Cat. No. TR17234)

[a/] When 200 A apparatus bushing wells and bushing plug inserts are supplied with the cabinet, 200 A load-break elbows (or straight receptacle) must be ordered separately. When PILC potheads are specified, complete potheads are supplied with the cabinet.

= For Reference Only

Note(s):
1. See TP Section for Terminating Instructions.

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PD 315 Live Front Cabinet 15 kV Pad-Mounted

Scope PD 315.1 15 kV Live-Front, Pad-Mounted Fuse Cabinets (PMH-4) Installation Instructions

1.0 General Information

NOTE

PME equipment is the preferred design. See PD 335.

1.1 15 kV pad-mounted fuse cabinets (M/C 567-46142 for SMU fuses, M/C 567-00073 for CL fuses) are applicable for all 12- and 16-kV outdoor installations, particularly with nonfused pad-mounted transformers where switching is provided elsewhere (for example, RAM SWITCH). The PMH SML cabinet contains SML-20 fuse holders, which accept SMU-20 fuses (maximum 200 A per phase) which can be used only where the fault duty is under 14,000 A. The PMH CL cabinet contains CL fuses (maximum 2-50 A per phase) and can be used in any location.

1.2 Stainless steel cabinets are recommended for areas with severe corrosion problems such as coastal installations or greenbelt areas where irrigation water and water in the structure are historically a problem, or if the cabinet is expected to be changed out within five years.

1.3 The PMH-4 cabinets provide adequate termination mounting height when installed over a pad/box (Refer to UGS SS 592) or a cable trench. If the pad/box, or cable trench is not available (for example, rooftop installation), base spacers are available in 6-, 12-, 18-, or 24-inch heights. Specific base requirements should be specified on the material requisition.

1.4 The fuse cabinet has been equipped with single pole, 200 A load interrupter fuses (hot-stick operated), and need not be equipped with KIRK-key interlock. The older fuse cabinet (M/C 567-40400) will accept a KIRK-key interlock. (This cabinet is no longer manufactured and the code is now “Key 6” status.

1.5 These units are equipped with an integral (factory installed) vermin/moisture barrier. Cable seals are supplied with the cabinet. Both 4 inch cable seals (M/C 656-00967) and 3 inch cable seals (M/C 656-00959) may be ordered separately. See Scope PD 315.3 (Sheet 6) for barrier installation instructions.

1.6 Maintain 1-1/2 inch minimum clearance from energized hardware to all insulating barriers. Check all compartment barriers to ensure they are properly installed and secured as designed by the manufacturer.

1.7 See TX 160 for general requirement for anchoring, sealing, and stenciling of pad-mounted equipment.

2.0 Fusing Information

2.1 Disconnect-style 45 degree opening end fittings for SMU-20 or CL fuse units are supplied with each cabinet. Fuse units are not included with the cabinet and must be ordered separately. See listing of SMU-20 fuses in PD 205.

FOR REFERENCE ONLY

2.2 The SML-20 fuse holders in the SML cabinet accept SMU-20 fuses.The fuse tables for SMU-20 fuses are in PD 205 and PD 315. Fusing requirements for current limiting fuse application are the same as the 3-wire and 4-wire radial laterals for fused BURD switches, as shown in PD 212. Consideration must be given to possible ferroresonant conditions when single-phase switching will occur. If potential ferroresonance exists use gang-operated equipment (PME-5 or PMH-5). (See PD 317 and PD 337).

3.0 Replacement Fuseholder

For missing or damaged fuseholders, replacements for S&C switches are available under the following code numbers:

CL Fuse Holder: M/C 572-00586

SML Power Fuse Holder: M/C 572-00115

Table PD 315–1: 15 kV Live-Front, Pad-Mounted Fuse Cabinet (PMH-4), Fuse Applications

SMU-20 Application	MAX Fuse Rating	Interrupt Rating	MAX 3Ø kVA Bank
12 kV	200E	290 MVA	2,500
16 kV	200E	388 MVA	3,750

SM-4S Application	MAX Fuse Rating	Interrupt Rating	MAX 3Ø kVA Bank
12 kV	210E	260 MVA	—
16 kV	210E	355 MVA	3,750

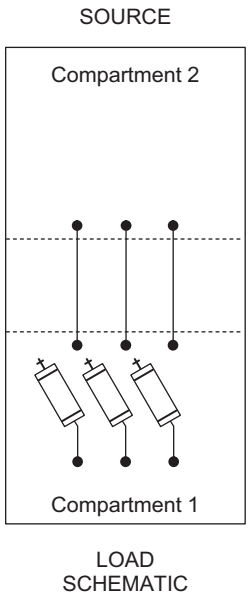
CL Fuse Applications

NX Fuse Application	MAX Fuse Rating	Interrupt Rating	MAX 3Ø kVA Bank
12 kV	80 A[a/]	1,040 MVA	1,500
16 kV	80 A[a/]	1,385 MVA	1,500

[a/] 2-40A NX Fuses

FOR REFERENCE ONLY

Figure PD 315–1: 15 kV Live Front, Pad-Mounted Fuse Cabinet (PMH-4)



STANDARD

PMH-4 SML
M/C 567-46142
(Key 6)

PMH-4 CL
M/C 567-00073
(Key 6)

Table PD 315–2: 15 kV Live-Front, Pad-Mounted Fuse Cabinets (PMH-4) Cable Terminations

Cable Size	Material Code
#2 and 1/0	650-00010
350 kcmil	650-00150

NOTE

See TP 206 for type of terminals to use with terminations.

Table PD 315–3: 15 kV Live-Front, Pad-Mounted Fuse Cabinets (PMH-4) Dimensions

	Width (in)		Depth (in)		Height (in)		Weight (lb)	
Cabinet	Scott	S&C	Scott	S&C	Scott	S&C	Scott	S&C
PMH-4	40	34	40	35-1/2	60	44	700	700

4.0 Cable Terminals

See TP 100 for type of terminals to use with terminations.

FOR REFERENCE ONLY

5.0 Structure

5.1 May be installed over a cable trench.

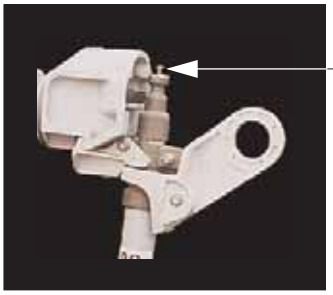
5.2 Refer to UGS SS 592 for pad/box requirements.

5.3 Contact Linear and Structural Strategies for other applications.

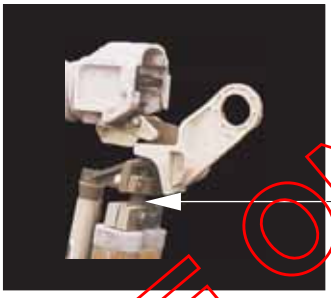
FOR REFERENCE ONLY

Scope PD 315.2 15 kV Live-Front, Pad-Mounted Fuse Cabinet Fuse Compartment Details

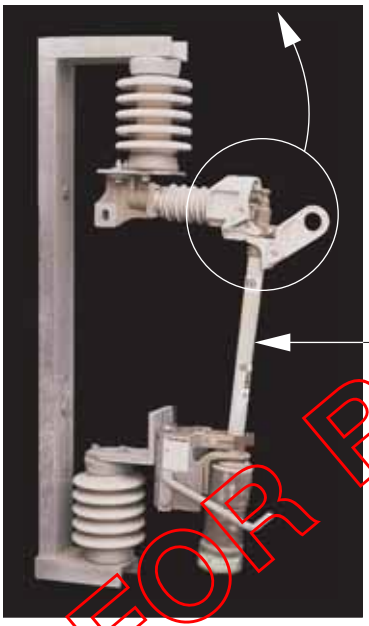
Figure PD 315–2: 15 kV Live-Front, Pad-Mounted Fuse Cabinet Fuse Compartment Details



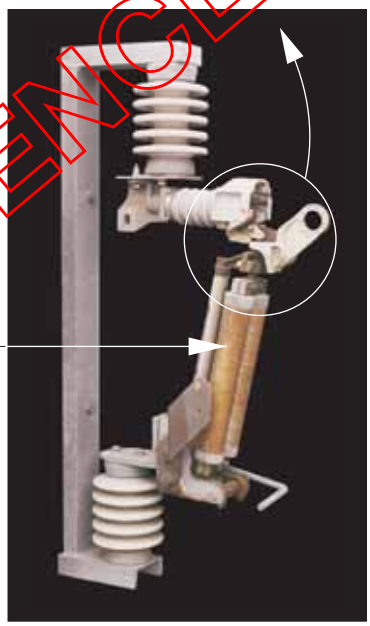
Blown Fuse Target



Blown Fuse Target: McGraw-Edison old style "NX" fuse was supplied with a pop-up blown fuse indicator. Currently approved fuse suppliers do not provide a blown fuse indicator.



Replaceable Fuse Units



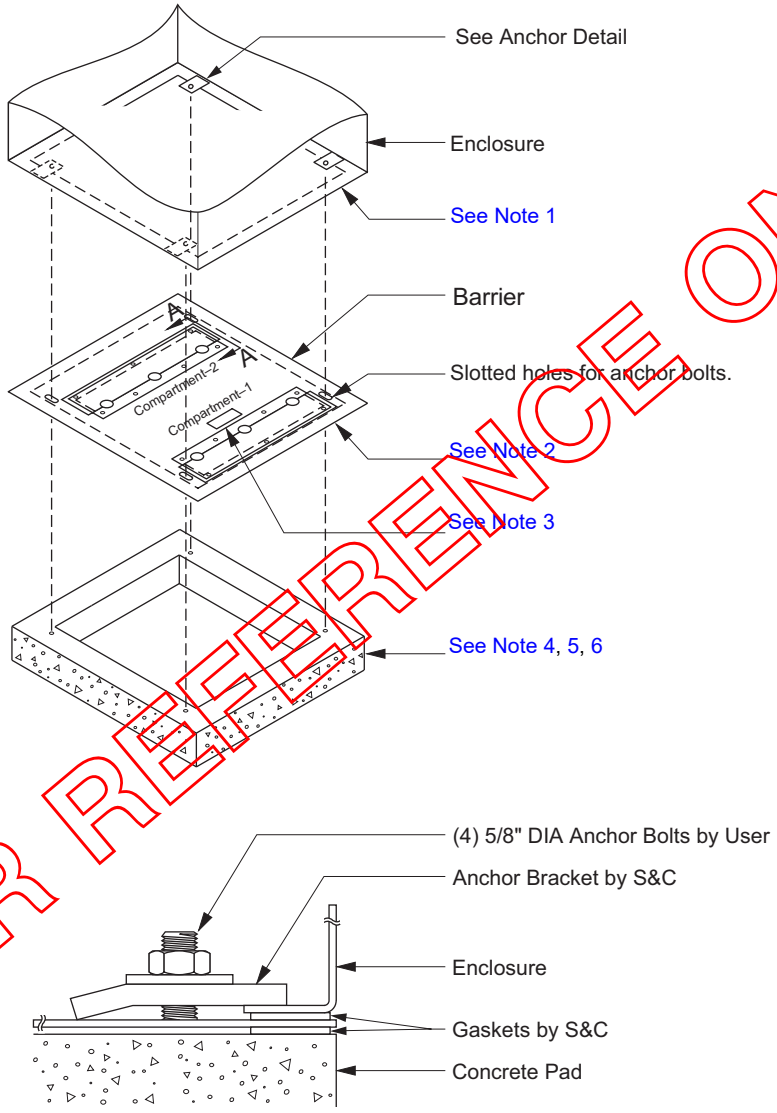
200A Fused Load Interrupter w/SMU-20 Fuse Unit

200A Fused Load Interrupter w/Current Limiting Interrupter

FOR REFERENCE ONLY

Scope PD 315.3 15 kV Live-Front, Pad-Mounted Fuse Cabinets (PMH-4) Installation Instructions

Figure PD 315–3: 15 kV Live-Front, Pad-Mounted Fuse Cabinets (PMH-4) Installation Instructions



Detail "A"

FOR REFERENCE ONLY

Note(s):
1. Gasket included with PMH-4 cabinet.
2. Gasket included with barrier. Install it on underside of barrier.
3. Label installed on this surface marks topside of this barrier assembly.
4. Install pull string for future. Since access to the pull box is minimal, this structure should not be used as a cable pulling structure.
5. Install ground wire.
6. The vapor/vermin barrier may be used as a template for installing anchor bolts where inserts are not provided.

PD 317 Live Front PMH Type Fuse/Switch Cabinet Pad-Mounted

Scope PD 317.1 15 kV 600A Live-Front, Pad-Mounted Fuse/Switch Cabinets (PMH) Installation Instructions and General Information

1.0 General Information

NOTE

PME equipment is the preferred design, see PD 337.

1.1 PMH switch/fuse cabinets contain at least one 600A external handle, gang-operated, 3-phase interrupter. In addition to the interrupter(s), there may be one or more sets of three 200A, 1-phase hookstick operated fuses. The PMH SML cabinet contains SML-20 fuses (maximum 200A per phase) which can be used only where the fault duty is under 14,000A. The PMH CL cabinet contains CL fuses (maximum 2–50A per phase) and can be used in any location.

1.2 Stainless steel cabinets are recommended for areas with severe corrosion problems such as coastal installations or greenbelt areas where irrigation water or water in the structure are historically a problem or if the cabinet is expected to be changed out within five years due to corrosion.

1.3 All PMH units made after 4-96 had an integral (factory installed) vermin/moisture barrier. Cable seals are supplied with the cabinet, 4 inch cable seals for 600A compartments, and 3 inch seals for 200A compartments. Both 4 inch cable seals, M/C 656-00967, and 3 inch cable seals, M/C 656-00959 may be ordered separately.

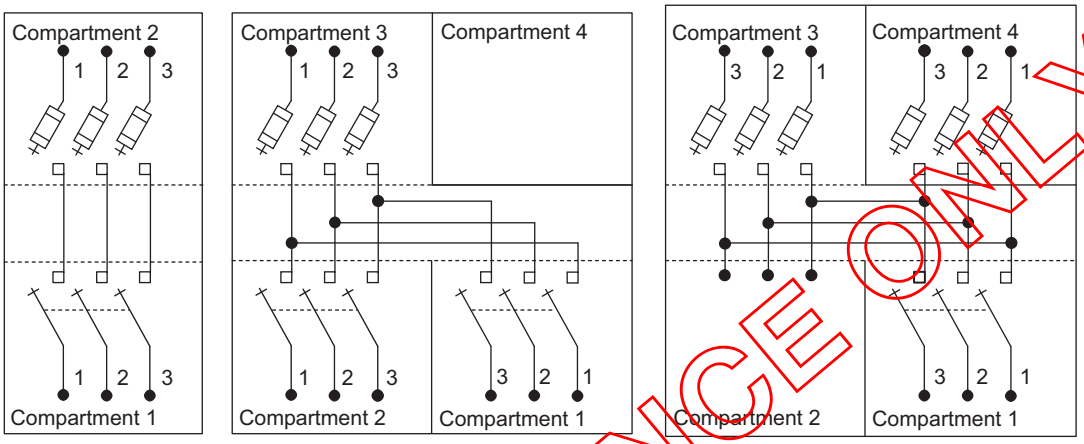
1.4 Maintain 1-1/2 inch minimum clearance from energized hardware to all insulating barriers. Check all compartment barriers to assure they are properly installed and secured as designed by the manufacturer.

2.0 Fusing Information

The fuse tables for SMU-20 fuses on PD 205 and PD 315 are applicable to the SML-20 style fuse (the fuse curves are the same; only the holders are different). Current limiting fuse requirements are the same as the 3-wire and 4-wire radial laterals for fused BURD and pad-mounted systems as shown on PD 212. Consideration must be given to possible ferroresonant conditions in these applications.

FOR REFERENCE ONLY

Figure PD 317–1: 15 kV 600A Live-Front, Pad-Mounted Fuse/Switch Cabinets (PMH) (1 of 3)



STANDARD

PMH-5 SML
M/C 567-75208*

PMH-5 CL
M/C 567-46084*

STAINLESS STEEL
PMH-5 SML
M/C 567-00826*

PMH-5 CL
M/C 567-00818*

STANDARD

PMH-6 SML
M/C 567-75307*

PMH-6 CL
M/C 567-46100*

STAINLESS STEEL
PMH-6 SML
M/C 567-00834*

PMH-6 CL
M/C 567-00842*

STANDARD

PMH-8 SML
M/C 567-75406*

PMH-8 CL
M/C 567-46092*

STAINLESS STEEL

PMH-8 SML
M/C 567-00859*

PMH-8 CL
M/C 567-00867*

* Key 6

FOR REFERENCE ONLY

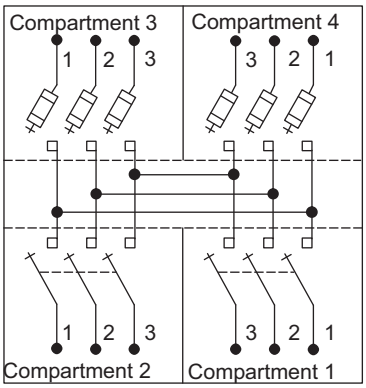
Figure PD 317–2: 15 kV 600A Live-Front, Pad-Mounted Fuse/Switch Cabinets (PMH) (2 of 3)

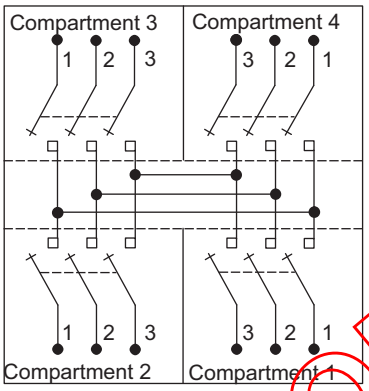
STANDARD
PMH-9 SL
M/C 567-75505*

PMH-9 CL
M/C 567-46043*

STAINLESS STEEL
PMH-9 SML
M/C 567-00875*

PMH-9 CL
M/C 567-00883*





STANDARD
PMH-10
M/C 567-75604*

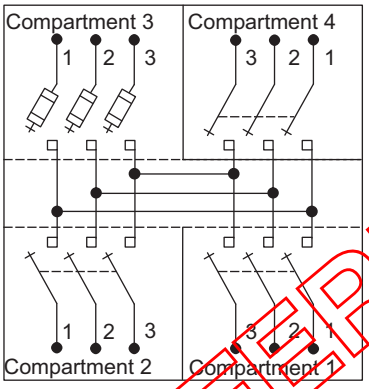
STAINLESS STEEL
PMH-10
M/C 567-00891*

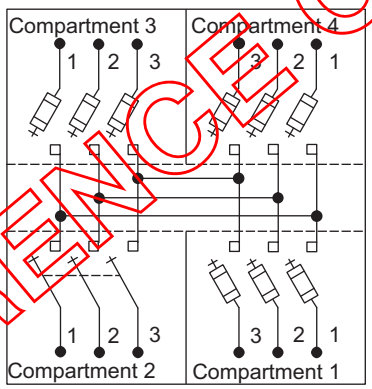
STANDARD
PMH-11 SML
M/C 567-75703*

PMH-11 CL
M/C 567-46050*

STAINLESS STEEL
PMH-11 SML
M/C 567-00909*

PMH-11 CL
M/C 567-00917*





STANDARD
PMH-12 SML
M/C 567-75802*

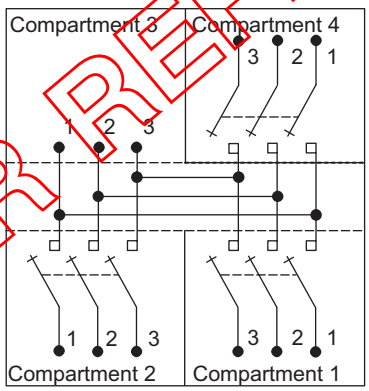
PMH-12 CL
M/C 576-46068*

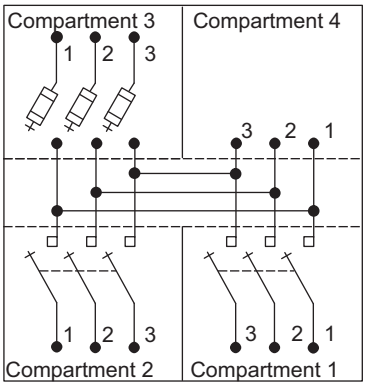
STAINLESS STEEL
PMH-12 SML
M/C 567-00925*

PMH-12 CL
M/C 567-00933*

STANDARD
PMH-13
M/C 567-76008*

STAINLESS STEEL
PMH-13
M/C 567-00784*





STANDARD
PMH-14 SML
M/C 567-75901*

PMH-14 CL
M/C 567-46076*

STAINLESS STEEL
PMH-14 SML
M/C 567-00792*

PMH-14 CL
M/C 567-00800*

*Key 6

FOR REFERENCE ONLY

Note(s):

1. When fusing greater than 200A is required, a PMH-5 may be replaced with a PMU-5 (M/C 567-72908). This is a 600A, 15 kV fused load interrupter, with 420A maximum SM5S nondisconnectable style fuseholder. VFIs may also be considered for this application. Contact Field Engineering for assistance.
2. A PMH-4 (PD 315) may be used in place of a PMH-5 if separate switching (for example, RAM switch) is already available.
3. A potentially ferroresonant condition may exist if the single pole fused positions are used to switch 3-phase or 1-phase transformers of 3-wire systems.
4. A terminator adapter bracket (M/C 600-00346) is available for connecting 2 cables per phase on 600A switch positions. The adapter kit includes 3 adapters, nuts, and washers for one 3-phase 600A position.

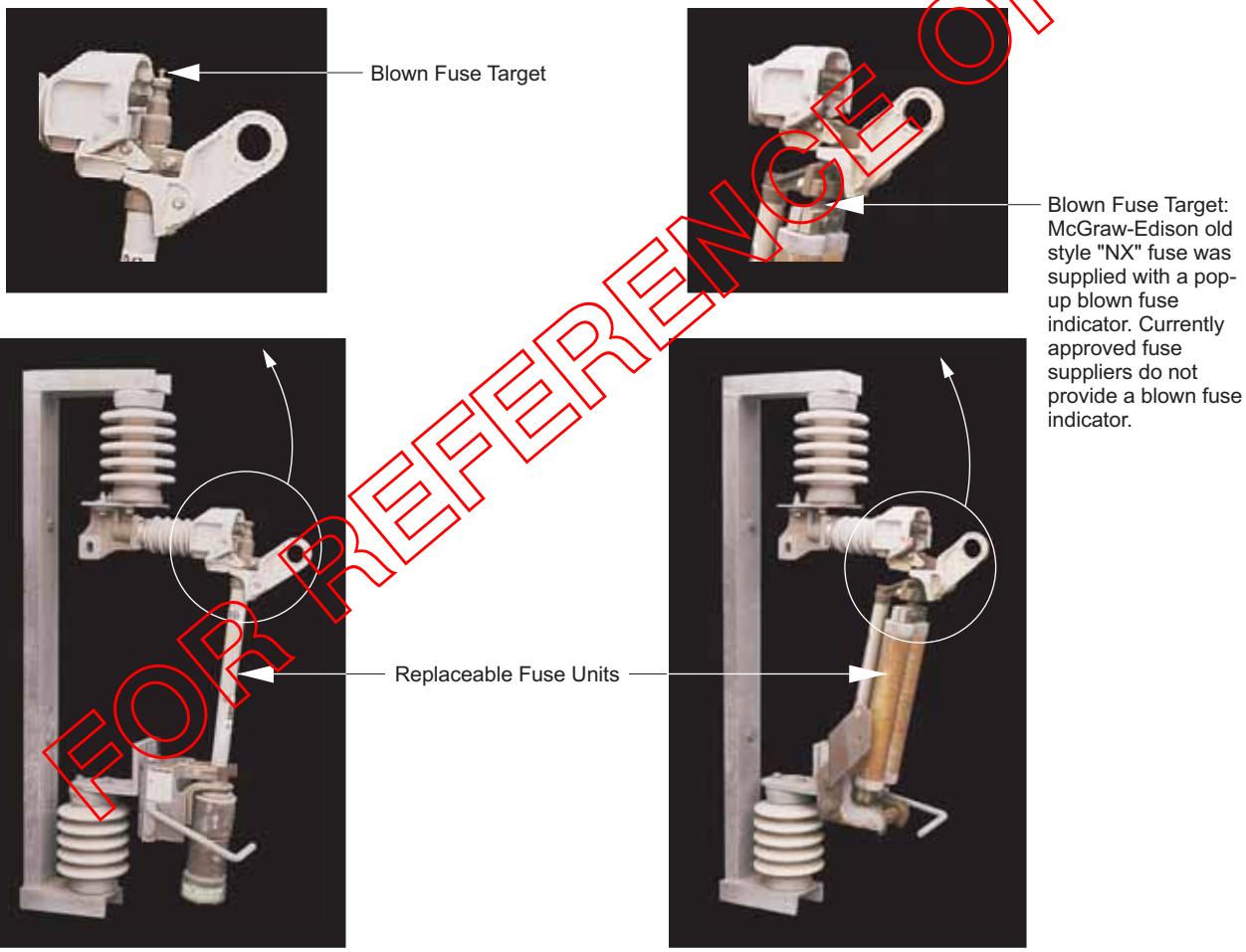
5. Recommended Structure:
   a. PMH-5 (Refer to UGS SS 591)
   b. PMH-6 through PMH-14 (Refer to UGS SS 590)

NOTE

May be installed over a cable trench. Contact Distribution Engineering for other applications.

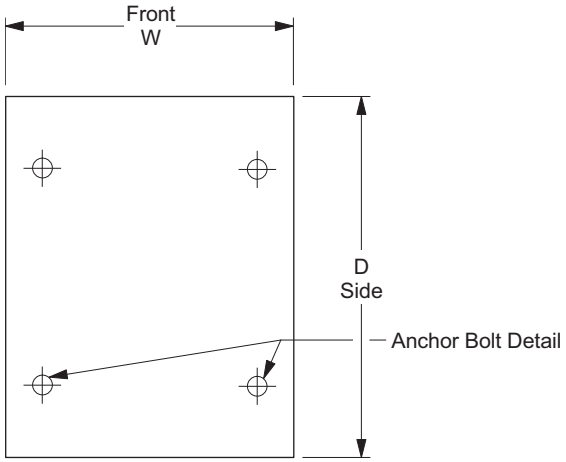
6. See TX 160 for general anchoring, stenciling, and sealing requirements for pad-mounted equipment.
7. A solid bar SMU fuse replacement (M/C 537-00225) is available for locations where fusing at a PMH (SML power fuse style) is not required. Use M/C 537-00217 for CL style fuseholders.
8. Replacements for missing or damaged fuseholders, CL style M/C 572-00586 and SML power style M/C 572-00115.

Figure PD 317–3: 15 kV 600A Live-Front, Pad-Mounted Fuse/Switch Cabinets (PMH) (3 of 3)

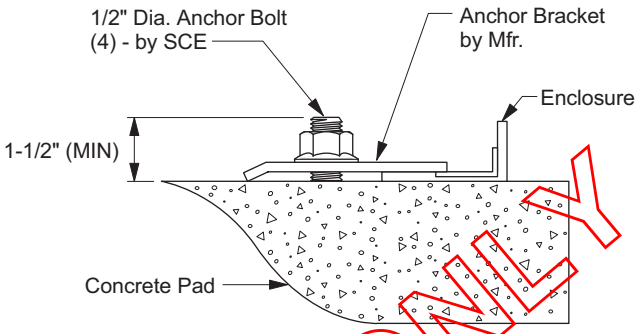


FOR REFERENCE ONLY

Figure PD 317–4: 15 kV 600A Live-Front, Pad-Mounted Fuse/Switch Cabinets (PMH) — Cabinet Anchor Details



Cabinet Plan



3.0 Cable Terminations

See TP 206 and TP 207.

Table PD 317–1: 15 kV 600 A Live-Front, Pad-Mounted Fuse/Switch Cabinets (PMH) — Dimensions and Weights

Cabinet Type	Width (in)			Depth (in)			Weight (lb)		
	S&C	Scott	EEI	S&C	Scott	EEI	S&C	Scott	EEI
PMH-5	34-1/2	42	35-1/2	35-1/2	60	58-1/2	825	1000	900
PMH-6	67	72	67	58-1/2	70	58-1/2	1475	2135	1300
PMH-9	67	72	67	58-1/2	70	58-1/2	1550	2245	1700
PMH-10	67	72	67	58-1/2	72	58-1/2	1725	2500	1800
PMH-11	67	72	67	58-1/2	72	58-1/2	1625	2355	1750
PMH-12	67	72	67	58-1/2	72	58-1/2	1450	2100	1600

4.0 Cable Terminals

See TP 200 for type of terminals to use with terminations.

Table PD 317–2: 15 kV 600A Live-Front, Pad-Mounted Fuse/Switch Cabinets (PMH) — Cable Terminations

Cable Size	Material Code
#2 and 1/0	650-00010
350 kcmil	650-00150
750 kcmil	650-00168
1000 kcmil	650-00176

FOR REFERENCE ONLY

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PD 318 15 kV and 35 kV, 600 A, Dead-Front, Pad-Mounted and Underground Switch/Vacuum Fault Interrupter Cabinets (VFI)

Scope PD 318.1 15 kV and 35 kV, 600 A, Dead-Front, Pad-Mounted and Underground Switch/Vacuum Fault Interrupter Cabinets (VFI) Installation Instructions and General Information

1.0 General Information

Pad-mounted and underground switch/vacuum fault interrupter apparatus, designated VFI apparatus for the purposes of this standard, is primarily used for large customer transformer (1,500 kVA and greater) installations. These devices consist of 600 A load interrupter switches in combination with 600 A vacuum fault interrupter (VFI) devices that are initiated by electronic devices that simulate relay and fuse curves.

This apparatus will be used for applications where existing PMH or PME switch equipment will not satisfy customer requirements for three-phase fault clearing, ground fault sensing or special protection curves, or if load size is beyond capacity of PMH and PME equipment. All VFI installations shall be approved by Field Engineering.

This apparatus may be oil or gas-insulated. This apparatus will primarily be installed in pad-mounted installations, but may be used in underground vaults or other below-grade applications where needed. The apparatus is available in 15 kV rating that is suitable for both 12 kV and 16 kV applications and in 35 kV rating for applications on 34.5 kV system.

The apparatus is packaged in two- or four-compartment cabinets containing three-pole, 600 A, gangoperated load-break switches, three 600 A fault interrupters, which may be operated either as singlephase or three-phase devices, or a combination of these devices. The switches and fault interrupters are in separate compartments. Underground cable is connected to the switch and fault interrupter positions using load-break components.

2.0 Protection Information

VFI apparatus comes equipped with a protection package for each fault interrupter position. This protection package will simulate a variety of fuse, oil fuse cutout, recloser and relay time current (TCC) curves including special features such as three-phase and ground trip, instantaneous trip and tripping initiated from an external source. Protection settings will be obtained by Field Engineering and set or changed only by qualified apparatus technicians prior to installation and being put into service. Bypass switch shall be used in order to provide isolation and allow for trip tests and maintenance of the VFI. See AP 200 for installation details of the bypass switch.

3.0 Equipment Ratings

Table PD 318–1: Equipment Ratings

Rating	15 kV Apparatus	35 kV Apparatus
Maximum Voltage (kV)	17.1	38
Continuous Current (A)	600	600
Interrupting Current for Switch (A)	600	600
Interrupting Current for FI (kA)[a/]	20	20
Momentary and Fault Close (kA)[a/]	20	20

[a/] Existing vintage VFI equipment may only have interrupting ratings of 16 kA and lower.

4.0 Recommended Structures

Reference:

- UGS SS 530—use 6' x 8'-6" slab box for VFI 4.
- UGS SS 538—use 8' x 10' x 8" slab box for VFI 9 and VFI 12.

Exception:

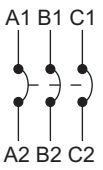
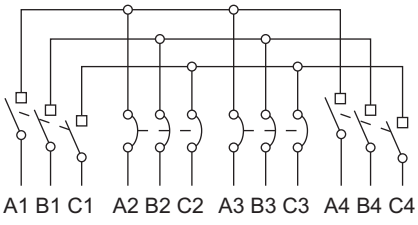
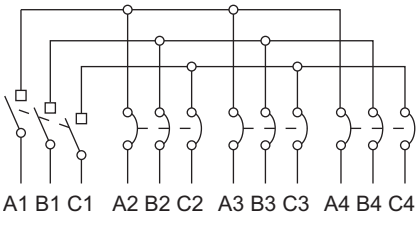
- UGS SS 591—for S&C VFI 4, use PME 5 pad.

Note(s):

1. May be installed over a cable trench. Contact Linear and Structural Strategies or Field Engineering for custom applications.
2. A special 6' x 12' x 7' PMH structure which may be used as an alternate design as determined by Field Engineering.
3. See TX 160 for general anchoring, stenciling, and sealing requirements for pad-mounted equipment.
4. Ground the cable concentric wires and switch tank to the vault 4/0 copper ground/neutral per material and installation requirements of GR 100.

5.0 Equipment Configurations

Table PD 318–2: Equipment Configurations

			
	VFI 4	VFI 9	VFI 12
	SAP	SAP	SAP
12 and 16 kV	10106397	10106398	10106401
34.5 kV	10106410	10106411	10106412

6.0 Equipment Outline (Typical)

Figure PD 318–1: Equipment Outline (Typical)

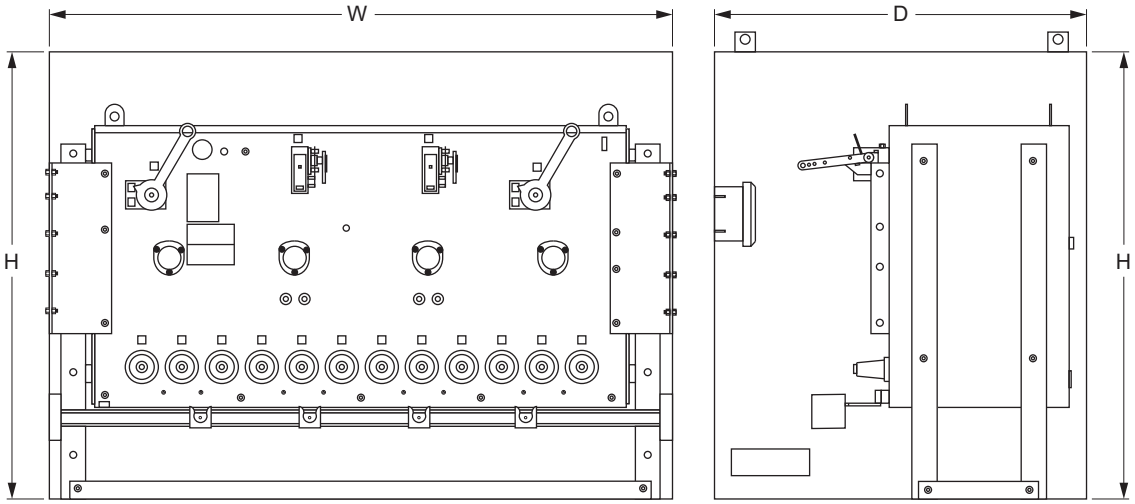
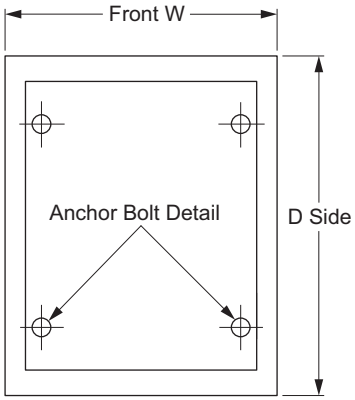


Figure PD 318–2: Cabinet Vacuum Anchor Details



Cabinet Plan

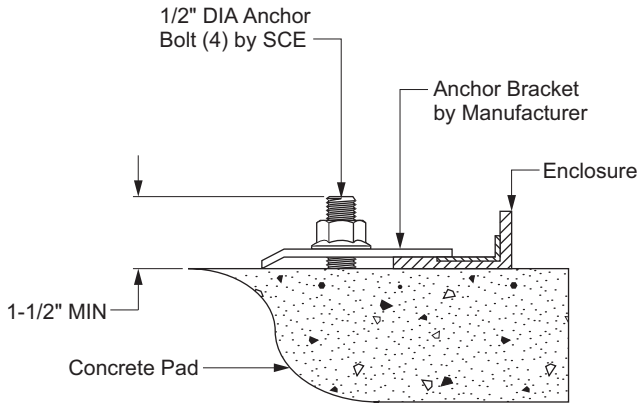


Table PD 318–3: Cabinet Dimensions and Weights

Cabinet Type	W (in)	D (in)	H (in)	Weight (lb)
S&C				
VFI 4-12/17 kV	39	61	37	550
VFI 9	72	61	37	1,100
VFI 12	72	61	37	1,100
VFI 4-35 kV	39	61	41	800
VFI 9	80	61	41	1,350
VFI 12	80	61	41	1,350
G&W				
VFI 4-12/17 kV	61	52	61	1,650
VFI 9	85	58	61	2,650
VFI 12	87	58	61	2,650
VFI 4-35 kV	61	52	61	1,650
VFI 9	85	58	61	2,650
VFI 12	87	58	61	2,650
Cooper				
VFI 4-12/17 kV	71	48	49	1,000
VFI 9	63	62	43	1,225
VFI 12	62	66	43	1,500
VFI 4-35 kV	71	59	49	1,000
VFI 9	63	66	43	1,200
VFI 12	63	66	63	1,500

= For Reference Only

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PD 320 Fused Pad-Mounted Transformer

Scope Scope PD 320.13Ø Pad-Mounted Transformer Installation Procedure for Current-Limiting Fuses 750 kVA–1,000 kVA for 12/16-kV Application

Most three-phase pad-mounted transformers rated 12- and 16-kV, and 750–1,000-kVA, have facilities for mounting current limiting fuseholders in the primary cable compartment. The fuse mounting provisions will vary with manufacturers and may be either threaded studs, threaded bosses, or channels mounted on the transformer tank. When current-limiting fuses are installed in the primary compartment, a KIRK interlock shall be installed.

These transformers will also be equipped with pothead mounting brackets. The brackets in some cases must be removed to maintain adequate clearances.

Figures, on the next page, show the single and double fuseholders, pothead mounting brackets and required minimum clearances.

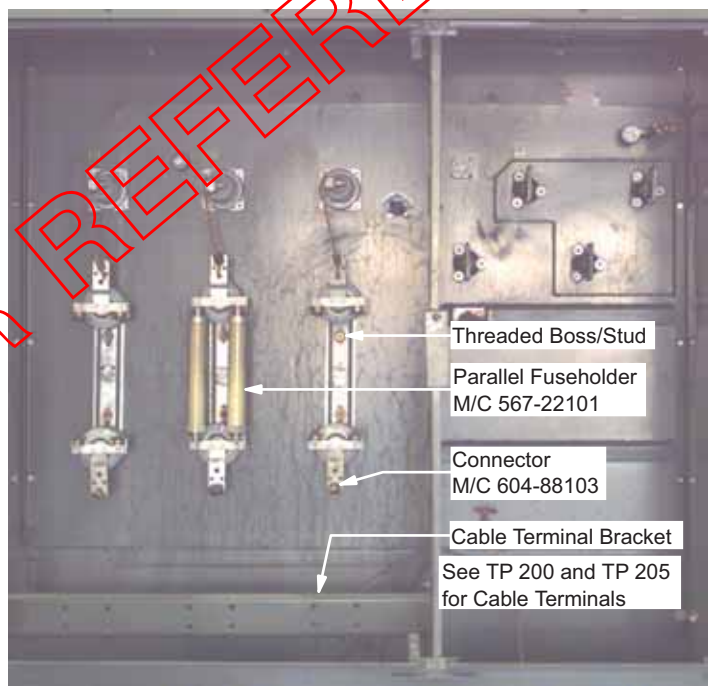
For those units without phase barriers, the following minimum clearances must be maintained:

- Phase-to-Phase — 5-1/2 inches;
- Phase-to-Ground — 5 inches;
- Phase-to-Insulating Barriers — 1-1/2 inches

FOR REFERENCE ONLY

Scope PD 320.2 Typical Fused Pad-Mounted Transformer — 15 kV 225 kVA–1,000 kVA

Figure PD 320–1: Typical Fused Pad-Mounted Transformer — 15 kV 225 kVA–1,000 kVA

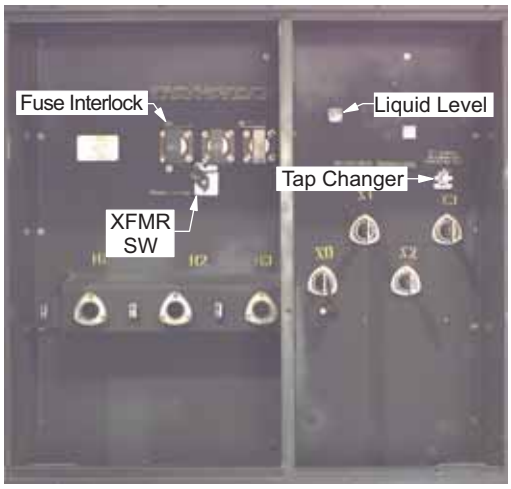


FOR REFERENCE ONLY

Note(s):
1. Primary fuses must be de-energized from the source before removal.
2. Maintain minimum of 1-1/2 inches from all energized parts to any barrier board.

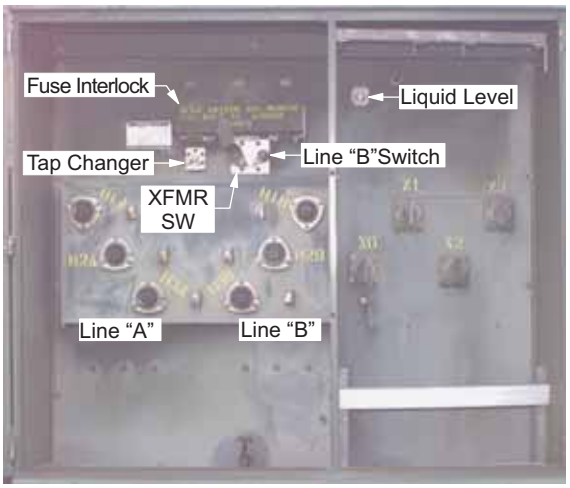
Scope PD 320.1 3Ø Pad-Mounted Transformer with Switch and Current-Limiting Fuses 75 kVA–500 kVA for 12/16-kV Application

Figure PD 320–2: 3Ø Pad-Mounted Transformer with Switch and Current-Limiting Fuses (75 kVA–500 kVA) for 12/16-kV Application



One Circuit

Fuse Interlock



Two Circuits

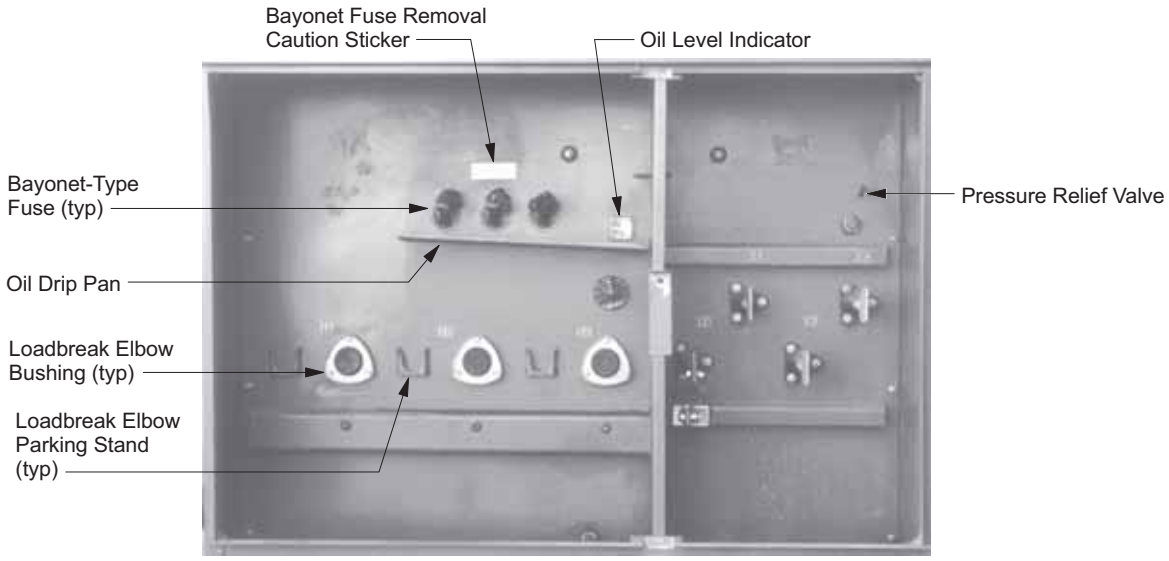
Table PD 320–1: 3Ø Pad-Mounted Transformer with Switch and Current Limiting Fuses 75 kVA–500 kVA for 12/16-kV Application

kVA	One Circuit				Two Circuits			
	Height (in)	Width (in)	Depth (in)	Approximate Weight (lb)	Height (in)	Width (in)	Depth (in)	Approximate Weight (lb)
75	62	70	48	3400	62	67	48	3500
150	62	70	48	3700	62	67	48	3900
225	62	70	48	4200	62	67	48	4500
300	62	70	48	4600	62	70	48	5000
500	62	70	48	5700	66	70	55	6000

FOR REFERENCE ONLY

Scope PD 320.2 **Typical 3Ø Pad-Mounted Transformer (45–1,000 kVA) Equipped with Load-Break Elbows, Bay-O-Net-Type Fuses, and an Internal Partial Range Current-Limiting Fuse**

Figure PD 320–3: Typical 3Ø Pad-Mounted Transformer (45–1,000 kVA) Equipped with Load-Break Elbows, Bay-O-Net-Type Fuses, and an Internal Partial Range Current-Limiting Fuse



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PD 321 Pad-Mounted 3-Way Junction 12/16-kV

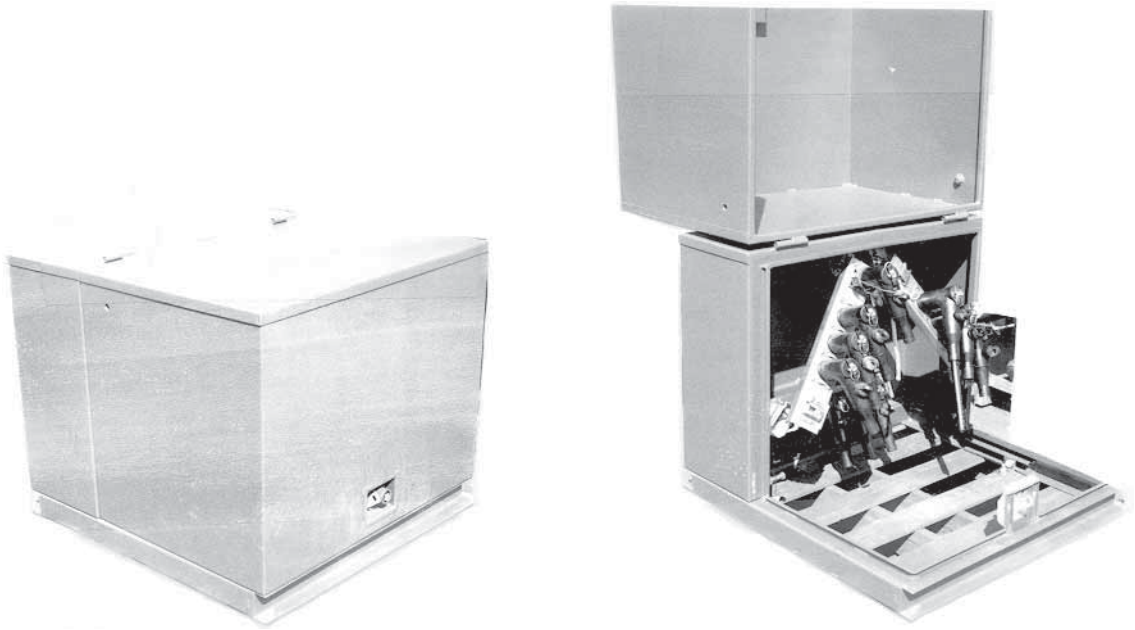
Scope PD 321.1 Pad-Mounted 3-Way Junction 12/16-kV (M/C 567-00610)

1.0 Application

Replacement for 3-way 3-pole BURD switch when nonswitched installation is acceptable. This unit can be mounted over the existing 4' x 4' BURD switch enclosure.

New installations can be mounted over the 4' x 4' BURD switch enclosure where a switch will be required in the future, but not needed at the present time. New installations requiring a nonswitched disconnecting point can be mounted on a transformer pad (M/C 656-08804) with a 17" x 30" handhole (M/C 655-48000) installed beneath the slab opening. The 3-way junction (M/C 655-62555) must be ordered separately. For noncorrosive areas 2-1/2' x 4' splice box is the preferred installation.

Figure PD 321–1: Pad-Mounted 3-Way Junction 12/16-kV



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PD 335 Dead-Front Fuse Cabinet 15 kV Pad-Mounted

Scope PD 335.1 15 kV Dead-Front, Pad-Mounted Fuse Cabinets (PME-4) Installation Instructions

1.0 General Information

1.1 15 kV pad-mounted fuse cabinets (SAP 10107420 for SMU fuses, SAP 10107421 for CL fuses) are applicable for all 12 kV and 16 kV outdoor installations, particularly with nonfused pad-mounted transformers where switching is provided elsewhere (for example, RAM SWITCH).

1.2 Stainless steel cabinets are recommended for areas with severe corrosion problems such as coastal installations or greenbelt areas where irrigation water and water in the structure are historically a problem, or if the cabinet is expected to be changed out within 15 years. The use of stainless steel cabinets requires Field Engineering approval. (SAP 10107438 for SMU fuses, SAP 10107439 for CL fuses.)

1.3 The PME-4 cabinets provide adequate termination mounting height when installed on a pad or a cable trench.

1.4 The fuse cabinet has been equipped with 200A bushing wells for use with load-break inserts and elbows (hot-stick operated) and need not be equipped with KIRK-key interlock. Load-break elbows rated 15 kV should be used on the 12 kV system and elbows rated 25 kV should be used on the 16 kV system. See Table PD 335–1 (Sheet 2).

1.5 See TX 160 for general requirement for anchoring, sealing, stenciling of pad-mounted equipment.

1.6 PME switches are completely dead-front construction.

2.0 Fusing Information

2.1 It is recommended that the standard PME switch installed be equipped for CL fuses. See PD 337 for additional information and exceptions to this requirement.

2.2 End fittings for SME-20 fuse holders, which accept SMU-20 fuses, or CL fuse holders are supplied with each cabinet. SMU-20 fuses or current-limiting fuses are not included with the cabinet, and must be ordered separately.

2.3 Fuses are replaced by:

A. Moving the load-break elbow to a standoff insulator on a parking stand.

B. Raising the mechanical interlock on the fuse mounting assembly, unlatching the assembly at the bottom of the cabinet and pivoting the assembly to the open position.

C. In the open position, the de-energized and isolated fuse is accessible to the operator for replacement.

2.4 Load-break elbows shall be used on both the source and load side of the units, see PD 335 (Sheet 1). However, energizing and de-energizing of the load shall be on the load side as described above, to allow fusing to protect the load-break elbows and the operator.

2.5 The SME-20 fuse holders accept SMU-20 fuses. The fuse tables for SMU-20 fuses are in PD 205 and PD 315. Fusing requirements for current limiting fuse application are the same as the 3-wire and 4-wire radial laterals for fused BURD switches, as shown in PD 212. Consideration must be given to possible ferroresonant conditions where single-phase switching may occur. Information for CL type fuses (current limiting) for PME CL cabinets is found on PD 210.

Table PD 335–1: 15 kV and 25 kV Components

15 kV and 25 kV Components		
Component	**15 kV**	**25 kV**
#2 Elbow	SAP 10117361	SAP 10117359
1/0 Elbow	SAP 10117360	SAP 10117358
Bushing Insert	SAP 10117356	SAP 10117355
Insulating Cap	SAP 10117350	SAP 10117349

SM-4S Application	MAX Fuse Rating	Interrupt Rating	MAX 3Ø kVA Bank
12 kV	200E	290 MVA	2,500
16 kV	200E	388 MVA	3,750

CL Fuse Applications

NX Fuse Application	MAX Fuse Rating	Interrupt Rating	MAX 3Ø kVA Bank
12 kV	80 A[a/]	1,040 MVA	1,500
16 kV	80 A[a/]	1,385 MVA	1,500

[a/] 2-40 A ELX or KHT Fuses

= For Reference Only

Figure PD 335–1: 15 kV Dead-Front, Pad-Mounted Fuse Cabinet (PME-4)

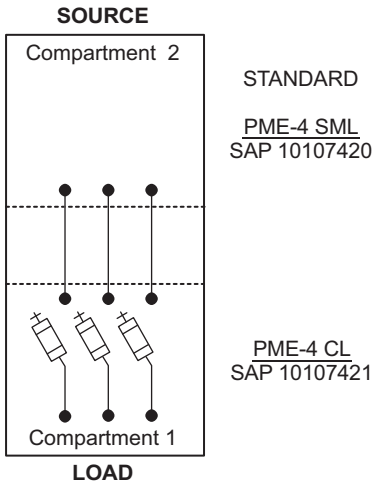


Table PD 335–2: PME-4 Cabinet Dimensions

Width (in)	Depth (in)	Height (in)	Weight (lb)
41	56	44	650

3.0 Replacement Fuseholder

For missing or damaged fuseholders, replacements for S&C switches are available under the following code numbers:

CL Fuse Holder with bolted fuse mounting (units manufactured prior to year 2000): SAP 10109151

For CL fuse holders with clip style design (units manufactured after year 2000), mount fuses directly onto clip of transfuser door. Replacement parts not available for field installation, unit may be repairable by SSID.

SME Power Fuse Style End Fittings (including Silencer): SAP 10109150

4.0 Structure

4.1 May be installed over a cable trench.

4.2 Refer to UGS SS 591 for pad requirements. Where PME-4 is installed in place of PMH-4, refer to UGS SS 593 for replacement pad to use with existing box. Rotate new switch 90 degrees for proper cable alignment.

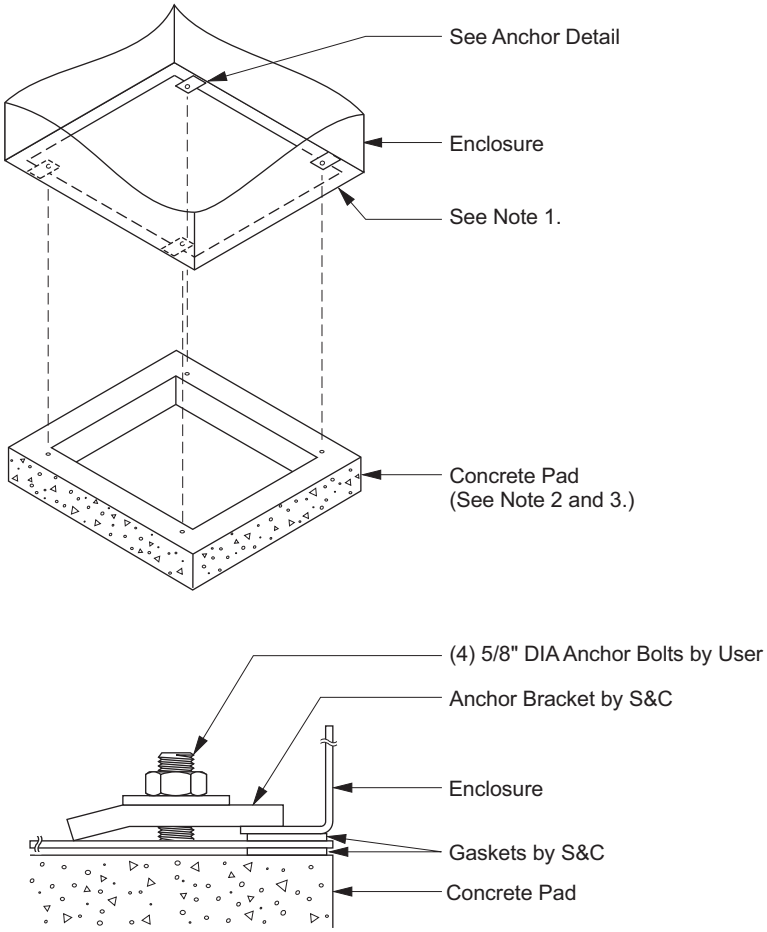
4.3 Contact Linear and Structural Strategies for other applications.

Figure PD 335–2: PME-4 Cable Termination Compartment

Figure PD 335–3: PME-4 Transfuser Compartment

Scope PD 335.2 15 kV Dead-Front, Pad-Mounted Fuse Cabinets (PME-4) Installation Instructions

Figure PD 335–4: 15 kV Dead-Front, Pad-Mounted Fuse Cabinets (PME-4) Installation Instructions



Detail "A"

Note(s):

1. Gasket included with PMH-4 cabinet.
2. Install pull string for future. Since access to the pull box is minimal, this structure should not be used as a cable pulling structure, that is, it should be used for "feed" only.
3. Attach all cable concentric wires and the switch enclosure to the structure 4/0 ground/neutral bus per the material and installation requirements of GR 100.

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PD 337 Dead-Front PME-Type Fuse/Switch Cabinet — Pad-Mounted

Scope PD 337.1 15 kV, 600 A, Dead-Front, Pad-Mounted Fuse/Switch Cabinets (PME) Installation Instructions and General Information

1.0 General Information

1.1 PME switches are equipped with dead-front terminations. All PMEs (with the exception of the PME-4) have at least one 600 A switch position with a gang-operated load-break switch. Fuse positions have 200 A bushing wells for use with load-break inserts and elbows. The SME-20 fuse holders used in the PME cabinet accept SMU-20 fuses (maximum 200 A per phase). The PME with SME fuse holders should be used where the available fault duty will remain below 10,000 A and if fusing will be required in excess of 100 A per phase. PME CL (current-limiting) cabinets contain CL fuses (maximum of 2–50 A per phase) and are the preferred installation for providing fuse protection up to 100 A per phase, and limiting fault duty below the 10,000 A limit for operating load-break elbows. For applications requiring fusing greater than 100 A, with fault duty above 10 kA, see exceptions below in Fusing Information.

1.2 Stainless steel cabinets are recommended for areas with severe corrosion problems such as coastal installations or greenbelt areas where irrigation water or water in the structure are historically a problem or if the cabinet is expected to be changed out within 15 years due to corrosion. The use of stainless cabinets requires Field Engineering approval.

NOTE

15 kV load-break elbows shall be used on the 12 kV system and 25 kV load-break elbows be used for the 16 kV system. See Table PD 337–1 (Sheet 3), for SAP numbers of various components to be used.

2.0 Fusing Information

2.1 Because of the application of load-break elbows in PME switches, **most PME switches will be ordered with current-limiting fuses (see exceptions below).** This will ensure that, regardless of fault duty at the location of the switchgear, it will be safe to operate the load-break elbows. This provides the additional advantages of better protection of downstream, nonfused transformers and other equipment being fed from the fused positions in the switchgear.

2.2 There are two exceptions to this recommended standard practice, both involving transformer bank sizes in excess of 1,000 kVA:

A. For three-phase, 12 kV, 3,750 kVA transformer banks, use a PMU-5 (SAP 10107582). This is a 600 A, 15 kV-fused load interrupter cabinet, equipped with 420E maximum SM-5S nondisconnectable style fuseholders. Refer to DDS, Section 3. VFIs may also be considered for these applications. Contact Field Engineering for assistance.

B. For three-phase, 12 kV and 16 kV, 1,500 kVA and 2,500 kVA transformers and three-phase, 16 kV, 3,750 kVA transformers connected from an underground source, the loading is potentially beyond the capabilities of standard available current-limiting fuses (two 50 A fuses in parallel). Field engineering will determine the best choice from the following:

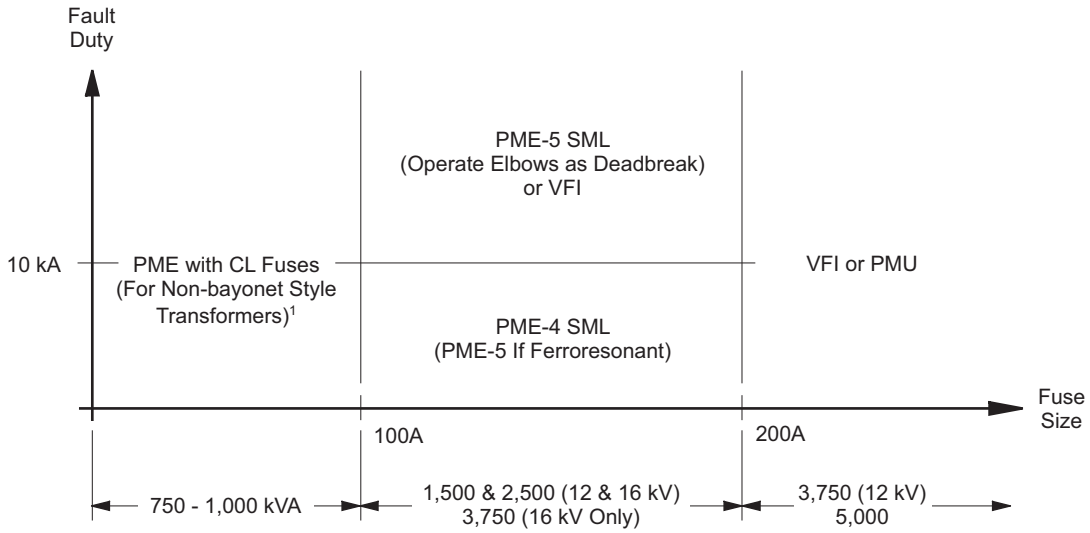
1. **If fault duty at the location is less than 10 kA**, fuse with a PME-4 fused load interrupter adjacent to the transformer (by definition, no ferroresonance problem with this design), equipped with power (SME) fuses. It is also possible to use a four compartment PME (PME-9 or PME-11, for example), fusing the transformer from a fused position, as long as ferroresonance is not a problem.

2. If ferroresonance is a problem, or if fault duty at the location is greater than 10 kA, it is still possible to use a PME but it will have to be a PME-5 or similar configuration to allow switching with a 600 A, three-phase switch. A sign should be hung in the fuse compartment to indicate the ferroresonance problem and that the load-break elbows should not be used for switching, similar to the practice used for PMH switches.

NOTE

In the case of a 1,000 kVA installation where the likelihood exists that a larger transformer will be installed within five years, consideration should be given to future accommodation of the larger transformer with the initial switch selection. In the event that a PME switch, with current-limiting fuse holders has been installed, replacement fuse clips (that is, to change from current-limiting style mounting to power fuse mounting) can be installed in the PME cabinet. Contact Linear and Structural Strategies for additional information. Fusing criteria is summarized in Figure PD 337–1 (Sheet 2).

Figure PD 337–1: Switch Selection Criteria by Transformer Size



[1] New transformers, 1,000 kVA and below, are internally fused and do not require a separate fuse cabinet.

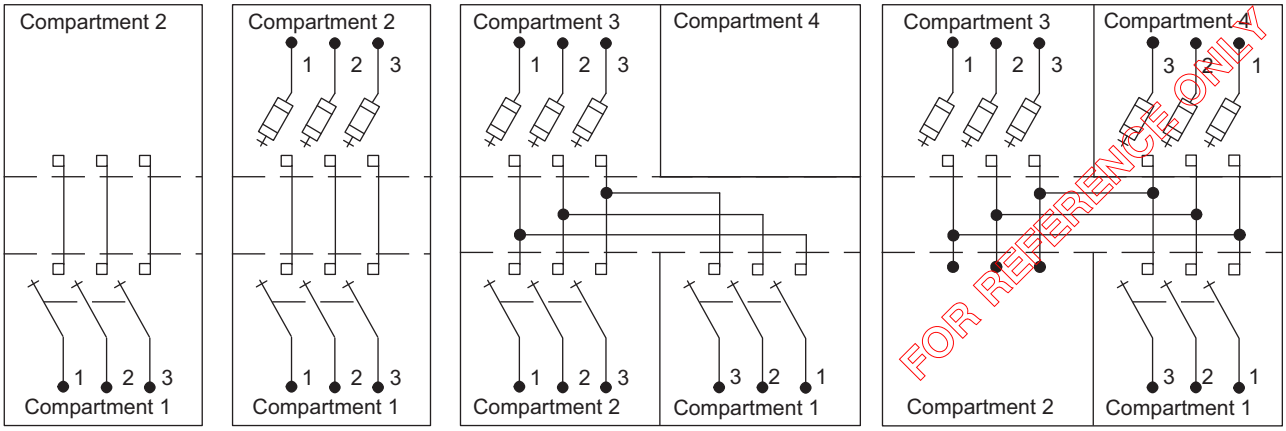
The PME fuse cabinet uses SME-20 fuse holders, which accept SMU-20 fuses. The fuse tables for SMU-20 fuses are in PD 205 and PD 315. Current-limiting fuse requirements are the same as the 3-wire and 4-wire radial laterals for fused BURD and pad-mounted systems as shown on PD 212. Consideration must be given to possible ferroresonant conditions in these applications.

Table PD 337–1: 15 kV and 25 kV Components

Component	15 kV	25 kV
#2 Elbow	SAP 10117361	SAP 10117359
1/0 Elbow	SAP 10117360	SAP 10117358
Bushing Insert	SAP 10117356	SAP 10117355
Insulating Cap	SAP 10117350	SAP 10117349

= For Reference Only

Figure PD 337–2: 15 kV, 600 A, Dead-Front, Pad-Mounted Fuse/Switch Cabinets (PME) — 15 kV and 25 kV Components



STANDARD
PME-3
SAP 10107295

STAINLESS STEEL
PME-3
SAP 10107303

STANDARD
PME-5 SML
SAP 10107416

PME-5 CL
SAP 10107429

STAINLESS STEEL
PME-5 SML
SAP 10107433

PME-5 CL
SAP 10107440

STANDARD
PME-6 SML
SAP 10107418

PME-6 CL
SAP 10107417

STAINLESS STEEL
PME-6 SML
SAP 10107434

PME-6 CL
SAP 10107441

Note: PME-8 not available, use PME-9 or PME-12.

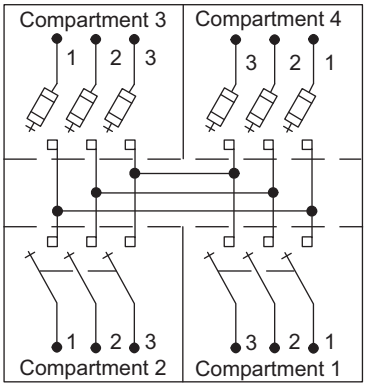
Figure PD 337–3: 15 kV, 600 A, Dead-Front, Pad-Mounted Fuse/Switch Cabinets (PME)

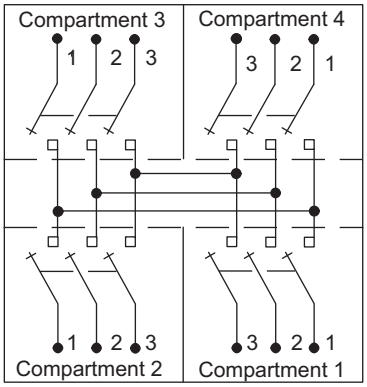
STANDARD
PME-9 SML
SAP 10107422

PME-9 CL
SAP 10107423

STAINLESS STEEL
PME-9 SML
SAP 10171172

PME-9 CL
SAP 10107442





STANDARD
PME-10
SAP 10107424

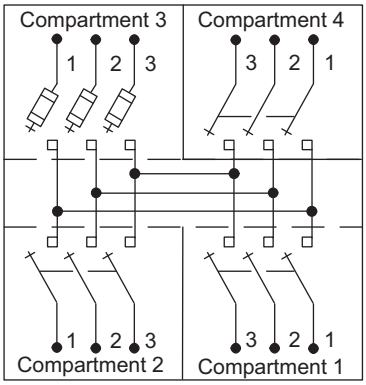
STAINLESS STEEL
PME-10
SAP 10107443

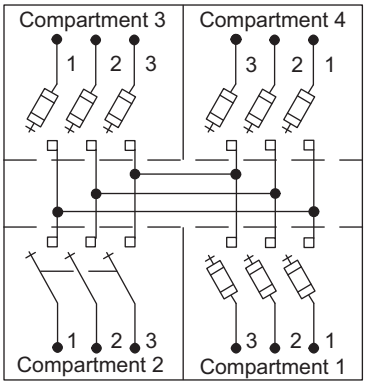
STANDARD
PME-11 SML
SAP 10107425

PME-11 CL
SAP 10107426

STAINLESS STEEL
PME-11 SML
SAP 10107436

PME-11 CL
SAP 10107444





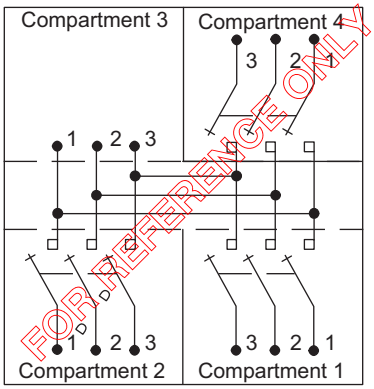
STANDARD
PME-12 SML
SAP 10107427

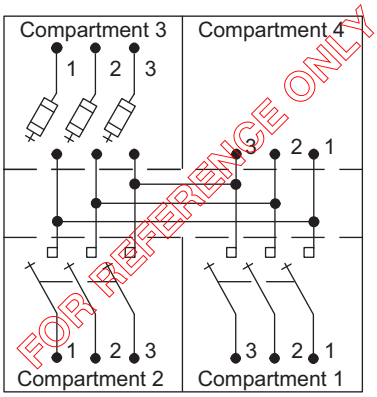
PME-12 CL
SAP 10107428

STAINLESS STEEL
PME-12 SML
SAP 10107437

PME-12 CL
SAP 10107445

STANDARD
PME-13 SML
(Not Available)
Use PME-10
or
Use PME-11 CL





STANDARD
PME-14 SML
(Not Available)
Use PME-9 SML

PME-14 CL
(Not Available)
Use PME-9 CL
or
Use PME-11 CL

FOR REFERENCE ONLY
FOR REFERENCE ONLY

Note(s):

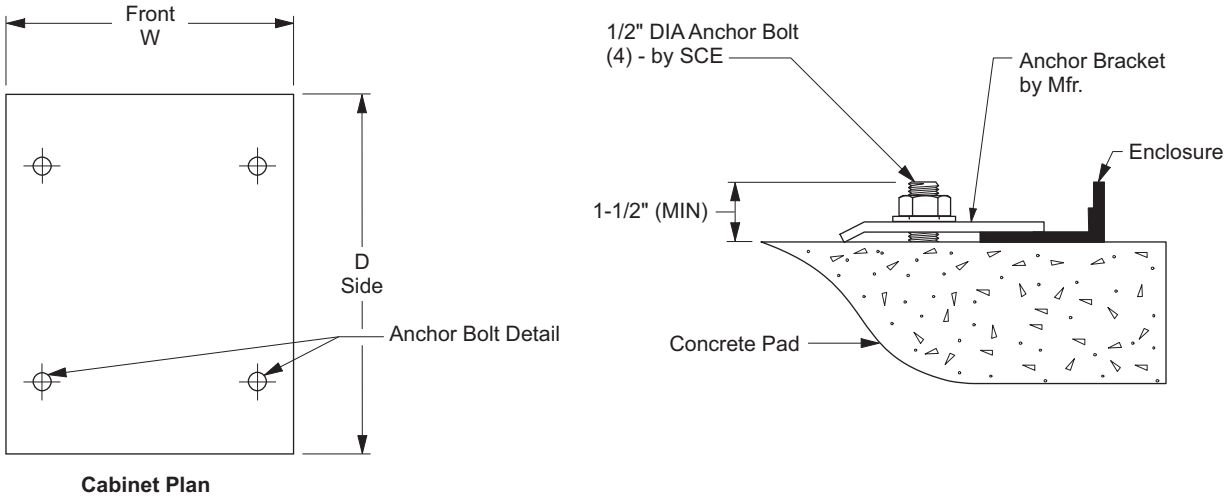
1. A PME-4 (PD 335) may be used in place of a PME-5 if separate switching (for example, RAM switch) is already available.
2. A potentially ferroresonant condition may exist if the single-pole fused positions are used to switch three-phase and single-phase transformers of 3-wire systems.
3. Recommended Structure:
4. PME-5 (Refer to UGS SS 591);
5. PME-6 through PME-12 (Refer to UGS SS 590 and SS 541);
6. May be installed over a cable trench. Contact Distribution Engineering for other applications.
7. See TX 160 for general anchoring, stenciling, and sealing requirements for pad-mounted equipment.
8. A solid bar SMU-fuse replacement (SAP 10106746) is available for locations where fusing is already located in customer's equipment or is otherwise not desirable. Use SAP 10106747 for CL-style fuses with bolted-type fuse mounting (PME Units manufactured prior to year 2000). Use SAP 10106738 for CL-style fuses with clip type fuse mounting (PME units manufactured after year 2000).

9. Replacements for missing or damaged CL-style fuse holders with bolted fuse mounting (PME units manufactured prior to year 2000), use SAP 10109151. For units with CL clip style design (PME units manufactured after year 2000), mount fuses directly onto clip of transfuser door. Field replacement parts are not available.
10. Replacements for missing or damaged SME-style fuse holders (end fittings including silencer), use SAP 10109150.
11. For automating PME/PMH switched positions, refer to SE 275 for SAP material codes and general installation requirements.

Figure PD 337–4: PME Transfuser Compartment

Figure PD 337–5: PME Cable Termination Compartment

Figure PD 337–6: PME Cabinet Anchor Details



Cabinet Plan

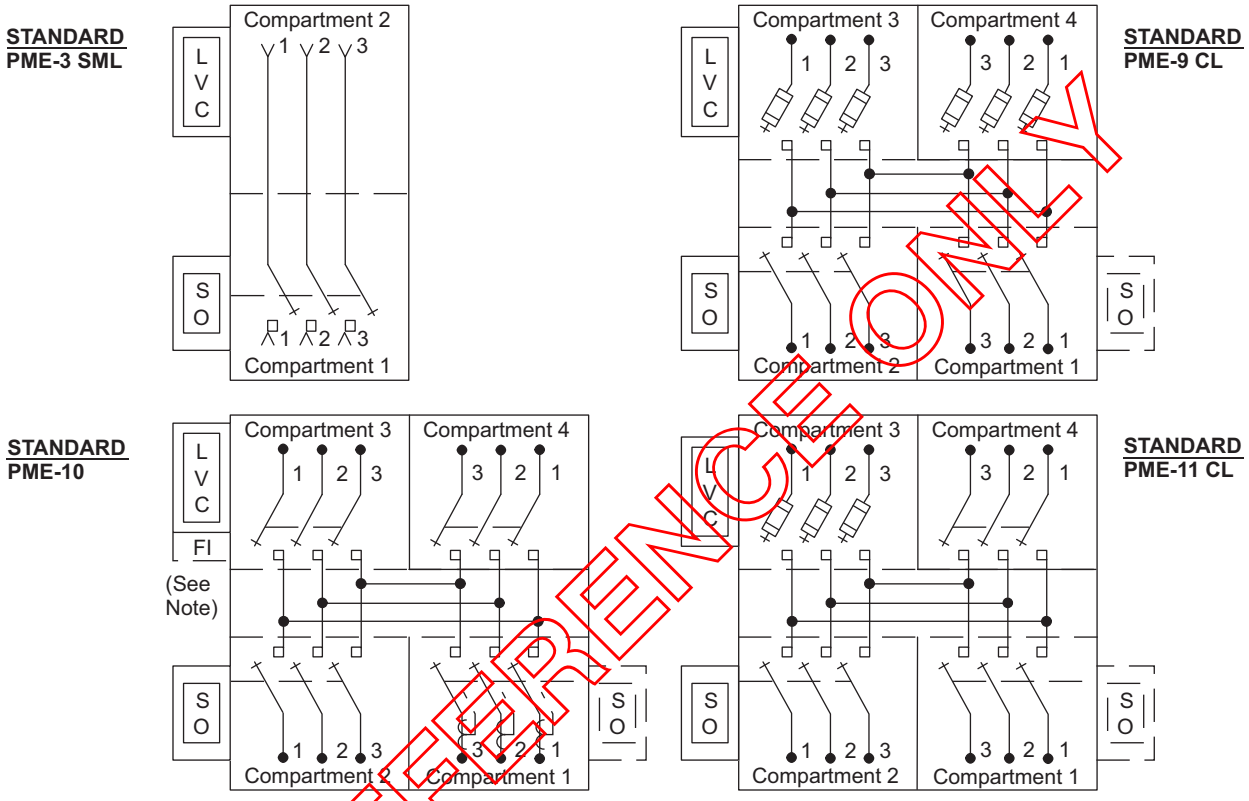
Table PD 337–2: Cabinet Dimensions and Weight

Cabinet Type	Width (in)	Depth (in)	Height (in)	Weight (lb)
	S&C	S&C	S&C	S&C
PME-3	41	67	44	740
PME-5	41	67	44	1103
PME-6	75	67	44	1821
PME-9	75	67	44	1998
PME-10	75	72	44	2092
PME-11	75	72	44	2025
PME-12	75	67	44	1980

Note(s):
1. See JJ Section for 600 A dead-break termination information.
2. See TP 150 and TP 151 for 15 kV load-break elbow cable terminations.
3. See TP 161 for 25 kV load-break elbow cable termination information.
4. Attach all cable concentric wires and the switch enclosure to the structure 4/0 ground/neutral bus per the material and installation requirements of GR 100.

Scope PD 337.2 Automated, 15 kV, 600 A, Dead-Front, Pad-Mounted Fuse/Switch Cabinets (PME) Installation Instructions and General Information

Figure PD 337–7: Automated, 15 kV, 600 A, Dead-Front, Pad-Mounted Fuse/Switch Cabinets (PME)



FOR REFERENCE ONLY

Table PD 337–3: Automated, 15 kV, 600A, Dead-Front, Pad-Mounted Fuse/Switch Cabinets (PME) — SAP for Switches

Switch	SAP	
	One Switch Operator	Two Switch Operators
PME-3	10107453	—
PME-9 CL	10107462	10107461
PME-10	10107454	10107460
PME-11 CL	10107456	10107459

Note(s):
1. See JJ Section for 600A dead-break termination information.
2. See TP 150 and TP 151 for 15 kV load-break elbow cable terminations.
3. See TP 161 for 25 kV load-break elbow cable termination information.

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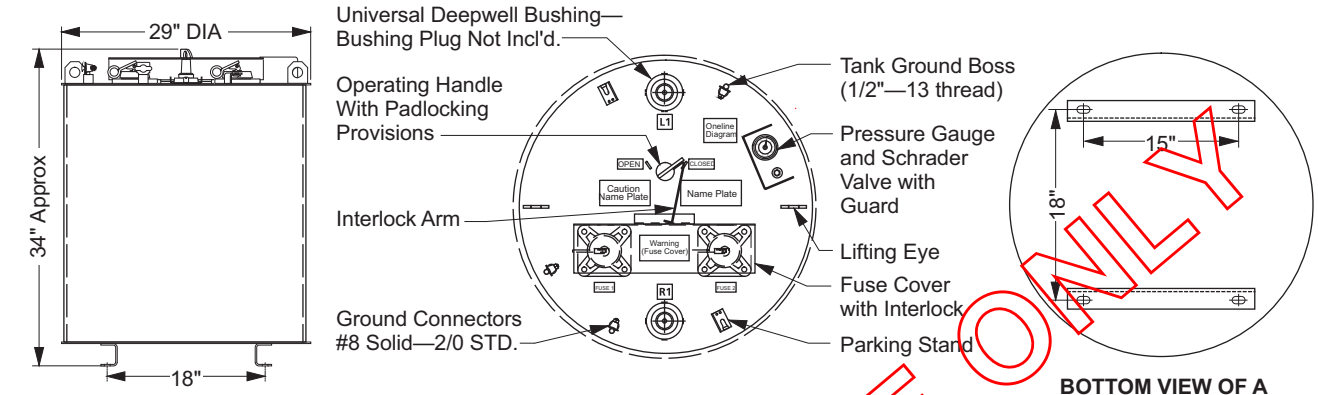
PD 400 1Ø and 3Ø Fused Switch — 17 kV Buried Underground Residential Distribution (BURD) Switch

Scope PD 400.1 Submersible Fused Switch (BURD Switch), SF_6 or Oil Filled, 2-Way, Single-Pole, 4-Wire

Figure PD 400–1: Submersible Fused Switch (BURD Switch), SF_6 or Oil Filled, 2-Way, Single-Pole, 4-Wire



SIDE VIEW OF A TYPICAL SWITCH
(SF_6 Switch Shown)

TOP VIEW OF A TYPICAL SWITCH
(SF_6 Switch Shown)

BOTTOM VIEW OF A TYPICAL SWITCH
(Anchor Detail)

FOR REFERENCE ONLY

1.0 Application

The fused switch has been designed to provide single phase short circuit protection and load-break switching on 6.9 kV and 9.4 kV, 4-wire BURD systems. Switches installed in vaults, SOEs, or other concrete structures where the switch may float must be securely anchored to the structure wall or floor using stainless steel anchors per RS 100.

2.0 Features

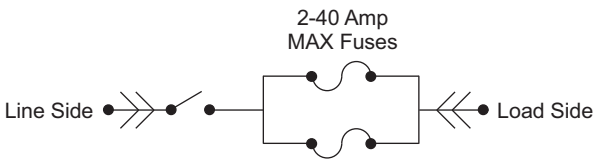
- Mechanical Interlock — Prevents fuse removal when switch is closed.
- Termination — Two high voltage bushing wells. 200 A bushing plugs are not included (load-break preferred, SAP 10117356 (15 kV) SAP 10117355 (25 kV); dead-break SAP 10118014).
- Switch — Single-pole, double-action type.
- Tank — Stainless steel. Unit is completely submersible.

3.0 Fusing

Fuse Size Current Limiting	Total Transformer Capacity		Fuse SAP Number
	6.9 kV	9.4 kV	
1–40A	25–150 kVA	25–250 kVA	10108851[a/]
2–40A	175–375 kVA	275–500 kVA	10108851[b/]

[a/] Use one fuse chamber.
[b/] Use both fuse chambers.

Figure PD 400–1.1: Switch Circuit Diagram



Note(s):
1. Fuses not included with switch, order separately.
2. See SE Section for marking of switches.

4.0 Specifications

- Voltage Class — 17 kV
- Basic Impulse (Insulation) Level (BIL) — 95 kV
- Continuous Current — 200 A
- Load Switching — 200 A
- Switch Close/Latch — 10,000 A
- Approximate Oil Capacity — 17 gal
- Approximate Weight — Oil Filled = 460 lb / — SF_6 Gas Filled = 190 lb

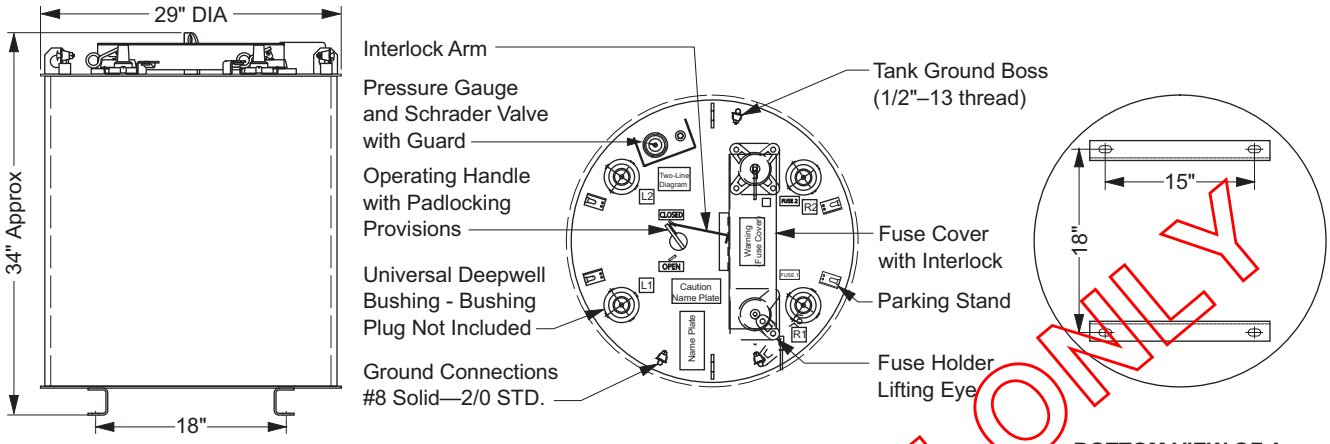
5.0 Ordering Information

SAP 10106422 Switch, submersible fused load-break 200 A, 17 kV, with current limiting fuse chamber, 2-way, single-pole with 2 HV terminals and mechanical interlock.

FOR REFERENCE ONLY

Scope PD 400.2 Submersible Fused Switch (BURD Switch), SF_6 or Oil Filled, 2-Way, 2-Pole, 3-Wire

Figure PD 400–2: Submersible Fused Switch (BURD Switch), SF_6 or Oil Filled, 2-Way, 2-Pole, 3-Wire



SIDE VIEW OF A TYPICAL SWITCH
(SF_6 Switch Shown)

TOP VIEW OF A TYPICAL SWITCH
(SF_6 Switch Shown)

BOTTOM VIEW OF A TYPICAL SWITCH
(Anchor Detail)

FOR REFERENCE ONLY

1.0 Application

The fused switch has been designed to provide single phase short circuit protection and load-break switching on 12 kV and 16 kV, 3-wire BURD systems. Switches installed in vaults, SOEs, or other concrete structures where the switch may float must be securely anchored to the structure wall or floor using stainless steel anchors per RS 100.

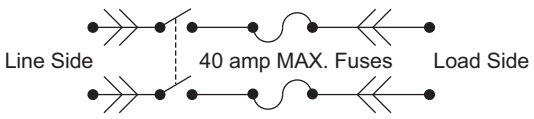
2.0 Features

- Mechanical Interlock — Prevents fuse removal when switch is closed.
- Termination — Four high voltage bushing wells. 200 A bushing plugs are not included (load-break preferred, SAP 10117356 (15 kV) SAP 10117355 (25 kV); dead-break SAP 10118014).
- Switch — SF_6 gas, double-pole, double-action type.
- Tank — Stainless steel. Unit is completely submersible.

3.0 Fusing

Fuse Size Current Limiting	Total Transformer Capacity		Fuse SAP Number
	12 kV	16 kV	
1–40 A per Ø	25–325 kVA	25–450 kVA	10108857

Figure PD 400–2.1: Switch Circuit Diagram



Note(s):
1. Fuses not included with switch, order separately.
2. See SE Section for marking of switches.

4.0 Specifications

- Voltage Class — 17 kV
- BIL — 95 kV
- Continuous Current — 200 A

- Load Switching — 200 A
- Switch Close/Latch — 10,000 A
- Approximate Oil Capacity — 17 gal
- Approximate Weight — Oil Filled = 260 lb / — SF_6 Gas Filled = 190 lb

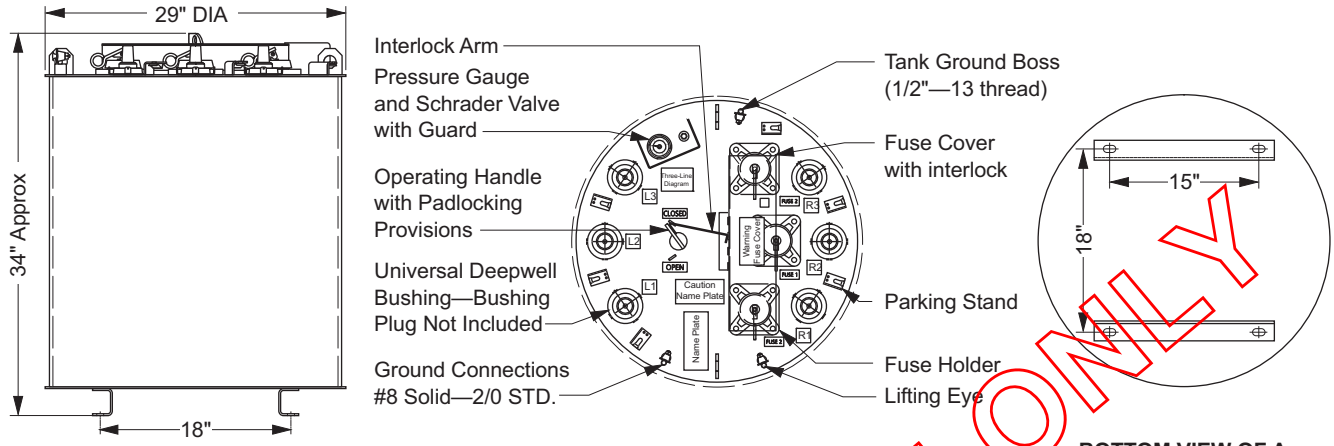
5.0 Ordering Information

SAP 10106423 Switch, submersible fused load-break 200 A, 17 kV, with current limiting fuse chamber on each phase, 2-way, double-pole with 4 HV ESNA terminals and mechanical interlock.

FOR REFERENCE ONLY

Scope PD 400.3 Submersible Fused Switch (BURD Switch), SF_6 or Oil Filled, 2-Way, Single-Pole, 4-Wire

Figure PD 400–3: Submersible Fused Switch (BURD Switch), SF_6 or Oil Filled, 2-Way, Single-Pole, 4-Wire



SIDE VIEW OF A TYPICAL SWITCH
(SF_6 Switch Shown)

TOP VIEW OF A TYPICAL SWITCH
(SF_6 Switch Shown)

BOTTOM VIEW OF A TYPICAL SWITCH
(Anchor Detail)

FOR REFERENCE ONLY

1.0 Application

The fused switch has been designed to provide single phase short circuit protection and load-break switching on 12 kV and 16 kV, 3Ø loads. Switches installed in vaults, SOEs, or other concrete structures where the switch may float must be securely anchored to the structure wall or floor using stainless steel anchors per RS 100.

2.0 Features

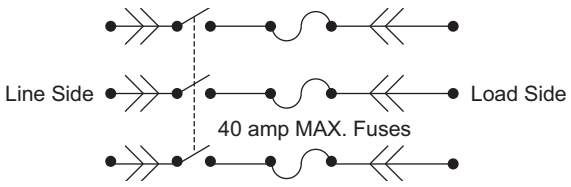
- Mechanical Interlock — Prevents fuse removal when switch is closed.
- Termination — Six high voltage bushing wells. 200 A bushing plugs are not included (load-break preferred, SAP 10117356 (15 kV), SAP 10117355 (25 kV); dead-break SAP 10118014).
- Switch — SF_6 gas, 3-pole, double-action type.
- Tank — Stainless steel. Unit is completely submersible.

3.0 Fusing

Fuses are not ordered with the switch and must be ordered separately according to transformer size, see PD 210.

Note(s):
1. See SE Section for marking of switches.

Figure PD 400–3.1: Switch Circuit Diagram



4.0 Specifications

- Voltage Class — 17 kV
- BIL — 95 kV
- Continuous Current — 200 A
- Load Switching — 200 A
- Switch Close/Latch — 10,000 A

- Approximate Oil Capacity — 44 gal
- Approximate Weight — Oil Filled = 504 lb / — SF_6 Gas Filled = 190 lb

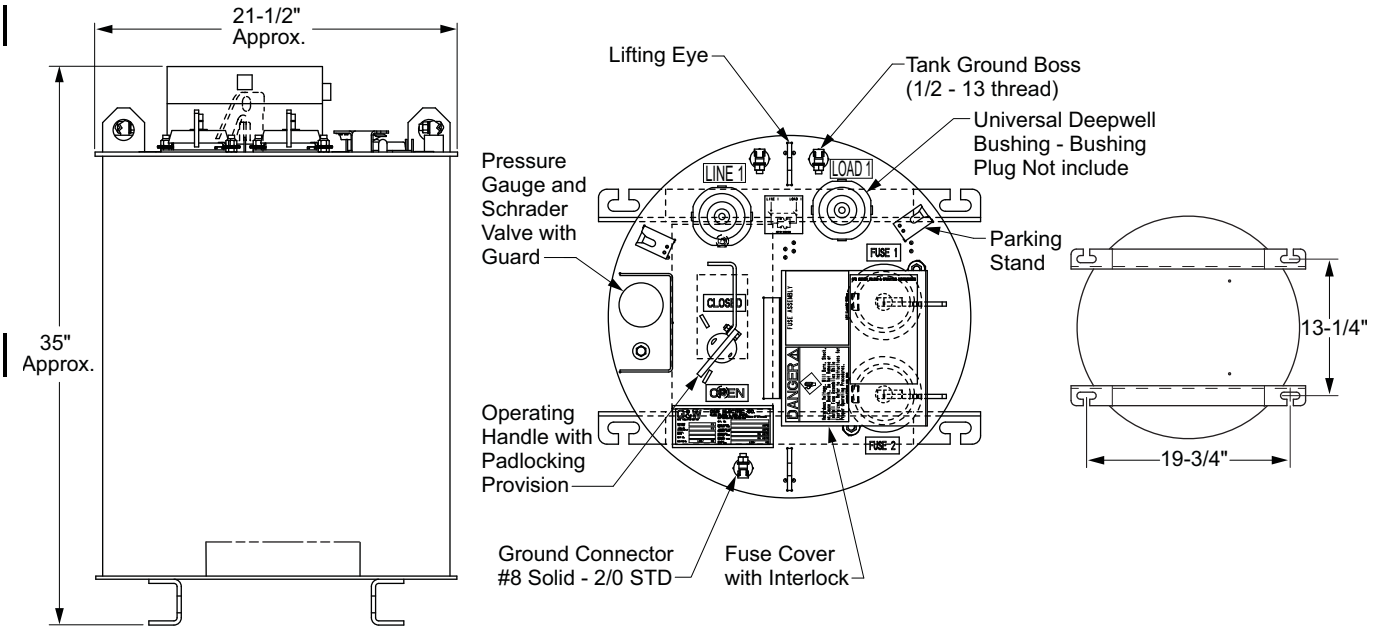
5.0 Ordering Information

SAP 10106424 Switch, submersible fused load-break 200 A, 17 kV, with current limiting fuse chamber on each phase, 2-way, 3-pole with 6 HV terminals and mechanical interlock.

FOR REFERENCE ONLY

Scope PD 400.4 Submersible Fused Switch (BURD Switch), SF_6, 2-Way, 1-Pole, 4-Wire System

Figure PD 400–4: Submersible Fused Switch (BURD Switch), SF_6, 2-Way, 1-Pole, 4-Wire System



Side View **Top View** **Bottom View**

1.0 Application

The fused switch has been designed to provide single-phase short circuit protection and load-break switching on 6.9 kV and 9.4 kV, 4-wire BURD systems. Switches installed in vaults, SOEs, or other concrete structures where the switch may float must be securely anchored to the structure floor using stainless steel anchors per RS 100.

Field configuration shall be verified with the schematic diagram shown in Figure PD 400–4.1.

2.0 Features

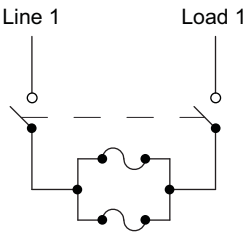
- Mechanical Interlock — Prevents fuse removal when switch is closed.
- Termination — Two 200 A bushing wells.
- Switch — 1-pole gang operated Line and Load side switch design for complete isolation of fuse canisters.
- Tank — Stainless steel. Unit is completely submersible

3.0 Fusing

The switch requires 8.3 kV rated current-limiting fuses. Fuses are not included with the switch and must be ordered separately according to transformation. See PD 210 for Current-Limiting Fuses on 6.9 kV and 9.4 kV 4-wire systems.

Note(s):
1. See SE Section for marking of switches.

Figure PD 400–4.1Switch Circuit Diagram



2-40 Amp MAX CL Fuses

4.0 Specifications

- Voltage Class — 17 kV
- Basic Impulse (Insulation) Level (BIL) — 95 kV
- Continuous Current — 200 A
- Load Switching — 200 A
- Switch Close/Latch — 10,000 A
- Approximate Weight = 400 lb

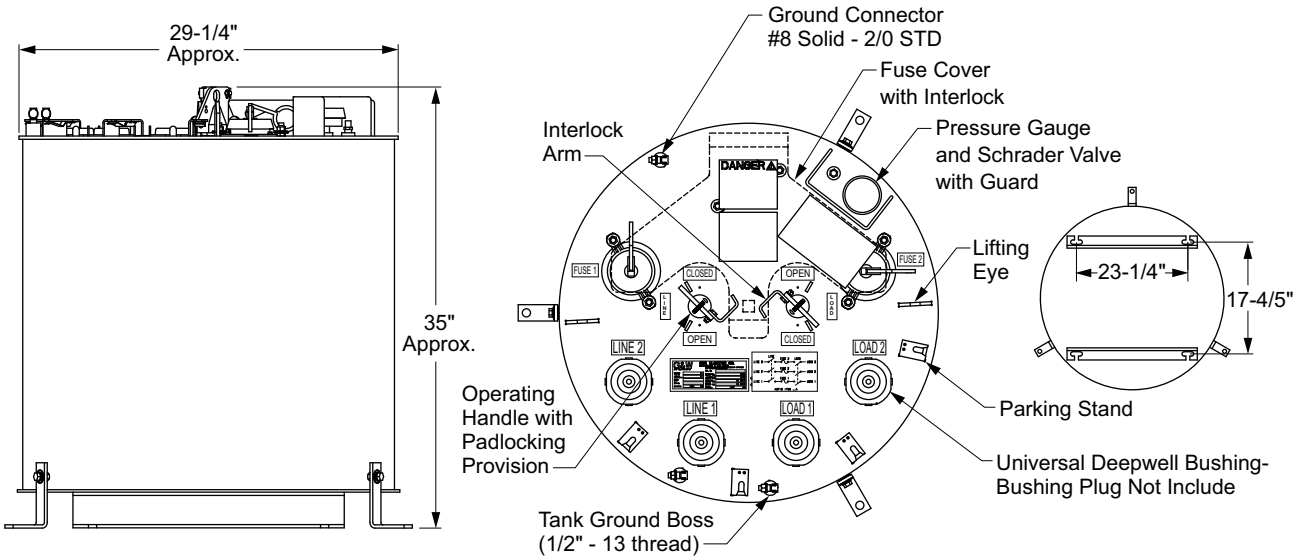
Note(s):
1. Two-way one-pole gang operated fused BURD switches designed with isolation of fuse provisions manufactured prior to 2014 are nameplate rated for 160 A continuous current and load switching.

5.0 Ordering Information

SAP 10106422 Switch, submersible fused load-break 200 A, 17 kV, with current limiting fuse chamber, 2-way, 1-pole with 2 HV terminals and mechanical interlock.

Scope PD 400.5 Submersible Fused Switch (BURD Switch), SF_6, 2-Way, 2-Pole, 3-Wire System

Figure PD 400–5: Submersible Fused Switch (BURD Switch), SF_6, 2-Way, 2-Pole, 3-Wire System



Side View **Top View** **Bottom View**

1.0 Application

The fused switch has been designed to provide single phase short circuit protection and load-break switching on 12 kV and 16 kV, 3-wire BURD systems. Switches installed in vaults, SOEs, or other concrete structures where the switch may float must be securely anchored to the structure floor using stainless steel anchors per RS 100. Structure cover must be removed for installation.

Field configuration shall be verified with the schematic diagram shown in Figure PD 400–5.1.

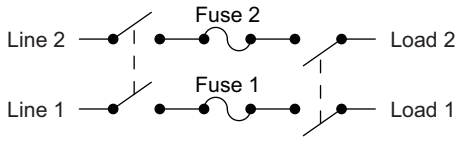
2.0 Features

- Mechanical Interlock — Prevents fuse removal when switch is closed.
- Termination — Four 200 A bushing wells.
- Switch — 2-pole gang operated Line and Load side switch design for complete isolation of fuse canisters.
- Tank — Stainless steel. Unit is completely submersible.

3.0 Fusing

The switch requires 15.5 kV rated current-limiting fuses. Fuses are not included with the switch and must be ordered separately according to transformation. See PD 210 for Current-Limiting Fuses on 12 kV and 16 kV 3-wire systems.

Figure PD 400–5.1Switch Circuit Diagram



40 Amp MAX CL Fuses per Phase

Note(s):
1. See SE Section for marking of switches.
2. Removal of structure cover is required when installing this switch..

4.0 Specifications

- Voltage Class — 17 kV
- BIL — 95 kV
- Continuous Current — 200 A
- Load Switching — 200 A
- Switch Close/Latch — 10,000 A
- Approximate Weight = 400 lb

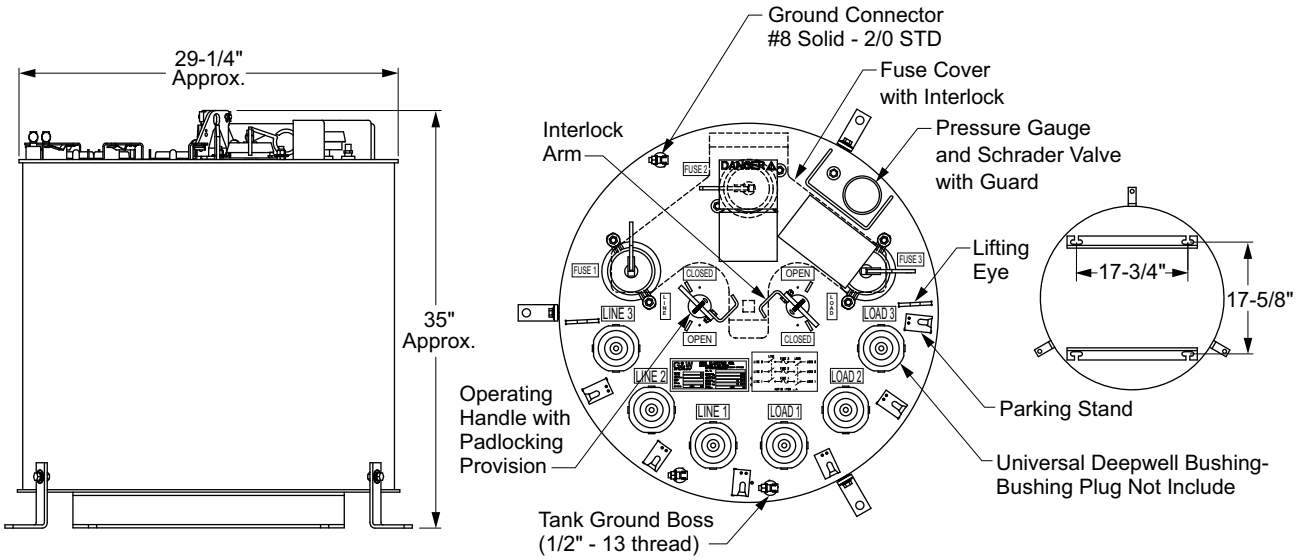
Note(s):
1. Two-way two-pole gang operated fused BURD switches designed with isolation of fuse provisions manufactured prior to 2014 are nameplate rated for 160 A continuous current and load switching.

5.0 Ordering Information

SAP 10106423 Switch, submersible fused load-break 200 A, 17 kV, with current limiting fuse chamber on each phase, 2-way, 2-pole with 4 HV ESNA terminals and mechanical interlock.

Scope PD 400.6 Submersible Fused Switch (BURD Switch), SF_6, 2-Way, 3-Pole, 3-Wire System

Figure PD 400–6: Submersible Fused Switch (BURD Switch), SF_6, 2-Way, 3-Pole, 3-Wire System



1.0 Application

The fused switch has been designed to provide single phase short circuit protection and load-break switching on 12 kV and 16 kV, 3Ø loads. Switches installed in vaults, SOEs, or other concrete structures where the switch may float must be securely anchored to the structure floor using stainless steel anchors per RS 100. Structure cover must be removed for installation.

Field configuration shall be verified with the schematic diagram shown in Figure PD 400–6.1.

2.0 Features

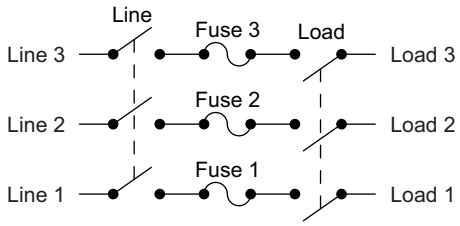
- Mechanical Interlock — Prevents fuse removal when switch is closed.
- Termination — Six 200 A bushing wells.
- Switch — 3-pole gang operated Line and Load side switch design for complete isolation of fuse canisters.
- Tank — Stainless steel. Unit is completely submersible.

3.0 Fusing.

The switch requires 15.5 kV rated current-limiting fuses. Fuses are not included with the switch and must be ordered separately according to transformation. See PD 210 for Current-Limiting Fuses on 12 kV and 16 kV 3-wire systems.

Note(s):
1. See SE Section for marking of switches.
2. Removal of structure cover is required when installing this switch..

Figure PD 400–6.1Switch Circuit Diagram



40 Amp MAX CL Fuses per Phase

4.0 Specifications

- Voltage Class — 17 kV
- BIL — 95 kV
- Continuous Current — 200 A
- Load Switching — 200 A
- Switch Close/Latch — 10,000 A
- Approximate Weight = 400 lb

Note(s):
1. Two-way three-pole gang operated fused BURD switches designed with isolation of fuse provisions manufactured prior to 2014 are nameplate rated for 160 A continuous current and load switching.

5.0 Ordering Information

SAP 10106424 Switch, submersible fused load-break 200 A, 17 kV, with current limiting fuse chamber on each phase, 2-way, 3-pole with 6 HV terminals and mechanical interlock.

PD 410 Fused Switch — 15 kV — Pad-Mounted

Scope PD 410.1 Pad-Mounted Fused Switch - 15 kV (PME-2)

1.0 General Information

1.1 The Pad-Mounted fused switch (PME-2) is used to fuse 12 kV or 16 kV Phase to Phase connected single phase radials. The Pad-Mounted fused switch is equipped with 200A bushing wells for use with load-break inserts and load-break elbows (hot-stick operated). Load break elbows rated at 15 kV shall be used on the 12 kV system, and elbows rated at 25 kV shall be used on the 16 kV system.

1.2 The weight of the PME-2 is approximately 950 pounds.

1.3 See TX 160 for general requirements of anchoring, stenciling, and sealing of Pad-Mounted equipment.

1.4 The Pad-Mounted fused switch is completely dead-front construction.

1.5 Feed-through inserts are not allowed in this Pad-Mounted fuse switch. If multiple runs need to exit this switch, a splice box will have to be installed on the load side.

1.6 An 8-foot minimum working clearance is required directly in front of the Pad-Mounted fuse switch and 3 feet on switch handle side.

Figure PD 410–1: Pad-Mounted Fused Switch (PME-2)

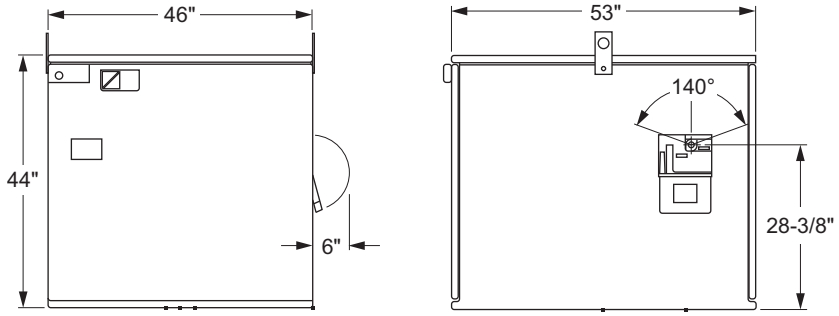


Table PD 410–1: Pad-Mounted Fused Switch (PME-2)

Type/Description[a/]	SAP Number	Recommended Pad	
		Size (in)	Related Standards
PME-2 CL/2W-2P	10107353	48 x 54	UGS SS 506
PME-2 SML/2W-2P	10107354		

[a/] For PME-1, see PD 420 for details.

Figure PD 410–2: Switch Circuit Diagram - PME-2, 2-Way, 2-Pole

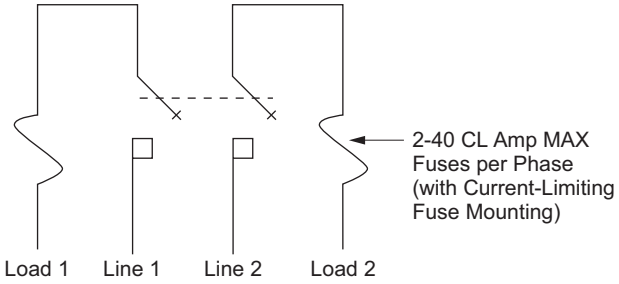


Figure PD 410–3: Open Front View

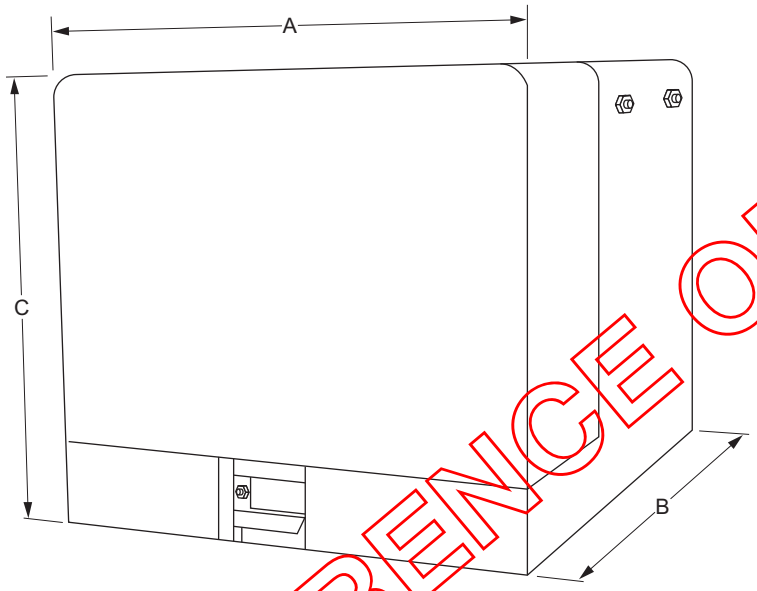
Figure PD 410–4: Closed View

Note(s):

1. When a PME-1 or PME-2 is being used to replace an existing Pad-Mounted oil fused switch, a splice (see DUG JJ611), or elbow extension (see DUG TP 152) should be used to achieve appropriate elbow connection. If a splice or elbow extension can not be made in a safe and proficient manner, new cable may be required to feed the PME.
2. An inverted hand-hole (see UGS SS 506) is required to perform the cable splices.
3. When a PME-2 is used to replace an existing Pad-Mounted oil fused switch, install 1-40CL per phase only.
4. Attach all cable concentric wires and the switch enclosure to the structure 4/0 ground/neutral bus per the material and installation requirements for GR 100.

Scope PD 410.2 Pad-Mounted Fused Oil Switch

Figure PD 410–5: Pad-Mounted Fused Oil Switch — 15 kV



FOR REFERENCE ONLY

Table PD 410–2: Pad-Mounted Fused Oil Switch

Type	Westinghouse Material Code	Westinghouse A	Westinghouse B	Westinghouse C	Recommended Pad "Polymer Concrete" Size (in)	Recommended Pad "Polymer Concrete" Material Code
2-way, 1-pole	535-90709	36	40	32	54 x 48	656-52687
2-way, 2-pole	535-90808	44	47	32	54 x 48	656-52687

Figure PD 410–6: Switch Circuit Diagram — 2-Way, Single-Pole, 4-Wire

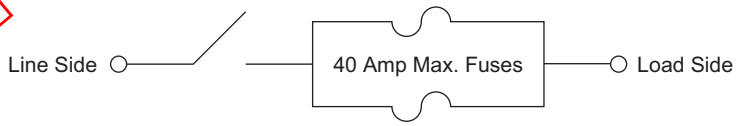
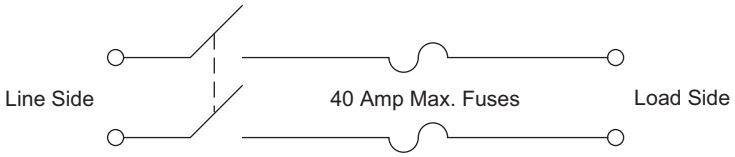


Figure PD 410–7: Switch Circuit Diagram — 2-Way, 2-Pole, 3-Wire



Note(s):

1. This switch is not approved for new construction. Use a PME-1 (see PD 420) or PME-2 (see 1. (Sheet 5)) for new construction or replacement of pad-mounted oil switches.

Figure PD 410–8: Switch Circuit Diagram — 2-Way, 2-Pole, 3-Wire

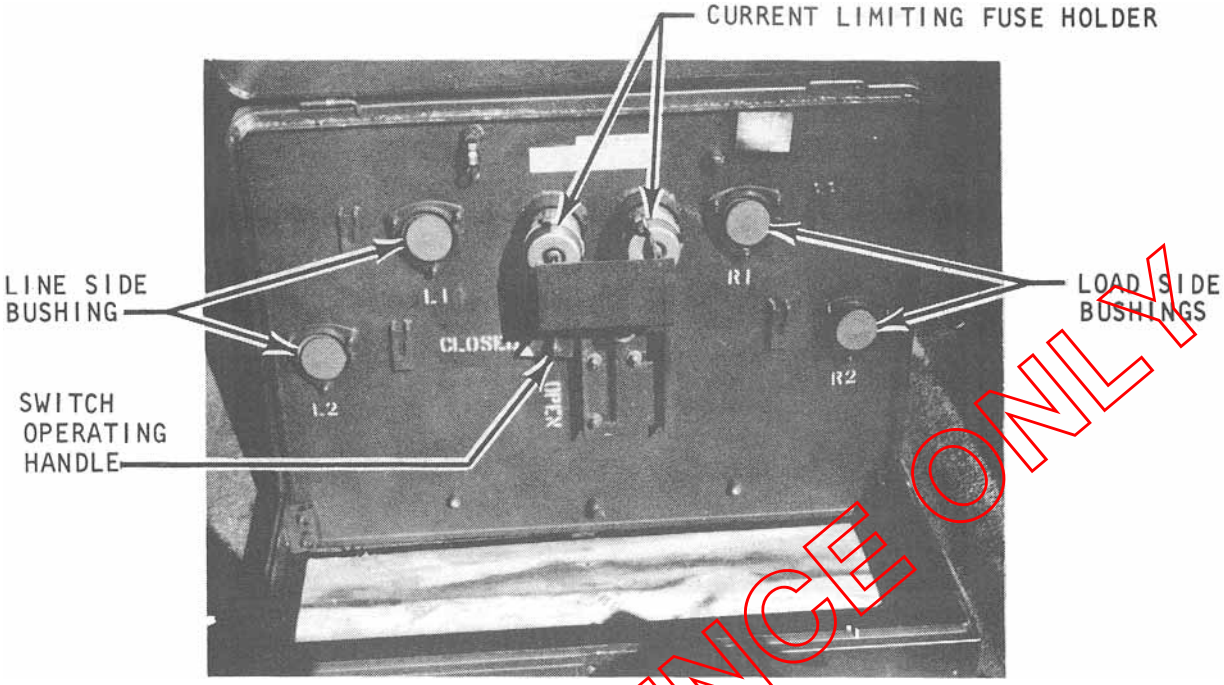
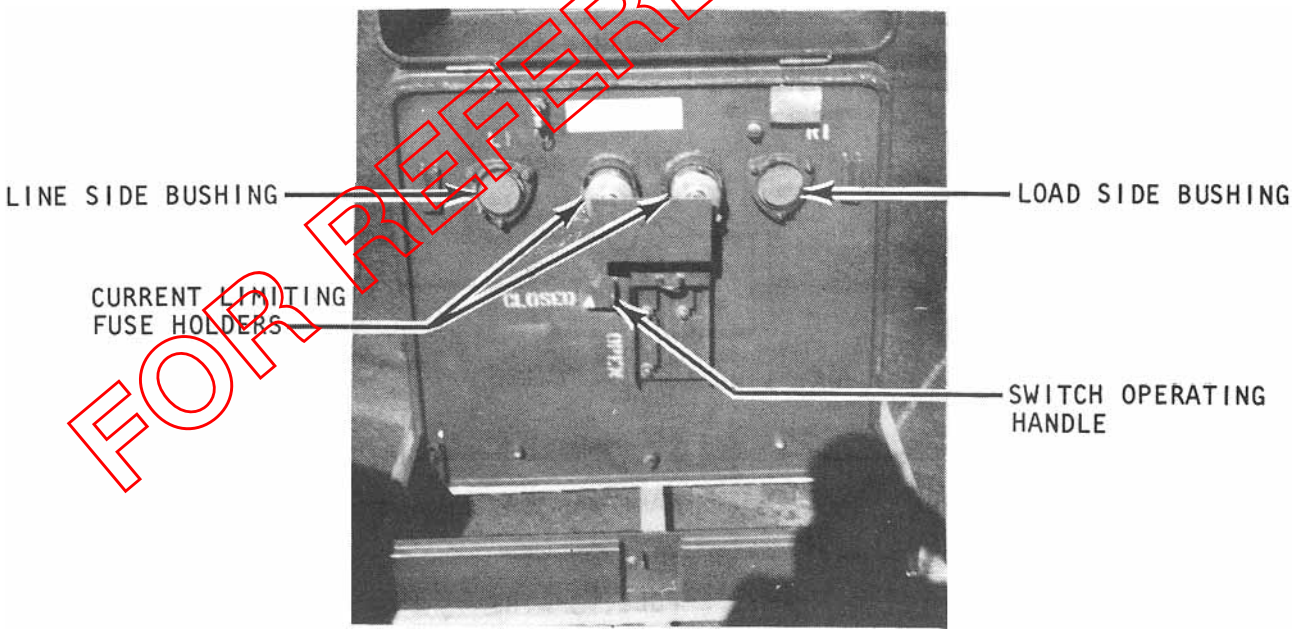


Figure PD 410–9: Switch Circuit Diagram — 2-Way, Single-Pole, 4-Wire



FOR REFERENCE ONLY

Note(s):

1. This switch is not approved for new construction. Use a PME-1 (see PD 420) or PME-2 (see 1. (Sheet 3)) for new construction or replacement of pad-mounted oil switches.

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PD 420 Pad-Mounted Fuse Cabinet — 6.9 kV and 9.5 kV

Scope PD 420.1 Dead-Front Pad-Mounted Fuse Cabinet (PME-1) — 6.9 kV and 9.4 kV

1.0 General Information

1.1 The pad-mounted fuse cabinet (PME-1) is used to fuse 4-wire 6.9 kV or 9.4 kV residential radials. The fuse cabinet is equipped with 200 A bushing wells for use with load-break inserts and load-break elbows (hot-stick operated). Load-break elbows rated at 15 kV shall be used on the 12 kV system, and elbows rated at 25 kV shall be used on the 16 kV system.

1.2 The fusing tables for SMU-20 fuses on PD 212 (for pole-mounted fuses) are applicable to this fuse cabinet. Use CL fuses for fault duties above 10,000 A.

1.3 The weight of the PME-1 is approximately 400 pounds.

1.4 See TX 160 for general requirements of anchoring, stenciling, and sealing of pad-mounted equipment.

1.5 The PME-1 is completely dead-front construction.

1.6 Feed-through inserts are not allowed in this PME-1. If multiple runs need to exit this PME-1, a splice box will have to be installed on the load side.

1.7 An 8-foot minimum working clearance is required directly in front of the PME-1.

2.0 Recommended Pad

2.1 For replacement of PFC and pad-mounted oil-filled switch, use existing pad.

2.2 For new installations, the following pad is recommended.

Table PD 420–1: Pad Information

Recommended Pad	
Size (in)	**Related Standards**
48 x 54	UGS SS 506

Figure PD 420–1: Fuse Cabinet Circuit Diagram (PME-1)

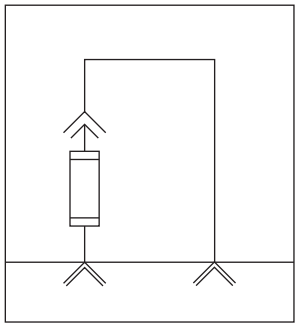

Table PD 420–2: Dead-Front Pad-Mounted Fuse Cabinet (PME-1)

Type/Description	SAP
PME-1 CL/2W-1P	10107339
PME-1 SML/2W-1P	10107343

Figure PD 420–2: Open-Front View of Pad-Mounted Fuse Cabinet (PME-1)

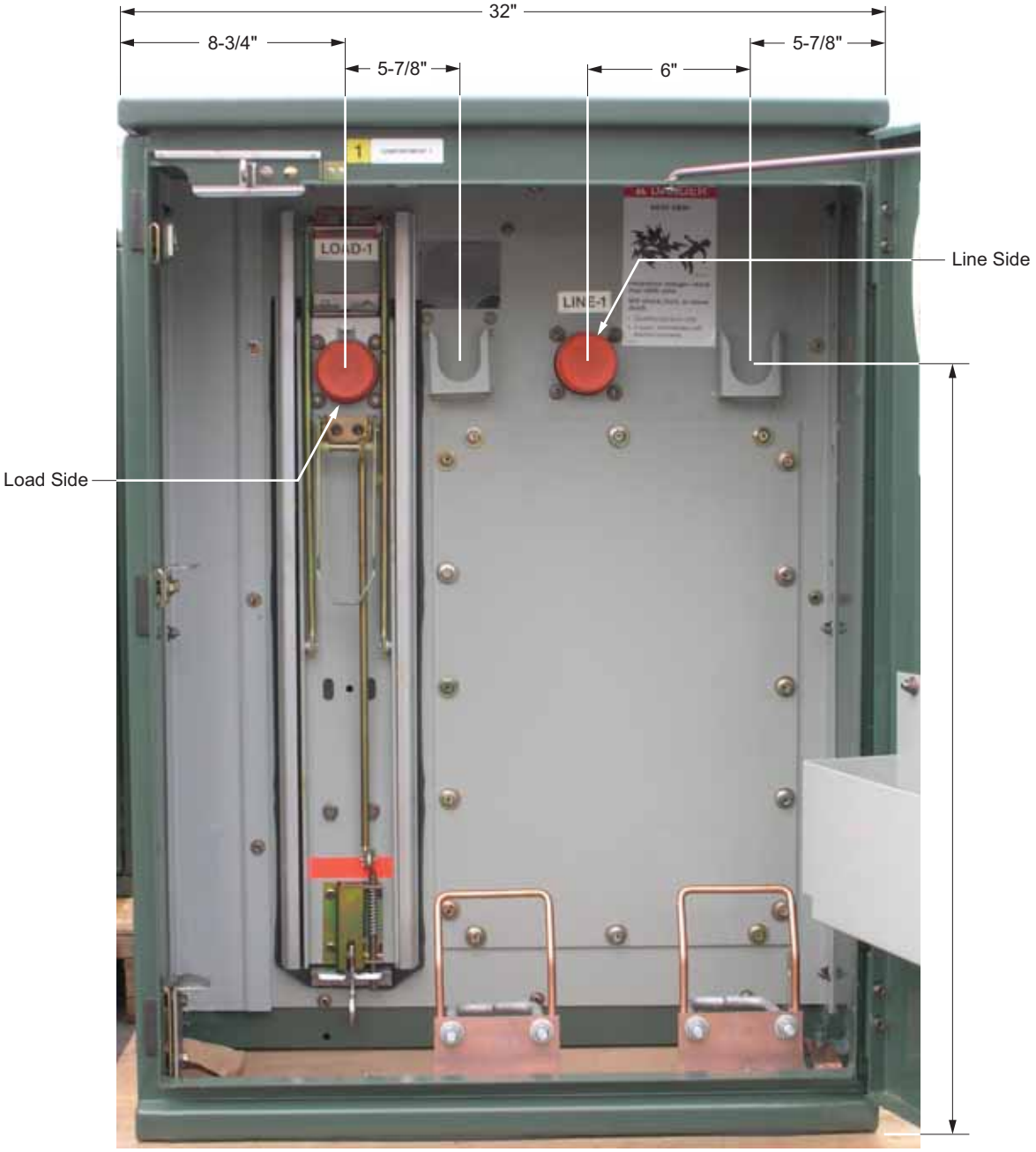

Table PD 420–3: Cabinet Dimensions and Weight

Width (in)	Depth (in)	Height (in)	Weight (lb)
32	38	44	400

Table PD 420–4: Load-Break Components

Component	6.9/12 kV System	9.4/16 kV System
#2 Elbow	SAP 10117361	SAP 10117359
1/0 Elbow	SAP 10117360	SAP 10117358
Bushing Insert	SAP 10117356	SAP 10117355
Insulating Cap	SAP 10117350	SAP 10117349

= For Reference Only

Scope PD 420.2 Pad-Mounted Fuse Cabinet — SML (M/C 567-00941)

1.0 General Information

1.1 The pad-mounted fuse cabinet (PFC) is used to fuse 4-wire 6.9 kV or 9.4 kV residential radials. It contains a 200 A, single-phase, Grip-all stick-operated Unirupter with an SML-20 fuse mounting. In addition, the PFC has removable clear acrylic protective barriers.

1.2 The fusing tables for SMU-20 fuses on PD 212 (for pole-mounted fuses) are applicable to this fuse cabinet.

1.3 The weight of the PFC is approximately 325 pounds.

1.4 See TX 180 for general requirements of anchoring, stenciling, and sealing of pad-mounted equipment.

2.0 Recommended Pad

Install the PFC on the 34" x 40" polymer concrete pad (M/C 656-00504). This pad comes with two 1/2-inch bolts in threaded inserts for securing the cabinet to the pad. Secure the PFC to the pad using the anchor brackets provided with the PFC.

FOR REFERENCE ONLY

Figure PD 420–3: Pad-Mounted Fuse Cabinet — 6.9 kV and 9.5 kV

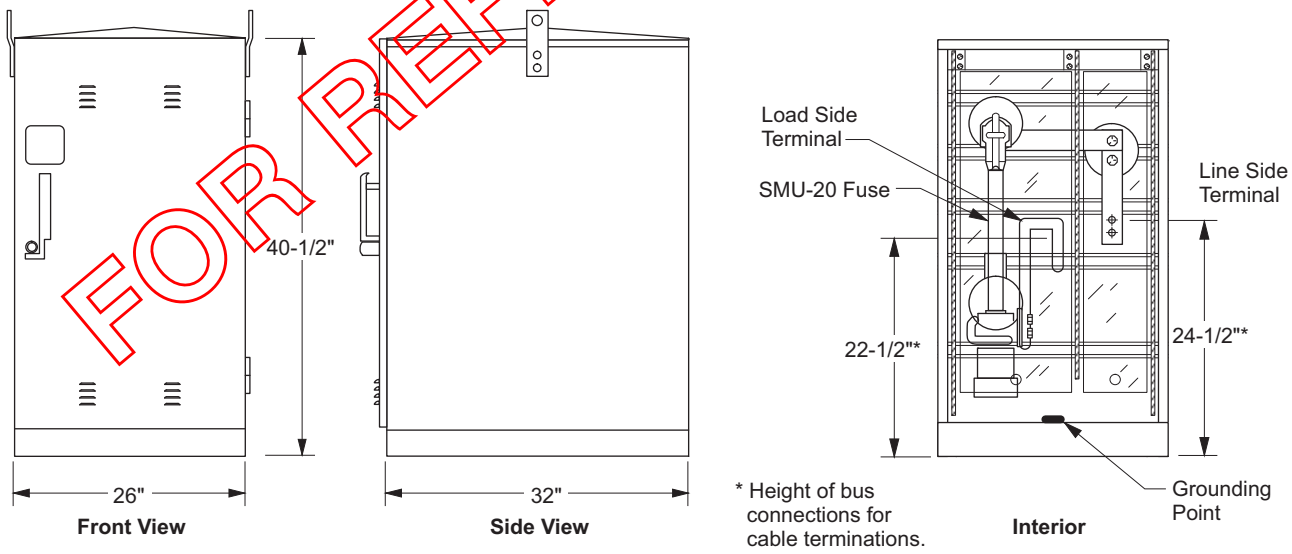

Table PD 420–5: Pad-Mounted Fuse Cabinet — 6.9 kV and 9.5 kV — Cable Terminations

Cable Size	Material Code	
	Termination	Compression Lug
#2 CLP	650-00010	610-75404
1/0 CLP	650-00010	610-75909

Scope PD 420.3 Pad-Mounted Fuse Cabinet — SWL/CL (M/C 567-01089)

1.0 General Information

1.1 The pad-mounted fuse cabinet (PFC) is used to fuse 4-wire 6.9 kV or 9.4 kV residential radials. It contains a 200 A, single-phase, Grip-all stick-operated Unirupter with an SML-20 fuse mounting. In addition, the PFC has removable clear acrylic protective barriers.

1.2 The fusing tables for SMU-20 fuses on PD 212 (for pole-mounted fuses) are applicable to this fuse cabinet.

1.3 The weight of the PFC is approximately 325 pounds.

1.4 See TX 180 for general requirements of anchoring, stenciling, and sealing of pad-mounted equipment.

2.0 Recommended Pad

Install the PFC on the 34" x 40" polymer concrete pad, M/C 656-00504. This pad comes with two 1/2-inch bolts in threaded inserts for securing the cabinet to the pad. Secure the PFC to the pad using the anchor brackets provided with the PFC.

FOR REFERENCE ONLY

Figure PD 420–4: Pad-Mounted Fuse Cabinet — SWL/CL (M/C 567-01089)

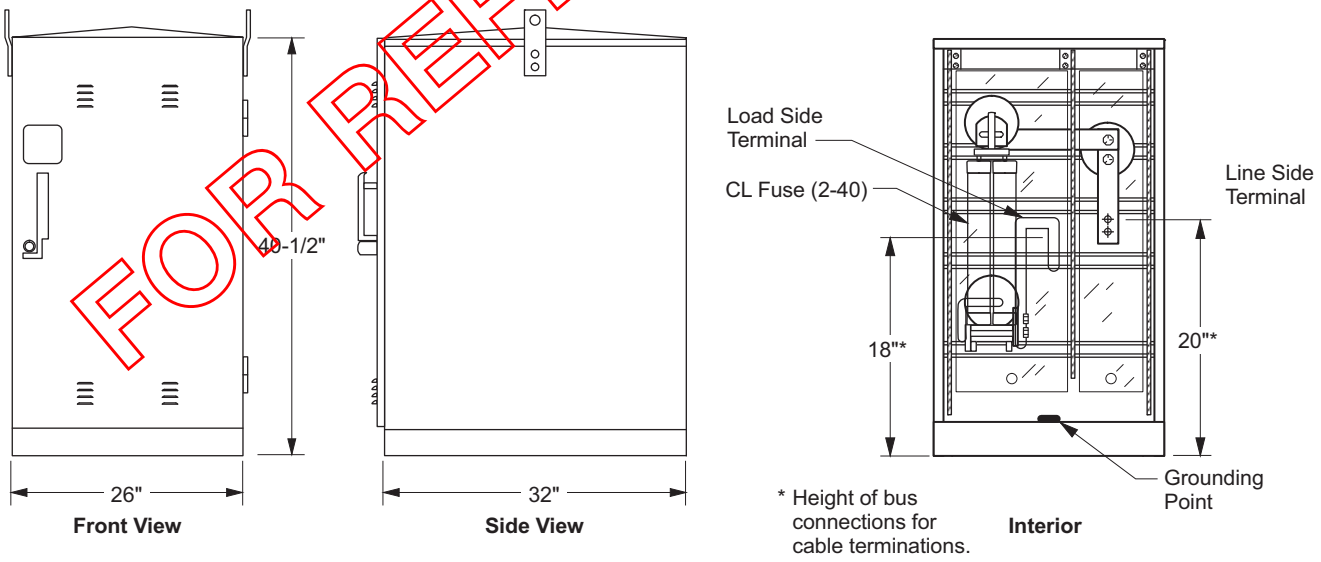

Table PD 420–6: Pad-Mounted Fuse Cabinet — SWL/CL (M/C 567-01089) — Cable Terminations[1/]

Cable Size	Material Code	
	Termination	Compression Lug
#2 CLP	650-00010	610-75404
1/0 CLP	650-00010	610-75909

1/ See TP 100 and TP 207.

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PD 422 Pad-Mounted Load-break Elbow Fuse Cabinet (LBFC)

Scope PD 422.1 Pad-Mounted, Load-break Elbow Fuse Cabinet Mounted on a Handhole/Pad

1.0 General Information

1.1 This pad-mount fuse cabinet (M/C 567-01022) is used to fuse 4-wire, 6.9 kV or 9.4 kV residential radials. Cables are terminated to the cabinet with load-break elbows and bushing inserts inside the front cover of the cabinet. The load-break elbows are used to energize and de-energize the cabinet. (Refer to DOM Procedure PD-4).

1.2 Current-limiting (CL) fuses are mounted inside the back cover of the cabinet. The fusing tables for current-limiting fuses in PD 212 are applicable to this fuse cabinet.

1.3 Front and rear working clearances of 8 feet must be maintained. A suggested location and orientation for this cabinet would be adjacent to a sidewalk and turned so that the operating space is parallel to the sidewalk.

1.4 The weight of the cabinet is approximately 350 lb.

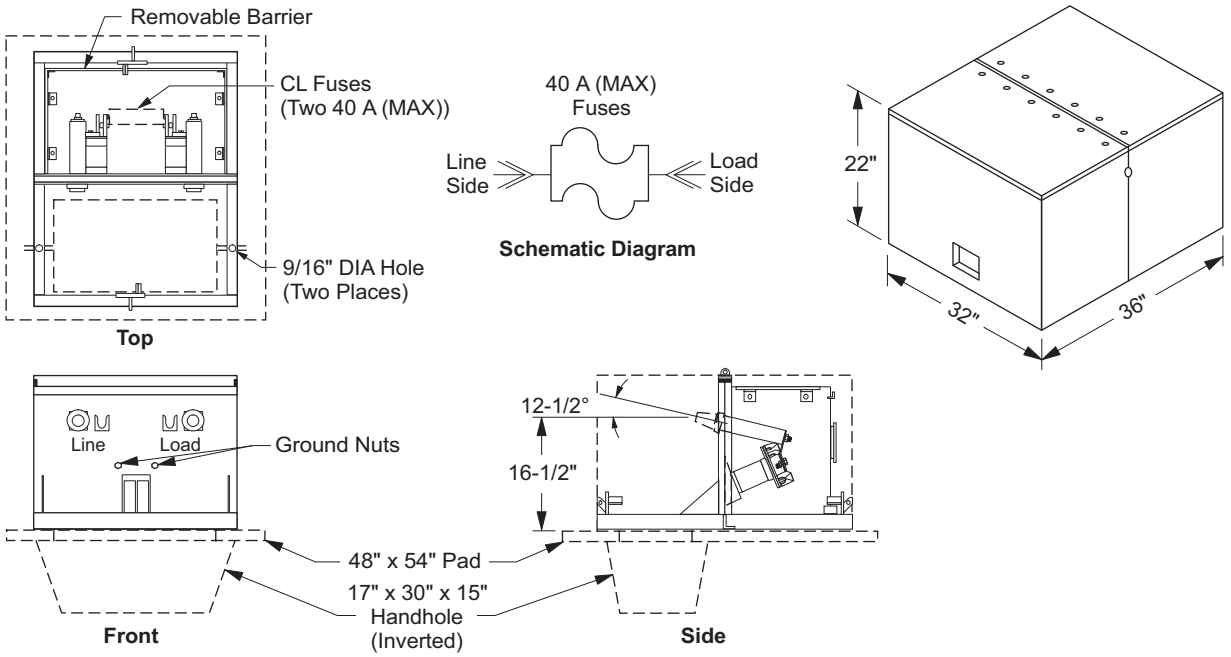
1.5 Ground in accordance with the preferred or alternate method for grounding switches described in GR 110.

2.0 Cable Termination

See TP 150, TP 151, TP 160, and TP 161.

2.1 When terminating cable, adequate slack should be provided to allow operation of the load-break elbows.

Figure PD 422–1: Pad-Mounted Load-break Elbow Fuse Cabinet Mounted on a Handhole/Pad



3.0 Recommended Structure

3.1 Install the cabinet on a 48" x 54" precast concrete pad (SAP 10118012). Secure the cabinet to the unistrut in the pad with two 1/2" x 3" bolts through the holes provided in the frame under the front cover.

3.2 A 17" x 30" x 15" plastic handhole (SAP 10117726) should be inverted and installed under the cable opening in the pad. This is necessary to provide adequate cable slack for operation of the load-break elbows. Seal the bottom of the handhole opening around the conduits with a thin layer of Redi-Crete (or equivalent) for rodent or weed control.

PD 500 **Capacitor Ground Fault Relay (CGFR) for use with Grounded Pad-Mounted Capacitor Banks on 4-Wire 12/16-kV Circuits**

Scope PD 500.1 **Capacitor Ground Fault Relay (CGFR) for use with Grounded Pad-Mounted Capacitor Banks on 4-Wire 12/16-kV Circuits**

Figure PD 500–1: Capacitor Ground Fault Relay (CGFR) for use with Grounded Pad-Mounted Capacitor Banks on 4-Wire 12/16-kV Circuits

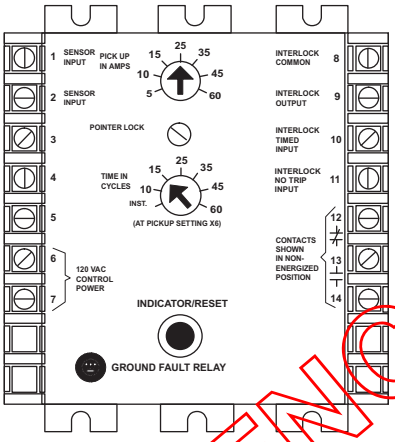


Figure PD 500–1.1: CGFR Relay (M/C 507-00020)

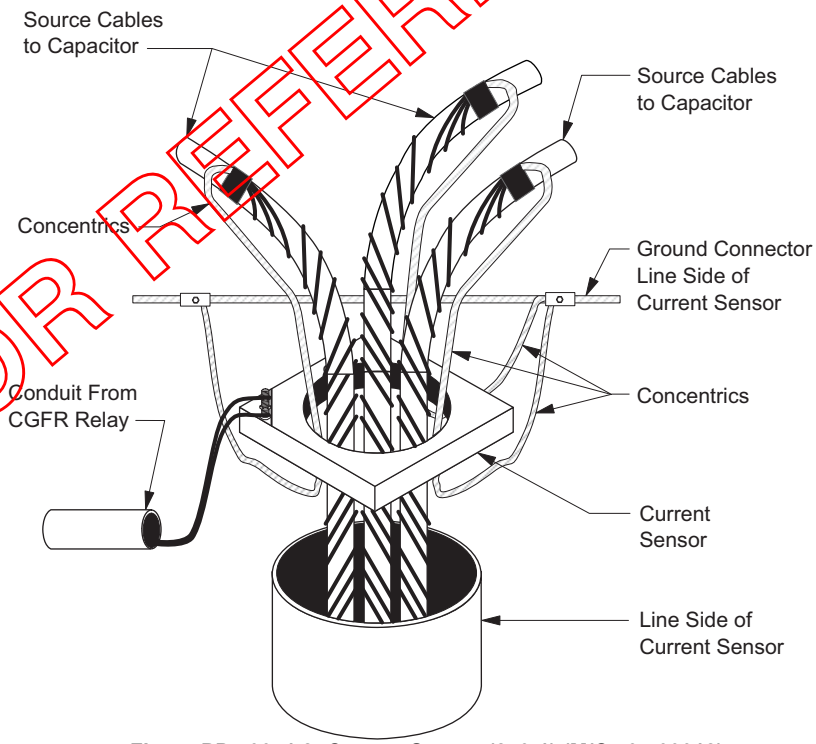


Figure PD 500–1.2: Current Sensor (250:1) (M/C 507-00012)

FOR REFERENCE ONLY

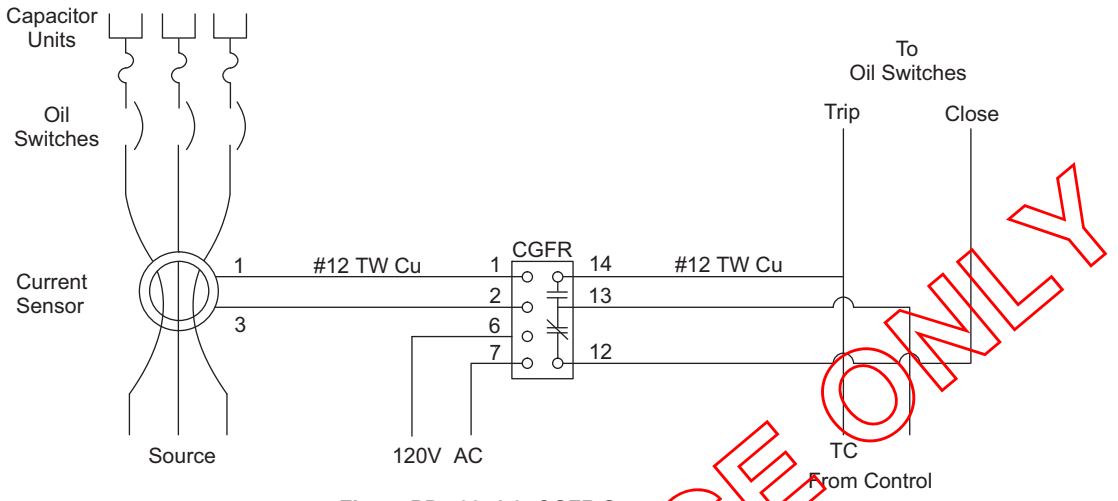


Figure PD 500–1.3: CGFR System

FOR REFERENCE ONLY

1.0 Installation Procedures:

1.1 If bank is in service, de-energize through established procedures (APM 317 and DOM CA-2).

1.2 Mount CGFR Relay (Figure PD 500–1.1 [Sheet 1]) in proximity of capacitor controller.

1.3 Re-wire CGFR Relay into "TRIP" and "CLOSE" circuits of the capacitor controller (in junction box below controller). Connect CGFR Relay to 120V source (Figure PD 500–1.3 [Sheet 2]).

1.4 Install current sensor around primary cables (Figure PD 500–1.2 [Sheet 1]). Loop concentrics back through the sensor and ground on line side of sensor.

1.5 Connect sensor and relay (Figure PD 500–1.3 [Sheet 2]).

1.6 Set relay current and time per Distribution Engineering fuse coordination recommendations. (Typical settings: 15A and 85 sec).

2.0 Testing Procedures

Refer to DOM Manual, Section CA-4.

Note(s):
1. Concentric wires must loop back through sensor so that ground connector is on the line side of the sensor.
2. Consult Distribution Engineering for Application and Settings.

PD 510 Capacitor Unbalance Sensing Relay (CUSR) for Use with Ungrounded Pad-Mounted Capacitor Banks

Scope PD 510.1 Capacitor Unbalance Sensing Relay (CUSR) for Use with Ungrounded Pad-Mounted Capacitor Banks — Installation and Test Procedure

Figure PD 510–1: Capacitor Unbalance Sensing Relay (CUSR) for Use with Ungrounded Pad-Mounted Capacitor Banks

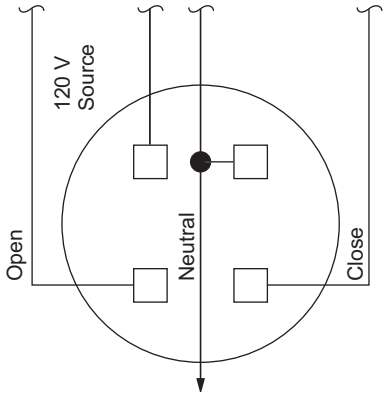


Figure PD 510–1.1: Meter Socket

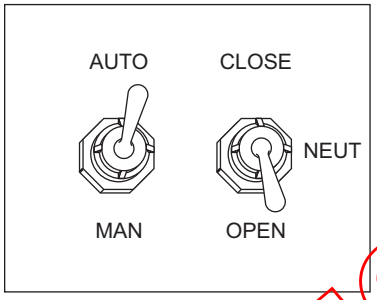


Figure PD 510–1.2: Control Knobs

Figure PD 510–1.3“ CUSR Relay Panel

FOR REFERENCE ONLY

1.0 Installation Procedures

1.1 CUSR 2 Relay (M/C 397-44222):

A. Disconnect the lead to the “Close” position of the socket (See Figure PD 510–1.1 [Sheet 1]) and splice it to the loose conductor at the rear of the CUSR 2 socket adapter. **(CAUTION: The “source” position in the socket is energized.)**

B. Insert the CUSR 2 socket adapter into the existing socket and install a meter ring.

C. Insert the control into the CUSR 2 socket adapter and install a meter ring.

1.2 Install the probe (voltage-dividing sensor) and coax cable.

1.3 Attach connector to coax cable and plug it into the CUSR relay.

1.4 Replace the control fuse (if necessary) with an FNM-15 fuse (M/C 688-74035). Verify that the fuse supplied with the CUSR relay is an MDA-10 (M/C 568-75750).

1.5 Test the relay and capacitor installation per the following procedures.

2.0 Testing Procedures

2.1 Relay Test

A. Place the control in the "Manual" and "Close" mode, see Figure PD 510–1.2 (Sheet 1).

B. Set the CUSR relay to "V_1T_2", see Figure PD 510–1.3 (Sheet 1).

C. Press the CUSR Test Button and hold. If operating normally, the CUSR will trip in approximately five seconds. If CUSR fails to trip, it is defective.

D. Switch the control from "Close" to "Open" (trip).

2.2 Capacitor Installation Test

A. Leave the CUSR relay settings on "V_1T_2" if the system voltage is 12 kV or 16 kV.

B. Install two primary fuses.

C. Energize the capacitor bank by switching the control from "Open" to "Close" and then pressing the CUSR reset button. If the CUSR relay is operating correctly, the switches should reopen within 15 seconds.

D. Return the control to the "Open" position.

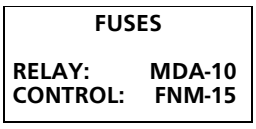
E. Install the third primary fuse and reenergize the bank by switching the control from "Open" to "Close" and then pressing the CUSR reset button. If the CUSR operates, test the capacitors with a C-meter, check the oil switches and inspect the probe, relays, control wiring, and primary fuses. If necessary, replace the CUSR relay and/or the probe.

F. When the bank remains energized, set the CUSR relay to the final, in-service VT settings as determined by Division Engineering (typical settings are "V_1T_2" for banks with solenoid-operated oil switches and "V_2T_2" or "V_1T_3" for banks with motor-operated switches).

G. If bank is to be left in an energized mode, set control to "Automatic" and "Neutral" or "Manual" and "Close." DO NOT LEAVE CONTROL IN THE "NEUTRAL" AND "MANUAL" POSITION! (This setting bypasses the CUSR.) Decals () for the capacitor control panel are available from the Customer Service Operations Center.

FOR REFERENCE ONLY

Figure PD 510–2: Capacitor Unbalance Sensing Relay (CUSR) for use with Ungrounded Pad-Mounted Capacitor Banks — Capacitor Decals



Note(s):

1. Install CUSR Relay with socket-mounted control in low-voltage section of pad-mounted cabinet.
2. Each relay is supplied with a voltage-sensing probe and coax cable. An opening is provided in the panel between the low-voltage and capacitor sections for mounting the probe.
3. If the relay and probe are unavailable in local or division warehouse stock, contact Division Engineering.

FOR REFERENCE ONLY

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PD 520 Capacitor Voltage Unbalance Relay (LUC) for Use with Ungrounded Pad-Mounted Capacitor Banks on 3- or 4-Wire 12/16-kV Circuits

Scope PD 520.1 Capacitor Voltage Unbalance Relay (LUC) for Use with Ungrounded Pad-Mounted Capacitor Banks on 3- or 4-Wire 12/16-kV Circuits

1.0 Installation

New ungrounded-wye pad-mounted capacitor banks are supplied with an LUC relay and sensor already installed. The following instructions (Steps 1.1 to 1.6) are for retrofitting (if necessary) older banks which have defective LUC relays or sensors.

1.1 If bank is in service, de-energize through established procedures (APM 317 and DOM CA-2).

1.2 Mount LUC in proximity of control (Figure PD 520–1.1 [Sheet 1]).

1.3 Rewire “Trip” and “Close” (in junction box below control) to LUC through control socket.

1.4 Install voltage sensor in capacitor compartment (Figure PD 520–1.2 [Sheet 1]). Connect sensor to capacitor neutral bus.

1.5 Connect sensor and relay (Figure PD 520–2 [Sheet 2]).

1.6 Set relay current and time per Field Engineering fuse coordination recommendations. Typical settings: Lockout Level = 20, Time = MAX (approximately 30 sec). Refer to CA-4 DOM Procedures.

FOR REFERENCE ONLY

Figure PD 520–1: Capacitor Voltage Unbalance Relay (LUC) for Use with Ungrounded Pad-Mounted Capacitor Banks on 3-Wire or 4-Wire 12/16-kV Circuits FRO

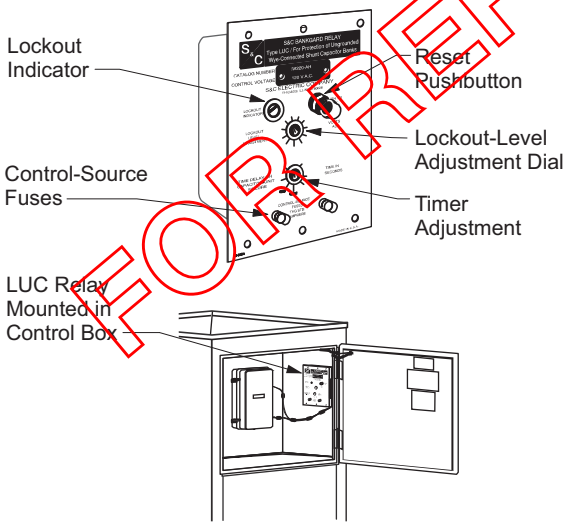


Figure PD 520–1.1: LUC Relay (M/C 397-04986)

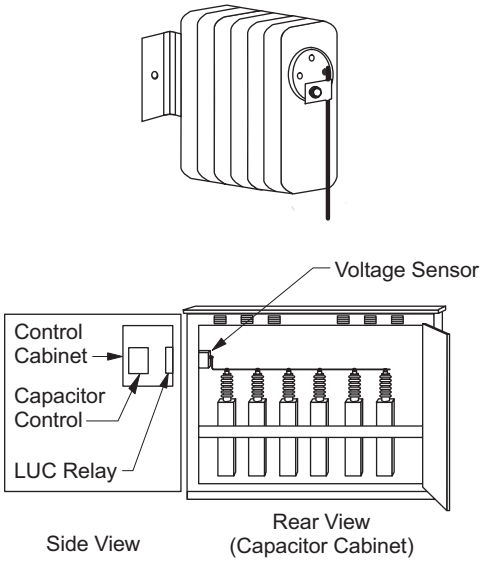
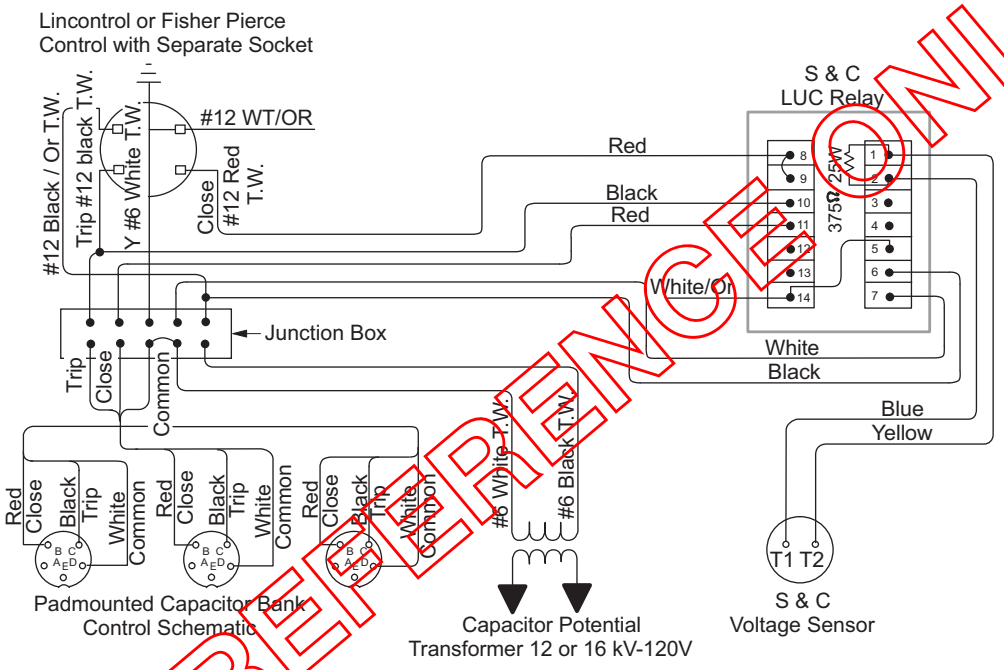


Figure PD 520–1.2: Voltage Sensor (M/C 397-04994)

Note(s):
1. Consult Filed Engineering for application and settings.
2. LUC relays and CUSR relays are no longer required in pad-mounted capacitor banks.

Figure PD 520–2: Capacitor Voltage Unbalance Relay (LUC) for Use with Ungrounded Pad-Mounted Capacitor Banks on 3-Wire or 4-Wire 12/16-kV Circuits



FOR REFERENCE ONLY

2.0 Testing Procedures

Refer to DOM manual, Section CA-4.

PD 600 Network Protectors

Scope PD 600.1 Network Protector (Wall Mounted) Submersible 125V/216V, 1875 Amps, Model 313NP

1.0 General Information

The Network Protector is a three-phase, low-voltage device, rated at 1875 Amps, 125/216 Volts (SAP 10118036). It is wall-mounted, and may be used for both submersible and non-submersible installations. The weight of the network protector is 1,200 pounds. The network protector comes with a flow switch, to accommodate transformer connections to either the top or bottom terminals (See Figure PD 600–4 (Sheet 4)). Due to the bend of the transformer cables, the preferred connection will be for the transformer cables to be connected to the bottom terminals of the network protector.

When the network protector installation is complete, the construction crew shall verify that network protector handle is placed in the “Open" position. Never leave the protector handle in the “Close" or “Auto" position. Upon completion of work, notify Distribution Apparatus that the network protector installation is completed, and that the network protector is ready for “in-service" and automation testing.

Figure PD 600–1: Network Protector (Wall Mounted) Submersible, 125V/216V, 1875 Amps, 313NP Network Protector with Flow Switch, and Remote Rigging Handle

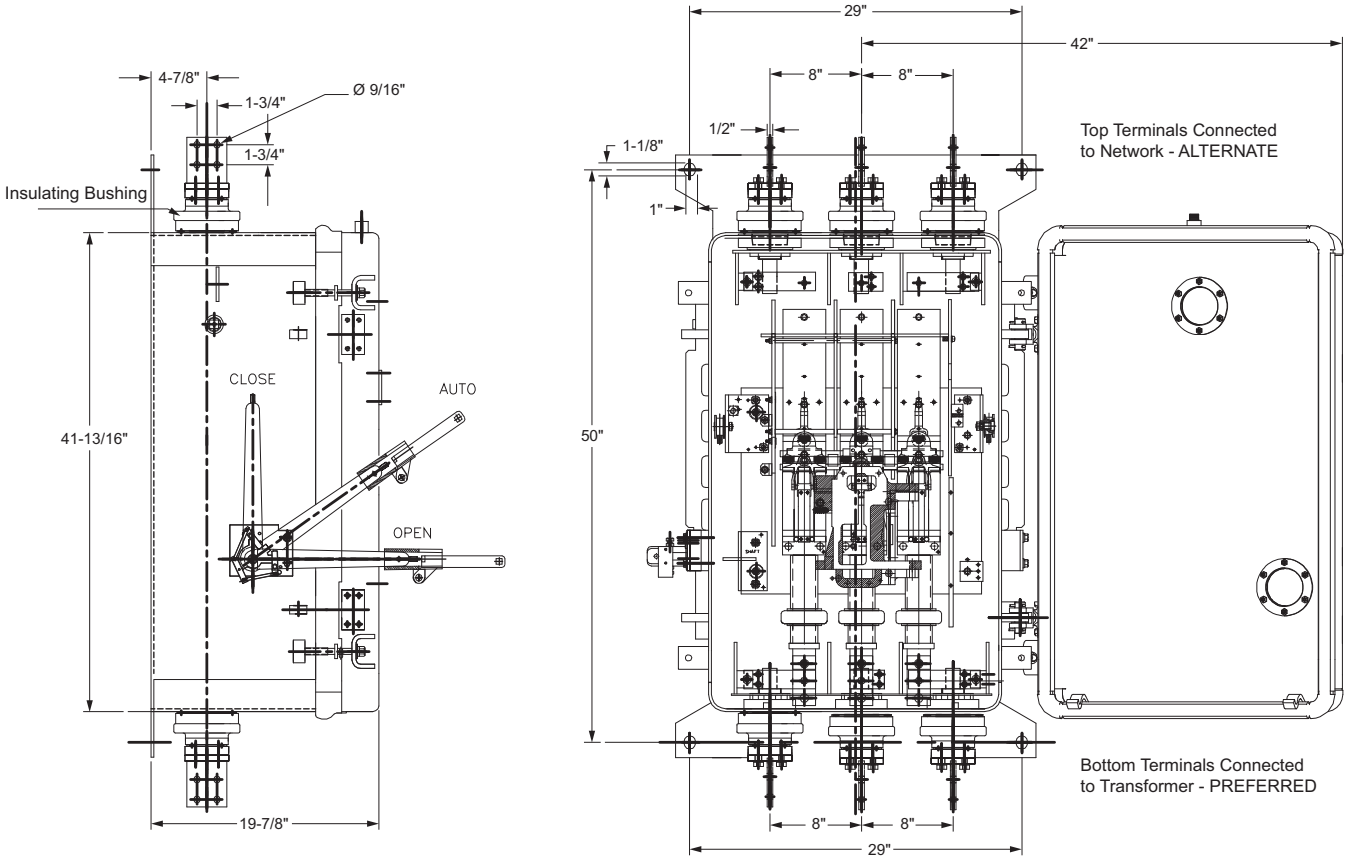


Figure PD 600–2: Network Protector Mounted on Wall of Vault

2.0 Network Protector Installation

1. Use four 5/8", stainless steel wedge stud anchors (SAP 10072174), per RS 100, to fasten network protector to wall. Use washers between the concrete and network protector to maintain a flat mounting surface to prevent flexing of the equipment case.
2. Do not install network protector near any obstacles which would prevent full opening of the door.
3. Network protectors shipped after 2011 come with a handle with a stopping mechanism to accommodate remote rigging. Refer to DOM, Section PD-3 for instructions on retro-fitting network protectors which are not equipped with the handle which accommodates remote rigging.
4. Network protectors are ordered separate from the relay. Each network protector ordered must also have a separate order for a corresponding relay (SAP 10108886).
5. Network protector terminals are 4-hole NEMA pads. Use four 500 MCM cables for each phase of the network protector. General Cable 500 MCM Cu EAM cable (SAP 10203851) is the preferred choice for all wiring to the network protector paddles, and for all new and replacement wiring of 500 MCM cable in network vaults. If this cable is not available, 500 MCM XLPE Cu (SAP 10109550) is the alternate choice for network 500 MCM connections. Existing installations may have a total of 1000 MCM Cu for 300 kVA transformers and 1500 MCM Cu for 500 kVA installations.

6. Use two runs of 2/0 stranded copper wire to connect the network protector's ground terminals, to the structure ground. Clean the structure ground and add grease at the two connection points to the structure ground. See Figure PD 600–3. The network protector's connection to the structure ground shall not be connected to any other equipment.
7. Use four layers of tape all to cover connections to the NEMA pad terminals. See Figure PD 600–5 (Sheet 5). The first layer is Resinite (SAP 10116969). The second layer is 2" tape (SAP 10116916). The third layer is 23 tape (SAP 10116970), and the final layer is 33 tape (SAP 10116918).
8. On a network protector connected to the network and/or the transformer, the fuses and disconnect links, all items between the fuses and the terminals, and all items between the disconnect links, are energized with secondary voltage. Use insulated equipment when installing and removing the fuses and disconnects. Follow all APM guidelines on PPE.
9. The standard network protector circuitry, and its internal fusing, is matched to a 500 kVA transformer. Network protector fuses should always be installed at each terminal which connects to the network. On network protectors with the flow switch, the vast majority of network protector installations will have the transformer connections at the bottom of the network protector. See Figure PD 600–4 (Sheet 4). In this case, the fuses will be installed on the top terminals of the transformer. When the network protector is used with a 300 kVA transformer, remove the network protector fuses which come with the network protector, and instead use fuses which are matched to the 300 kVA transformer. To order network protector fuses for a 300 kVA transformer, use SAP 10203893.

Figure PD 600–3: Two-runs of wire connecting network protector to structure ground

Table PD 600–1: Items Required for Double-Grounds from Network Protector Case to Structure Ground

Description	SAP
Flat Washers (30/ea box)	10072028
1-3/4" Bolt	10070831
NEMA 2-Hole Terminal	10111263
Hex Nut	10069588

Figure PD 600–4: Close-up of Network Protector Fuses and Flow Switch

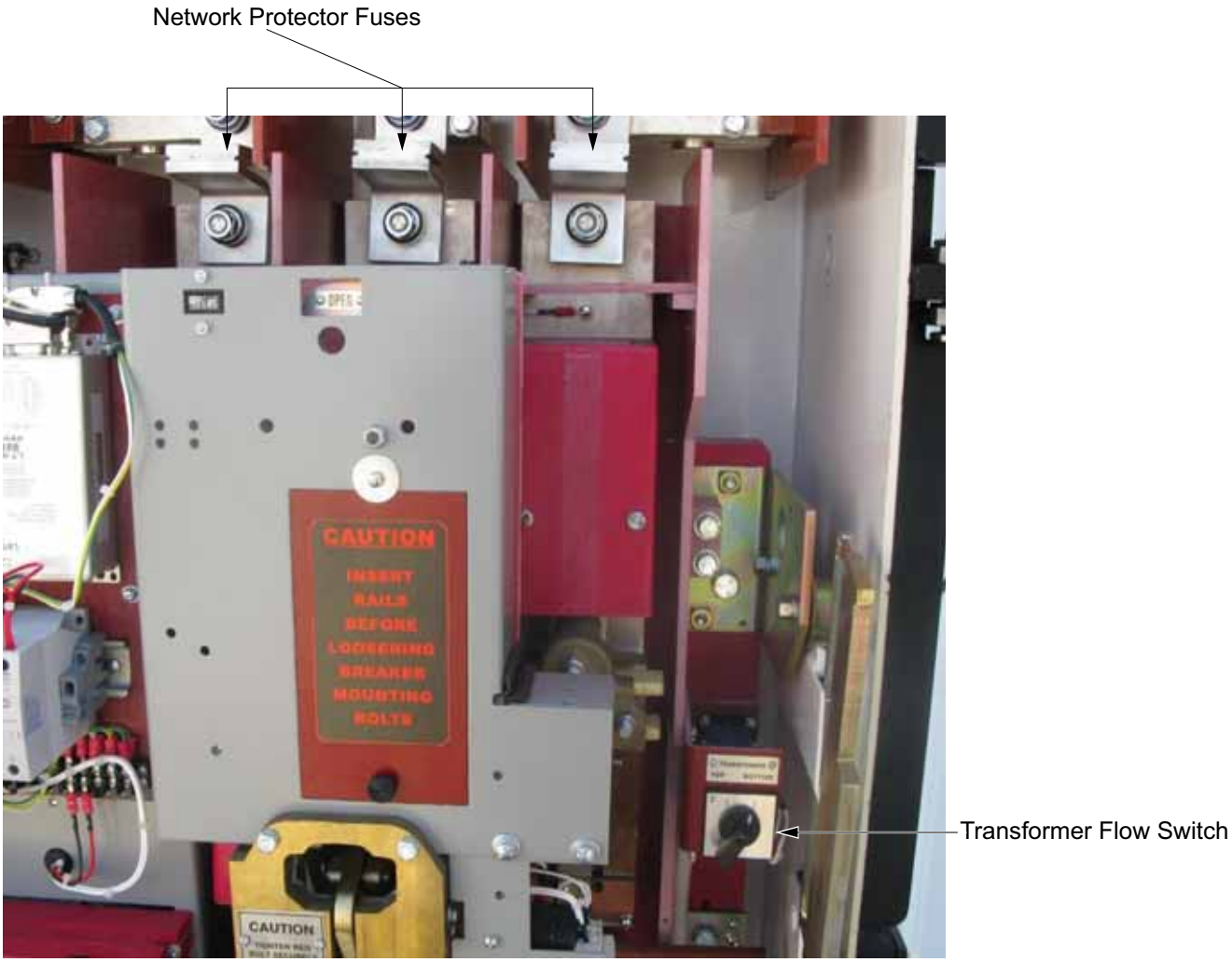


Figure PD 600–5: Close-Up of Taped Terminals of Network Protector

Scope PD 600.2 Radial Box

1.0 General Information

SCE's network protectors are wall-mounted. The radial box (SAP 10117977) is installed on the throat of a network transformer, to enable the secondary terminals of the network transformer to be connected to the transformer terminals of the wall-mounted network protector. If the network vault contains a transformer that is not of a network transformer type, then a radial box is not needed.

After installing the radial box on the network transformer, connect four 500 MCM cables to each paddle of the radial box, and run the cables to the network protector, then tape each paddle of the radial box as shown in Figure PD 600–5 (Sheet 5).

The radial box can be mounted with terminal facing either upward, or downward. The preferred installation is with the terminals facing downward, which will most easily accommodate the wall-mounted network protector.

Figure PD 600–6: Radial Box on a Network Transformer

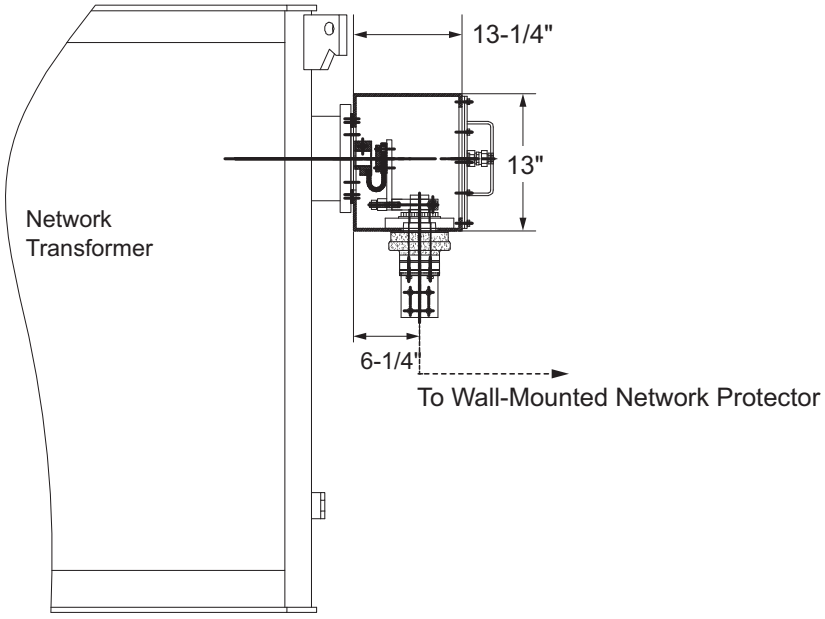


Figure PD 600–7: Radial Box Installed on Network Transformer

Scope PD 600.3 Low-Voltage Network Connectors, and Mo-Limiters

1.0 MOLE-Style Secondary Bus Bars

The secondaries of underground secondary networks are connected to junction points in the network vaults.

Secondary Junction Bar Connectors (also called MOLE-style Multiple Outlet Connectors/Multi-Cable Connectors, or MOLE bars), are insulated secondary bus bars with multiple cable outlets, which allow multiple secondary cable connections to be made off of junction points inside the network vaults. See Figure PD 600–8.

If a network vault has existing MOLE bars, and they are in good condition, these MOLE bars should remain in the vault, and be utilized. See Section 1.1 for instruction on interfacing the network protector to existing MOLE bars.

If a MOLE bar needs replacement, see Figure PD 600–8, and Table PD 600–2 (Sheet 11) for ordering information. Each outlet of a new MOLE bar which is connected to 500 MCM cable, or to a Mo-Limiter, requires a Socket and Nut assembly, and a Compression cone. See Table PD 600–7 (Sheet 22) for ordering information.

Figure PD 600–8: MOLE-style Secondary Junction Bar Connectors

1.1 Existing MOLE Junction Bars

When installing new equipment in a network vault, if the existing MOLE junction bars are in good condition, they should be kept in place, and utilized. The standard 500 MCM cables cannot directly interface to the existing MOLE junction bars, which accept 1000 MCM or 2000 MCM at the bottom outlets. The existing 1000 MCM or 2000 MCM cable must be removed from the bottom MOLE outlet, and a new, 5-outlet MOLE junction bar must be used, along with a coupler. See Figure PD 600–9 (Sheet 10). This 5-outlet MOLE junction bar is preferred, because it will allow the standard 4 runs of 500 MCM cable to the MOLE bars with the 1000 MCM or 2000 MCM bottom outlets. If the 5-outlet MOLE bar cannot be used due to space constraints, then a 4-outlet MOLE bar, which allows 3 runs of 500 MCM, may be used in its place.

Four of the five outlets on the 5-outlet MOLE bar will accept 500 MCM, and the coupler will connect the bottom outlet of the 5-outlet MOLE bar to the bottom of the existing MOLE bar. If the 5-outlet MOLE bar cannot be used due to space constraints, then three of the four outlets on the new 4-outlet MOLE bar will accept the three 500 MCM runs from one phase of the network protector, and the coupler will connect the bottom outlet of the 4-outlet MOLE bar to the bottom outlet of the existing MOLE bar. See Table PD 600–2 (Sheet 11) for 5-outlet MOLE and 4-outlet MOLE and coupler ordering information.

The 5-outlet MOLE and 4-outlet MOLE bar also requires a Socket and Nut assembly, and Compression Cones for each 500 MCM cable. See Table PD 600–7 (Sheet 22) for ordering information on these items.

Figure PD 600–9: Details for Replacing Vintage 1000 MCM and 2000 MCM Cable Between the Network Protector and Existing MOLE bars

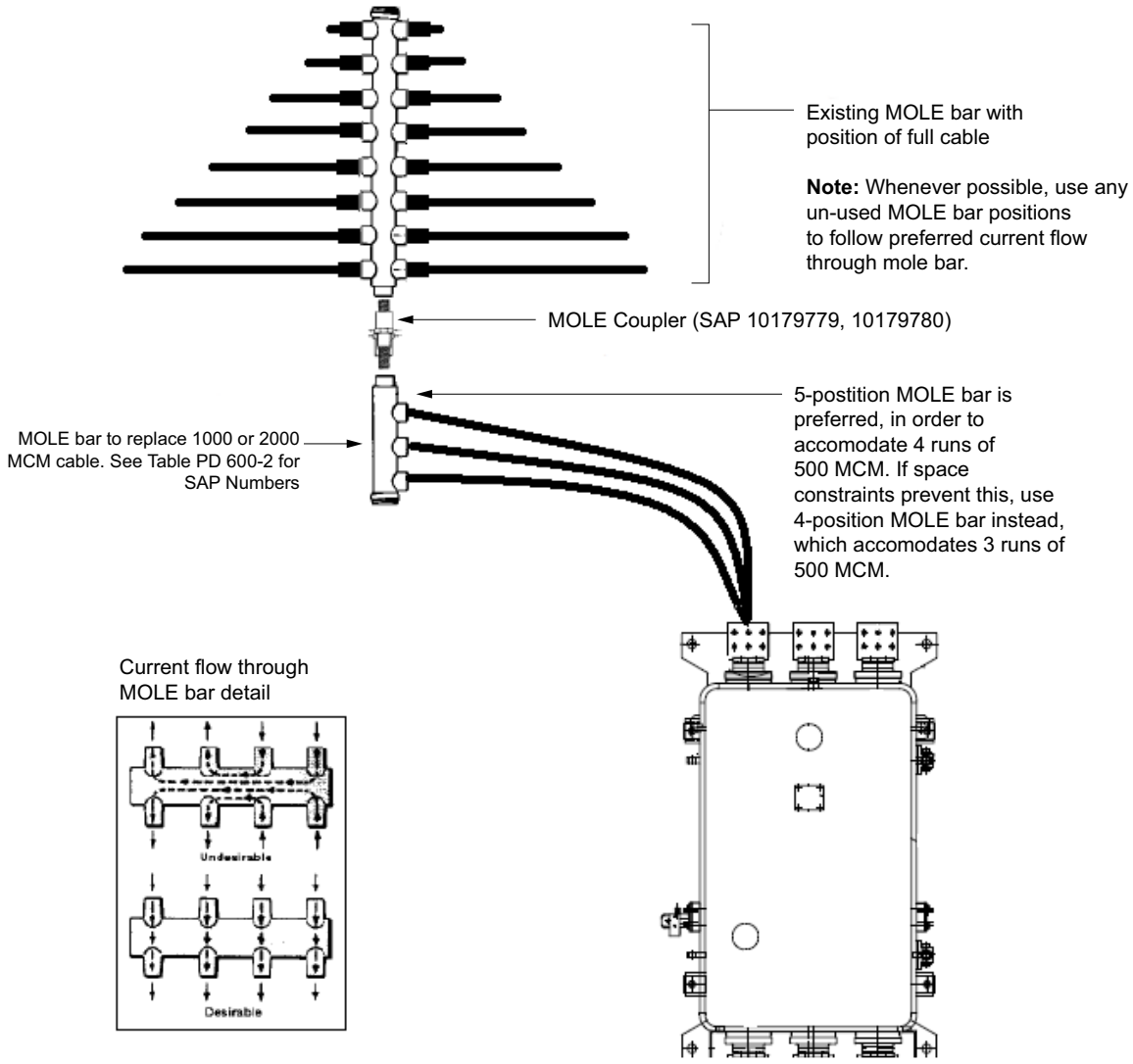
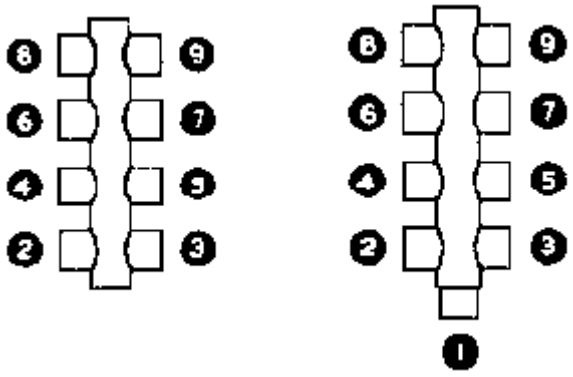


Table PD 600–2: Table of Parts Required for Connecting 500 MCM Cables from Network Protector to Existing 1000 MCM and 2000 MCM MOLE bars

Item	Quantitiy	SAP
500 Cu EAM, 600 V, 1.068" OD, 3-C. Preferred Choice is General Cable, P/N: 889264	Need 4 cable runs for each network protector phase	10203851
500 MCM, Cu, CLP. Alternate Choice. Use only if 500 Cu EAM cable above is not available.	Need 4 cable runs for each network protector phase	10109550
Network Protector Fuse, 1200 A, for 300 kVA transformer	Network Protector comes with fuses for 500 kVA transformer. Only use these if vault has a 300 kVA transformer.	10203893
MOLE Outlet Insulating Sleeve	Need 1 for each cable run	10204588
Socket and Nut Assembly, Stud Size 5/8"-18	Need 1 for each cable run	10117880
Compression Cone. Use with Socket and Nut Assembly.	Need 1 for each cable run	10117788
5-Outlet MOLE Bar (Preferred), with three 5/8" outlets, and one 7/8" outlet. To interface with 1000 MCM MOLE bar.	Need 1 for Each Existing 1000 MCM MOLE bar	10204193
4-Outlet MOLE Bar (Alt. choice) with three 5/8" outlets, and one 7/8" outlet. To interface with 1000 MCM MOLE bar.	Need 1 for Each Existing 1000 MCM MOLE bar	10179774
Coupler, 7/8"-14 (B-type or 88 outlet), for 1000 MCM MOLE bar.	Need 1 for Each Existing 1000 MCM MOLE bar	10179779
5-Outlet MOLE Bar (Preferred), with three 5/8" outlets, and one 1-1/8" Outlet, for 2000 MCM MOLE bar	Need 1 for Each Existing 2000 MCM MOLE bar	10204192
4-Outlet MOLE Bar (Alt. choice), with three 5/8" outlets, and one 1-1/8" Outlet, for 2000 MCM MOLE bar	Need 1 for Each Existing 2000 MCM MOLE bar	10179775
Coupler, 1-1/8"-12 (C-type, or 112 outlet), for 2000 MCM MOLE bar. To interface with 2000 MCM MOLE bar.	Need 1 for Each Existing 2000 MCM MOLE bar	10179780

1.2 New MOLE Bar Installations

Figure PD 600–10: The Two Types of Junction Bar Connectors (MOLE Style – Type ZM and Type ZMT)



Without End Outlet

With End Outlet (to accomodate connection to additional MOLE Secondary Junction Bars)

Table PD 600–3: List of MOLE Secondary Junction Bar Connectors

Secondary Junction Bar	Rating	Length	SAP
6 Outlets	1500 Amp 1500 MCM	10-1/8"	10117770
8 Outlets	1500 Amp 1500 MCM	13-1/8"	10117771
10 Outlets	1500 Amp 1500 MCM	16-1/8"	10117772
12 Outlets	1500 Amp 1500 MCM	19-1/8"	10117773
5 Outlets – With End Outlet	1500 Amp 1500 MCM	8"	10117774
7 Outlets – With End Outlet	1500 Amp 1500 MCM	11"	10117775
9 Outlets – With End Outlet	1500 Amp 1500 MCM	14"	10117776
11 Outlets – With End Outlet	1500 Amp 1500 MCM	17"	10117777
MOLE Outlet Plug – to plug type A (5/8") unused outlets in MOLE bars			10117793
MOLE Outlet Plug – to plug type B (7/8") unused outlets in MOLE bars			10179771
MOLE Outlet Plug – to plug type C (1-1/8") unused outlets in MOLE bars			10179772

Note(s):
1. All are MOLE Style, with “A” Size Outlets - accepts 5/8”-18 Stud.

2.0 Mo-Limiters

Mo-Limiters (See Figure PD 600–11 (Sheet 14)), also called Cable Limiters, are connected at the junction points in each network vault, in order to prevent cable damage for secondary faults.

All networked secondary ties must have cable limiters. Where junctions extend in three or more directions and at all Network Protector installations.

The complete Mo-Limiter (replaceable-link style) assembly consists of the insulating sleeve, replaceable limiter element, limiter base, and cable bushings.

The complete Mo-Limiter (standard replaceable element style) assembly consists of a ceramic shell, insulating sleeve, and replaceable standard limiter element.

Mo-limiters can either be connected directly to the MOLE-style secondary junction bars, or to the 500 MCM secondary cables somewhere in the vault downstream from the MOLE secondary junction bar. It is preferred to connect the Mo-Limiter directly to the MOLE secondary junction bar (Mole-to-cable Mo-Limiter). If connecting the Mo-Limiter directly to the MOLE junction bar is not feasible, then the Mo-Limiter must be connected to the cable elsewhere in the vault, and the Mo-Limiter must be a Cable-to-Cable type.

When the Mo-limiter is to be connected to a MOLE-style junction bar socket, then one socket and nut assembly, and one compression cone (See Figure PD 600–16 (Sheet 16)and Figure PD 600–22 (Sheet 20)) are needed to fasten the terminal of the Mo-limiter to the outlet of the MOLE secondary junction bar. See Table PD 600–7 (Sheet 22) for ordering information. Cable-to-cable Mo-Limiters do not require socket and nut assemblies or compression cones.

Three items must be specified when ordering Mo-Limiters:

1. The Mo-Limiter can be either MOLE-to-Cable (Preferred), or Cable-to-Cable.
2. The Mo-Limiter can be either the standard limiter element type, or the replaceable link type.
3. The Mo-Limiter can either accept rubber cable, or paper-insulated cable.

3.0 Mo-Limiter Installation Details

3.1 Mo-Limiter Installation Procedure for Cable-to-Cable

Figure PD 600–11: Internal Components of a Cable-to-Cable Mo-Limiter

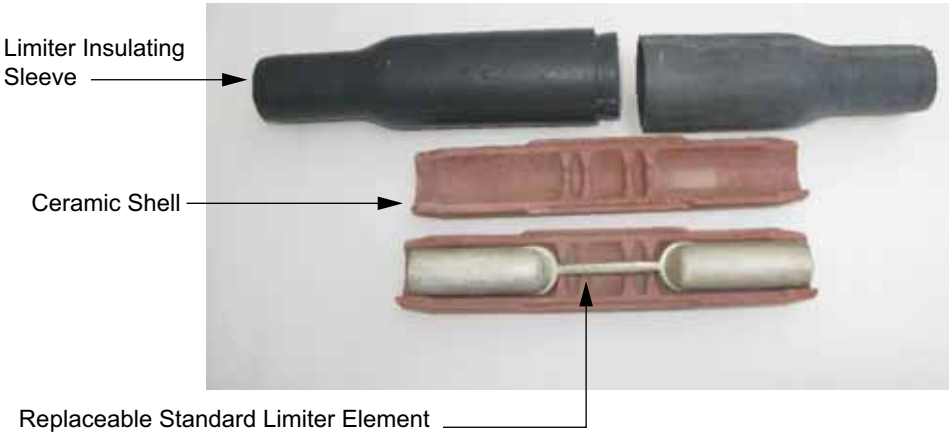
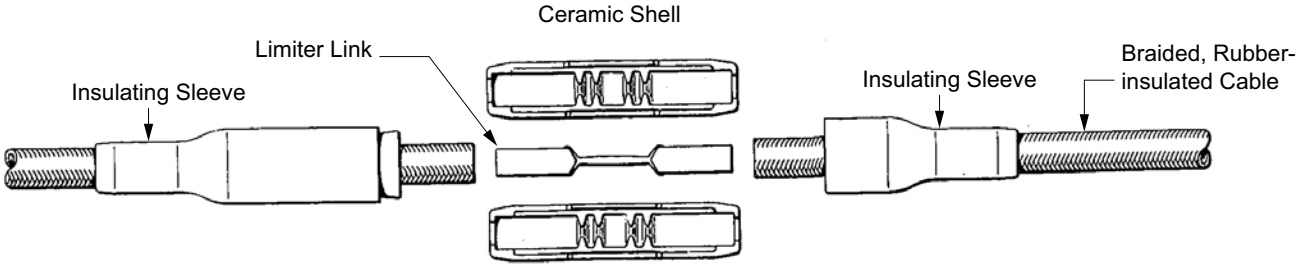


Figure PD 600–12: Mo-Limiter Assembly for Cable-to-Cable



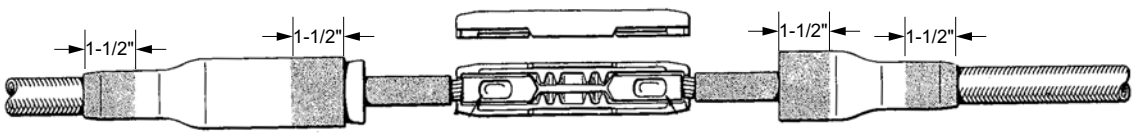
Step 1. Slide the insulating sleeve halves of the Limiter over the cable ends.

Step 2. For 4/0 to 400MCM cable, remove 2-1/2 inches of the cable's jacket, measuring from the cable end. For 500MCM and 750MCM cable, remove 3-1/4 inches of the cable's jacket, measuring from the cable end.

Step 3. Using a wire brush, clean the cable strands.

Step 4. Using a wire brush, roughen and clean the jacket of the cables.

Figure PD 600–13: Cable-to-Cable Mo-Limiter Reference for Steps 5-7

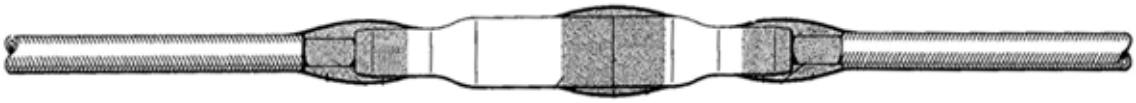


Step 5. Insert the cables into the Mo-Limiter link socket and indent once for cable sizes up to 250 MCM. Indent twice for all cable sizes above 250 MCM. Use the UT-15 compression tool (SAP 10148809). For 500 MCM cable use the adapter die (SAP 10148852) and the 15CA87R die (SAP 101448894). For SAP numbers of the dies for other cable sizes, refer to JJ 700 and TP 101.

Step 6. Roughen and clean both halves of the insulating sleeve for a length of 1-1/2 inches on each end.

Step 7. Place the ceramic shells over the Limiter link, centering the shells over the fusible section.

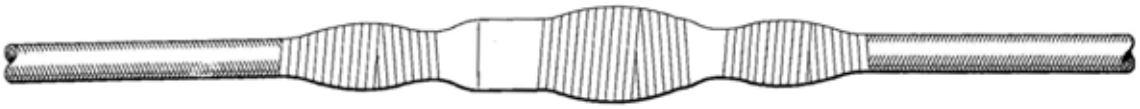
Figure PD 600–14: Cable-to-Cable Mo-Limiter Reference for Steps 8-9



Step 8. Slide the insulating sleeve halves together over the ceramic shells until they interlock

Step 9. Apply three half-lapped layers of rubber tape with sufficient tension to reduce its width from 3/4 inch to 1/2 inch. On both ends, wrap rubber tape in continuous layers for a length of 1-1/2 inches over the cable and 1-1/2 inches over the insulating sleeve. Where the two halves interlock, wrap 1-1/2 inches of rubber tape over each end.

Figure PD 600–15: Cable-to-Cable Mo-Limiter Reference for Steps 10-11



Step 10. Completely cover the rubber tape with two half-lapped layers of friction tape applied with considerable tension in order to compress the rubber tape. The friction tape shall extend 3/4 inch over the rubber tape on the insulating sleeve and 3/4 inch over the cable jacket.

Step 11. Cover the entire splice with ScotchKote Electrical Coating (SAP 10118091).

3.2 Mo-Limiter Installation Procedure for MOLE-to-Cable

Figure PD 600–16: Internal Components of a MOLE-to-Cable Mo-Limiter

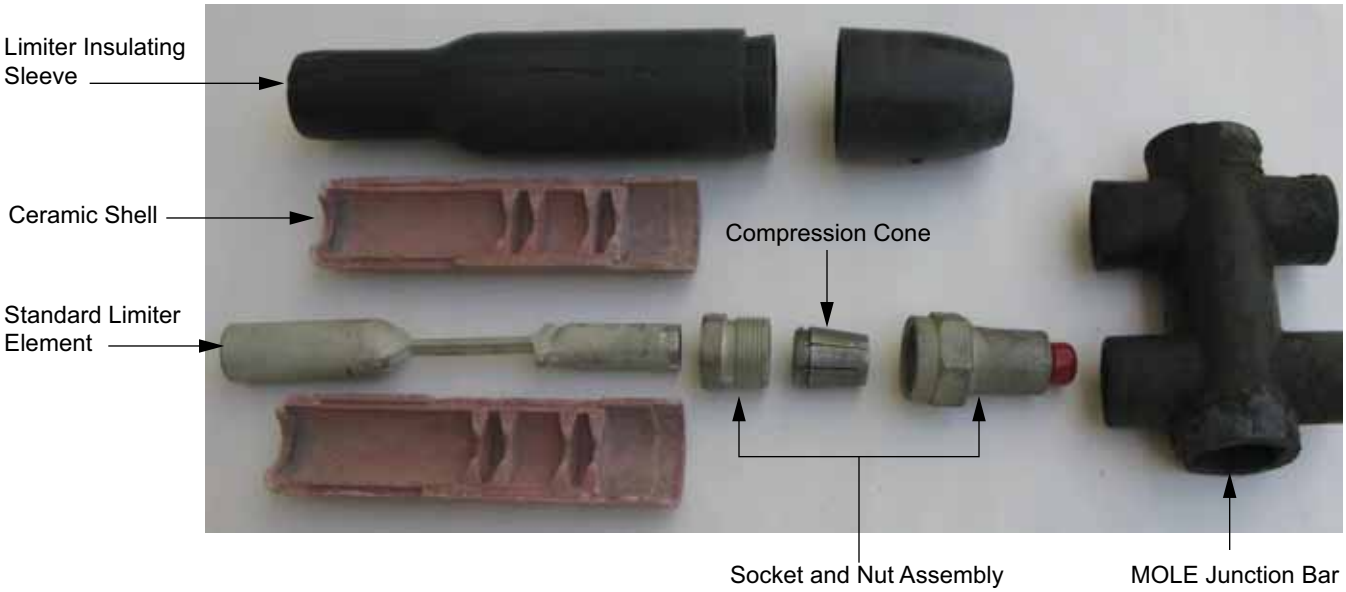
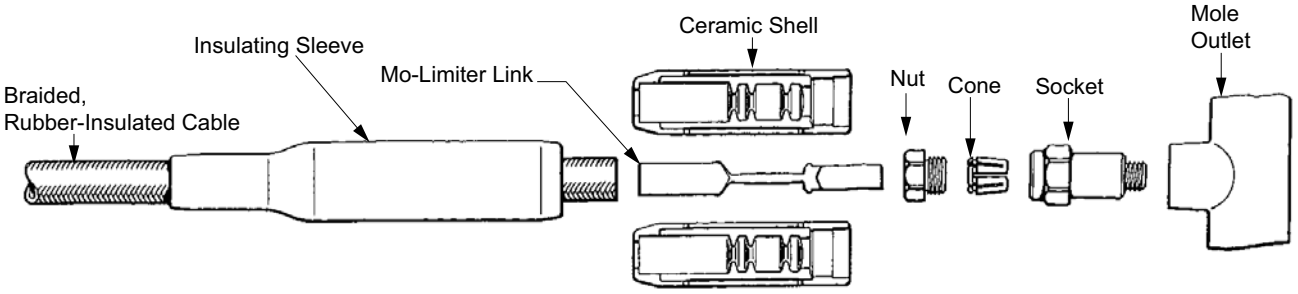


Figure PD 600–17: Mo-Limiter Assembly for MOLE-to-Cable



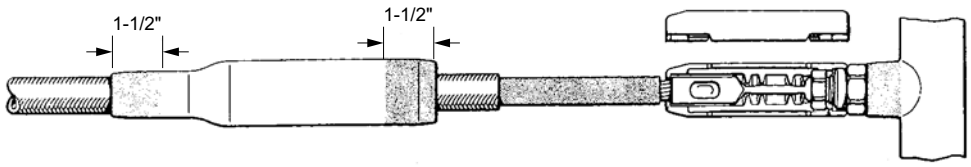
Step 1. Slide the insulating sleeve of the Mo-Limiter over the cable and behind the area where the cable jacket is to be removed.

Step 2. For 4/0 to 400MCM cable, remove 2-1/2 inches of the cable's jacket, measuring from the cable end. For 500MCM and 750MCM cable, remove 3-1/4 inches of the cable's jacket, measuring from the cable end.

Step 3. Using a wire brush, clean the contact surfaces of the socket, cone, cable strands, and the Mo-Limiter link.

Step 4. Screw the socket tightly into the MOLE outlet.

Figure PD 600–18: MOLE-to-Cable Mo-Limiter Reference for Steps 5-9



Step 5. Insert the cable into the Mo-Limiter link socket and indent once for cable sizes up to 250 MCM. Indent twice for all cable sizes above 250 MCM. Use the UT-15 compression tool (SAP 10148809). For 500 MCM cable use the adapter die (SAP 10148852) and the 15CA87R die (SAP 101448894). For SAP numbers of the dies for other cable sizes, refer to JJ 700 and TP 101.

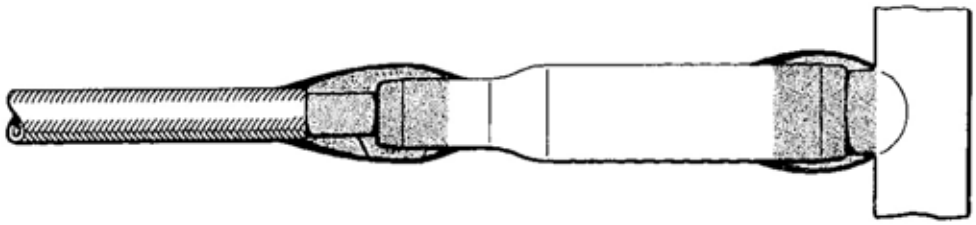
Step 6. Slide the clamping nut and cone over the plug-end of the Mo-Limiter link.

Step 7. Insert the clamping cone, assembled on the Mo-Limiter link plug-end, into the socket and tighten the nut.

Step 8. Using a wire brush, roughen and clean the MOLE outlet, the cable, and both ends of the insulating sleeve for a length of 1-1/2 inches on the outside and 1/2 inch on the inside.

Step 9. Place the ceramic shells over the Mo-Limiter link, centering the shells over the fusible section.

Figure PD 600–19: MOLE-to-Cable Mo-Limiter Reference for Steps 10-11



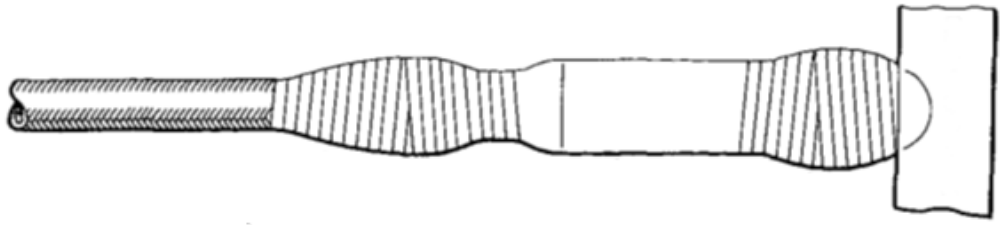
Step 10. Slide the insulating sleeve over the ceramic shells so that it is within ½ inch of the MOLE secondary connector body.

Note(s):

1. When the insulating sleeve of the Mo-Limiter is in two parts, the smaller part is slipped over the MOLE outlet before the ceramic shell is put in place. The remaining part of the sleeve is slipped over the ceramic shell until it interlocks with the sleeve on the side of the MOLE outlet.

Step 11. Apply three half-lapped layers of rubber tape with sufficient tension to reduce its width from 3/4 inch to 1/2 inch. On the MOLE outlet side, wrap continuous half-lapped layers of rubber tape over the MOLE outlet and 1-1/2 inches of the insulating sleeve. On the cable side, wrap 1-1/2 inches of both the insulating sleeve and the cable with rubber tape.

Figure PD 600–20: MOLE-to-Cable Mo-Limiter Reference for Steps 12-13



Step 12. Completely cover the rubber tape with two half-lapped layers of friction tape applied with considerable tension in order to compress the rubber tape. The friction tape shall extend 3/4 inch beyond the rubber tape on the insulating sleeve and 3/4 inch over the cable's jacket.

Step 13. Cover the entire splice with ScotchKote Electrical Coating (SAP 10118091)

3.3 Mo-Limiter Components

Figure PD 600–21: Internal Components of a Replaceable-Link Mo-Limiter

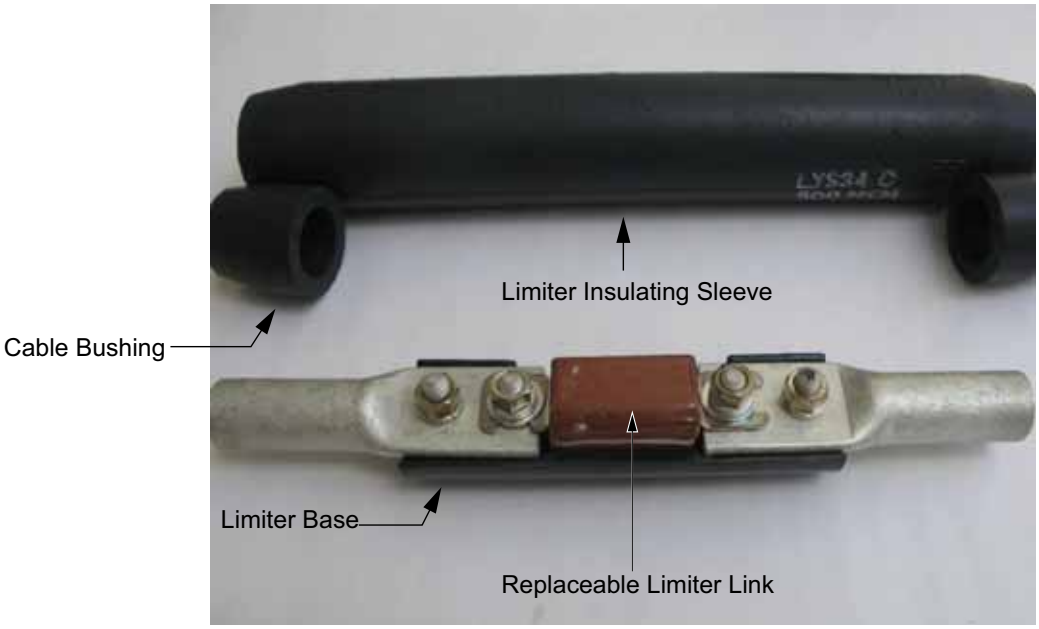


Table PD 600–4: Mo-Limiter (Replaceable Link Style) Ordering Information

Item	Description	SAP
Mo-Limiter (Replaceable Link Style) - Complete Assembly	Cable-to-Cable Limiter. Complete Assembly (Outer Insulation Sleeve, Replaceable Limiter Link, Limiter Base, and Cable Bushings.) Replaceable link style. For 500 MCM cable. For use on both rubber and paper-insulated cable	10117763
Mo-Limiter (Replaceable Link Style) - Complete Assembly	MOLE-to-Cable Outlet Limiter. Complete Assembly. (Outer Insulation Sleeve, Replaceable Limiter Link, Limiter Base, and Cable Bushings.) Replaceable link style. For 500 MCM cable. For use on both rubber and paper-insulated cable. Order one socket and nut assembly and one compression cone (see Table PD 600-6) for each MOLE-to cable Mo-Limiter.	10117515
Replaceable Limiter Link	Replaceable Link for 500 MCM cable. Use on either Mole-to-Cable or Cable-to-Cable limiters.	10117519
Limiter Base	For Use on Replaceable Limiters (both Mole-to-Cable and Cable-to-Cable limiters).	10117520
Limiter Insulating Sleeve	For Use on Replaceable Limiter. Use for both Cable-to-Cable and MOLE-to-Cable limiters with Replaceable Link.	10117521
Bushing-Limiter to MOLE	MOLE Junction Bar Outlet to Mo-Limiter (Replacement Link style limiters) Bushing	10117522
Bushing-Cable	Mo-Limiter to Cable Bushing, (for Replacement Link style limiters). 300-500MCM	10117523

Figure PD 600–22: Components Required for Mo-Limiter (Replaceable-Link type) Connection to the Outlets of the MOLE-Style Secondary Junction

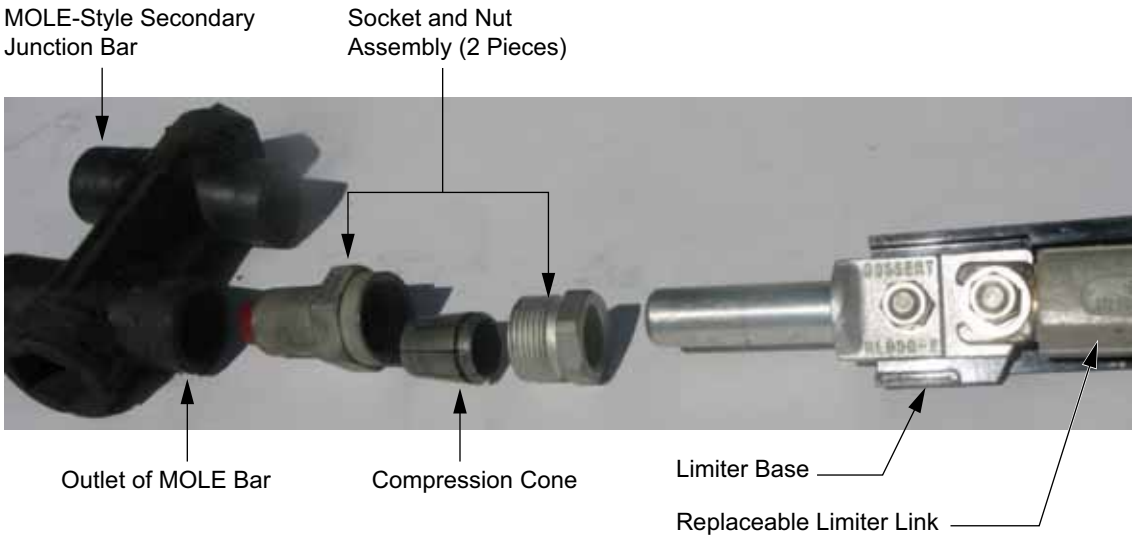


Table PD 600–5: Mo-Limiter (Standard Element Style) Assemblies – Mole-to-Cable Ordering Information

Item	Description	SAP
Mo-Limiter (Standard Limiter Element style) - Complete Assembly	MOLE-to-Cable Limiter. Complete Assembly (Outer Insulation Sleeve, shell, and Standard Limiter Element.) For 500 MCM cable with Rubber insulation. Order one socket and nut assembly and one compression cone (see Table PD 600-7) for each MOLE-to cable Mo-Limiter.	10203864
Mo-Limiter (Standard Limiter Element style) - Complete Assembly	MOLE-to-Cable Limiter. Complete Assembly (Outer Insulation Sleeve, shell, and Standard Limiter Element.) For 500 MCM cable with Paper insulation. Order one socket and nut assembly and one compression cone (see Table PD 600-7) for each MOLE-to cable Mo-Limiter.	10203863
Long Mo-Limiter (Standard Limiter Element style) - Complete Assembly	MOLE-to-cable Outlet Limiter. Complete Assembly. (Outer Insulation Sleeve, Replaceable Limiter Link, Limiter Base, and Cable Bushings.) For 500 MCM cable with paper insulation. Order one socket and nut assembly and one compression cone (see Table PD 600-7) for each MOLE-to cable Mo-Limiter.	10203867
Replaceable Limiter Element	Replaceable Standard Limiter Element. MOLE-to-Cable, for 500 MCM cable with rubber insulation.	10203870
Replaceable Limiter Element	Replaceable Standard Limiter Element. MOLE-to-Cable. For 500 MCM cable with paper insulation.	10203868
Long Replaceable Limiter Element	Replaceable Long Standard Limiter Element. Mole-to-Cable for 500 MCM cable with paper insulation.	10203867
Limiter Shell	For Use on Standard Limiter style. MOLE-to-Cable. 500 MCM. Rubber-insulated cables.	10204172
Limiter Shell	For Use on Standard Limiter style. MOLE-to-Cable. 500 MCM. Paper-insulated cables.	10204171
Limiter Insulating Sleeve	Insulating Sleeve for Standard Limiter Element style. MOLE-to-Cable limiters.	10119773

Table PD 600–6: Mo-Limiter (Standard Element Style) Assemblies – Cable-to-Cable Ordering Information

Item	Description	SAP
Mo-Limiter (Standard Limiter Element style) - Complete Assembly	Cable-to-Cable Limiter. Complete Assembly (Outer Insulation Sleeve, shell, and Standard Limiter Element.) For 500 MCM cable with Rubber insulation.	10203871
Mo-Limiter (Standard Limiter Element style) - Complete Assembly	Cable-to-Cable Limiter. Complete Assembly (Outer Insulation Sleeve, shell, and Standard Limiter Element.) For 500 MCM cable with Paper insulation.	10203873
Replaceable Limiter Element	Replaceable Standard Limiter Element. Cable-to-Cable, for 500 MCM cable with Rubber insulation.	10203872
Replaceable Limiter Element	Replaceable Standard Limiter Element. Cable-to-Cable. For 500 MCM cable with Paper insulation.	10203874
Limiter Shell	For Use on Standard Limiter style. Cable-to-Cable. 500 MCM. Rubber-insulated cables.	10203866
Limiter Shell	For Use on Standard Limiter style. Cable-to-Cable. 500 MCM. Paper-insulated cables.	10203865
Limiter Insulating Sleeve	Insulating Sleeve for Standard Limiter Element style. Cable-to-Cable limiters. 500 MCM.	10204170

4.0 Associated Components for Connections to MOLE-Style Secondary Junction Bars

Each outlet of the MOLE-style secondary junction bars can be connected either to a Mo-Limiter, which is a secondary fuse (refer to section on Mo-Limiters), or to a cable which will be connected to a Mo-Limiter elsewhere in the vault. Both a socket and nut assembly, and a compression cone, are required to interface each of the MOLE-style secondary junction bar outlets either to a Mo-Limiter, or to cable. See Table PD 600–7for ordering information of the associated components required to connect Mo-Limiters or cable to the outlets of the MOLE-style Junction Bars.

If any outlet of a MOLE-style secondary junction bar is unused, it must be covered with a MOLE Outlet Plug (See Table PD 600–3 (Sheet 12)).

Table PD 600–7: Components Required to Connect Outlets of MOLE-style Junction Bars to Mo-Limiter, or to Cable.

Item	Description	SAP
Socket and Nut Assembly	500 MCM, “A” Style Outlets. Need 1 for each MOLE Outlet	10117880
Compression Cone	Type Z, for Use with Socket and Nut Assembly for MOLE-Style Junction Bar, 500 MCM. “A” Style Outlets. Need 1 for each MOLE Outlet	10117788
MOLE Outlet Insulating Sleeve	Need 1 for each MOLE Outlet-to-Cable Installation. Do not order if connecting Mo-Limiter to MOLE outlet.	10204588

Racks and Supports
Table of Contents

Standard	Title
RS 100	Anchors for Concrete and Masonry
RS 100.1	Installation Instructions for Wedge and Flush Type Anchors for Concrete and Masonry
RS 102	Anchor Tie Downs for BURD Switches
RS 102.1	Anchor Tie Downs for BURD Switches
RS 105	Hex/Penta Bolts and Sockets
RS 105.1	Hex/Penta Bolts and Sockets
RS 110	Cable Racks and Hooks
RS 110.1	Cable Racks and Hooks
RS 200	Racking Cables in Underground Structures
RS 200.1	Racking Cables in Underground Structures
RS 205	Racking Splices and Premolded Elbows
RS 205.1	Preferred Method of Racking Premolded Splices and Elbows
RS 210	Cable Support BURD Switch/Transformer Enclosures
RS 210.1	Cable Support BURD Switch/Transformer Enclosures
RS 300	Riser Grips
RS 300.1	Riser Grips
RS 305	Cable Restraints
RS 305.1	Cable Restraints
RS 305.2	Lower Terminal Riser Cable Support — Field Installation
RS 310	Riser Grip Sizing Chart
RS 310.1	Selection Chart for Determining Grip Size when more than one Cable is held in a Single Grip

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RS 100 Anchors for Concrete and Masonry

Scope RS 100.1 Installation Instructions for Wedge and Flush Type Anchors for Concrete and Masonry

Figure RS 100–1: Wedge Stud Anchor

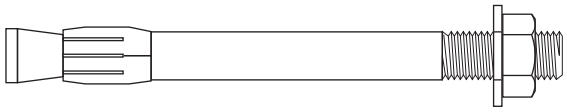

Figure RS 100–2: Flush Anchor

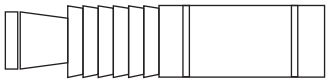

Table RS 100–1: Anchors for Concrete and Masonry

Type and Size Diameter (in)		Composition	Length[a/] of Wedge (in)	Maximum Allowable Loading per Anchor (lb) 6 to 1 S.F. Included	Diameter (in)	Dimension of Drilled Hole MIN Depth (in)		Material Code	SAP Number
Wedge	Flush					Wedge	Flush		
1/4		Carbon Steel	5/8	220	1/4	1-1/8		108-14333	10072329
3/8		Carbon Steel	2-1/4	490	3/8	1-1/2		108-14358	10072330
3/8		Stainless Steel	3-1/4	490	3/8	1-1/2		—	10200308
1/2		Carbon Steel	1-3/4	880	1/2	2-1/4		108-14366	10072331
1/2		Stainless Steel	3	880	1/2	2-1/4		108-00936	10200306
5/8		Stainless Steel	2-1/4	1050	5/8	2-3/4		108-00878	10200305
	5/8	Carbon Steel		1050	27/32		2-9/16	108-48802	10072372

[a/] That portion extending beyond the face of the wall.

Note(s):

1. The wedge stud anchors (Figure RS 100–1 [Sheet 1]), and flush anchors (Figure RS 100–2 [Sheet 1]) are recommended for attaching equipment in underground concrete structures without unistrut. Maximum loads tabulated in Table RS 100–1 (Sheet 1) are calculated on the minimum allowable concrete strength, or the shear value of the bolt, whichever is lower.
2. Drill anchor hole to the diameter shown in the table, and to a depth equal or exceeding the minimum depth shown in Table RS 100–1 (Sheet 1).
3. **Flush Anchor Installation** — Insert red plug into base of anchor until snug. Place in hole and expand anchor with a few blows of a hammer until anchor top is flush or slightly below the concrete surface.
4. **Wedge Anchor Installation** — Assemble supplied nut and washer to anchor, with top of nut flush with top of anchor. Drive anchor through equipment to be fastened, so that washer is flush with surface of material. Expand clip and set anchor by tightening nut a minimum of three full turns.

NOTE

A temporary spacer may be required to set the exposed stud at the required height, if equipment is not being attached at time of anchor installation.

5. To develop maximum strength, anchors should be set a minimum of ten diameters from an edge or from another anchor.

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RS 102 Anchor Tie Downs for BURD Switches

Scope RS 102.1 Anchor Tie Downs for BURD Switches

Figure RS 102–1: Anchor Tie Down

2' MIN to 2'-9" MAX
Attached Height to
BURD Switch
(SAP 10177875)

Figure RS 102–2: Anchor

3/8" DIA, 21/4" Length
(SAP 10072242)

Figure RS 102–3: Typical Installation of ATD on a BURD Switch

Figure RS 102–4: Top-Down View of ATD on a BURD Switch

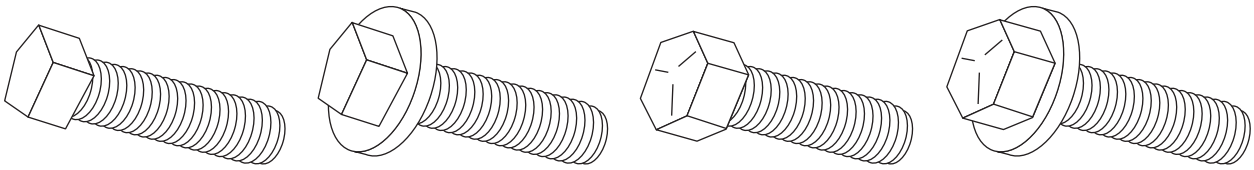
Note(s):

1. The Anchor Tie Down (ATD) Kit (SAP 10177875) consists of two (2) ATDs and six (6) anchors.
2. For a BURD switch that does not have channels to secure the BURD switch to the concrete floor, an alternate method for securing the BURD switch is to utilize Anchor Tie Downs (ATD) by attaching the plate of the ATD to the concrete floor and attaching the top portion of the ATD to the ears of the BURD switch. If there is limited space to secure both anchor plates to the concrete floor, an alternative is to utilize the concrete wall space for one anchor plate and the concrete floor for the other anchor plate.
3. Anchors (SAP 10072242) through the plate of the ATD are not shown in Figures RS 102-3 and RS 102-4 for clarity.

RS 105 Hex/Penta Bolts and Sockets

Scope RS 105.1 Hex/Penta Bolts and Sockets

Figure RS 105–1: Hex/Penta Bolts and Sockets



Penta Bolt | Penta Bolt with Captive Washer | Hex Bolt | Hex Bolt with Captive Washer

Table RS 105–1: Hex/Penta Bolts, Sockets, and Applications

Bolts		
Hex	5/8 - 11 x 1/2"	M/C 092-63401
	5/8 - 11 x 1/2" with captive washer	M/C 099-00846
Penta	3/8 - 16 x 1-1/2"	M/C 099-69502
	3/8 - 16 x 2-1/2"	M/C 099-69601
	1/2 - 13 x 2-1/2"	M/C 099-69700
	1/2 - 13 x 2-1/2" with captive washer	M/C 099-00838
Bolts with captive washers are designed to be used on polymer concrete covers		
Sockets		
3/8" Socket (Penta)		M/C 843-22007
1/2" Socket (Penta)		M/C 843-22106
15/16" Socket (Hex)		(Standard socket)
Underground structure wrench - (star wrench) lug wrench type with all three sockets (Penta & Hex) and screw driver point		M/C 839-00274
Applications		
Handhole		Use 3/8" — 16 Penta
BURD Transformer Enclosure		Use 3/8" — 16 Penta
BURD Switch Enclosure		Use 3/8" — 16 Penta
Subsurface Enclosure		Use 1/2" — 13 Penta
Pull Box		Use 1/2" — 13 Penta
Manhole		Use 5/8" — 11 Penta
Vault		Use 5/8" — 11 Penta

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RS 110 Cable Racks and Hooks

Scope RS 110.1 Cable Racks and Hooks

1.0 General Info

Cable racks shall be used to support cable in distribution manholes and vaults. There are two types of material used: metallic and composite.

2.0 Metal Cable Racks

2.1 Three cable components are utilized to support cable, a 2-1/2-inch hook, a 5-inch hook, and a 14-inch rack arm.

2.2 Holes are provided to allow cable to be restrained where required and to bolt the hook to a structure wall without using a cable rack.

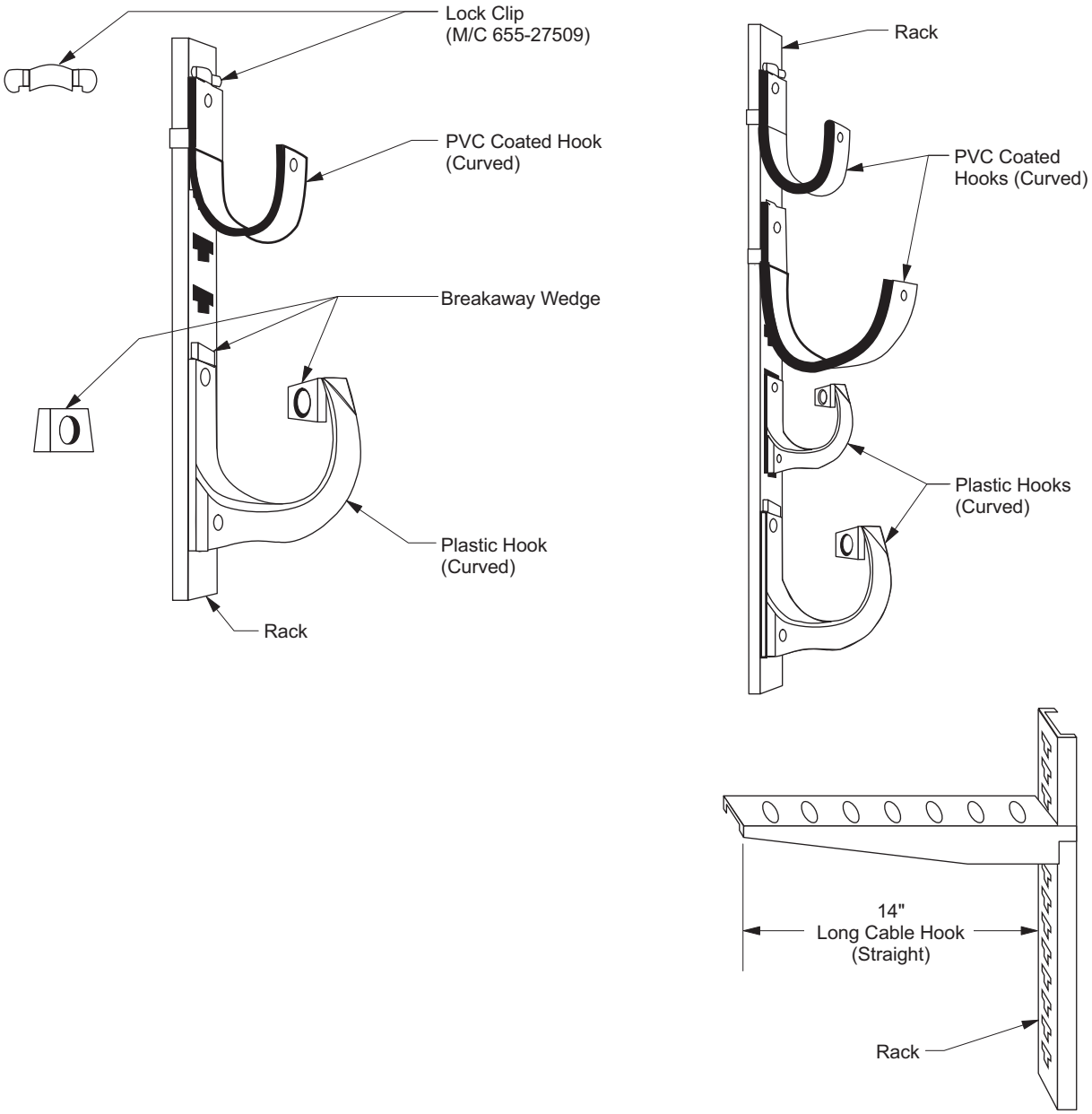
2.3 Locking clips and breakaway wedges can be utilized to prevent hooks from being accidentally loosened from the cable rack. Pressure applied to the clip with a screwdriver, forces it into a locking position and the screwdriver can also be used for removal. The breakaway wedge attached to the hook is easily detached and inserted into the rack. It can also be removed with a screwdriver and is reusable.

2.4 The 14 inch straight hook inserts into 2 slots of a cable rack. Multiple holes allows cables to be restrained with plastic straps where required.

Table RS 110–1: Rack Data

SAP	Description	Length (in)
10117739	Plastic Hook	2-1/2
10117740	Plastic Hook	5
10117304	Metal Rack Arm	14
10118040	Metal Rack	15
10118042	Metal Rack	30

Figure RS 110–1: Typical Metal Rack Section with Cable Hooks



Note(s):
1. Cable racks are only available in a 30 inch size (SAP 10118042) and a 15 inch size (SAP 10118040).
2. Cable Rack Mounting Methods
   a. Stainless steel bolts, SAP 10071038 (HDG bolts are not acceptable.)
   b. Unistrut nuts, SAP 10073651 through SAP 10073654.
   c. For concrete and masonry anchors, see RS 100 (page RS-1).

3.0 Composite Cable Racks

3.1 Composite cable racking material shall be used in places that cannot sustain a dry environment, especially in replacement of metallic material that has rapidly deteriorated.

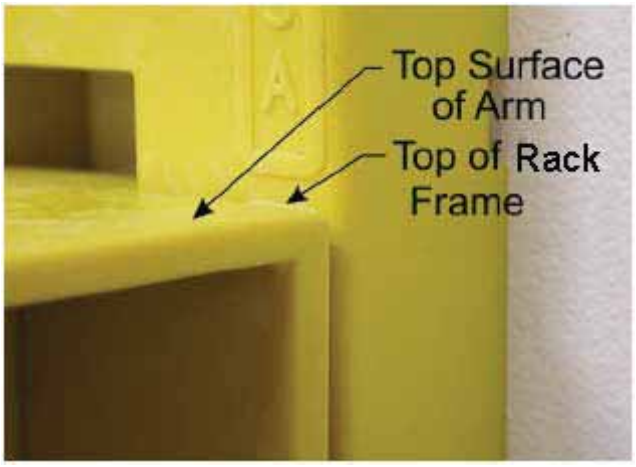
3.2 There is one hook and five rack arms utilized to support cable.

Table RS 110–2: Composite Rack Data

M/C	Description	Length (in)
656-01957	Hook	3
656-01965	Rack Arm	4
656-01973	Rack Arm	6
656-01981	Rack Arm	8
656-01999	Rack Arm	11
656-02005	Rack Arm	20

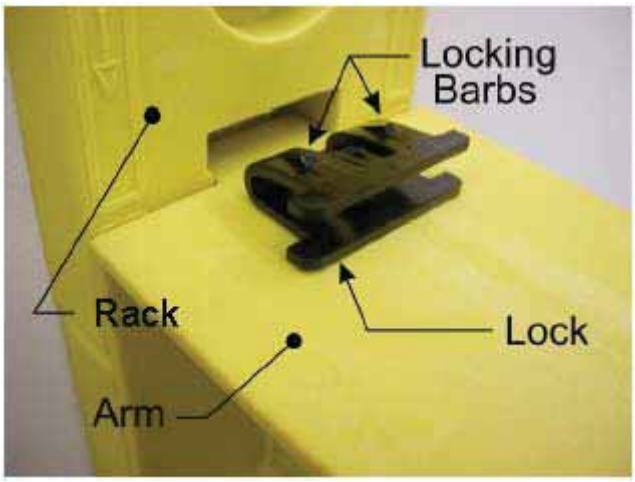
3.3 The hook and rack arms lock into place on the rack. In order to do so, mount the hook/rack arm onto the rack and apply a downward pressure until the hook/rack arm snaps into place.

Figure RS 110–2: Rack Arm Engagement



3.4 The cable rack arm locks (M/C 656-02047) can be utilized to ensure the hook/rack arm is in place and cannot be loosened from the rack by any means. The cable rack arm lock can be reused if not damaged (e.g. cracked). The cable rack arm lock is simply snapped into place and can be removed by hand or with a screwdriver.

Figure RS 110–3: Cable Rack Arm Lock



3.5 Composite racks are available in three sizes. These can be cut in the field at selected lengths with a carbide tipped saw (M/C 841-78730 or 841-96203). Field cuts should only made at the frame breaks molded on the front face of the rack. Lengths that can be cut from stock racks are shown in Table RS 110-3.

Figure RS 110–4: Molded Break on Racks

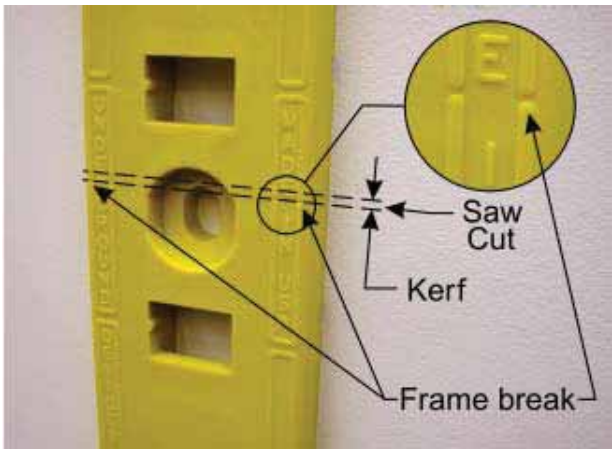


Table RS 110–3: Rack Cut Lengths

M/C	Description	Length (in)	Cut Length (in)
656-02013	Rack	12	—
656-02021	Rack	24	8
			16
656-02039	Rack	36	12
			20
			28

3.6 Rack Mounting Materials

Table RS 110–4: Rack Mounting Materials

Hardware	Dimensions		M/C
	Diameter (in)	Length (in)	
Spring Nut	1/2	—	133-66406
	5/8	—	133-66604
Everdur Bolt	1/2	1-1/2	099-39604
Penta Bolt	1/2	1-1/2	099-69403
Hex Bolt	5/8	1-1/2	092-63401
Washers	1/2	—	107-65105
	1/2	—	107-60304
	5/8	—	107-60502
Anchors	—	—	See RS 100.

Note(s):
1. For the highest cable rack load capacity, install one fastener in every elongated rack hole. Install the flat washer and tighten the cap screw just enough to attain a snug fit. Avoid high screw torque which induces compressive stress.

3.7 When two or more racks are used in tandem, a hook/rack arm can span the joint between the two racks. A hook/rack arms can also span joints on racks that have had their lengths modified (as per Section 3.5) at specified cut points.

Figure RS 110–5: Rack Arm Spanning Two Racks

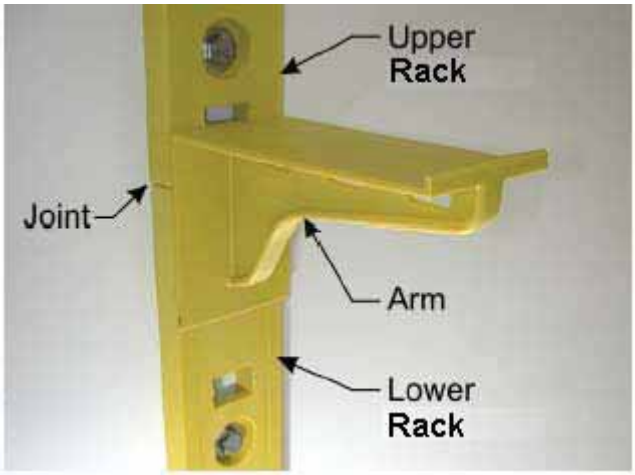
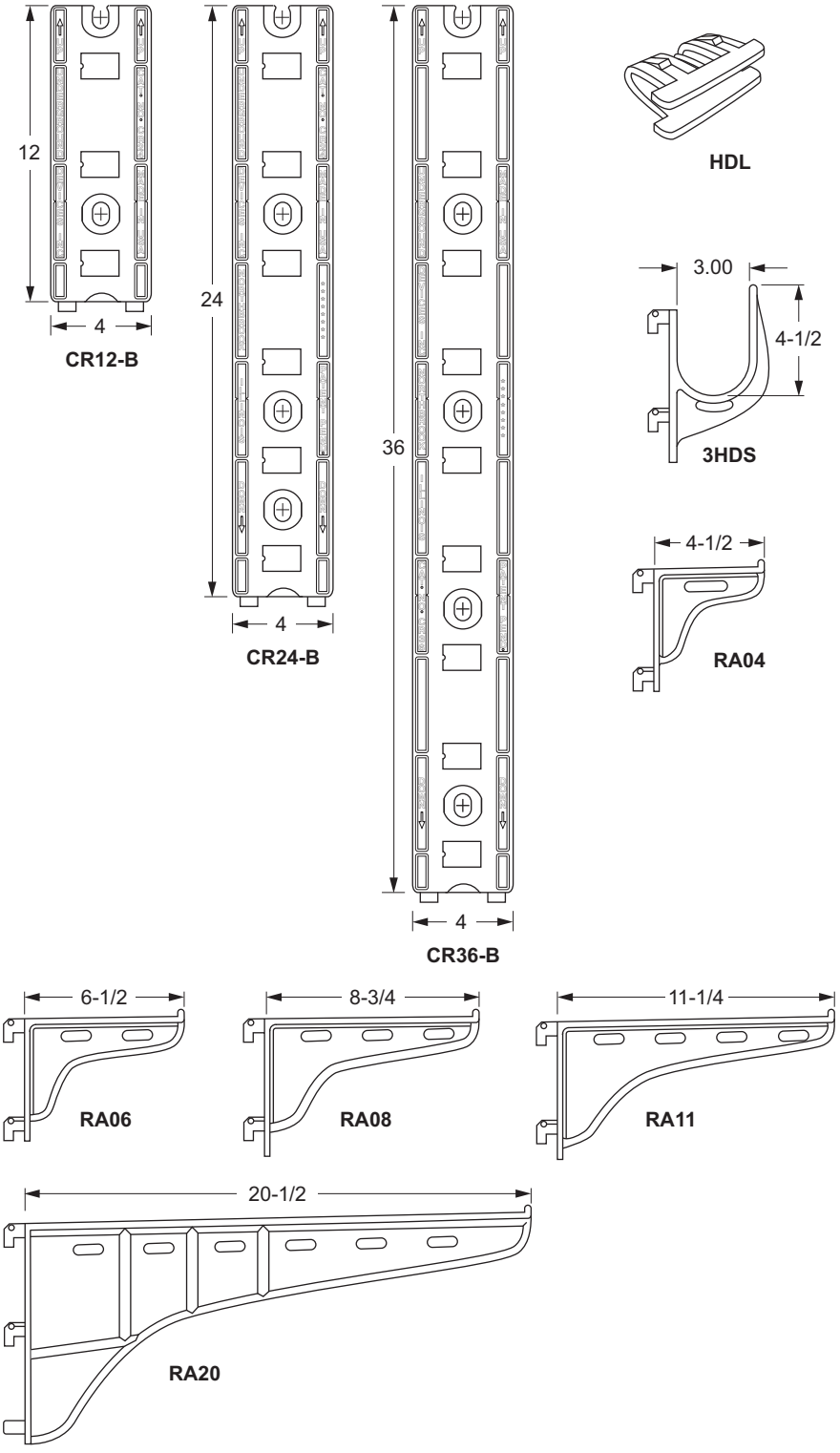


Figure RS 110–6: Composite Cable Rack Dimensions (in)



RS 200 Racking Cables in Underground Structures

Scope RS 200.1 Racking Cables in Underground Structures

1.0 General Information

1.1 This standard provides guidelines for racking cables in underground structures.

1.2 Racking cables in underground structures (i.e. vaults and manholes) will provide sufficient slack to accommodate thermal expansion and contraction and prevent damage to cable, components and equipment when extreme mechanical forces are exerted due to thermal cycling and fault activity.

2.0 Racking Cable Methodology

2.1 There are two methods for racking cables in underground structures: Wrap cable in structures (preferred) or cable offset (alternate)

2.2 Wrap cable in structures when adding new cable in new/existing structures.

2.3 Offset Cable when it is not practical to wrap cable in structures due to space constraints and equipment location.

2.4 Application Guide for Racking Cables

Table RS 200–1 (Sheet 2) provides guidelines for racking cables (wrap or offset) in structures. The table is based on the cable sizes allowed for a given structure size and type per Chapter 6 of the Distribution Design Standards (DDS) Manual.

Table RS 200–1: Racking Cable Application Table

Cable Allowed per UG Structure Based on Three 1/C[a/]										
Voltage		Pull Boxes			Padmounted Equipment Structures				SOE
(kV)	Description	2'x3'x3'	2'-6"x4'x 3'-6"	3'x5'x4'	6'x8'-6" slab box with 4'x7' pull box	8'x10 slab box with 4'x7' pull box	10'x12 slab with 5'x8'-6" box	10'x12' pad with 8'x10' slab box	5'x8'-6" x5'
4/12/16	#2 AWG[b/]	OFFSET	OFFSET	OFFSET	WRAP	WRAP	WRAP	WRAP	WRAP
	1/0 AWG	OFFSET	OFFSET	OFFSET	WRAP	WRAP	WRAP	WRAP	WRAP
	350 kcmil	—	—	OFFSET	Train Upwards	Train Upwards	WRAP	WRAP	WRAP
	750 kcmil[b/]	—	—	See Note c/	Train Upwards	Train Upwards	Train Upwards	WRAP[b/]	OFFSET
	1,000 kcmil	—	—	See Note c/	Train Upwards	Train Upwards	Train Upwards	WRAP[b/]	OFFSET
34.5	4/0 AWG	—	—	—	Train Upwards	Train Upwards	Train Upwards	WRAP[b/]	OFFSET
	750 kcmil[b/]	—	—	—	Train Upwards	Train Upwards	Train Upwards	WRAP[b/]	OFFSET
	1,500 kcmil	—	—	—	Train Upwards	Train Upwards	Train Upwards	WRAP[b/]	OFFSET

Voltage		Vaults				Manholes						
(kV)	Description	6'x12'x7'	7'x14'x8'	7'x16'x8' b/	7'x18'x8'	4'x4'x5' b/	4'x6'-6" x7'[b/]	4'-6"x8'-6"x7'[b/]	5'x10'-6" x7'	6'x8'x7' b/	6'x12'x7'	7'x7'x7' b/
4/12/16	#2 AWG[b/]	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP
	1/0 AWG	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP	WRAP
	350 kcmil	WRAP	WRAP	WRAP	WRAP	OFFSET	OFFSET	OFFSET	WRAP	WRAP	WRAP	WRAP
	750 kcmil[b/]	WRAP	WRAP	WRAP	WRAP	OFFSET	OFFSET	OFFSET	OFFSET b/c/	WRAP	WRAP	WRAP
	1,000 kcmil	WRAP	WRAP	WRAP	WRAP	OFFSET	OFFSET	OFFSET	OFFSET b/c/	WRAP	WRAP	WRAP
34.5	4/0 AWG	WRAP	WRAP	WRAP	WRAP	OFFSET	OFFSET	OFFSET	OFFSET b/c/	WRAP	WRAP	WRAP
	750 kcmil[b/]	OFFSET	WRAP	WRAP	WRAP	OFFSET	OFFSET	OFFSET	OFFSET b/c/	OFFSET	OFFSET	WRAP
	1,500 kcmil	OFFSET	OFFSET	OFFSET	OFFSET	OFFSET	OFFSET	OFFSET	OFFSET b/c/	OFFSET	OFFSET	OFFSET

[a/] For the table above, the limiting factor for wrapping and offsetting cables is the width of the structure. For example, in a 6' x 12' x 7' vault, the bending radius of the cable is compared to the 6' width.

[b/] Not approved for use on new construction per Chapter 6 of the DDS Manual.

[c/] When structure size is et underneath padmounted equipment, cable may be trained by sloping the cable upward into the equipment.

2.5 Cable offset – offset (train) cables entering and exiting conduits in structures.

- A two foot minimum offset is required between the conduit entrance position and the rack position. The two foot minimum offset is the perpendicular distance measured between an imaginary line extended from the center of the cable at the duct mouth and an imaginary line extended from the center of the cables in the rack position. See Figure RS 200–1 (Sheet 3) for details.
- Cables shall have a minimum of a two inch clearance from both the structure wall and from other cables. See Figure RS 200–2 (Sheet 3) for details.

Figure RS 200–1: Cable Offset

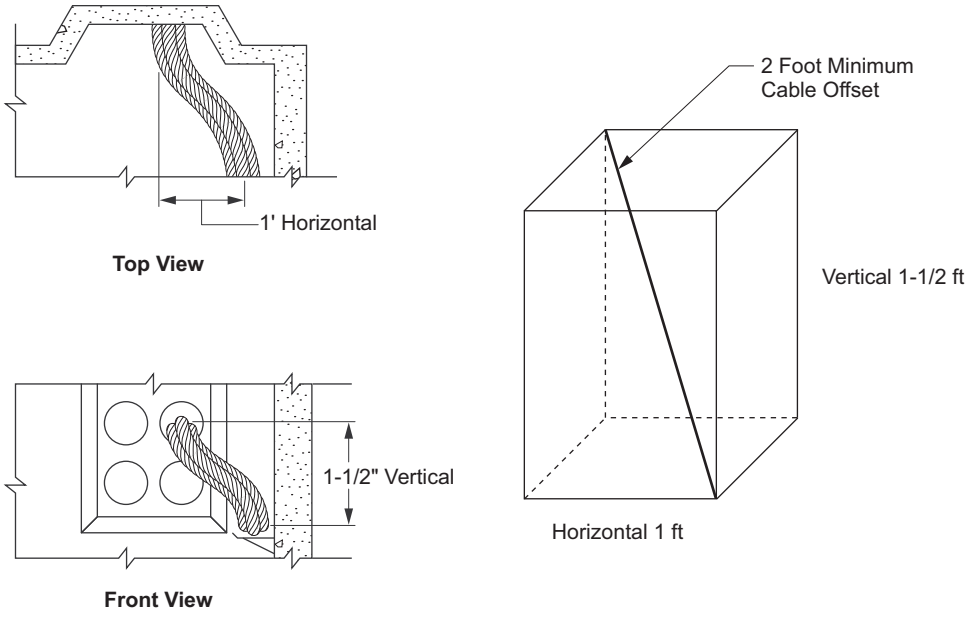
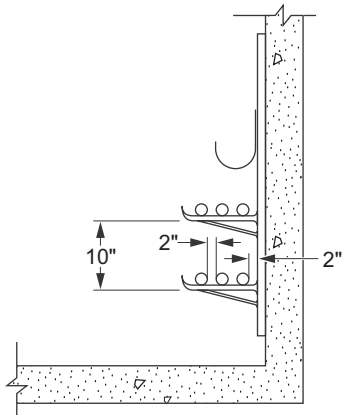


Figure RS 200–2: Typical Racking of Cables



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RS 205 Racking Splices and Premolded Elbows

Scope RS 205.1 Preferred Method of Racking Premolded Splices and Elbows

1.0 General

1.1 Always leave at least 6 inches of straight cable out of the end of each termination of splice. (Bent cable could distort elbow or splice and allow moisture to enter at cable entrance.)

1.2 If bails are used, do not use force in seating bail (excess pressure will distort elbow). (Tighten bails 1-1/2 to 2 turns.)

1.3 When tightening bolts on 600A elbow connections, use 50–60 ft/lb of force.

1.4 Disconnectable components, such as the 600A modular splices, should be racked in a manner relative to other devices, that will provide access to each splice or tap should it become necessary. Concentric neutral wires must have sufficient slack at these locations so that disconnecting the components can be done without cutting the concentric wires.

Figure RS 205–1: Typical Installation 200A Splice

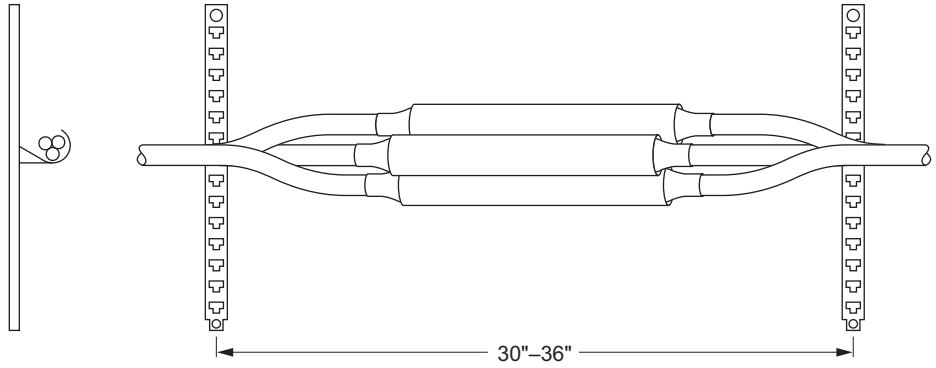


Figure RS 205–2: Typical Installation 600A Splice

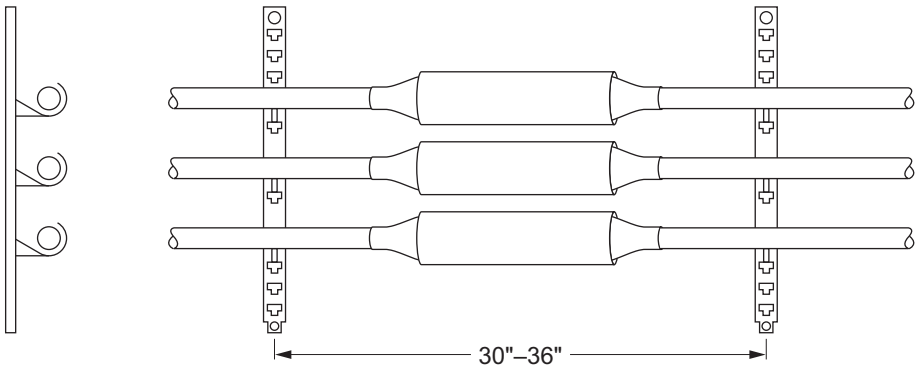
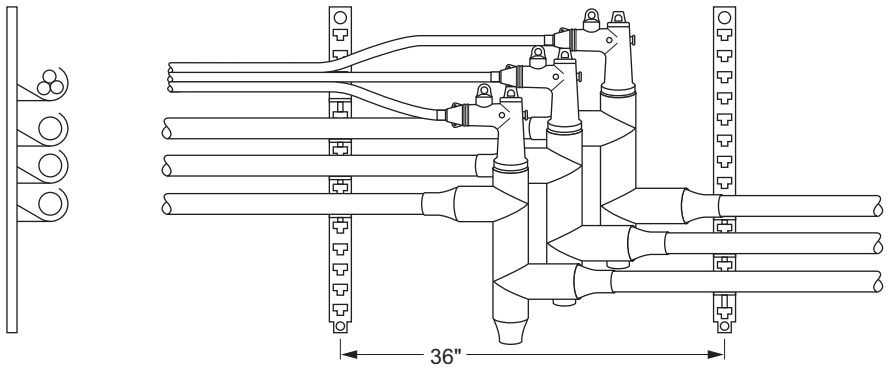


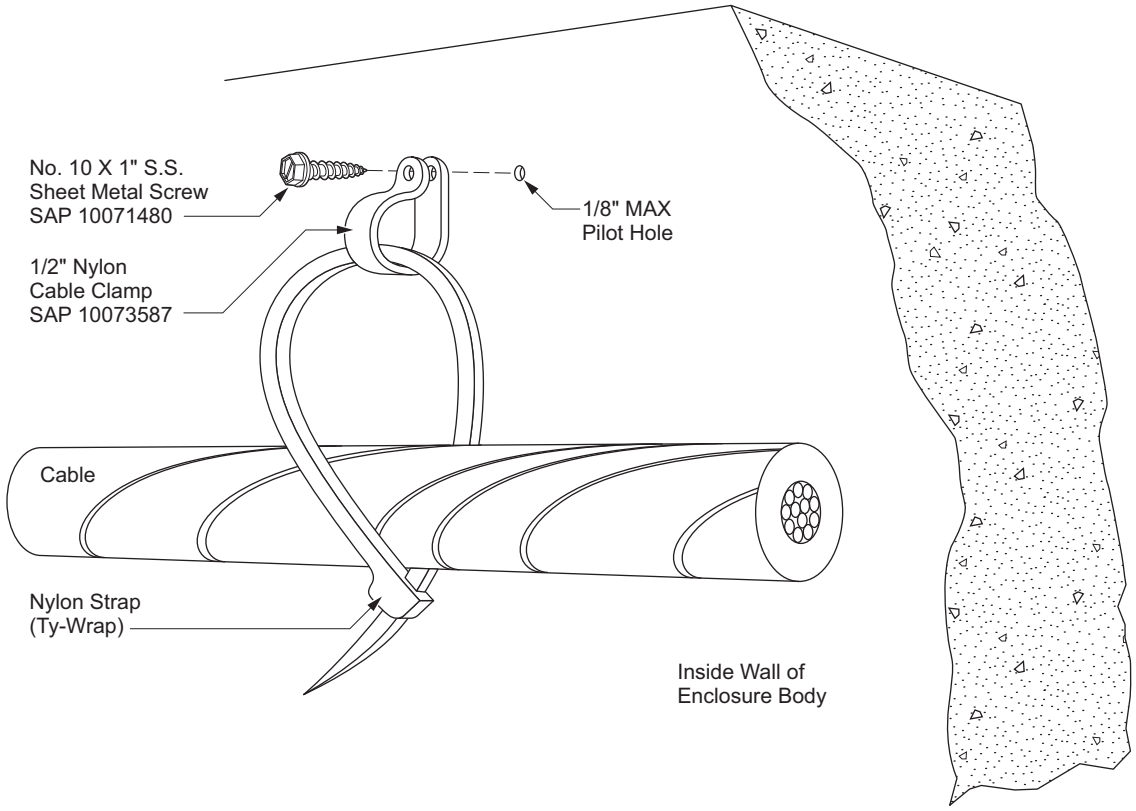
Figure RS 205–3: Typical Installation 600 A Elbow



RS 210 Cable Support BURD Switch/Transformer Enclosures

Scope RS 210.1 Cable Support BURD Switch/Transformer Enclosures

Figure RS 210–1: Cable Support BURD Switch/Transformer Enclosures



Note(s):

1. The sheet metal screws, cable clamps, and nylon straps can be installed to the inside of the BURD switch/transformer enclosure body whenever cable support is required.
2. Support of primary and/or low voltage cables must be provided when the potential exists for distortion of related cable components, or to prevent contact to the tank of the apparatus.
3. To aid in screw attachment, a pilot hole should be drilled through the wall of the enclosure body with a 1/8 inch maximum diameter metal drill bit.
4. Screw can be installed with a screwdriver or 5/16 inch hexhead socket tool. For maximum strength, the cable clamp should be mounted flush to the surface of the enclosure wall.

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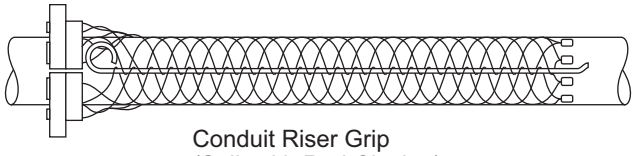
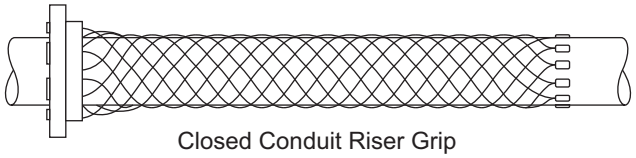
RS 300 Riser Grips

Scope RS 300.1 Riser Grips

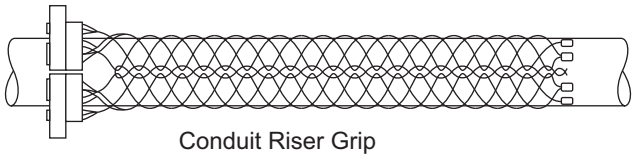
Figure RS 300–1: Riser Grips



Conduit Riser Grip
(Split with Rod Closing)



Closed Conduit Riser Grip



Conduit Riser Grip
(Split with Lacing Closing)

Table RS 300–1: Riser Grip Conduit Size and Cable Ranges

Normal Conduit Size	2"		2-1/2"	3"	3-1/2"	4"		5"		6"
Cable Range	1"–1-1/4"	1-1/4–1-1/2"	1-3/4"–2"	2"–2-1/2"	2-1/2"–3"	2-1/2"–3"	3"–3-1/2"	3-1/2"–4"	4"–4-1/2"	4-1/2"–5"
Closed Conduit Riser Grip M/C	655-39207	655-39306	655-39702	655-39900	655-40106	655-40403	655-40304	655-40502	655-40601	655-40700
Conduit Riser Grip Split Rod Closing M/C	—	—	655-37003	655-37201	655-37409	—	—	—	—	—

Note(s):

1. Cable riser grips shall be used on all risers.
2. Grips are rated for continuous loads to 300 pounds.
3. Use reducing rings to adapt any size grip to any larger size conduit desired.
4. Before installing cable riser grip on CLP cables apply two half lapped layers of friction tape to the area that will be used by the grip. After grip installation, bind the end of the grip with nylon cable ties (it may be necessary to hook several cable ties together) and apply two half lapped layers of plastic tape over nylon cable ties.

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RS 305 Cable Restraints

Scope RS 305.1 Cable Restraints

1.0 General

1.1 Cable restraints are used to prevent slipping of cable inside conduit after installation due to elevation change between structures.

1.2 Cable restraints shall be installed where the grade of the conduit between structures is 20% (2 feet vertical per 10 feet horizontal) or more.

Figure RS 305–1: Cable Restraint

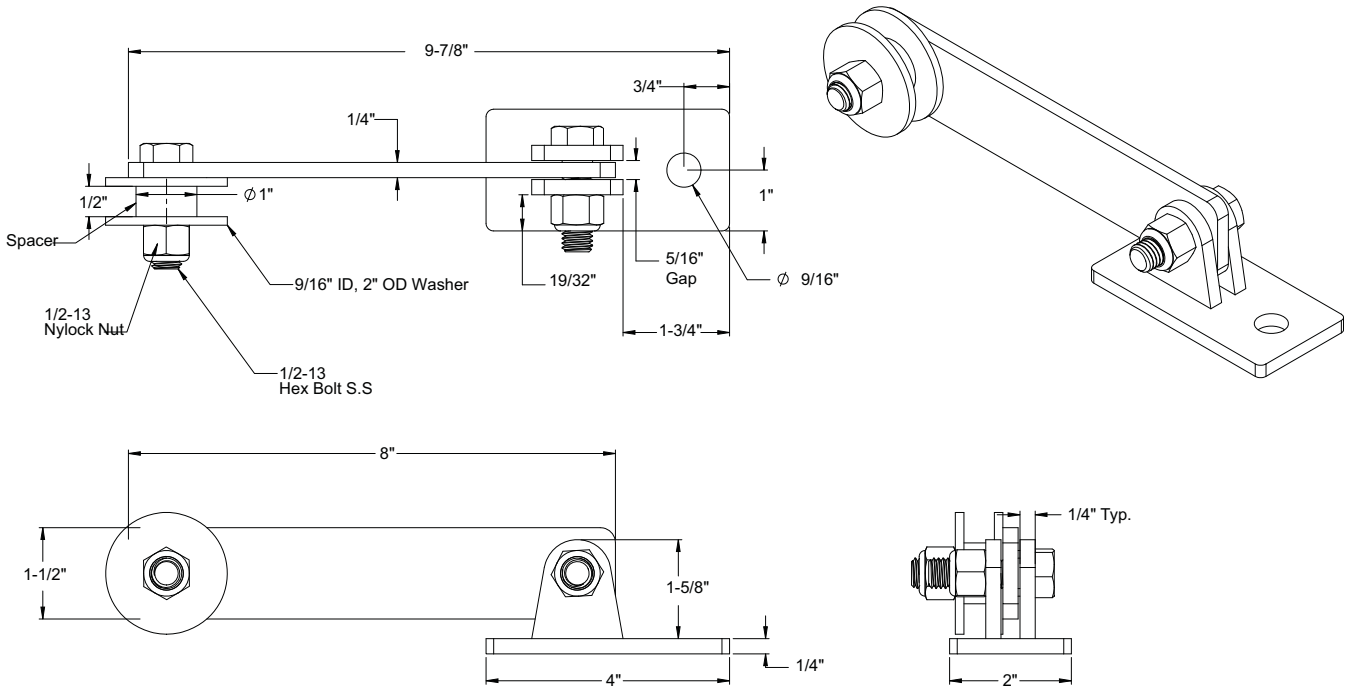
Note(s):

1. Approved for use on up to 1000 kcmil cable.
2. Refer to Table RS 350-1 for cable grip sizing.
3. Before installing cable riser grip on CLP cables apply two half lapped layers of friction tape to the area that will be used by the grip. After grip installation, bind the end of the grip with nylon cable ties (it may be necessary to hook several cable ties together) and apply two half-lapped layers of plastic tape over nylon cable ties.
4. Attach wedge stud anchors per RS 100

Table RS 305–1: Cable Grip Sizing for Cable Restraint

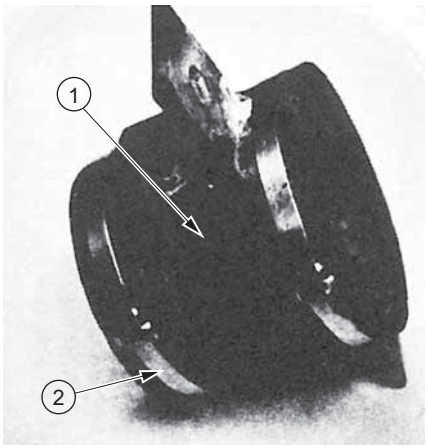
Cable Size	1/C 1/0 JCN	2/C 1/0 JCN	3/C 1/0 JCN or 1/C 1000kcmil JCN	3/C 350 kcmil JCN or 3/C 350 kcmil EPR	3/C 1000 kcmil JCN	3/C 500 kcmil EPR
Cable Grip Diameter	**3/4" – 1" Single Eye**	**1-3/4" – 2" Single Eye**	**2" – 2-1/2" Single Eye**	**3" – 3-1/2" Single Eye**	**3-1/3" – 4" Double Eye**	**3" – 3-1/2" Double Eye**
Cable Grip SAP Number	10210031	10210032	10210033	10210034	10210035	10210036

Figure RS 305–2: Cable Restraint Bracket Dimensions

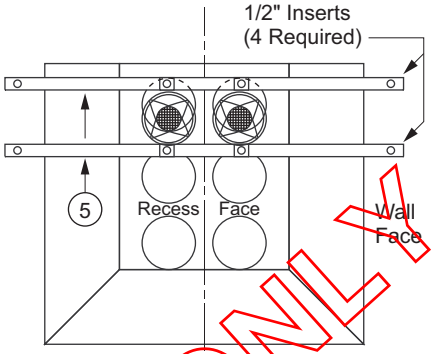


Scope RS 305.2 Lower Terminal Riser Cable Support — Field Installation

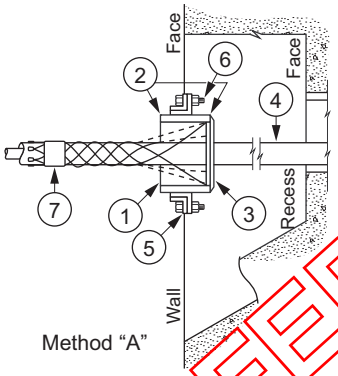
Figure RS 305–3: Lower Terminal Riser Cable Support — Field Installation



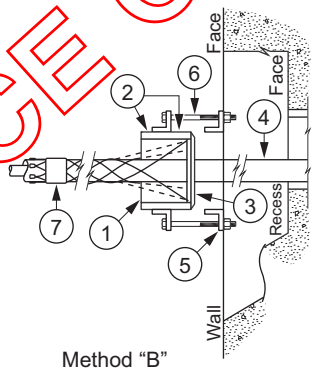
Anchor—Assembled



Angle or Unistrut Bolted in
Place Across Recess (See Note #5)



Method “A”



Method “B”

FOR REFERENCE ONLY

Note(s):

1. For general use to support riser cables at lower duct terminal when provision for anchoring cable has not been provided during initial construction.
   a. Split ring cable support anchor. MC 655-05000
   b. “Bandit” Tape, 1/2 inch Stainless Steel.
   c. Cable support with collar or adapter ring.
   d. One or more cables in duct.
   e. Angle or Unistrut bolted across duct opening or recess. (2 each required) Angles or Unistrut to be positioned to avoid contact with cable from adjacent ducts.
   f. Half inch bolt. (2 each required)
   g. Tape as necessary to maintain positive contact between cable and cable support.
2. METHOD “A” of installing the split ring cable support anchor will give the most compact installation and should be used wherever space is a consideration. METHOD “B” has the advantage of providing means to adjust the tension applied to the cable support and will generally provide the more satisfactory installation.

Table RS 305–2: Application

Risers:

The lower terminal cable support is required for lead cable when the horizontal run is less than three times the riser height. It is not required for any synthetic cable riser.

Structure to Structure:

The lower terminal cable support is required for cable runs (PILC or CLP) where a great elevation difference between adjacent structures is present (2 ft vertical per 10 ft horizontal or steeper).

FOR REFERENCE ONLY

RS 310 Riser Grip Sizing Chart

Scope RS 310.1 Selection Chart for Determining Grip Size when more than one Cable is held in a Single Grip

For cables of different or same diameters, grip size is determined by the envelope of the cables to be held. Measure circumference as shown in Figure RS 310–1 (Sheet 1). Refer to Table RS 310–1 (Sheet 1) for Grip Diameter Range.

Table RS 310–1: Riser Grip Sizing Chart

Grip Diameter Range	Grip Circumference Range (in)
1" – 1-1/4"	3.14–3.93
1-1/4" – 1-1/2"	3.93–4.71
1-1/2" – 1-3/4"	4.71–5.50
1-3/4" – 2"	5.50–6.28
2" – 2-1/2"	6.28–7.85
2-1/2" – 3"	7.85–9.42
3" – 3-1/2"	9.42–11.00
3-1/2" – 4"	11.00–12.57
4" – 4-1/2"	12.57–14.14
4-1/2" – 5"	14.14–15.71

Figure RS 310–1: Determining Grip Size

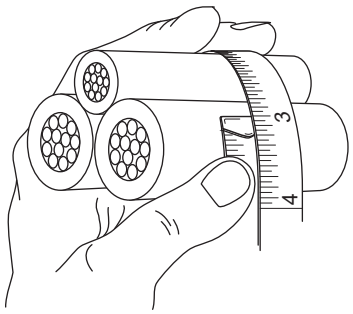


Table RS 310–2: Grip Size for Various Cable Configurations

0–600 V	Grip Diameter Range	5 kV	Grip Diameter Range	12/16-kV	Grip Diameter Range	35 kV	Grip Diameter Range
2 – #2 + 1 – #4	1" – 1-1/4"	3 – 1/0	1-3/4" – 2"	1 – #2	1" – 1-1/4"	3 – 1/0	3" – 3-1/2"
2 – 1/0 + 1 – #2	1" – 1-1/4"	3 – 350	2-1/2" – 3"	2 – #2	1-1/4" – 1-3/4"	3 – 750	4-1/2" – 5"
2 – 4/0 + 1 – 1/0	1-1/4" – 1-3/4"	3 – 750	3" – 3-1/2"	3 – #2	2" – 2-1/2"	3 – 1500	5" – 5-1/2"
2 – 350 + 1 – 4/0	1-1/4" – 1-3/4"			3 – 1/0	2" – 2-1/2"		
2 – 700 + 1 – 350	2" – 2-1/2"			3 – 350	3" – 3-1/2"		
3 – #2 + 1 – #4	1" – 1-1/4"			3 – 750	4" – 4-1/2"		
3 – 1/0 + 1 – #2	1" – 1-1/4"			3 – 1000	4" – 4-1/2"		
3 – 4/0 + 1 – 1/0	1-1/4" – 1-3/4"						
3 – 350 + 1 – 4/0	1-3/4" – 2"						
3 – 700 + 1 – 350	2-1/2" – 3"						

= For Reference Only

Table RS 310–3: Reducing Rings for Riser Grips

Conduit Size	SAP
2-1/2" – 2"	10118058
3" – 2-1/2"	10118059
3-1/2" – 3"	10118060
4" – 3"	10118061
4" – 3-1/2"	10118062
4-1/2" – 4"	10118063
5" – 4"	10118064
6" – 5"	10118066

Figure RS 310–2: Reducing Rings for Riser Grips (Tinned Bronze)

Switching Equipment
Table of Contents

Standard	Title
SE 100	Cablehead Assemblies — 400 A Switches
SE 100.1	Cablehead Assemblies 400A RAM and RAC Type Oil Disconnect Switches
SE 101	Cablehead Assemblies — 400A Switches — P/E Gear
SE 101.1	Cablehead Assemblies for 400A G&W Type RAD-M Preferred Emergency Switches
SE 105	Cablehead Assemblies — 600 A Switches
SE 105.1	Cablehead Assemblies — 600 A Switches
SE 150	Nonfused BURD Switches — 200 A — 17 kV
SE 150.1	16 kA, 200 A, 17 kV BURD-Type Submersible Load-Break Switches
SE 160	BURD Switches — Marking
SE 160.1	Standard Method of Marking 15 kV Fused and Nonfused BURD-Type Oil Switches
SE 205	Oil Switch — 600 A — 15 kV without Cableheads
SE 205.1	RAMS and RAC Type Bottom Connected Oil Switches 3-, 4-, 5-, and 6-Way — 3Ø — 15 kV — 600 A (Rated 600 A Load Switching) without Cableheads
SE 210	Oil Switch — 300 A — 15 kV — Surface-Operable
SE 210.1	Surface-Operable RAM Type Oil Switch 3-, 4-, and 5-Way — 3Ø — 15 kV Rated — 300 A Load Switching, 12,000 A Momentary (SYM)
SE 215	Preferred Emergency Switch — G&W
SE 215.1	G&W Preferred Emergency Oil Switch — Type RAD-ME
SE 215.2	Potential Transformer Wiring Diagram — G&W Preferred Emergency — Typical Installation — 3Ø Emergency Sensing
SE 215.3	Potential Transformer Wiring Diagram — G&W Preferred Emergency — Typical Installation — 1Ø Emergency Sensing
SE 217	Preferred Emergency Switch — ESCO
SE 217.1	ESCO Preferred Emergency Switch
SE 217.2	Potential Transformer Wiring Diagram for ESCO Preferred Emergency Installations
SE 220	Preferred Emergency Switch - Type PME/PMH
SE 220.1	17 kV, 600 A, S&C Preferred Emergency Switch—Type PME (Preferred)

Standard	Title
SE 220.2	17 kV, 600 A, S&C Preferred Emergency Switch—Type PMH (Alternate)
SE 250	Oil Switches — Marking
SE 250.1	Standard Method of Marking 7.5 kV and 15 kV “RA” Type Oil Switches
SE 255	Oil Switches — Installation
SE 255.1	Typical Installation “RA” Type Oil Switch in Vault or Manhole (Bottom Connected)
SE 255.2	Shows “RA” Type Oil Switch Installation
SE 256	Surface Operable Oil Switch — 600A — 15 kV
SE 256.1	Top/End Connected “RAM” Type Oil Switches 3-, 4-, 5-, and 6-Way, 3Ø, 15 kV — 600 A, 20,000 A Momentary
SE 256.2	Top/End Connected “RAC” Type Oil Switches 4-, 5-, and 6-Way, 3Ø, 15 kV, 600 A, 20,000 A Momentary
SE 256.3	Typical Installation Top/End Connected “RA” Type Oil Switch in a CST Enclosure (5' x 8'-6")
SE 258	Surface-Operable SF_6 RAM Switch — 600A
SE 258.1	Top Connected Staggered Bushing “RAM” Type SF_6 Gas-Filled Switches 3-, 4-, 5-, and 6-Way, 3Ø, 17 kV, 600 A
SE 258.2	G&W Top Connected Staggered Bushing “RAM” Type SF_6 Gas-Filled Switches 3- and 4-Way, 3Ø, 38 kV, 600 A, 25,000 A Momentary
SE 258.3	Typical Installation Procedures for Top Connected Staggered and Non-Staggered Bushing “RAM” Type SF_6 Gas-Filled Switches
SE 258.4	Typical Installation for Top-Connected Staggered Bushing "RAM" SF6 Switch in Vaults
SE 258.5	Joslyn Top Connected “RAM” Type SF6 Gas-Filled Switches 2-, 3-, and 4-Way, 3Ø, 27 kV, 600 A, 20,000 A Momentary
SE 258.6	G&W Top Connected Non-Staggered Bushing “RAM” Type SF6 Gas-Filled Switches 2-, 3-, 4-, and 5-Way, 3Ø, 17 kV, 600 A, 20,000 A Momentary
SE 258.7	G&W Top Connected Non-Staggered Bushing “RAM” Type SF_6 Gas-Filled Switches, 3- and 4-Way, 3Ø, 38 kV, 600 A, 20,000 A Momentary
SE 258.8	Typical Installation for Top Connected Non-Staggered Bushing "RAM" SF6 Switch in a Surface Operable Enclosure
SE 259	Surface Operable Gas-Filled RA-Type Ground (RAG) Switch — 600 A
SE 259.1	Switch Dimensions For Top-Connected Staggered Bushing RAG Switches – 600 A
SE 259.2	Typical Installation Procedures for Top-Connected Gas-Filled RA-Type Ground

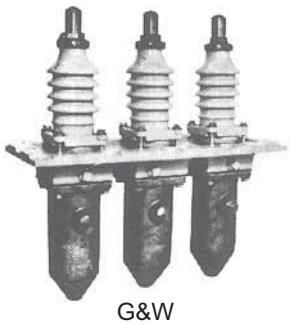
Standard		Title
		(RAG) Switches in Vaults
	SE 259.3	Typical Installations for Top-Connected RAG Switch in Vaults
SE 260		Pad-Mounted RAM Gas Switches — 600 A
	SE 260.1	Typical Installation Procedures for 2- Through 6-Way Pad-Mounted RAM Gas Switches on Equipment Slab Boxes
	SE 260.2	Dimensions for Pad-Mounted SF6 Gas Type RAM Switches – Units Manufactured after 2013
	SE 260.3	Dimensions for Pad-Mounted SF6 Gas Type RAM Switches
	SE 260.4	Typical Installation Procedures for 2-Way Pad-Mounted RAM Gas Switch on a 4'-6" x 7' Pad with 3' x 5' Pull Box
	SE 260.5	Typical Installation Procedures for Pad-Mounted RAM Gas Switches on Slab Boxes
SE 261		Pad-Mounted RAG Gas Switch — 600 A
	SE 261.1	Typical Installation Procedures for Pad-Mounted S&C and G&W RAG Gas Switch
	SE 261.2	Switch Dimensions for 2-, 3-, 4-, 5-, and 6-Way Pad-Mounted S&C and G&W RAG Gas Switch
	SE 261.3	Installation detail for Pad-Mounted RAG Gas Switches on Slab Boxes
SE 270		Automated PME Switches
	SE 270.1	Installation Procedures for Automated PME Switches
	SE 270.2	Interconnection Wiring Diagram S&C Remote Supervisory Pad-Mounted Gear with One (1) PM Switch Operator, Option Y4
	SE 270.3	S&C Pad-Mounted Gear Remote Supervisory Model PME-3 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL
	SE 270.4	S&C Pad-Mounted Gear Remote Supervisory Model PME-10 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL
	SE 270.5	S&C Pad-Mounted Gear Remote Supervisory Model PME-11 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL
	SE 270.6	S&C Pad-Mounted Gear Remote Supervisory Model PME-9 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL
	SE 270.7	S&C Pad-Mounted Gear Remote Supervisory Model PME-9, -10, and -11 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL
SE 275		Installation Procedure for Cleaveland/Price PAD with Motor Operator on S&C PMH or PME Switchgear
	SE 275.1	Installation Procedure for Retrofitting S&C PMH or PME Switchgear as a Remote Controlled Switch (RCS)

Standard	Title
SE 280	Installation Procedure for Elastimold Molded Vacuum Remote Controlled Switch
SE 280.1	Installation Procedure for Elastimold Molded Vacuum Remote Controlled Switch (RCS)
SE 280.2	Installation of Underground Automated Distribution (UAD) Cabinet
SE 280.3	Alternate Installation of Underground Automated Distribution (UAD) Cabinet
SE 285	Installation Procedure for Cleaveland/Price UAD and Motor Operator on G&W Gas Switch
SE 285.1	Installation Procedure for Retrofitting a G&W RAM-Type SF6 Gas-Filled Switch as a Remote Controlled Switch (RCS)
SE 285.2	Installation of Underground Automated Distribution (UAD) Controller Cabinet
SE 285.3	Alternate Installation of Underground Automated Distribution (UAD) Controller Cabinet
SE 285.4	Preferred Installation of Underground Automated Distribution Two-way (Double-UAD) Controller Cabinet
SE 285.5	Alternate Installation of Underground Automated Distribution Two-Way (Double-UAD) Controller Cabinet
SE 285.6	33/23/33 Taping Method for UAD Pressure Switch Connector
SE 286	Installation Procedure for Cleaveland/Price UAD and Motor Operator on Submersible G&W Gas-Filled RAG Switch
SE 286.1	Installation Procedure for Retrofitting a Top-Connected Gas-Filled RA-Type Ground (RAG) Switch in Vaults as a Remote Controlled Switch (RCS)
SE 286.2	Verifying Installation of Sliding Coupler
SE 286.3	Installation of Underground Automated Distribution (UAD) Controller Cabinet
SE 286.4	Preferred Installation of Underground Automated Distribution Two-Way (Double-UAD) Controller Cabinet (PILOT)
SE 287P	Installation Procedure for G&W and Motor Operator on Submersible G&W Gas-Filled RAG Switch Pilot
SE 287P.1	Installation Procedure for Retrofitting a Top-Connected Gas-Filled RA-Type Ground (RAG) Switch in Vaults as a Remote Controlled Switch (RCS)

SE 100 Cablehead Assemblies — 400 A Switches

Scope SE 100.1 Cablehead Assemblies 400 A RAM and RAC Type Oil Disconnect Switches

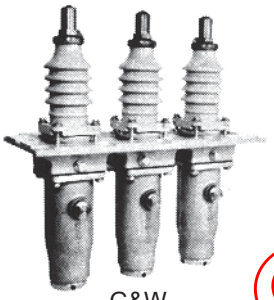
Figure SE 100–1: Cablehead Assemblies 400 A RAM and RAC Type Oil Disconnect Switches



G&W

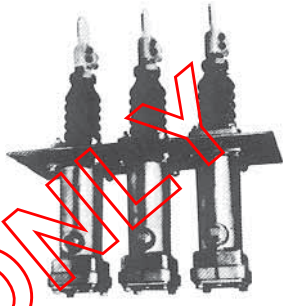
Figure SE 100–1.1: Wiping Sleeve

ESCO

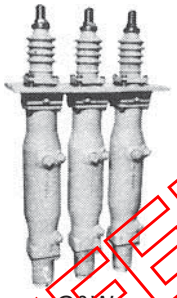


G&W

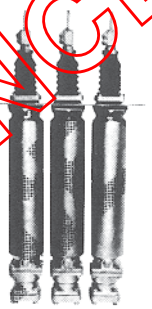
Figure SE 100–1.2: Stuffing Box



ESCO



G&W



ESCO

Figure SE 100–1.3: Stud Bushing

FOR REFERENCE ONLY

Table SE 100–1: Cablehead Assemblies 400 A RAM and RAC Type Oil Disconnect Switches

Type	MFG.	Cable		Material Code
		Type	Size	
Wiping Sleeve	G&W	PILC	500 kcmil MAX	550-46098
Wiping Sleeve	ESCO	PILC	500 kcmil MAX	550-30209
Stuffing Box	G&W	CLP	1/0 AWG	550-46171
			350 kcmil MAX	550-46163
Stuffing Box	ESCO	CLP	1/0 AWG	550-30159
			350 kcmil MAX	550-30167
Stud Bushing	G&W	CLP	750 kcmil MAX	550-46155
Stud Bushing	ESCO	CLP	750 kcmil MAX	550-30258

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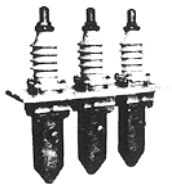
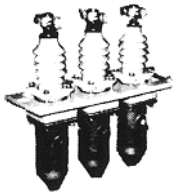
SE 101 Cablehead Assemblies — 400A Switches — P/E Gear

Scope SE 101.1 Cablehead Assemblies for 400A G&W Type RAD-M Preferred Emergency Switches

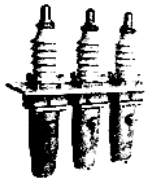
Figure SE 101–1: Cablehead Assemblies for 400 A G&W Type RAD-M Preferred Emergency Switches



Wiping Sleeve
M/C 550-46098

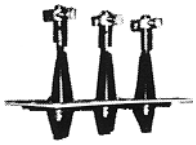


Wiping Sleeve
M/C 550-46106



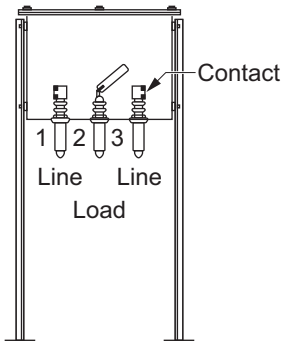
Stuffing Box
M/C 550-46171
M/C 550-46163

Stud Bushing
M/C 550-46155

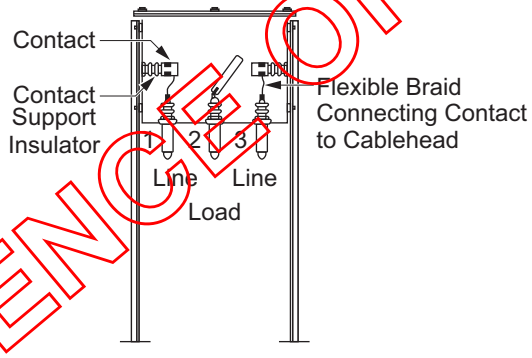


200A ESNA
M/C 550-46114 or
600 Amp ESNA
M/C 550-46304

200A ESNA
M/C 550-46122



STYLE I — Contacts Mounted Directly on Cableheads
This style manufactured prior to 1960



STYLE II — Contacts Mounted Separately
From Cablehead on Support Insulator

FOR REFERENCE ONLY

Table SE 101–1: Cablehead Assemblies 400 A for G&W Type RAD-M Preferred Emergency Switches

Type	Switch Style	Switch Ways	Cable		Material Code
			Type	Size	
Wiping Sleeve	I and II	1, 2, 3	PILC	500 kcmil MAX	550-46098[1/]
Wiping Sleeve with Contact Adapter	II	1, 3	PILC	500 kcmil MAX	550-46106
Stuffing Box	I and II	1, 2, 3	CLP	1/0 AWG	550-46171[a/]
				350 kcmil MAX	550-46163[a/]
Stud Bushing	I and II	1, 2, 3	CLP	750 kcmil MAX	550-46155[a/]
200A ESNA	II	1, 3	CLP	#2 and 1/0 AWG	550-46114
200A ESNA	I and II	2	CLP	#2 and 1/0 AWG	550-46122
600A ESNA	II	1, 3	CLP	350 kcmil MAX	550-46304

[1/] When this cablehead is used for ways 1 and 3 of Style II switches, a cablehead contact adapter assembly, M/C 550-46080, must be used.

Note(s):
1. Contact arrangements can be determined by looking through the view windows.

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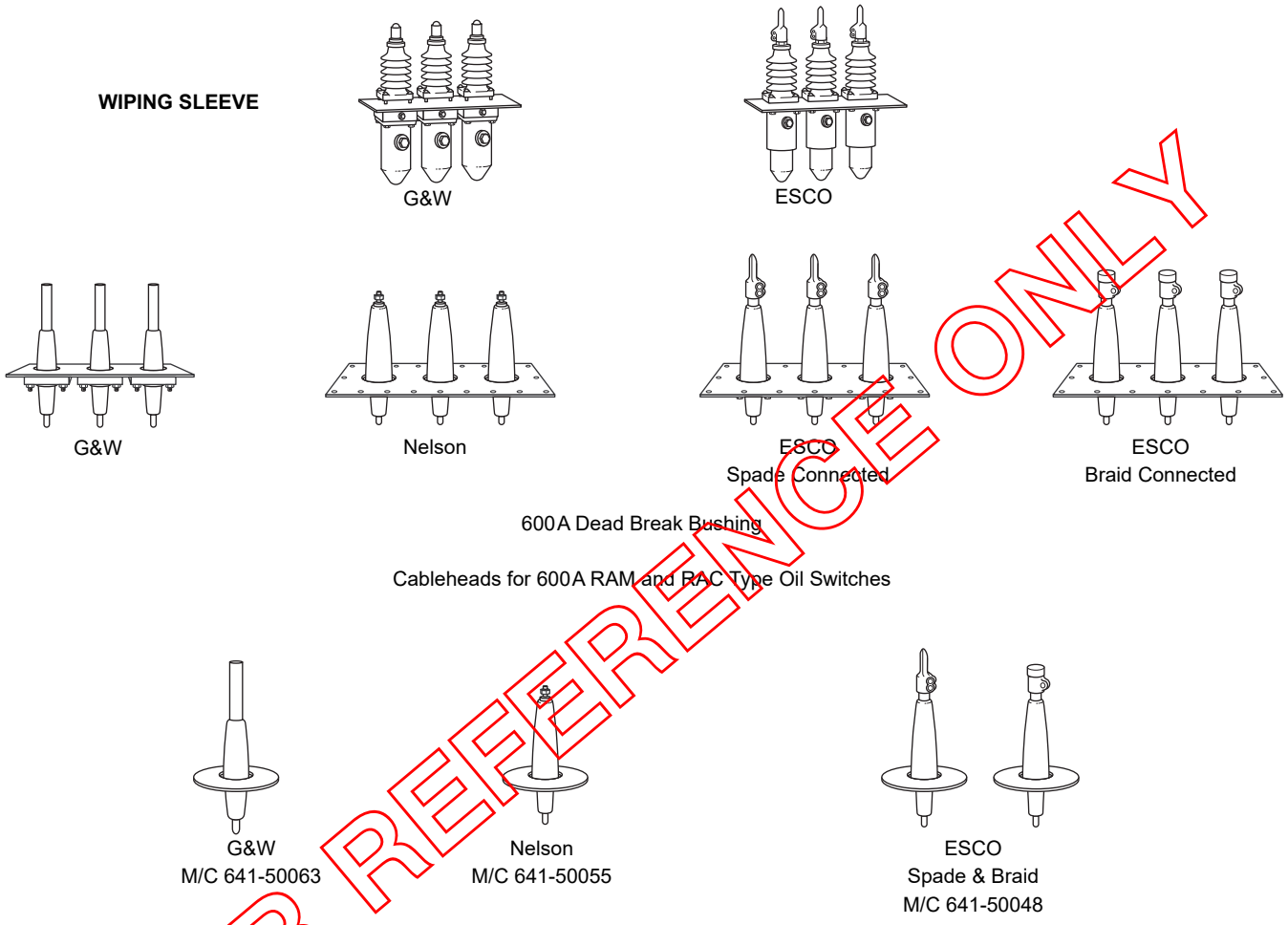
SE 105 Cablehead Assemblies — 600 A Switches

Scope SE 105.1 Cablehead Assemblies — 600 A Switches

Figure SE 105–1: Cablehead Assemblies — 600 A Switches



FOR REFERENCE ONLY

Table SE 105–1: Cablehead Assemblies — 600 A Switches

Type	Mfr.	Cable		Material Code
		Type	Size	
Wiping Sleeve	G&W	PILC	500 kcmil MAX	550-46106
Wiping Sleeve	ESCO	PILC	500 kcmil MAX	550-30209
600A DBB	Nelson	CLP	350-, 750-, and 1,000-kcmil	550-29607
600A DBB	G&W	CLP	350-, 750-, and 1,000-kcmil	550-46304
600A DBB Spade Connector	ESCO	CLP	350-, 750-, and 1,000-kcmil	550-30118
600A DBB Braid Connector	ESCO	CLP	350-, 750-, and 1,000-kcmil	550-46296

Note(s):
1. All ESCO RLD (RAC) switches will use spade type cableheads.
2. DBB – Dead Break Bushings

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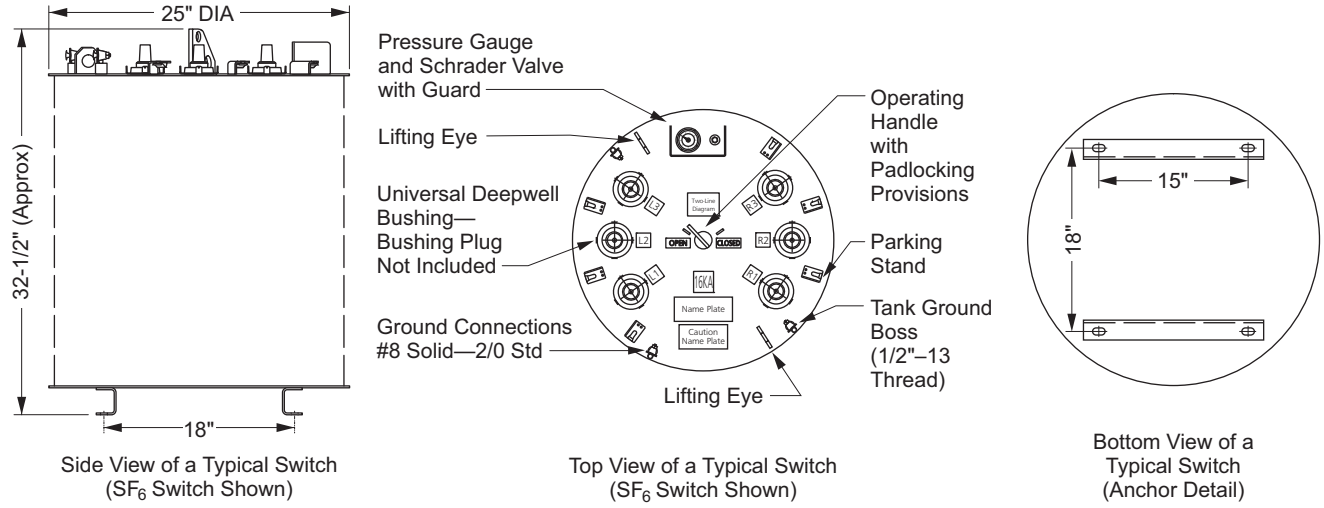
SE 150 Nonfused BURD Switches — 200 A — 17 kV

Scope SE 150.1 16 kA, 200 A, 17 kV BURD-Type Submersible Load-Break Switches

Figure SE 150–1: 16 kA, 200 A, 17 kV BURD-Type Submersible Load-Break Switches



Side View of a Typical Switch (SF_6 Switch Shown)

Top View of a Typical Switch (SF_6 Switch Shown)

Bottom View of a Typical Switch (Anchor Detail)

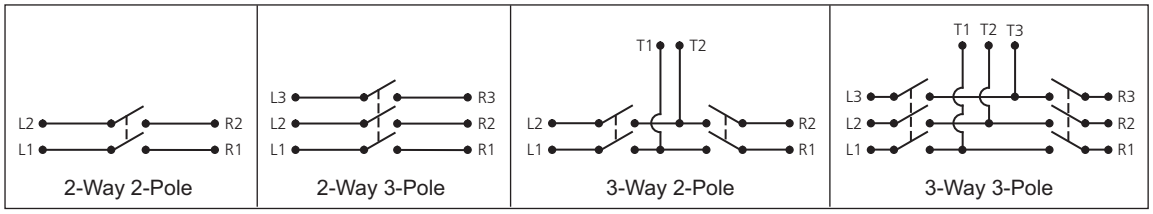


Table SE 150–1: SF_6 Gas Switch

Description	No. of Switches	Maximum Allowable Width (in)	Maximum Allowable Height (in)	Gas	Weight with SF_6 (lb)	SAP
2-Way 2-Pole	1	25	34	SF_6	160	10106425
2-Way 3-Pole	1	25	32-1/2	SF_6	160	10106426
3-Way 2-Pole	2	29	32-1/2	SF_6	200	10106427
3-Way 3-Pole	2	29	32-1/2	SF_6	200	10106428

Note(s):

1. Replacement bushing well studs for 16 kA BURD switch can be ordered using SAP 10117828.
2. 200 A bushing plugs (SAP 10118014) must be ordered separately for 16 kA BURD switches.
3. 1/0 CLP is recommended cable size to be used with 16 kA BURD switch.
4. Whenever possible, switches must be adequately anchored to the structure to prevent floating or movement. For a BURD switch that does not have channels to secure the BURD switch to the concrete floor, an alternate method for securing the BURD switch is to utilize Anchor Tie Downs (ATD) (SAP 10177875) by attaching the plate of the ATD to the concrete floor and attaching the top portion of the ATD to the ears of the BURD switch (refer to DUG RS 102). If there is limited space to secure both anchor plates to the concrete floor, an alternative is to utilize the concrete wall space for one anchor plate and the concrete floor for the other anchor plate.
5. For new installations, 200 A load break elbows are required. For existing dead break elbows, replace 200 A dead break elbows with 200 A load break elbows during apparatus replacement due to failure, end of life, or upgrade of equipment.

Table SE 150–2: Oil Switch

Description	No. of Switches	Maximum Allowable Width (in)	Maximum Allowable Height (in)	Oil Req'd	Weight Less Oil (lb)	Weight with Oil (lb)	SAP
2-Way 2-Pole	1	23	42-1/2	26	175	367	10106389
2-Way 3-Pole	1	27	42-1/2	50	225	595	10106393
2-Way 2-Pole	2	23	42-1/2	26	185	377	10106391
2-Way 3-Pole	2	27	42-1/2	50	250	620	10106392

= For Reference Only

SE 160 BURD Switches — Marking

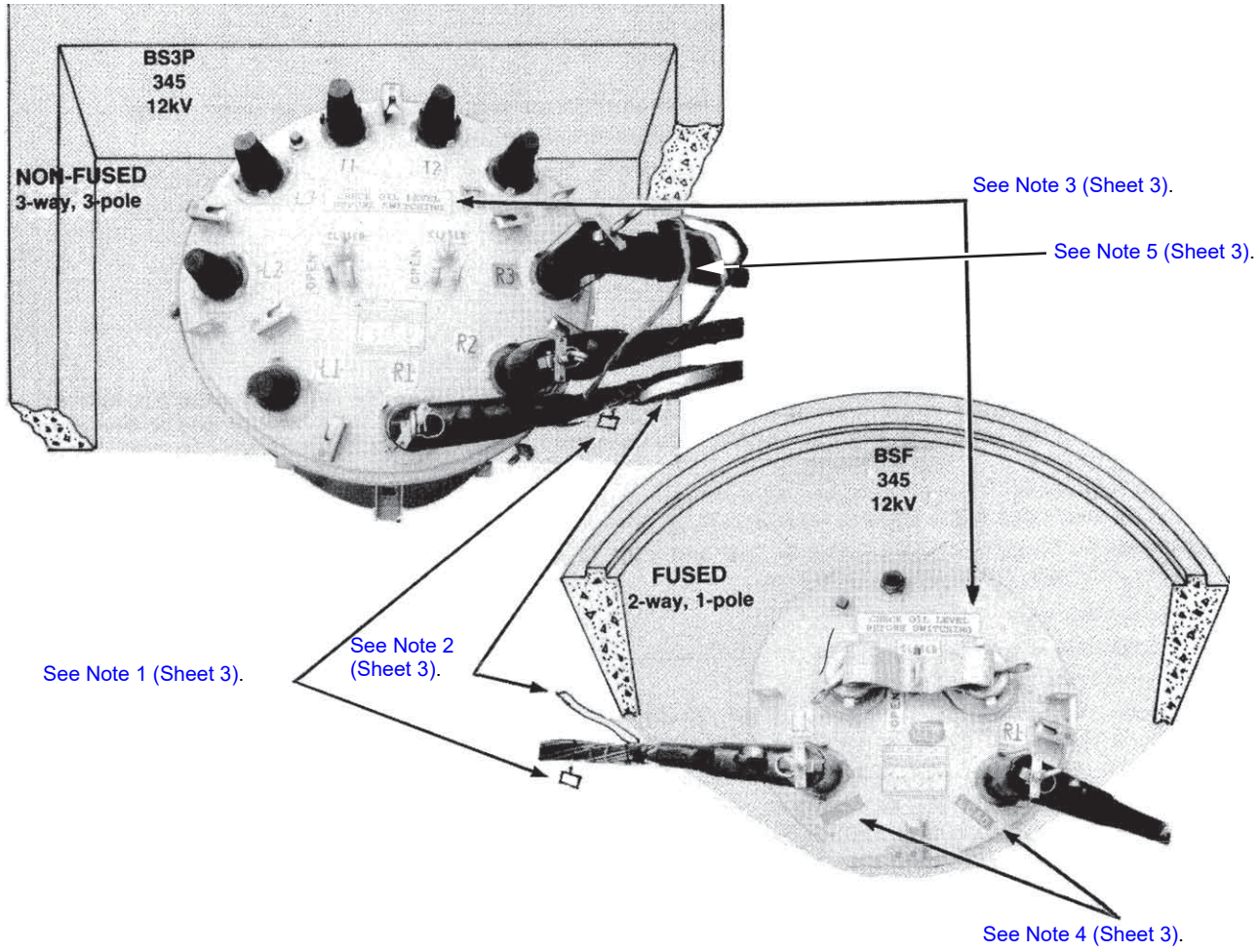
Scope SE 160.1 Standard Method of Marking 15 kV Fused and Nonfused BURD-Type Oil Switches

This standard provides a uniform method of marking BURD-Type oil switches. Standard Marking designates what information is required and where it is to be located on the switch or enclosure. Ordering Information specifies pertinent information about the marking materials to be used.

1.0 Standard Marking

1.1 Typical Nonfused and Fused BURD Switches

Figure SE 160–1: Standard Method of Marking 15 kV Fused and Nonfused BURD-Type Oil Switches



1.2 Information Required

A. Switch Number — Inside wall of enclosure where it is most easily seen from above. Use 2 inch stencil and black enamel spray paint.

B. Mark “Line” and “Load” beneath bushings.

Numbers are to be preceded by the following designations:

1. BSF — 1-pole fused switch
2. BS2F — 2-pole fused switch
3. BSP — 1-pole nonfused switch
4. BS2P — 2-pole nonfused switch
5. BS3P — 3-pole nonfused switch

C. Circuit kV Rating (12 or 16) — Beneath switch number on enclosure wall. Mark same way as switch number.

D. Switch Sign “Check oil level before switching.” — On any available space on switch cover.

E. Position Designation (L, R, or T) — Next to middle bushing for 3-pole units, between bushings for 2-pole units, next to bushing for 1-pole units. Use Scotchlite markers.

1. Positions are to be designated by the following letters:
    1. L — Left position for nonfused units or line side for fused units
    2. R — Right position for nonfused units or load side for fused units
    3. T — Tap position (applicable to 3-way units only)
2. L, R, and T designations shall be based on schematic diagram on top of the switch.

F. Phase Marking — AØ, BØ, CØ, on standard brass tag of stainless steel embossing tape attached to cable next to ESNA elbow. Phase markings on switch cover are not required; however, extreme care must be exercised so that poles designated by the same number are connected to the same phase. Example — 1L, 1R, and 1T must connected to the same phase.

G. Circuit Information — To or from, showing adjacent vault, pole, transformer, and installation date (refer to DUG IC 140. Section 4.0 for details). Stamp this information on a standard brass tag of stainless steel embossing tape and attach to cable.

H. Normally the fused switch will be marked “Line” or “Load” beneath the bushings. If not marked, use cable tags to mark “Line” or “Load” outside the elbows.

2.0 Ordering Information

2.1 Scotchlike Markers — (See ordering information sin SE 250.)

2.2 Standard Brass Tag — SAP 10118121

2.3 Stainless Steel Embossing Tape — Order using Form SD 197 with the description — tape, Dymo, 1/2 inch, stainless steel. Use Dymo M-11 (SAP 10132167) to mark tape.

2.4 Stencil, Figures, 2-inch — SAP 10146996

2.5 Stencil, Letters, 2-inch — SAP 10147001

2.6 Black Paint — Order on SD 197 with the description — paint, enamel, black, in 13-ounce aerosol can.

2.7 Switch sign, adhesive back, “Check oil level before switching.”, 1-1/2 x 6 inches, black lettering on yellow background — SAP 10135517.

Note(s):
1. Phase marking shall be on each cable connected to switch.
2. Circuit info shall be on each cable or group of cables connected to a switch way.
3. Switch sign — “Check oil level before switching.”
4. “Line” and “Load” marking
5. For new installations, 200 A load break elbows are required. For existing 200 A dead break elbows, replace 200 A dead break elbows with 200 A load break elbows during apparatus replacement due to failure, end of life, or upgrade of equipment.

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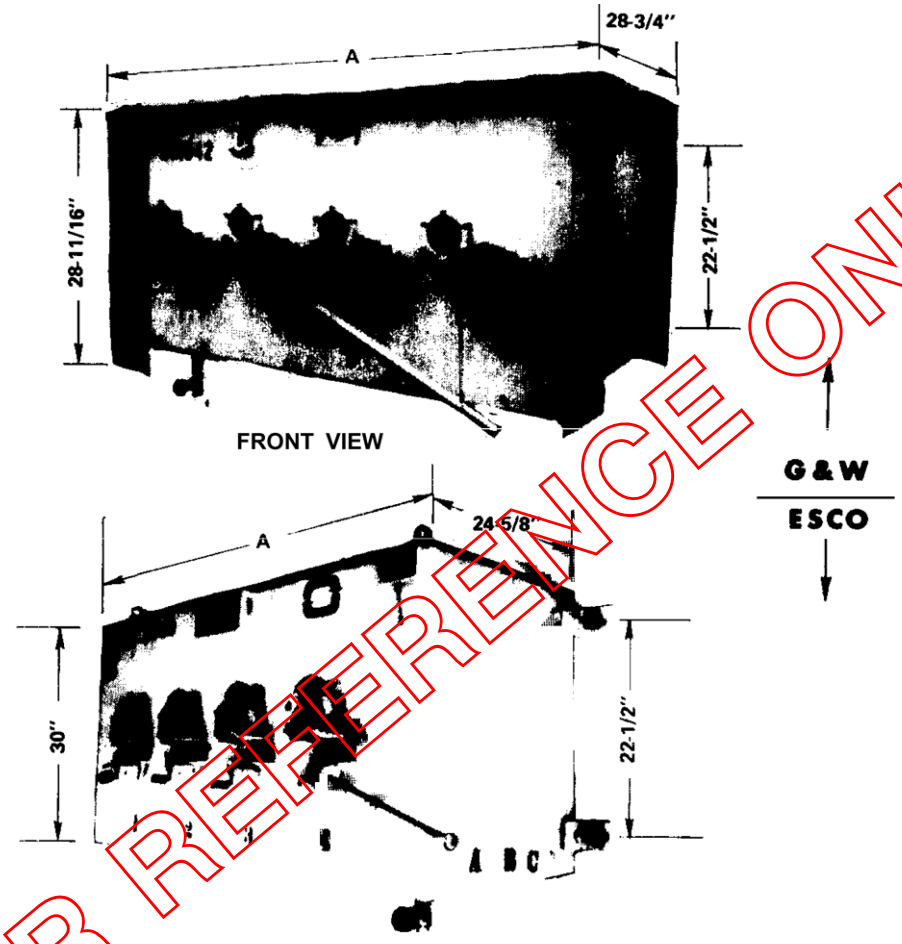
SE 205 Oil Switch — 600 A — 15 kV without Cableheads

Scope SE 205.1 RAMS and RAC Type Bottom Connected Oil Switches 3-, 4-, 5-, and 6-Way — 3Ø — 15 kV — 600 A (Rated 600 A Load Switching) without Cableheads

Figure SE 205–1: G&W/ESCO Oil Switch — 600 A — 15 kV without Cableheads



FOR REFERENCE ONLY

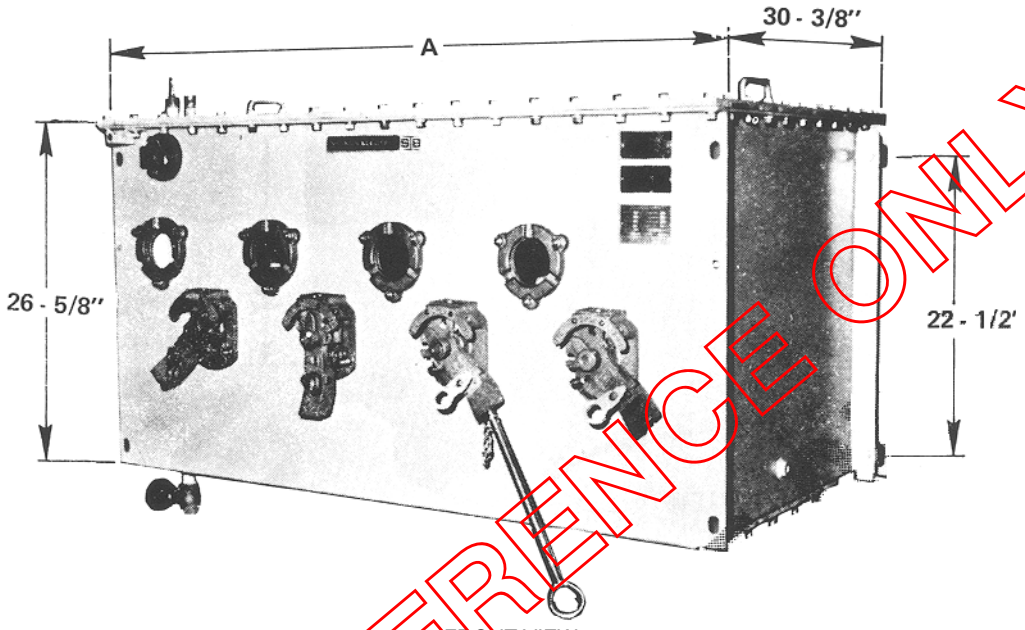
Table SE 205–1: G&W/ESCO Oil Switch — 600 A — 15 kV without Cableheads

No. of Ways	Material Code		G&W Switch Data						ESCO Switch Data					
			RAM-Type			RAC-Type			RAM-Type			RAC-Type		
	RAM	RAC	A	Weight	Oil	A	Weight	Oil	A	Weight	Oil	A	Weight	Oil
3-W	535-97308	—	42-1/2	800	105	—	—	—	51-3/4	885	111	—	—	—
4-W	535-97316	535-97365	54-3/4	1,000	137	57-3/8	1,100	156	63-1/4	1,135	138	58-1/4	1,150	131
5-W	535-97324	535-97373	67	1,300	170	70-1/4	1,425	192	74-3/4	1,385	165	70-1/4	1,400	166
6-W	535-97332	535-97381	79-1/4	1,515	200	83-1/8	1,600	229	86-1/4	1,635	192	82-1/4	1,660	197

[1/] Less oil

Note(s):
1. These switches require cablehead assemblies. See SE 105.

Figure SE 205–2: Nelson Oil Switch — 600 A — 15 kV without Cableheads



FRONT VIEW

FOR REFERENCE ONLY

Table SE 205–2: Nelson Oil Switch — 600 A — 15 kV without Cableheads

No. of Ways	Material Code		Nelson RAM-Type			Switch Data RAC-Type		
	RAM Type	RAC Type	A (in)	Weight (lb)[1/]	Oil Req'd (gal)	A (in)	Weight (lb)[a/]	Oil Req'd (gal)
3-W	535-97308	—	43-1/4	703	105	—	—	—
4-W	535-97316	535-97365	52-1/4	877	128	52-1/4	1,005	133
5-W	535-97324	535-97373	63	1,023	176	66	1,047	185
6-W	535-97332	535-97381	75	1,201	210	78	1,225	218

[1/] Less oil and cableheads

Note(s):
1. These switches require cablehead assemblies. See SE 105.

SE 210 Oil Switch — 300 A — 15 kV — Surface-Operable

Scope SE 210.1 Surface-Operable RAM Type Oil Switch 3-, 4-, and 5-Way — 3Ø — 15 kV Rated — 300 A Load Switching, 12,000 A Momentary (SYM)

Figure SE 210–1: Surface-Operable RAM Type Oil Switch 3-, 4-, and 5-Way — 3Ø — 15 kV Rated — 300 A Load Switching, 12,000 A Momentary (SYM)

FOR REFERENCE ONLY

Table SE 210–1: Surface-Operable RAM Type Oil Switch Data

Switch Data — 300A				
No. of Ways	Material Code	A (in)	Weight without Oil (lb)	Oil Required (gal)
3-W	535-00039	34-1/2	435	70
4-W	535-00054	44-1/2	540	90
5-W	535-00062	54	600	110
5-W[1/]	535-00484	54	600	110
6-W	535-00526	67-3/4	600	130

[1/] Way #1 has 600A ESNA cablehead–balance has 200A ESNA cableheads.

Note(s):
1. Oil fill plug and oil level gauge located on top of switch.
2. End ways normally equipped with 600A ESNA cableheads.

1.0 Application

These switches should only be used where the fault duty is below 12,000 symmetrical.

O-AMU Key 6

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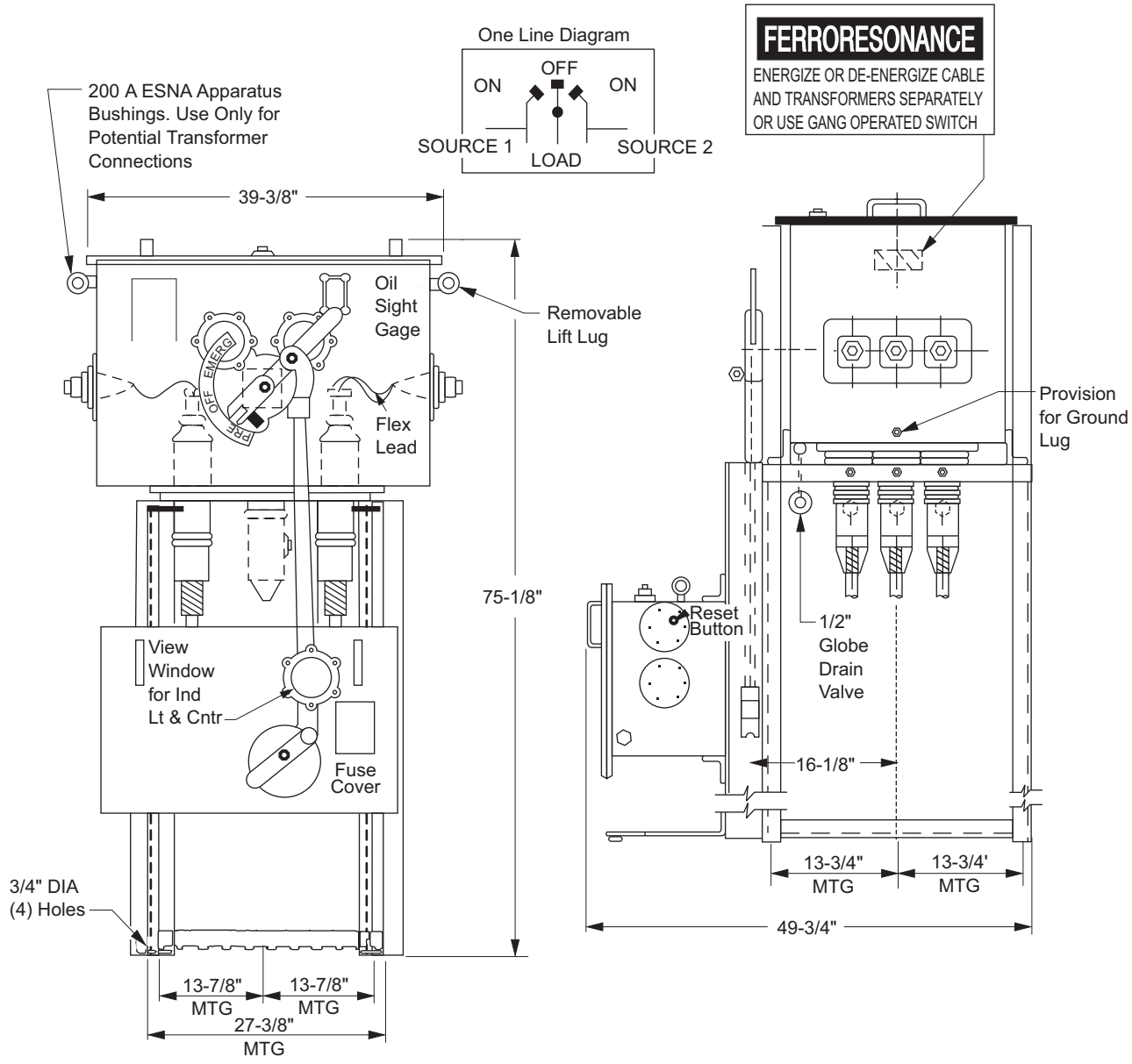
SE 215 Preferred Emergency Switch — G&W

Scope SE 215.1 G&W Preferred Emergency Oil Switch — Type RAD-ME

Figure SE 215–1: G&W Preferred Emergency Oil Switch — Type RAD-ME

3 Pole; 15 kV, 400A With "F3" Mechanism and ESNA Bushings for Potential Transformer Connections;
Frame Mounted for PED Operation Only M/C 535-98504

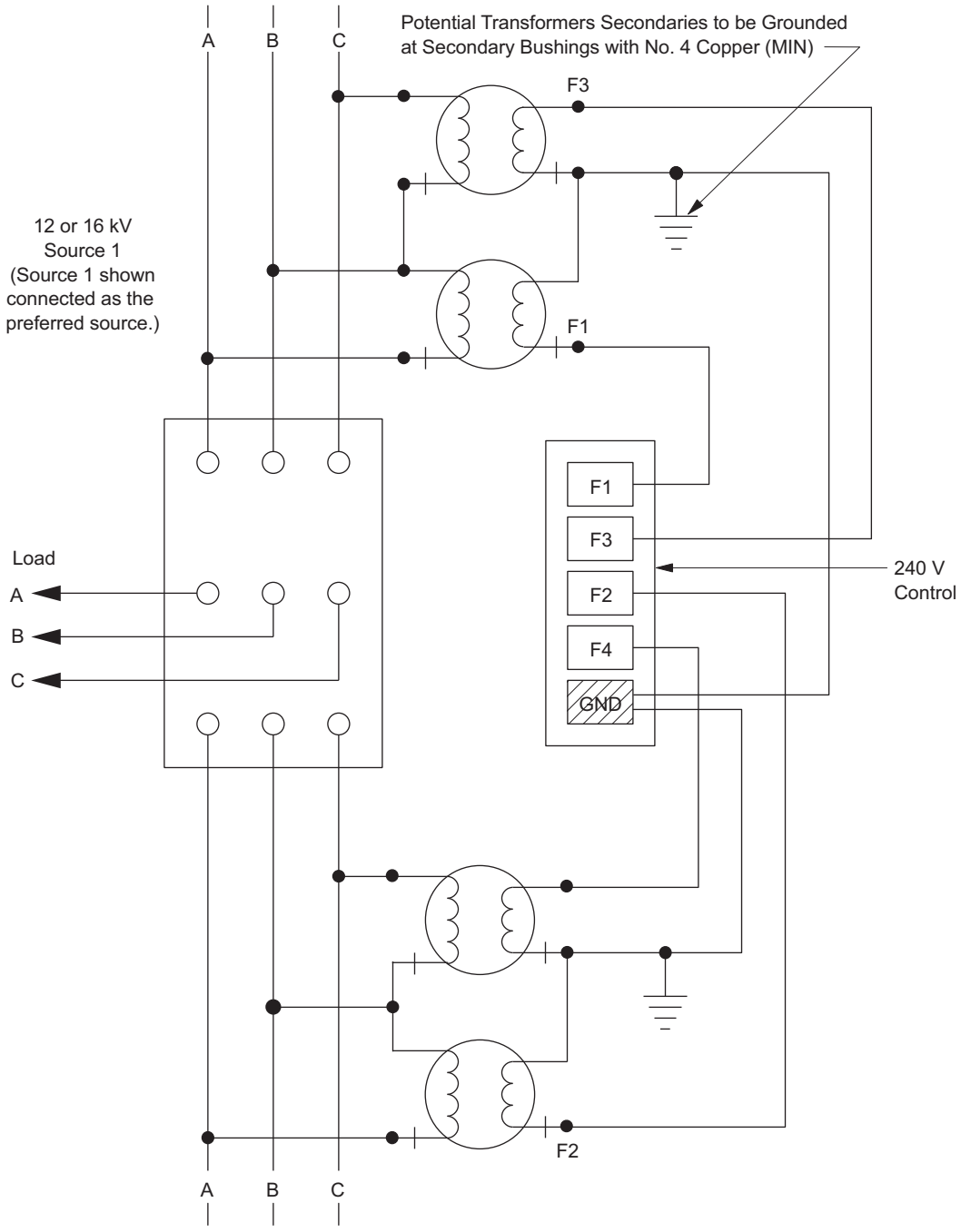


Note(s):

1. For operation and maintenance refer to the Operation and Maintenance Procedures Section of the Distribution Orders.
2. RB entrance provided on “F” mechanism case for leads to external potential transformers.
3. Order potential transformers separately. 12.0/16.34-kV — 240 M/C 493-00437.
4. Approximately 86 gallons of switch oil required.

Scope SE 215.2 Potential Transformer Wiring Diagram — G&W Preferred Emergency — Typical Installation — 3Ø Emergency Sensing

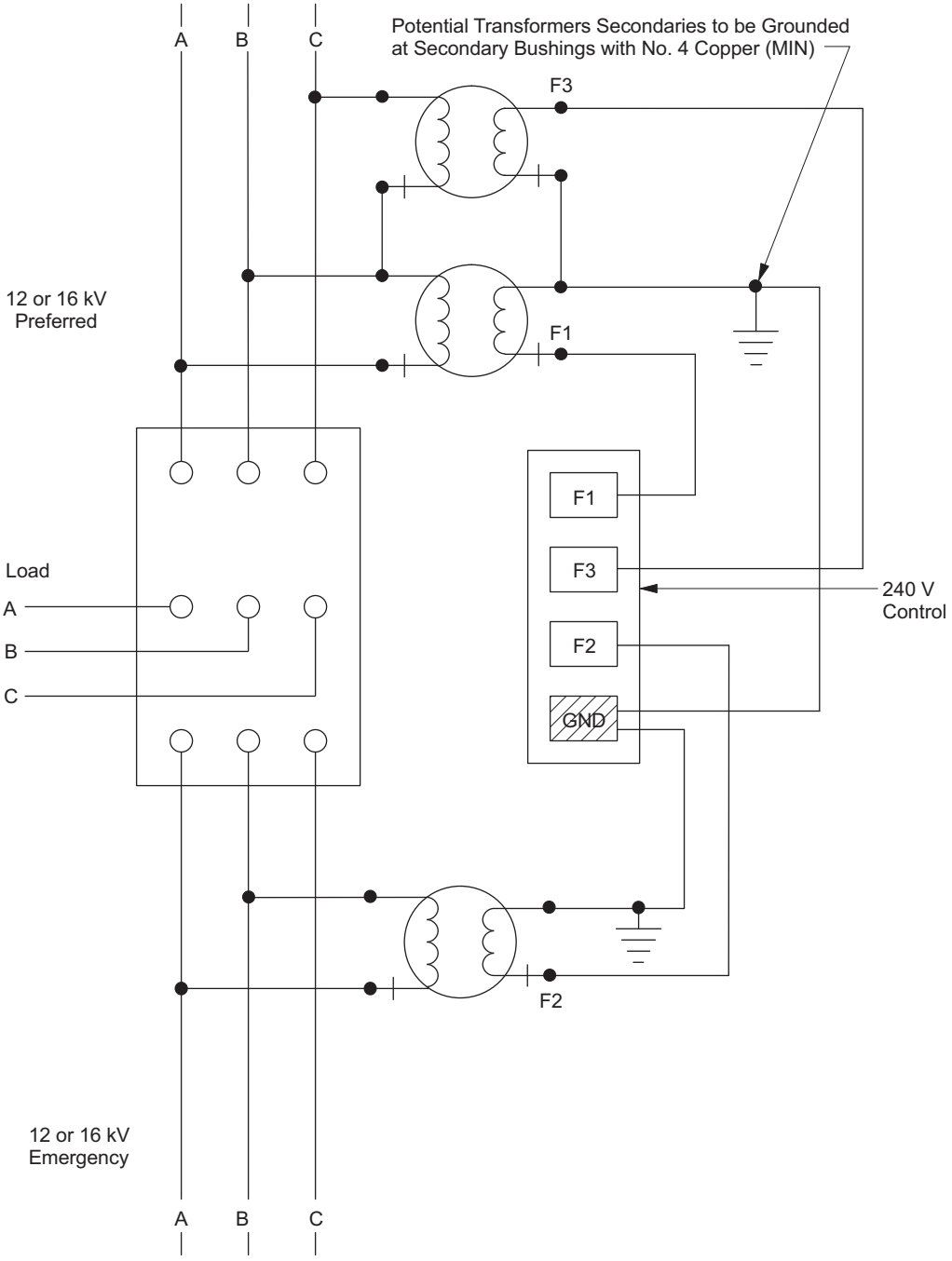
Figure SE 215–2: Potential Transformer Wiring Diagram — G&W Preferred Emergency — Typical Installation — 3Ø Emergency Sensing



Note(s):
1. Fuses F1 and F3 must be connected to the circuit selected to be the “Preferred” source.

Scope SE 215.3 Potential Transformer Wiring Diagram — G&W Preferred Emergency — Typical Installation — 1Ø Emergency Sensing

Figure SE 215–3: Potential Transformer Wiring Diagram — G&W Preferred Emergency — Typical Installation — 1Ø Emergency Sensing



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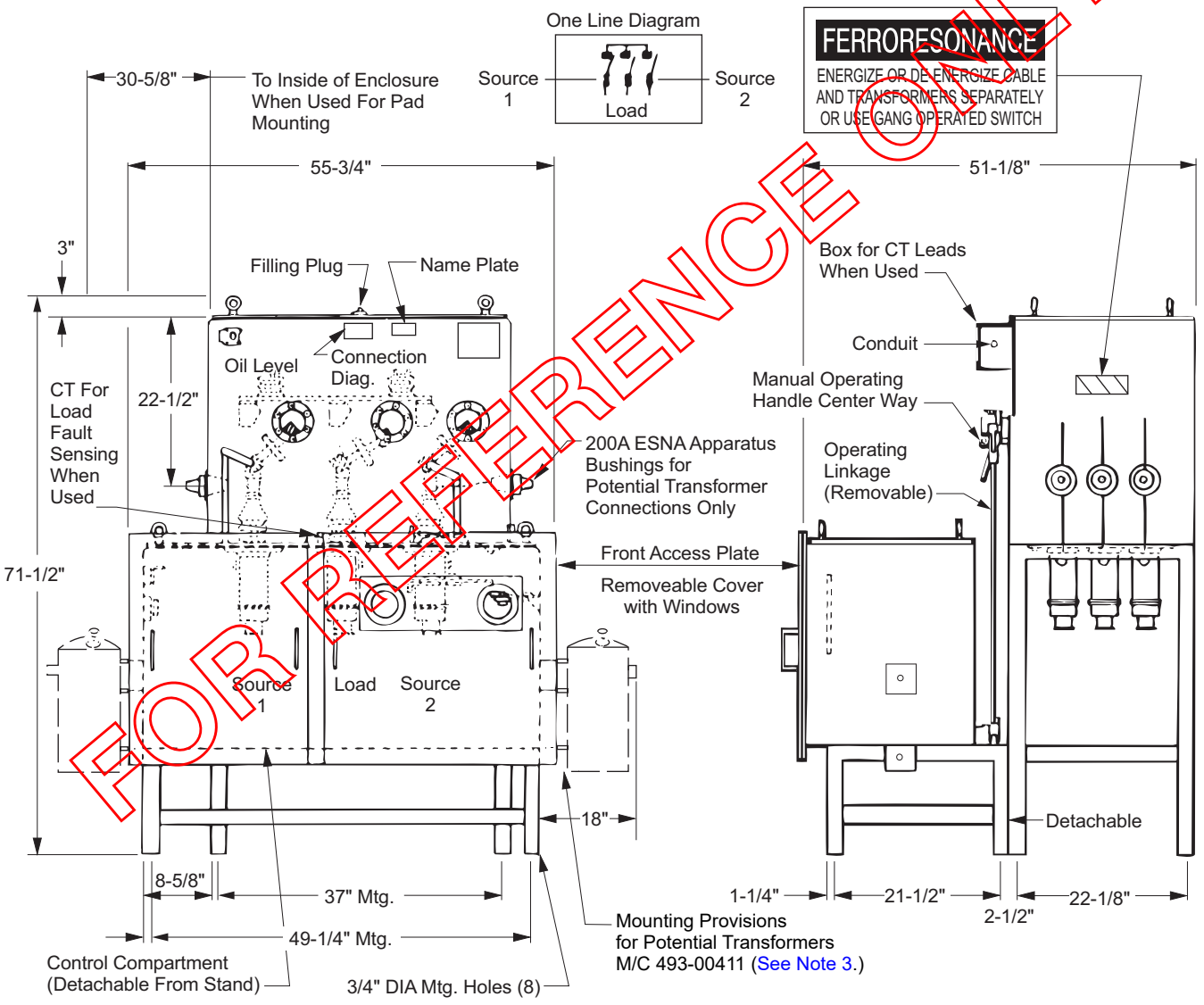
SE 217 Preferred Emergency Switch — ESCO

Scope SE 217.1 ESCO Preferred Emergency Switch

Figure SE 217–1: ESCO Preferred Emergency Switch

15 kV, 600A, for Submersible and Padmount Applications, Capable of PEA, PED, and Selective Service Operation
M/C 535-99700-Submersible; M/C 535-99908-Padmount



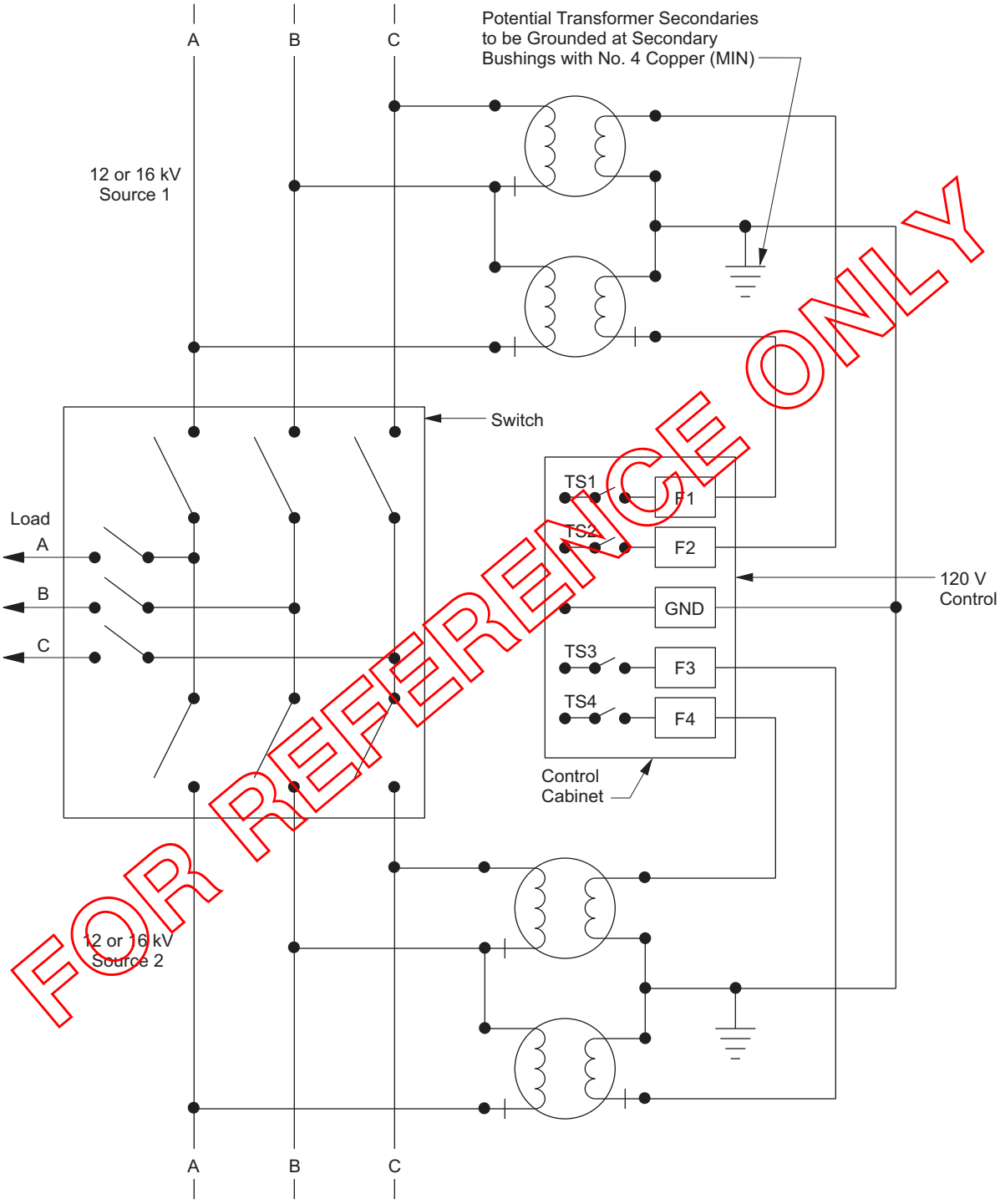
FOR REFERENCE ONLY

Note(s):

1. For operation and maintenance, refer to the Operation and Maintenance Procedures Section of the Distribution Orders.
2. RB entrance provided on mechanism case for leads to external potential transformers.
3. Order potential transformers separately: 12.0/16.34-kV (nonfused) — 120V M/C 493-00411
4. For pole mounted P.T.s order:12.0/16.34-kV (nonfused) — 120V M/C 493-00429
   12 kV (only/nonfused) — 120V M/C 507-81202
   16 kV (only/nonfused) — 120V M/C 507-06084

Scope SE 217.2 Potential Transformer Wiring Diagram for ESCO Preferred Emergency Installations

Figure SE 217–2: Potential Transformer Wiring Diagram for ESCO Preferred Emergency Installations



FOR REFERENCE ONLY

Note(s):

1. Ferroresonance signs shall be installed when necessary. See PD 100 for details.

SE 220 Preferred Emergency Switch - Type PME/PMH

Scope SE 220.1 17 kV, 600 A, S&C Preferred Emergency Switch—Type PME (Preferred)

Figure SE 220–1: 17 kV, 600 A, S&C Preferred Emergency Switch—Type PME (Preferred)

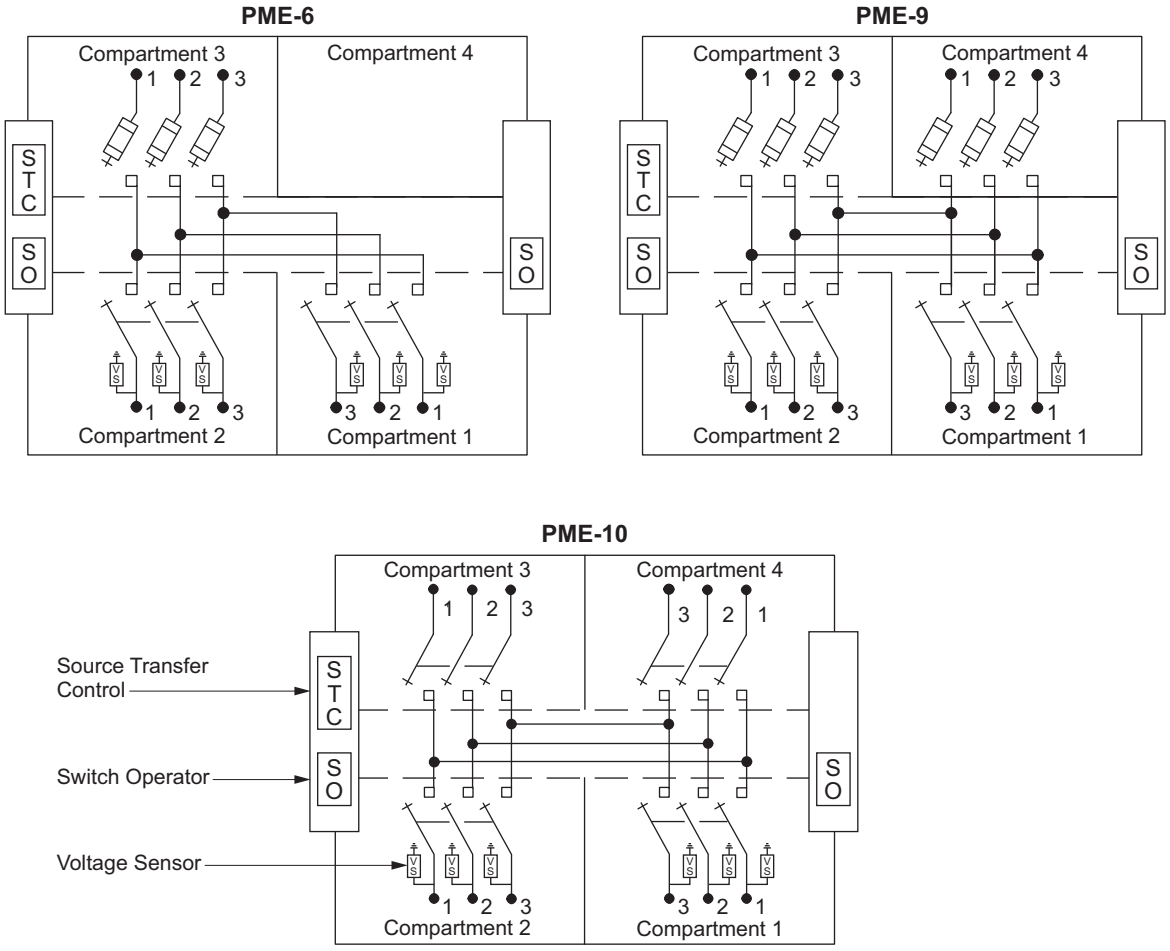
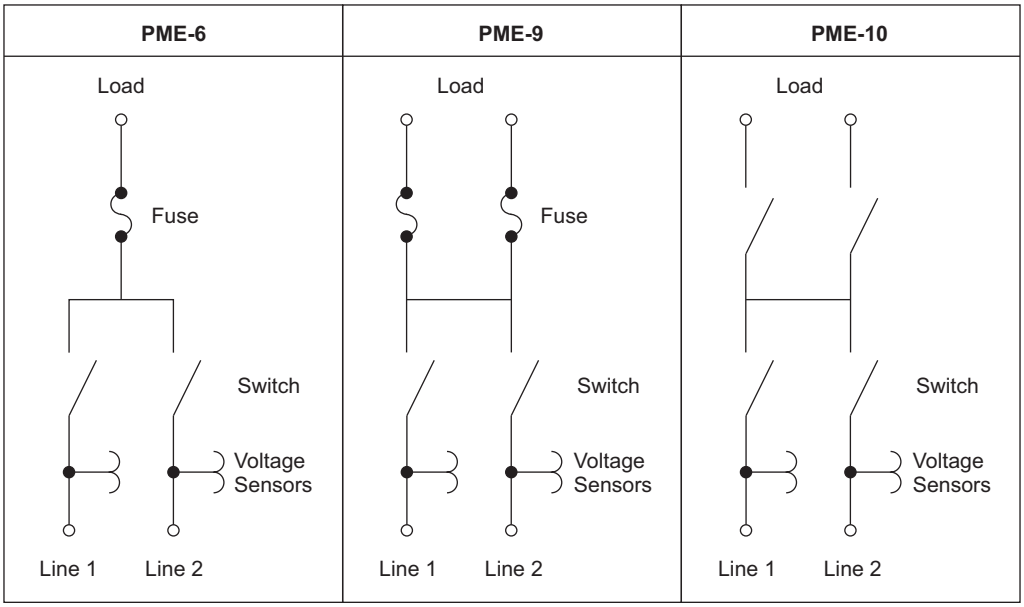


Table SE 220–1: PME PE Gear Ordering Information

Switch	SAP	Approximate Weight (lbs.)
PME-6 SME	10106413	1,700
PME-6 CL	10171171	1,700
PME-9 SME	10106453	1,800
PME-9 CL	10106442	1,800
PME-10	10200143	1,975

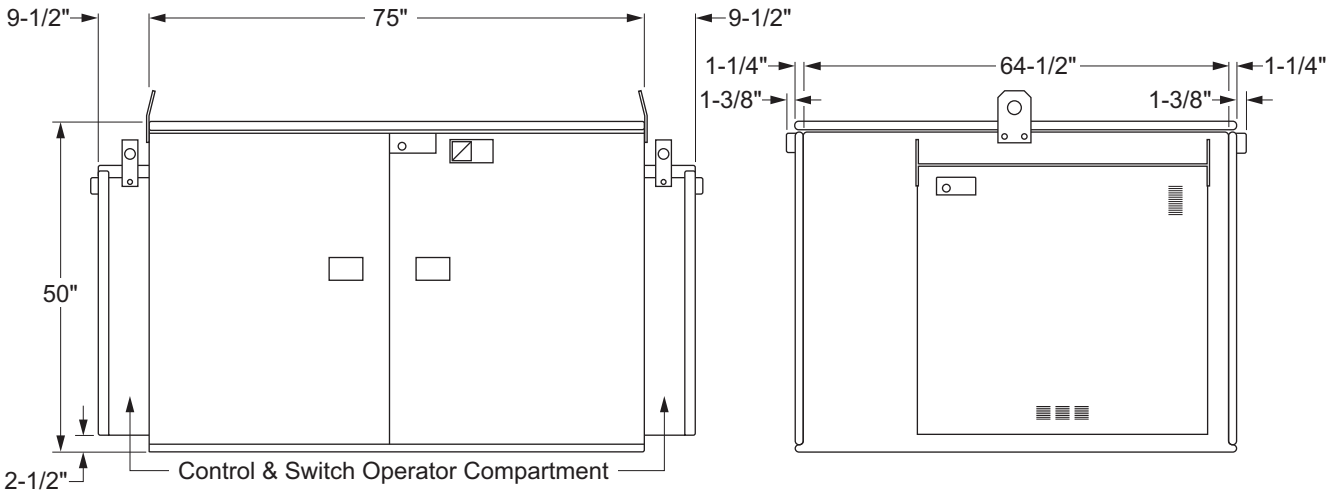
Figure SE 220–2: 17 kV, 600 A, S&C Preferred Emergency Switch—Type PME (Preferred) One-Line Diagrams



Note(s):

1. When fusing is not desired, a solid blade can be used in place of the fuse. Use solid blade SAP 10106746 with SME fuse mounting or SAP 10106738 with CL fuse mounting. Loading with solid blades should be limited to 200 A maximum continuous current.
2. Control Accessories
   a. Tripping Capacitors (SAP 10159322)
   b. Right counter (SAP 10167701), Left counter (SAP 10167700)
   c. Voltage Limiter (SAP 10168224)
   d. Voltage sensor (SAP 10100340)
   e. Low voltage (120 V) Test Accessory (SAP 10183366).

Figure SE 220–3: Preferred Emergency Pad-Mounted Switch—PME Dimensions



Front View **Left Side View**

Note(s):
1. Recommended Structure: (Refer to UGS SS 590).
2. See JJ Section for 600 A dead-break termination information.
3. See TP 150 and TP 151 for 15 kV load-break elbow cable terminations.
4. See TP 161 for 25 kV load-break elbow cable termination information.
5. See TX 160 for general requirement for anchoring, sealing, and stenciling of pad-mounted equipment.
6. Attach all cable concentric wires and the switch enclosure to the structure 4/0 ground/neutral bus per the material and installation requirements of GR 100.

Scope SE 220.2 17 kV, 600 A, S&C Preferred Emergency Switch—Type PMH (Alternate)

Figure SE 220–4: 17 kV, 600 A, S&C Preferred Emergency Switch—Type PMH (Alternate)

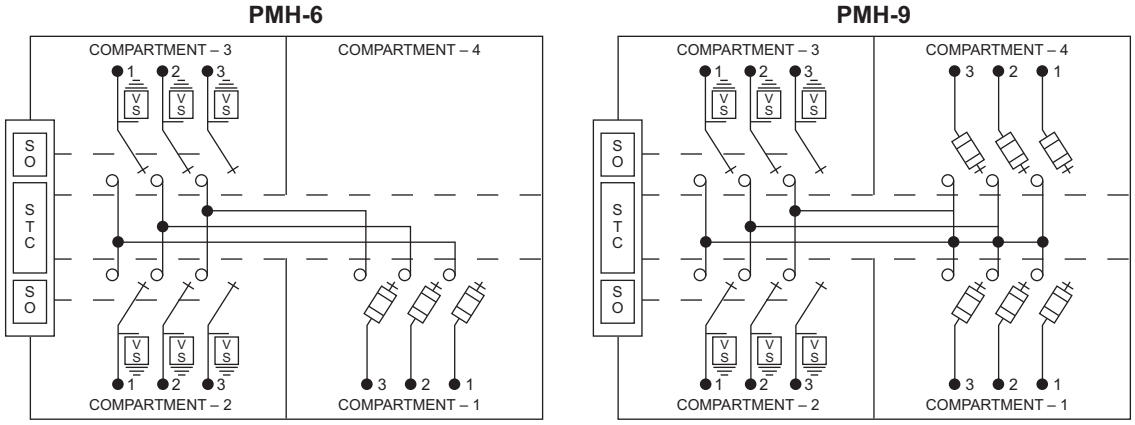


Table SE 220–2: PMH PE Gear Ordering Information

Switch	SAP
PMH-6 SML	10106429
PMH-6 CL	10106432
PMH-9 SML	10106430
PMH-9 CL	10106431

Note(s):
1. When fusing is not desired, a solid blade can be used in place of the fuse. Use solid blade SAP 10106745 with SML fuse mounting or SAP 10106744 with CL fuse mounting. Loading with solid blades should be limited to 400 A maximum continuous current.
2. Only use PMH style switchgear whenever fusing is required for loads between 200 A and 400 A. Fault Fiter Fuses or VFIs may also be considered for this application, contact Field Engineering for assistance. For loads below 200 A, use the preferred PME style switchgear.

Figure SE 220–5: 17 kV, 600 A, S&C Preferred Emergency Switch—Type PMH (Alternate)
One Line Diagrams

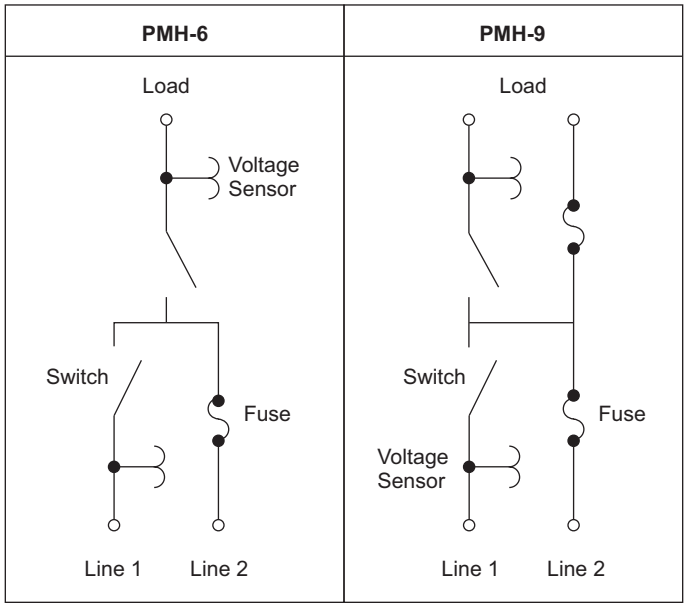
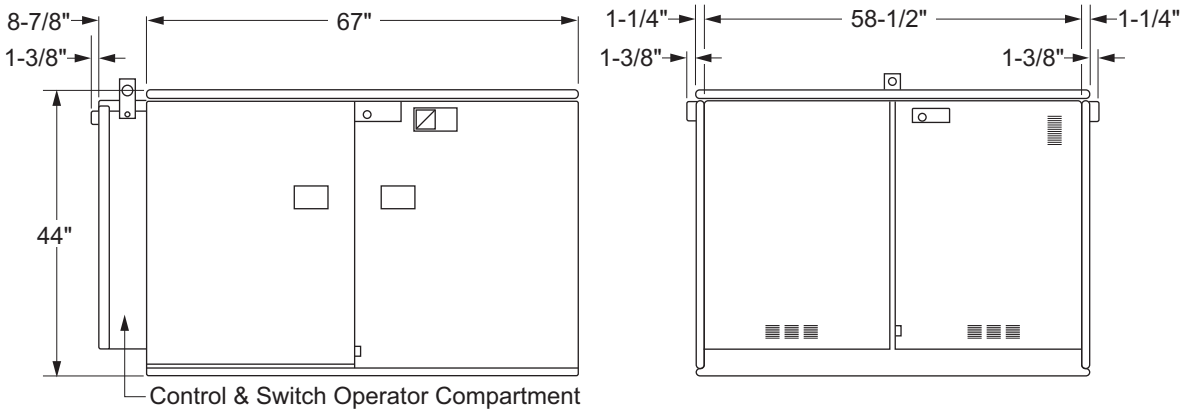


Figure SE 220–6: Preferred Emergency Pad-Mounted Switch—PMH Dimensions



Front View **Left Side View**

Note(s):
1. Recommended Structure: (Refer to UGS SS 590).
2. See TP 100 and TP 206 for type of termination to use with PMH style terminations.
3. See TX 160 for general requirement for anchoring, sealing, and stenciling of pad-mounted equipment.
4. Attach all cable concentric wires and the switch enclosure to the structure 4/0 ground/neutral bus per the material and installation requirements of GR 100.

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SE 250 Oil Switches — Marking

Scope SE 250.1 Standard Method of Marking 7.5 kV and 15 kV "RA" Type Oil Switches

This standard provides a uniform method of marking RA-type oil switches. Section 1.0 below specifies the type of markers to be used, along with pertinent information concerning these markers. Section 2.0 (Sheet 2) designates what information is required and where this information is to be located on the switch.

1.0 Markers

1.1 Markers Types

A. Switch Numbers

1. Scotchlite markers, adhesive back, 2-7/8" x 1-11/16" yellow reflective letters and numbers on black background.

2. Specifications: No. 5271 yellow Scotchlite base material, reversed silk-screened black with No. 725 black Scotchlite paste, and clear coated with No. 700 Scotchlite finishing.

B. Switch Signs (for 400A, 15 kV Switches Only)

1.2 Ordering

A. Order on Form SD 196. The Scotchlite signs are coded items and come 25 to a package. The Scotchlite letter and number markers are "memo" items and come 100 per package.

B. The following examples illustrate a typical order:

Item	Description	Code Number
1	3 Pkgs. Scotchlite Signs	816-31004
2	1-11/16" x 2-7/8" Scotchlite Markers as follows: 5 Pkgs. Letters A-C 2 Pkgs. Letters D-H, M, and N 1 Pkgs. Letters P 5 Pkgs. Numerals 0-9	"Memo"

1.3 Method of Applying (See instructions on the back of each label.)

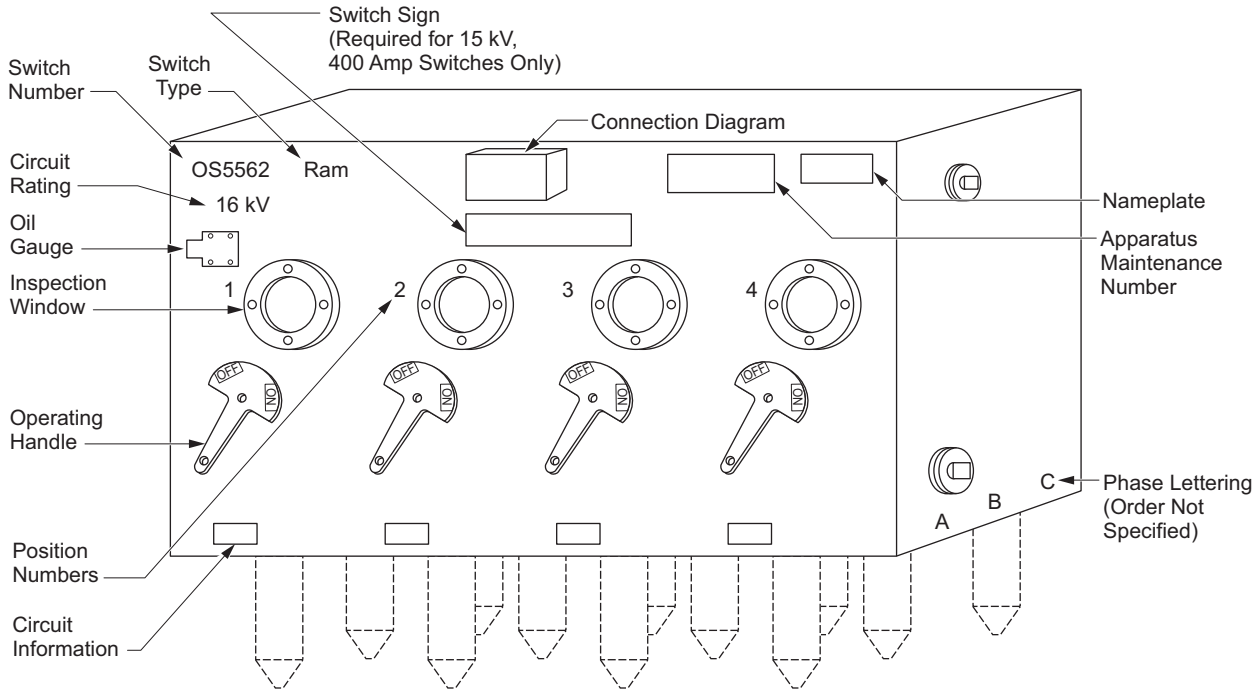
1.4 Storage

A. Store unused markers in a cool, dry location. If this is not possible, make certain that they are secured tightly in their original packages. Since shelf life of these markers is one year, they should be rotated such that the older ones are used first. The print date is on the back of each marker.

2.0 Standard Marking

2.1 Typical 4-Way Switch

Figure SE 250–1: Standard Marking — Typical 4-Way Switch



2.2 Information Required

A. Switch number — upper left-hand corner of face.

B. Apparatus number — upper right next to nameplate.

C. Circuit kV rating (4, 12, or 16) beneath switch number.

D. Sign — “DO NOT MANUALLY INTERRUPT CURRENT IN EXCESS OF 200 AMPS” — centered on switch face above inspection windows (15 kV, 400A switches only).

E. Position Numbers — numbered sequentially from left to right and placed next to the inspection window. For RAC type switches place numbers both under axis of each operating handle and next to the inspection window. Each position must be numbered even if no switch exists for that position.

F. Phase marking — lettered A-B-C on both ends of switch near bottom above respective cable entrances. Order of phases to be determined in field.

G. Circuit information — to or from, showing adjacent switch number and position number, pole, customer sub, and so on. Stamp this information on a standard brass tag (M/C 656-65507) or stainless steel embossing tape (order on SD 197 with the description — tape, Dymo, 1/2 inch, stainless steel) and cement to tank wall under position numbers, using 3M Industrial cement (order on SD 197, description Scotch Brand 3M sealant Nr. 1792). Use Dymo M-11 (M/C 797-60807) to mark the tape.

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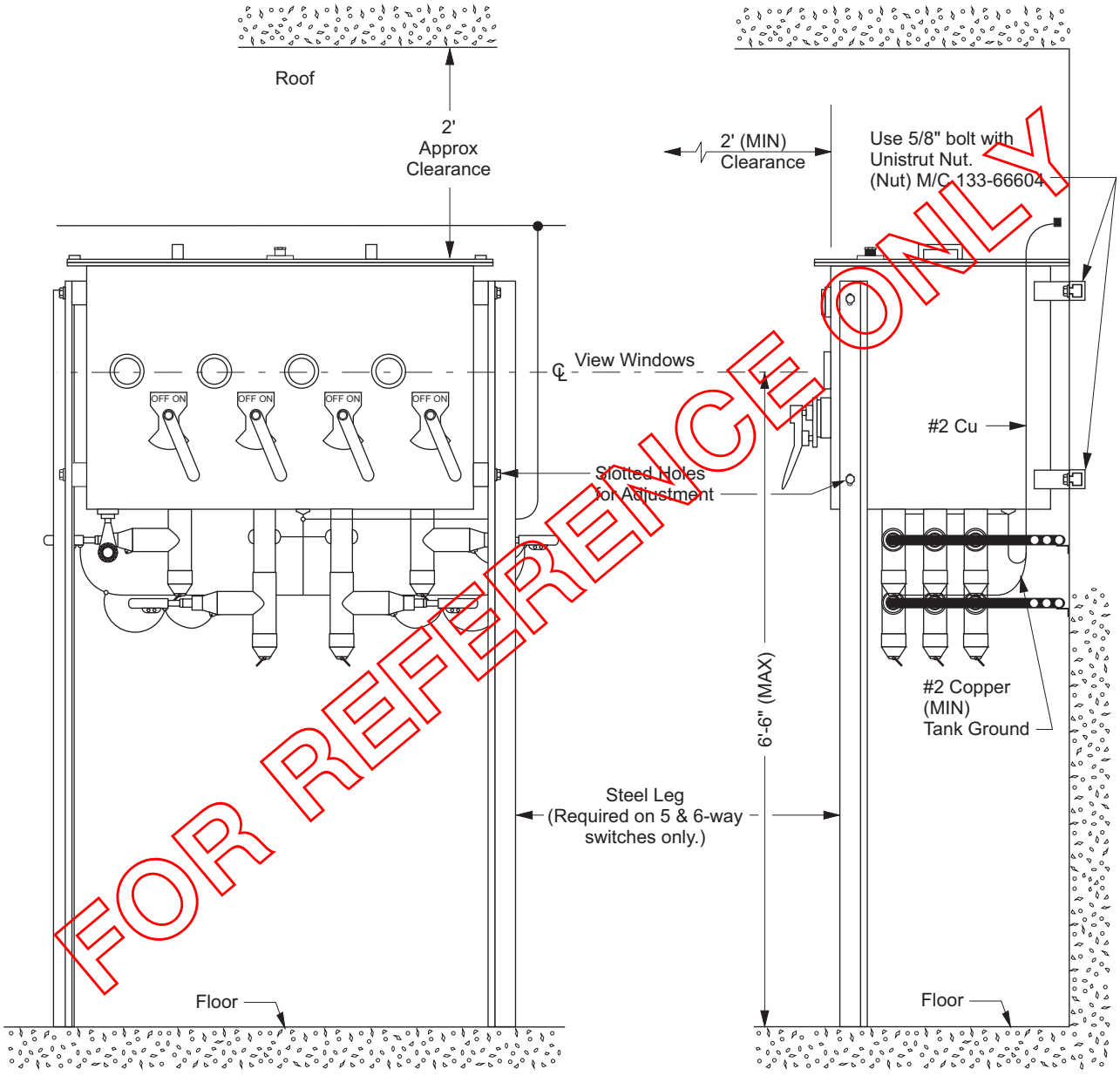
SE 255 Oil Switches — Installation

Scope SE 255.1 Typical Installation "RA" Type Oil Switch in Vault or Manhole (Bottom Connected)

Figure SE 255–1: Standard Method of Marking 7.5 kV and 15 kV "RA" Type Oil Switches



FOR REFERENCE ONLY

Note(s):

1. 6'-6" (maximum) Cable Bends; minimum radius equal to 10 times cable diameter.

1.0 Notes

1.1 This sheet shows the general procedure for mounting a type “RA” Oil Switch in a vault or manhole using 1/C cable. Dimensions and material shown should be used as a guide for installing other “RA” type switches.

1.2 The switch should be mounted at an elevation where it can be readily operated from the floor level.

1.3 Equipment in the vault or manhole should be arranged so that clearance around the switch may be provided as follows:

A. Allow approximately 2 feet above switch for working inside the tank.

B. Allow approximately 2 feet in front of switch for operating the control levers and maintenance.

C. Allow sufficient space under the switch to accommodate the minimum bending radius of each of the cables and adequate vertical separation between cables.

1.4 The switch tank should be mounted as follows:

A. Mount switch to cast-in unistruts using 5/8-inch bolts and 5/8-inch unistrut nuts (M/C 133-66604). For 5- and 6-way switches, support front-end with legs according to the following lowest cost priority:

1. Pole-top extensions (only when available from scrap) M/C 078-07506.

2. Lindsey Steady Legs M/C 655-67802.

3. Galvanized steel angle legs (2" x 2" x 1/4") M/C 115-03000 (indicate length required).

B. When “Red Heads” (M/C 108-48901) are used to mount the switch to the wall, install legs on all switches (3- to 6-way).

1.5 After switch has been mounted, install cableheads into tank and terminate aluminum cable. When using copper cable, install cable leads into cableheads first before installing into tank. Connect tank ground lead into lug provided.

1.6 Check interior of tank for cleanliness or loose bolts and connections, attach gasket and cover. Do not apply any type cement to gasket. Fill tank with dry nitrogen gas to a pressure of 3 to 5 psi for 15 minutes. Check for leaks.

1.7 Fill the tank with new circuit breaker oil (inhibited), M/C 896-35007, to the level shown on gauge. Purge tank with dry nitrogen gas for approximately 3 minutes to eliminate any air or moisture above oil. Release pressure and leave at atmosphere pressure.

FOR REFERENCE ONLY

Scope SE 255.2 Shows "RA" Type Oil Switch Installation

1.0 Instructions

1.1 Use unistruts to hold mounting bolts. If switch bolt patterns are not aligned with the cast-in unistruts, drill 2-3/4-inch holes in wall to mount bolts using "Red Heads."

1.2 Mount upper bolts.

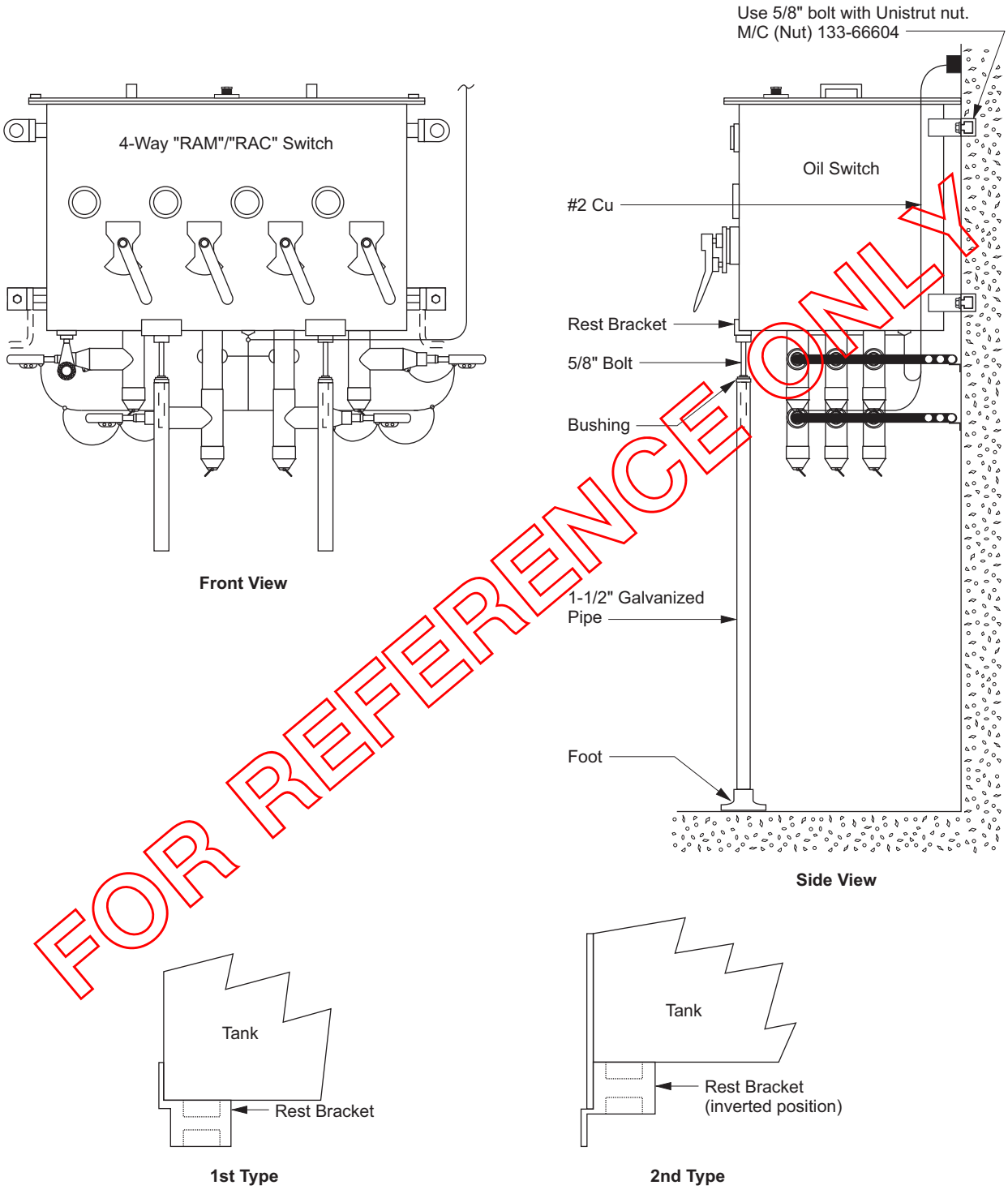
1.3 Insert lower bolts - do not tighten.

1.4 Tighten upper mounting bolts until bottom of switch starts to pull away from wall.

1.5 Tighten bottom wall mounting bolts.

1.6 Install Lindsey Steady Legs (M/C 655-67802 - consists of rest bracket, bushing, foot, and 1-1/2-inch galvanized pipe. Make sure legs are secured firmly underneath the switch.

Figure SE 255–2: "RA" Type Oil Switch — Installation



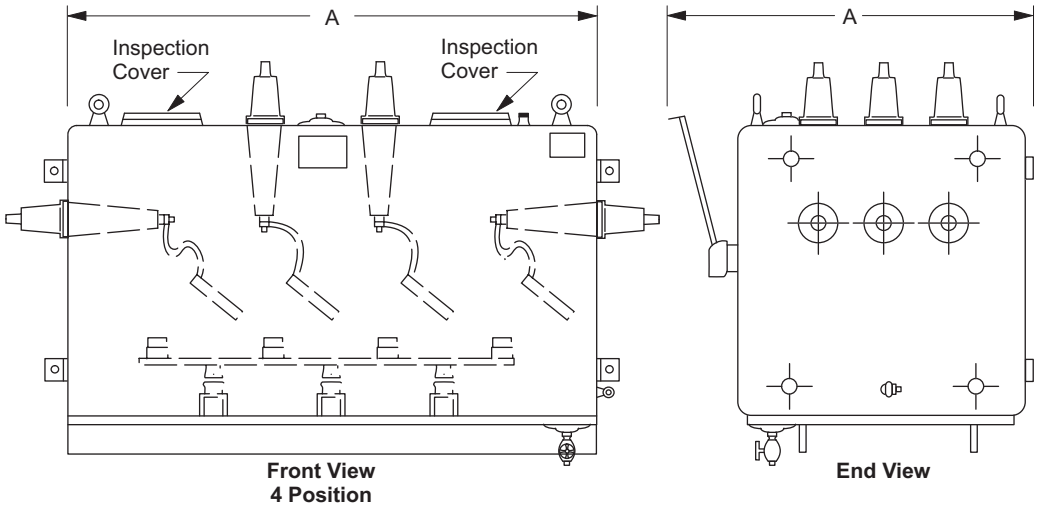
FOR REFERENCE ONLY

Note(s):
1. The rest bracket will fit the two types of switch tank. SCE is buying by simply turning it upside down as shown below.

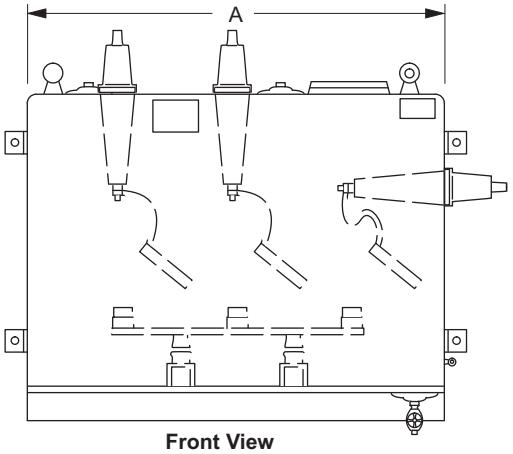
SE 256 Surface Operable Oil Switch — 600A — 15 kV

Scope SE 256.1 Top/End Connected "RAM" Type Oil Switches 3-, 4-, 5-, and 6-Way, 3Ø, 15 kV — 600 A, 20,000 A Momentary

Figure SE 256–1: Top/End Connected "RAM" Type Oil Switches 3-, 4-, 5-, and 6-Way, 3Ø, 15 kV — 600 A, 20,000 A Momentary



Front View 4 Position **End View**



Front View 3 Position

Table SE 256–1: Top/End Connected "RAM" Type Oil Switch

No. of Ways	Material Code	ESCO				Nelson			
	RAM	A (in)	B (in)	Weight (lb) w/o Oil	Oil Req'd (gal)	A (in)	B (in)	Weight (lb) w/o Oil	Oil Req'd (gal)
3-W[1/]	535-00211	46	34-5/8	650	105	47-3/4	38-5/8	820	128
4-W[a/]	535-00021	57-1/2	34-5/8	850	130	59	38-5/8	1,010	160
5-W[2/]	535-00229	69	34-5/8	1,000	155	70-1/4	38-5/8	1,205	193
6-W[b/]	535-00237	80-1/2	34-5/8	1,150	180	81-1/2	38-5/8	1,400	226

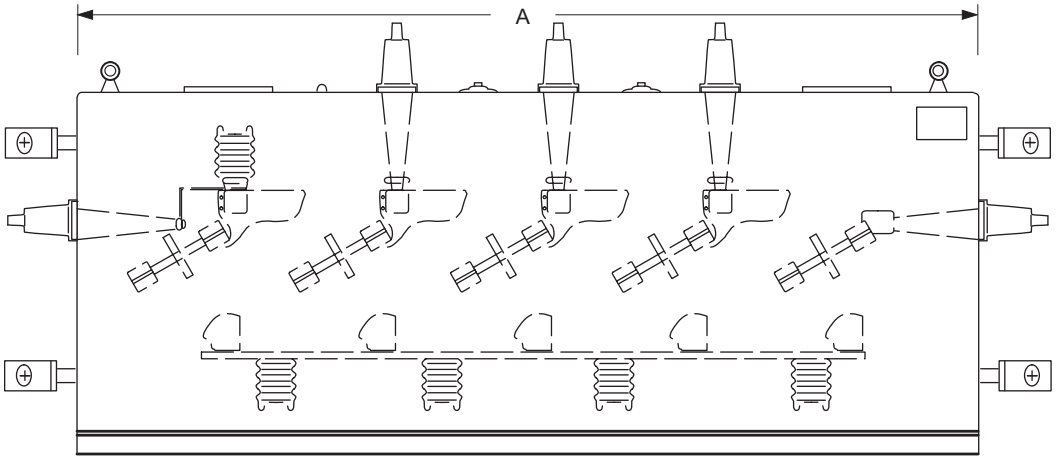
[1/] See Note 3.
[2/] See Note 4.

= For Reference Only

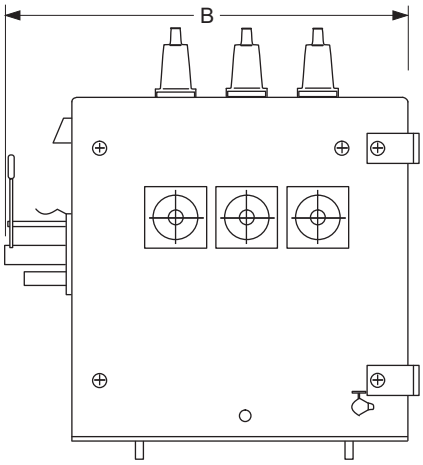
Note(s):
1. This switch has an all-welded tank without porthole viewing windows.
2. The switch comes complete with 600A ESNA-bolted removable bushings and inspection cover on top of the switch.
3. See SE 258 for information on 3- and 4-way SF_6 switches.
4. 5-way or 6-way oil switches are approved for vaults only, and requires District Manager and Division Engineering Manager's approval.
5. Refer to DOM Manual; SW-4, Reference 5.3 prior to switch installation

Scope SE 256.2 **Top/End Connected "RAC" Type Oil Switches 4-, 5-, and 6-Way, 3Ø, 15 kV, 600 A, 20,000 A Momentary**

Figure SE 256–2: Top/End Connected "RAC" Type Oil Switches 4-, 5-, and 6-Way, 3Ø, 15 kV, 600 A, 20,000 A Momentary



Front View
5 Position



End View

Table SE 256–2: Top/End Connected "RAC" Type Oil Switch

No. of Ways	Material Code RAM	ESCO A (in)	ESCO B (in)	ESCO Weight (lb) w/o Oil	ESCO Oil Req'd (gal)	Nelson A (in)	Nelson B (in)	Nelson Weight (lb) w/o Oil	Nelson Oil Req'd (gal)
4-W[1/]	535-00260	56-1/4	38-3/4	1,100	135	59	38-5/8	1,010	160
5-W[2/]	535-00252	68-1/4	38-3/4	1,400	160	70-1/4	38-5/8	1,205	193
6-W[b/]	535-00278	80-1/4	38-3/4	1,700	185	81-1/2	38-5/8	1,400	226

1/ See Note 3.
2/ See Note 4.

Note(s):

1. This switch has an all-welded tank without porthole viewing windows.
2. The switch comes complete with 6A ESNA-bolted removable bushings and inspection cover on top of the switch.
3. See SE 258 for information on 3- and 4-way SF_6 switches.
4. 5-way or 6-way oil switches are approved for vaults only, and requires District Manager and Division Engineering Manager's approval.
5. Refer to DOM Manual; SW-4, Reference 5.3 prior to switch installation

Scope SE 256.3 Typical Installation Top/End Connected "RA" Type Oil Switch in a CST Enclosure (5' x 8'-6")

1.0 Notes

1.1 The switch should be mounted at an elevation where it can be readily operated from ground level.

1.2 Equipment in the CST enclosure should be arranged so that clearance around the switch may be provided as follows:

1.3 Allow approximately 2 feet in front of switch for operating the control levers and maintenance.

1.4 The switch tank should be mounted as follows:

A. Use "Red Heads" (M/C 108-48901) to mount the switch to the wall; install legs on all switches according to the following lost-cost priority:

1. Pole-top extensions (only when available from scrap) M/C 078-07506.
2. Lindsey Steady Legs M/C 655-67802.
3. Galvanized steel angle legs (2" x 2" x 1/4") M/C 115-03000 (indicate legs required)

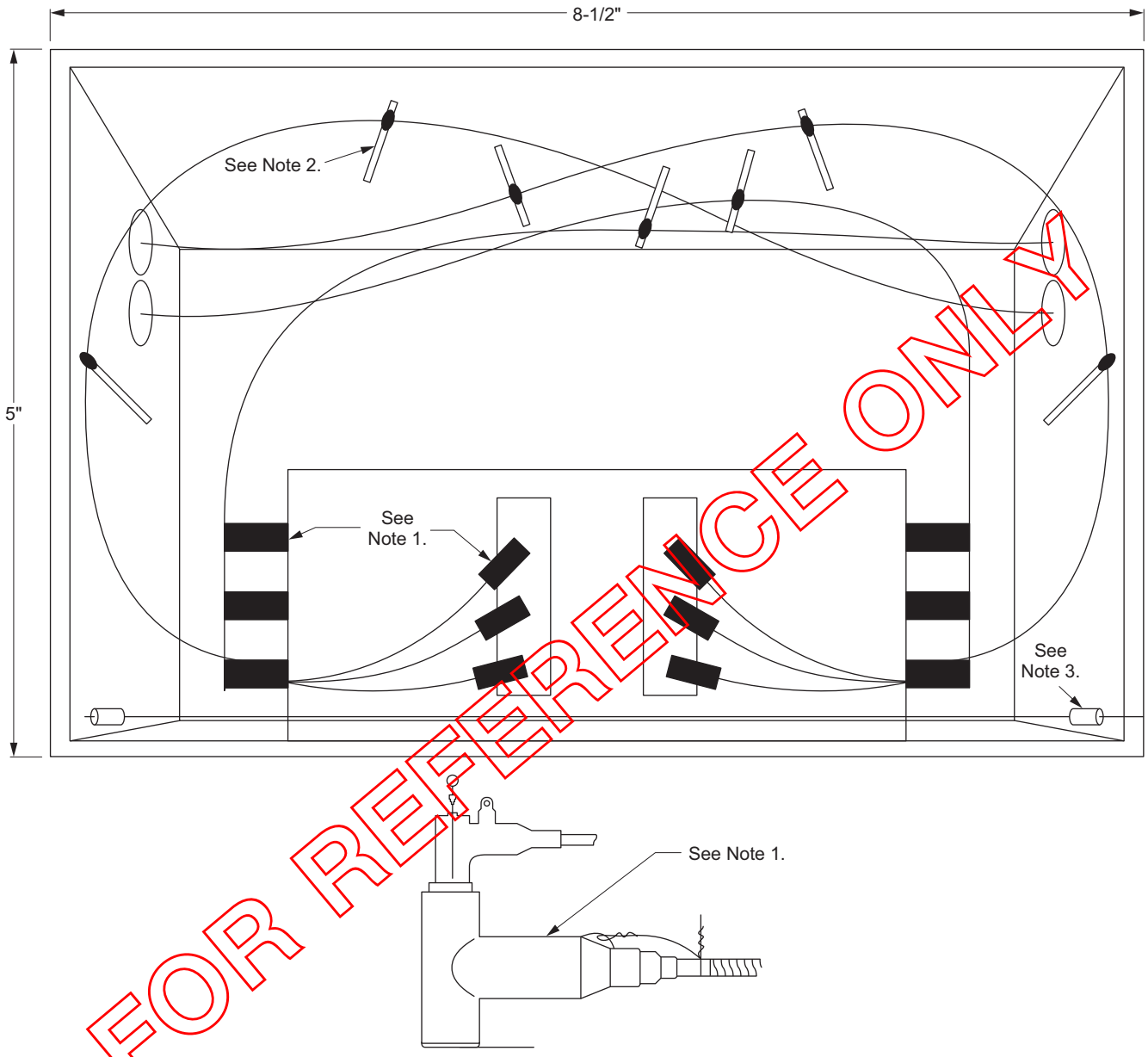
B. When switch is to be free standing, use four pole-top extensions as legs. Cross bracing may be installed is deemed necessary.

C. Connect tank ground into lug provided.

D. Purge tank with dry nitrogen gas for approximately three minutes to eliminate any air or moisture above oil. Release pressure and leave at atmospheric pressure.

FOR REFERENCE ONLY

Figure SE 256–3: Typical Installation — Top/End Connected "RA" Type Oil Switch in a CST Enclosure (5' x 8'-6")



FOR REFERENCE ONLY

Note(s):

1. Typical termination (optional 200 A elbow for grounding purpose).
2. Racks should be mounted at slanted attitude to support cable at right angles.
3. Ground bus should be installed at top of structure.
4. When using 600 A switch in a CST enclosure the cable should be limited to four runs of 100 kcmil or 750 kcmil.

SE 258 Surface-Operable SF_6 RAM Switch — 600 A

Scope SE 258.1 Top Connected Staggered Bushing "RAM" Type SF_6 Gas-Filled Switches 3-, 4-, 5-, and 6-Way, 3Ø, 17 kV, 600 A

Figure SE 258–1: G&W Top-Connected Staggered Bushing "RAM" Type SF_6 Gas-Filled Switches 3-, 4-, 5-, and 6-Way, 3Ø, 17 kV, 600 A

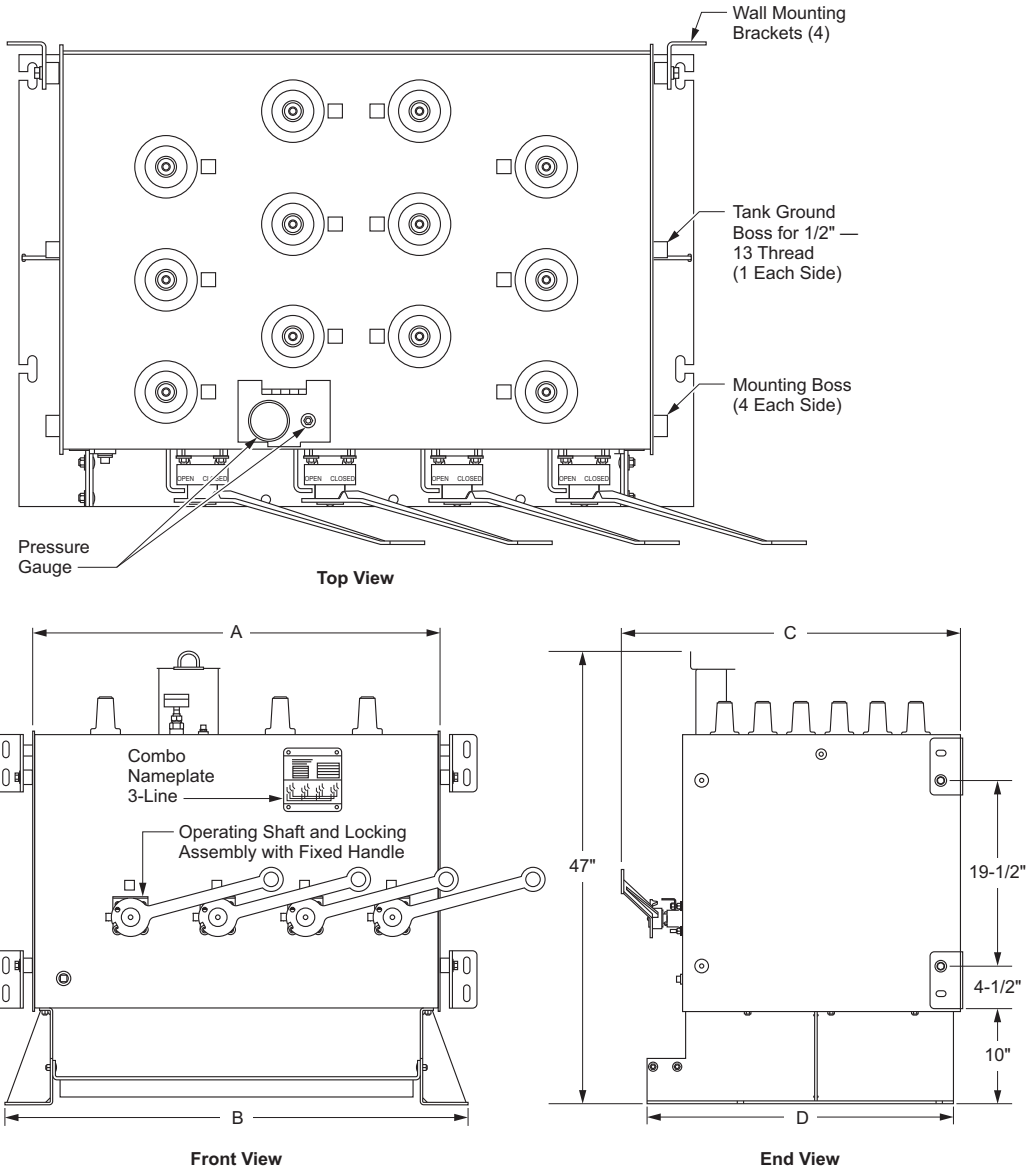


Table SE 258–1: 17 kV G&W Top Connected Staggered Bushing "RAM" Type SF_6 Gas-Filled Switch Data

Number of Ways	SAP Number	G&W					
		A (in)	B (in)	C (in)	D (in)	Approx. Weight with Gas (lb)	Approx Weight of Gas (lb)
2-W	10106402	19-1/2	25	32	32	230	4
3-W	10106407	34	39	35	32	760	9.5
4-W	10106409	43	48	35	32	800	12
5-W[1/]	10106457	51	57	35	32	1060	14
6-W[1/]	10106461	65	66	35	32	1190	17

[1/] Top-end connected, for replacement projects only.

Note(s):
1. Switch has an all-welded stainless steel tank, without porthole viewing windows.
2. Switch comes complete with 600 A bushings.
3. Switch has a color-coded gauge to indicate correct gas pressure.
4. Switch is approved for 4 kV, 12 kV, and 16 kV applications installed in vaults. For switch installation procedures, see SE 258 (Sheet 1).
5. Refer to the DOM Manual, Section SW-5, for inspection requirements of SF_6 switches prior to installation.
6. Staggered bushing configuration provides practical access for grounding.
7. Not to be installed in SOE structures.

Scope SE 258.2 G&W Top Connected Staggered Bushing "RAM" Type SF_6 Gas-Filled Switches 3- and 4-Way, 3Ø, 38 kV, 600 A, 25,000 A Momentary

Figure SE 258–2: G&W Top Connected Staggered Bushing "RAM" Type SF6 Gas-Filled Switches 3- and 4-Way, 3Ø, 38 kV, 600 A, 25,000 A Momentary

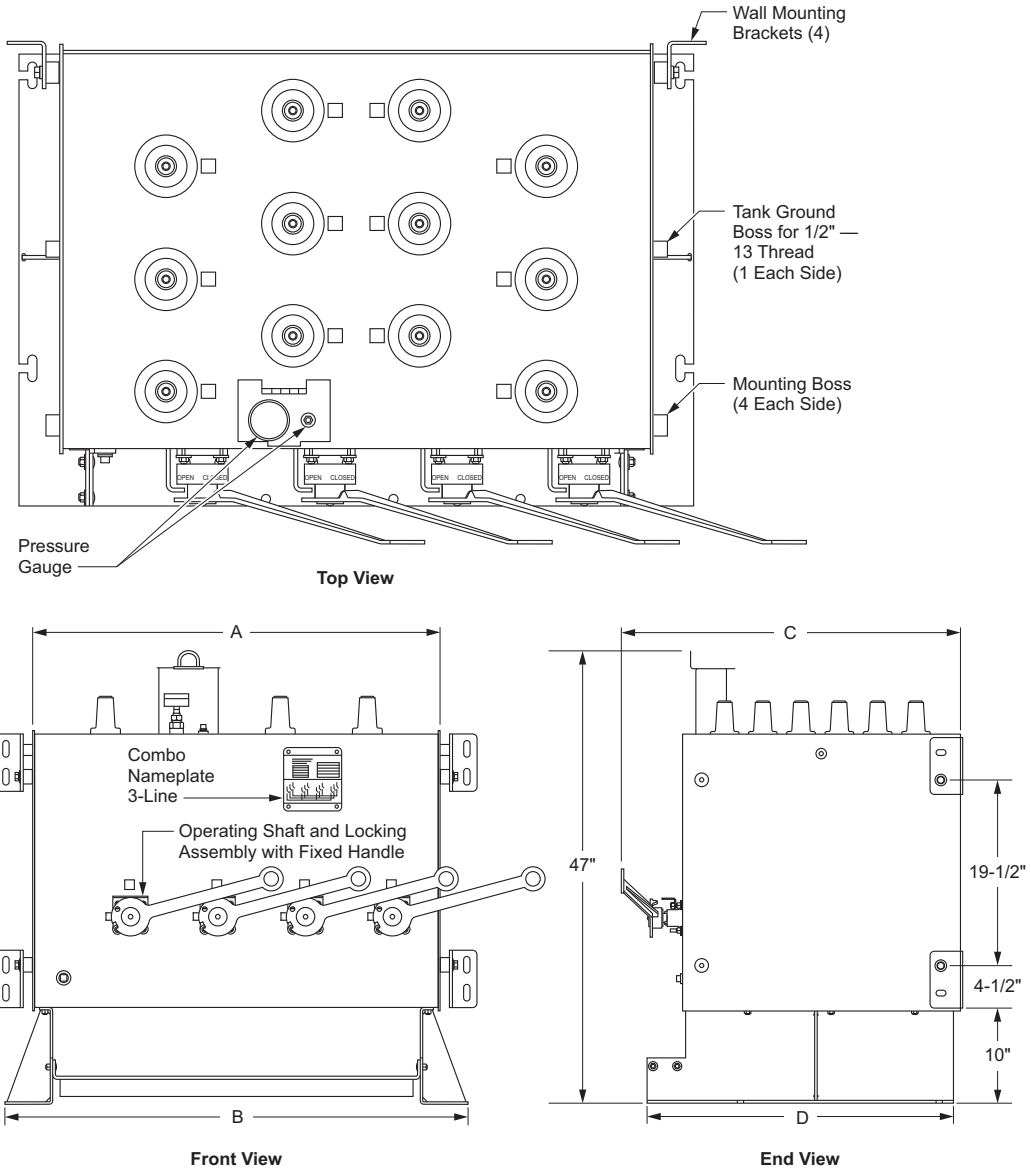


Table SE 258–2: 38 kV G&W Top Connected Staggered Bushing "RAM" Type SF6 Gas-Filled Switch Data

Number of Ways	SAP Number	G&W					
		A (in)	B (in)	C (in)	D (in)	Approx. Weight with Gas (lb)	Approx Weight of Gas (lb)
3-W	10106447	33	39	35	32	760	9.5
4-W	10106448	42	48	35	32	1100	12

Note(s):
1. Switch has an all-welded stainless steel tank, without porthole viewing windows.
2. Switch comes complete with 600 A bushings.
3. Switch has a color-coded gauge to indicate correct gas pressure.
4. Switch is approved for **33 kV applications** installed in vaults. For switch installation procedures, see SE 258 (Sheet 1)
5. Refer to the DOM Manual, Section SW-5, for inspection requirements of SF_6 switches prior to installation.
6. Staggered bushing configuration provides practical access for grounding.
7. Not to be installed in SOE structures.

Scope SE 258.3 Typical Installation Procedures for Top Connected Staggered and Non-Staggered Bushing "RAM" Type SF_6 Gas-Filled Switches

1.0 General

This standard outlines the minimum installation requirements for the placement of top connected SF_6 switches in either a vault, or a surface operable enclosure.

NOTE

Since this type of switch can float when exposed to water within the structure, it must always be secured to the structure. It is essential that the following installation procedures be followed to provide for the operation and maintenance of the switch, and cable terminations.

2.0 Vaults

2.1 Preferred placement of a SF_6 switch in a new or existing vault shall be on the structure wall, or may be secured to the structure floor when wall mounting is not feasible. The switch may have to be offset from the center line of the vault access opening to obtain sufficient clearance from the switch operating handles to the vault ladder. Switches are supplied with four wall mounting brackets. Secure the switch to the wall using all four brackets employing four 1/2-inch stainless steel wedge style concrete stud anchors (SAP 10200306). When the switch is to be floor mounted it must be secured to the structure floor to prevent the switch from floating. The switch is supplied with two bottom mounted support channels with 9/16-inch holes for floor mounting. The front hole of one channel and (1) the rear hole of the opposite channel, or (2) the corresponding wall bracket should be used to secure the switch with 1/2-inch stainless steel wedge style concrete stud anchors, as a minimum. Switches made after May 2001 have support channels which extend outside the tank bottom, each switch shall be secured at all four locations. Since structure floors are not always flat or level, care must be taken not to place any undue stress on the switch. Stainless steel washers should be used as shims under the bottom support channels to provide a flat surface for securing the switch. See RS 100 for additional anchor material information and installation instructions.

2.2 Ground the cable concentric wires, and the switch tank to the vault 4/0 copper ground/neutral per the material and installation requirements of GR 100.

3.0 Surface Operable Enclosure

3.1 The SF_6 switch shall always be placed adjacent to the structure sidewall, and be positioned under the center cover opening to provide for cable terminating and operability. See 2.1 above, for installation procedures and materials required to secure the switch to the enclosure wall or floor.

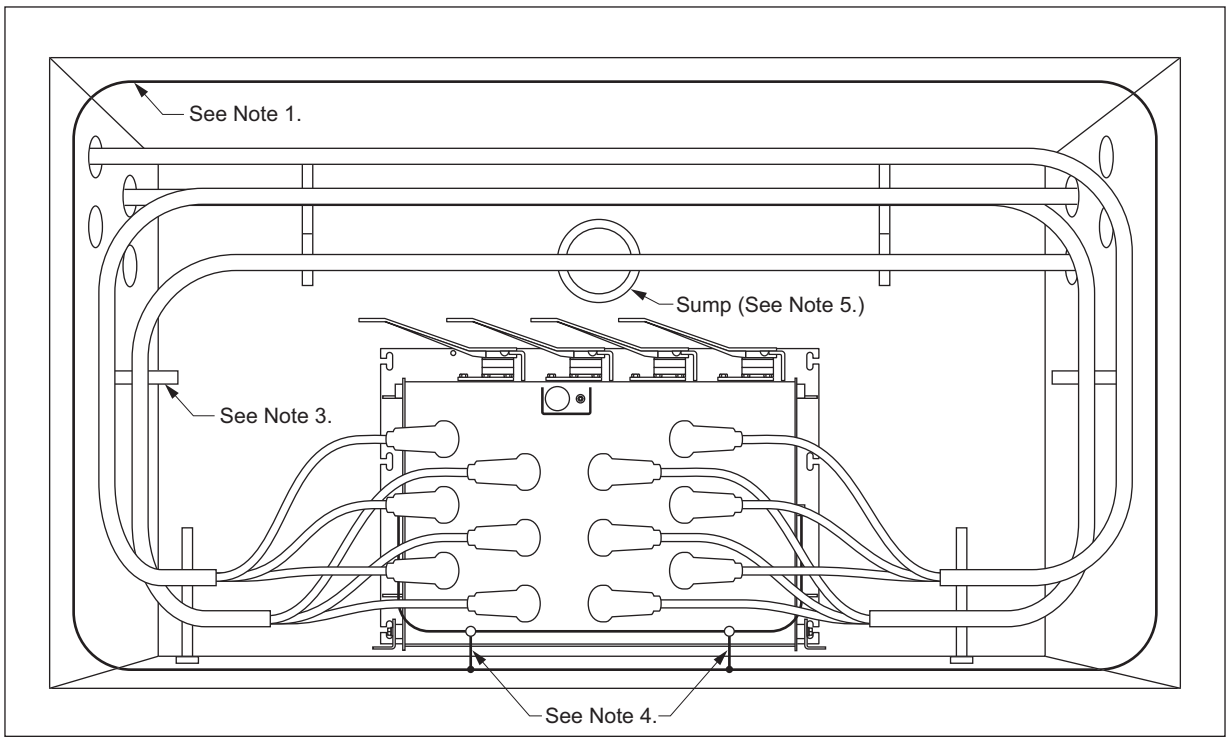
3.2 Attach a 4/0 bare copper ground bus to the furnished 1/2-inch threaded "J" bolts at top of both ends of enclosure. Install bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of structure. Interconnect ground bus to split bolt connector with #2 str copper wire at both end locations. Attach all cable concentric wires to 4/0 copper bus. Ground the switch tank to the 4/0 copper ground/neutral bus with #2 str copper.

3.3 See Scope SE 258.4 (Sheet 6) for switch placement, grounding and cable layout in the enclosure.

= For Reference Only

Scope SE 258.4 Typical Installation for Top-Connected Staggered Bushing "RAM" SF6 Switch in Vaults

Figure SE 258–3: G&W 4-Way Top Connected Staggered Bushing "RAM" Switch in Vault

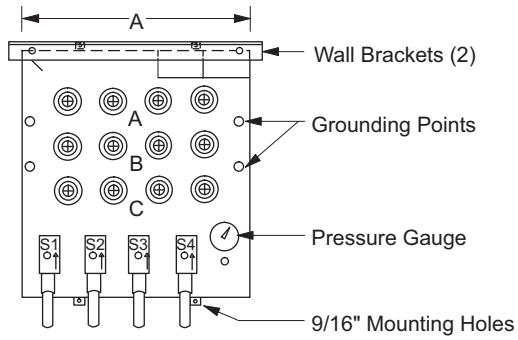


Note(s):

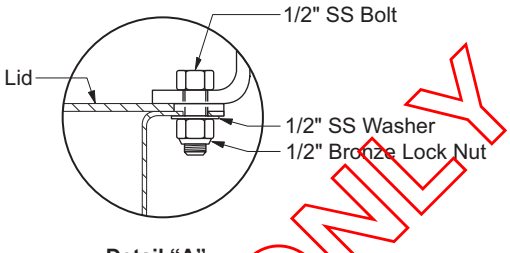
1. Attach 4/0 bare copper ground/neutral bus to furnished 1/2-inch threaded “J” bolts at top of both ends of enclosure.
2. Attach a bronze 1/2-inch threaded split bolt grounding connector (SAP 10111589) to the bronze grounding inserts at top of both ends of the enclosure. Connect the 4/0 Cu ground bus to the grounding connector with #2 str Cu wire.
3. Cable support hooks and racks (See RS 110).
4. Attach 4/0 bare copper to all grounding bosses on the switch. Connect switch 4/0 to structure ground at two locations using 4/0 bare copper.
5. 13" x 13" deep sump.

Scope SE 258.5 **Joslyn Top Connected "RAM" Type SF6 Gas-Filled Switches 2-, 3-, and 4-Way, 3Ø, 27 kV, 600 A, 20,000 A Momentary**

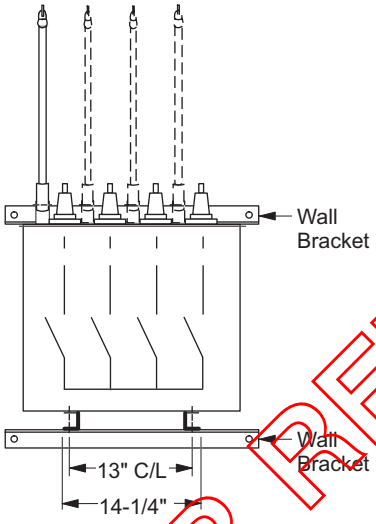
Figure SE 258–4: Joslyn Top Connected "RAM" Type SF6 Gas-Filled Switches 2-, 3-, and 4-Way, 3Ø, 27 kV, 600 A, 20,000 A Momentary



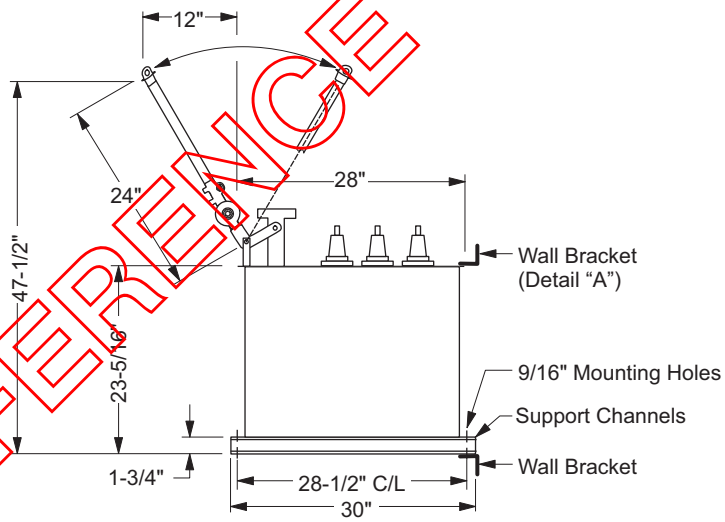
Top View



Detail "A"
Typical for Top and Bottom Wall Mounting Brackets



Front View
(3- or 4-way)



End View

Number of Ways	Material Code	Joslyn	
		A (in)	Weight (lbs)
2-W	535-00518	16-1/2	170
3-W	535-00567	20	300
4-W	535-00583	25	350

FOR REFERENCE ONLY

Note(s):

1. This switch has an all-welded stainless steel tank with a coal tar epoxy coating, without porthole viewing windows.
2. The switch comes complete with 600A ESNA bushings.
3. Switches are provided with a color coded gauge to indicate correct gas pressure.
4. The switch is approved for 4-, 12-, and 16-kV applications, installed in vaults or a 5' x 8'-6" x 5' surface operable enclosure. For switch installation procedures see SE 258 (Sheet 1).
5. Switches are supplied with one universal handle (M/C 568-01962). The angle of the switch handle may be adjusted to allow for stacked components on the switch.
6. Refer to DOM Manual; SW-5, for inspection requirements of SF_6 switches prior to installation.

Scope SE 258.6 G&W Top Connected Non-Staggered Bushing "RAM" Type SF6 Gas-Filled Switches 2-, 3-, 4-, and 5-Way, 3Ø, 17 kV, 600 A, 20,000 A Momentary

Figure SE 258–5: G&W Top Connected Non-Staggered Bushing "RAM" Type SF6 Gas-Filled Switches 2-, 3-, 4-, and 5-Way, 3Ø, 17 kV, 600 A, 20,000 A Momentary

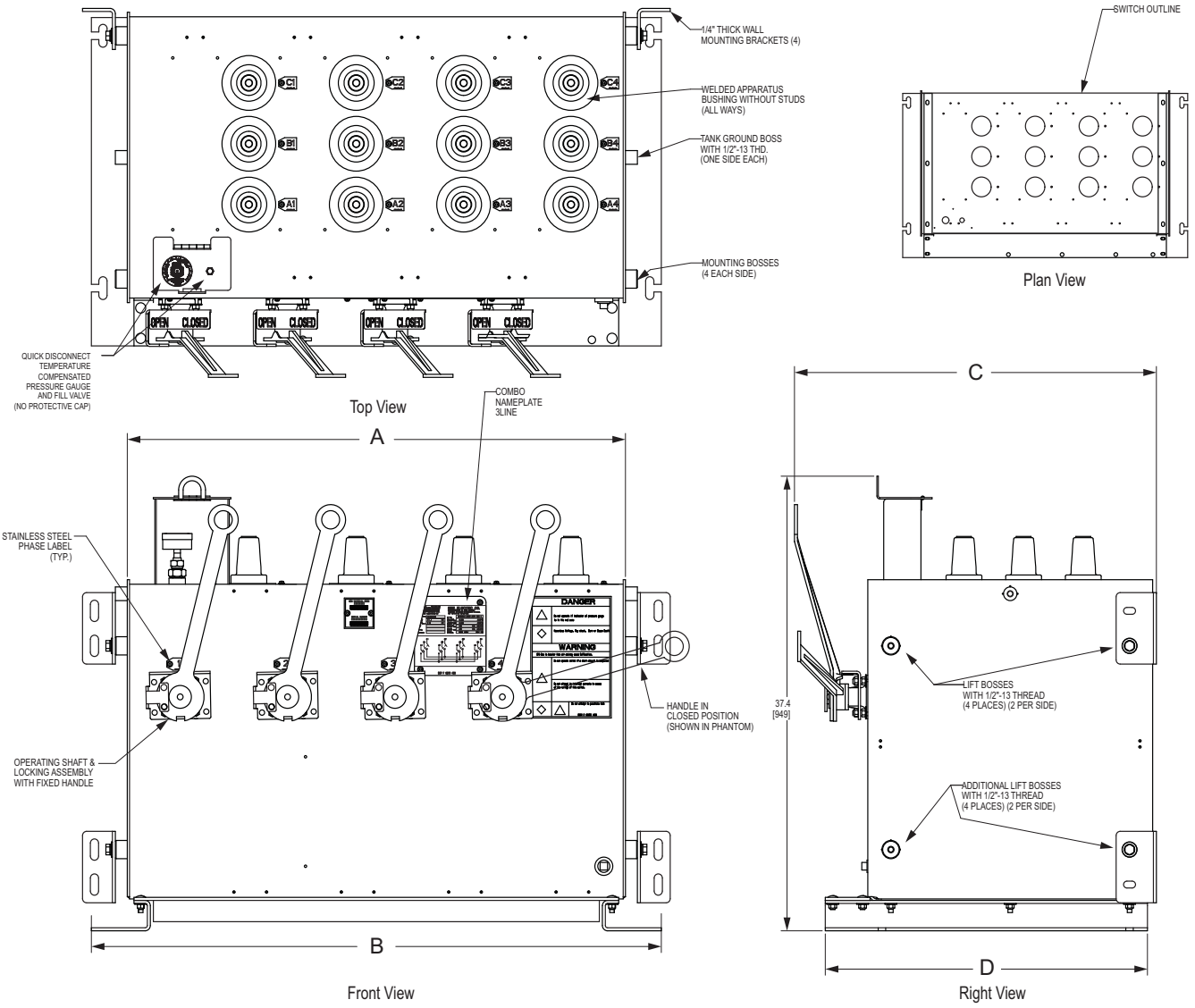


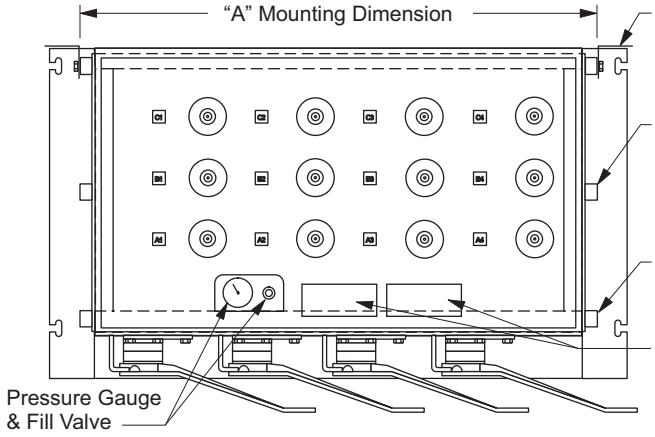
Table SE 258–3: 17 kV G&W Top Connected Non-Staggered Bushing "RAM" Type SF6 Gas-Filled Switch Data

Number of Ways	SAP Number	G&W					
		A (in)	B (in)	C (in)	D (in)	Approx. Weight w/ Gas (lb.)	Approx. Weight of Gas (lb.)
3-Way	10205242	33	38-1/2	30-1/4	27	550	6.8
4-Way	10205175	42	47-1/2	30-1/4	27	660	9.3
5-Way	10205176	51	56-1/2	30-1/4	27	770	10.6

Note(s):
1. This switch has an all-welded stainless steel tank, without porthole viewing windows.
2. The switch comes complete with 600A bushings.
3. Switch has a color coded gauge to indicate correct gas pressure.
4. The switch is approved for 4-, 12-, and 16-kV applications, only for switch replacements in SOE structures where staggered design RAM switches are not approved. For switch installation procedures see SE 258 (Sheet 1).
5. Refer to DOM Manual, Section SW-5, for inspection requirements of SF6 switches prior to installation.
6. For existing installations only.
7. For replacement switch in a vault, use the staggered bushing gas switch. See SE 258.4 for installation and instructions.

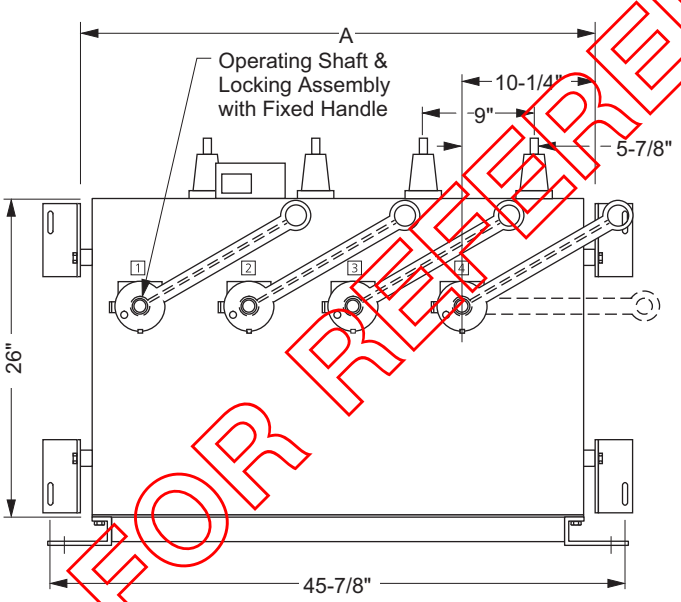
Scope SE 258.7 G&W Top Connected Non-Staggered Bushing "RAM" Type SF_6 Gas-Filled Switches, 3- and 4-Way, 3Ø, 38 kV, 600 A, 20,000 A Momentary

Figure SE 258–6: G&W Top Connected Non-Staggered Bushing "RAM" Type SF_6 Gas-Filled Switches, 3- and 4-Way, 3Ø, 38 kV, 600 A, 20,000 A Momentary

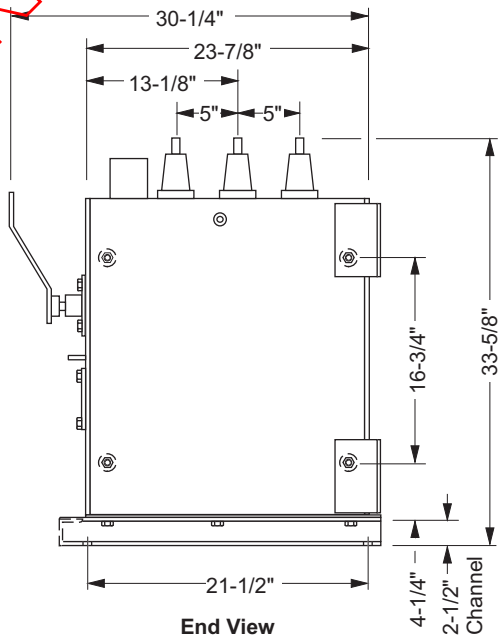


Top View

Number of Ways	Material Code	G&W A (in)	G&W Wt. (lbs)
3-W	535-00963	34	409
4-W	535-00971	43	545



Front View



End View

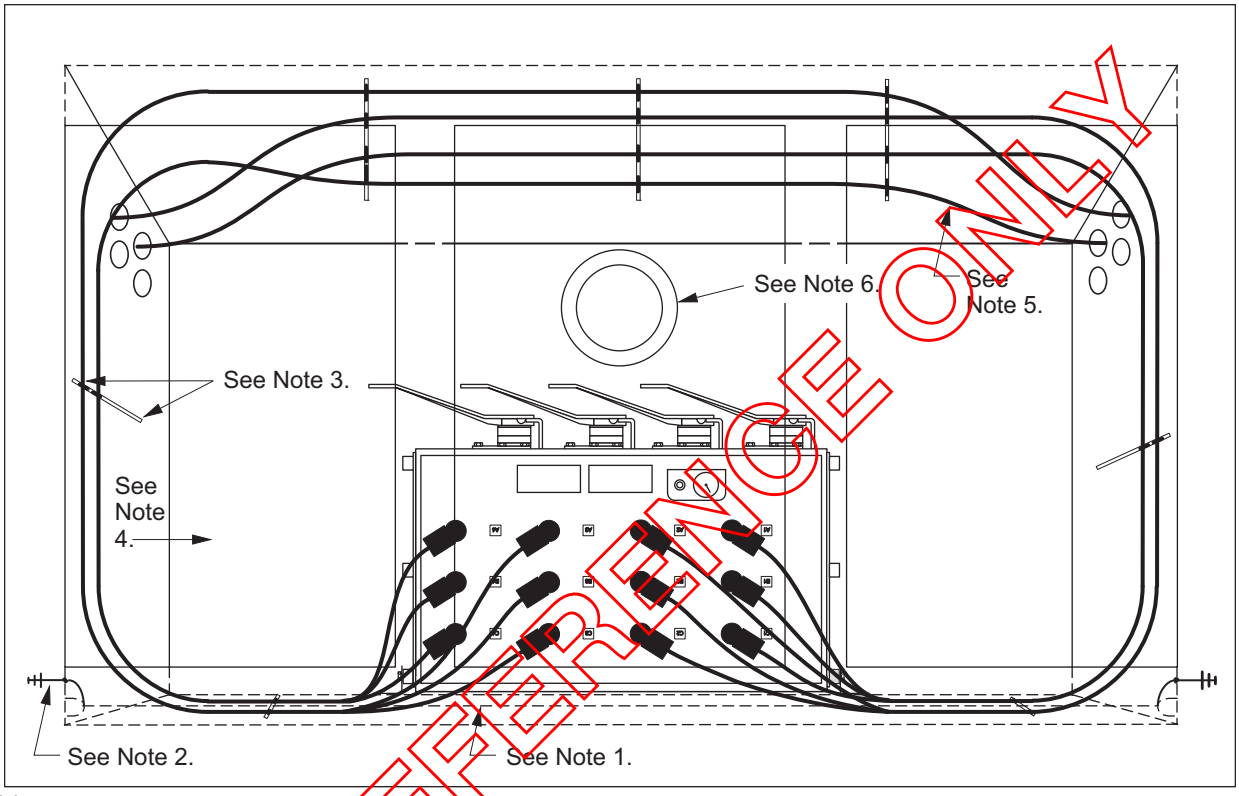
FOR REFERENCE ONLY

Note(s):

1. This switch has an all-welded stainless steel tank, without porthole viewing windows.
2. The switch comes complete with 600 A bushings.
3. Switch has a color coded gauge to indicate correct gas pressure.
4. The switch is approved for 35 kV applications, installed in vaults or a 5' x 8'-6" x 5' surface operable enclosure. For switch installation procedures see SE 258 (Sheet 1).
5. Refer to DOM Manual, Section SW-5, for inspection requirements of SF_6 switches prior to installation.
6. For existing installations only.
7. For replacement switch in a vault, use the staggered bushing gas switch. See SE 258.4 for installation and instructions.

Scope SE 258.8 Typical Installation for Top Connected Non-Staggered Bushing "RAM" SF6 Switch in a Surface Operable Enclosure

Figure SE 258–7: G&W 4-Way Top Connected Non-Staggered Bushing "RAM" Switch Shown in a 5' x 8'-6" Surface Operable Enclosure



FOR REFERENCE ONLY

Note(s):

1. Attach 4/0 bare copper ground/neutral bus to furnished 1/2-inch threaded "J" bolts at top of both ends of enclosure.
2. Attach a bronze 1/2-inch threaded split bolt grounding connector (M/C 606-25019) to the bronze grounding inserts at top of both ends of the enclosure. Connect the 4/0 Cu ground bus to the grounding connector with #2 str Cu wire.
3. Cable support hooks and racks (See RS 110).
4. Enclosure furnished with 30" x 48" polymer concrete covers.
5. When using a 2-, 3- or 4-way SF_6 switch in the 5' x 8'-6" x 5' structure, the primary cable should be limited to a maximum of four runs of 750 kcmil cable. Additional runs shall be 350 kcmil or smaller. A run is any cable that enters the structure from any direction
6. 13" x 13" deep sump.

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SE 259 Surface Operable Gas-Filled RA-Type Ground (RAG) Switch — 600 A

Scope SE 259.1 Switch Dimensions For Top-Connected Staggered Bushing RAG Switches – 600 A

Figure SE 259–1: Top-Connected Staggered Bushing RAG Switch – Dimensions

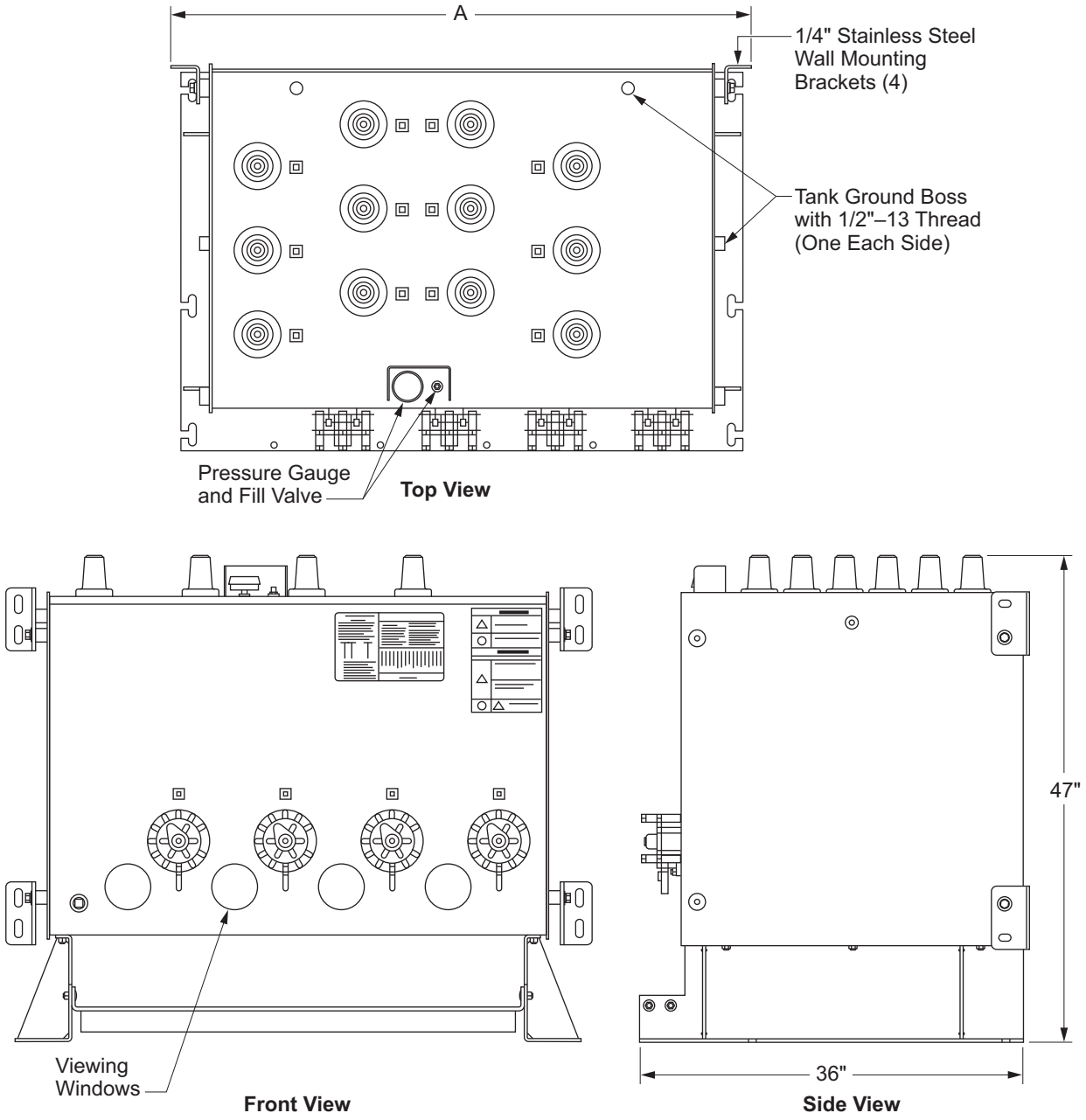


Table SE 259–1: 17 kV Top-Connected Staggered Bushing RAG Switches, 2-, 3-, 4-, 5-, and 6-Way, 3Ø, 600 A, 25,000 A Symmetrical

Number of Ways	Rated Voltage (kV)	Material Number (SAP Number)	G&W	
			A (in)	Weight (lb)
2-W[a/]	17	10171450	35	750
3-W	17	10171451	45	900
4-W	17	10171323	55	1200
5-W[b/]	17	10171452	66	1400
6-W[b/]	17	10171448	76	1600

[a/] 2-Way submersible RAG switches manufactured prior to 2014 are equipped with switching provisions on position 1 only. Refer to DOM SW-5 2-Way RAG switch schematic drawings for additional details.
[b/] Top-End Connected, For Replacement Projects Only

Note(s):
1. Switch has an all-welded stainless steel tank, with porthole viewing windows.
2. Switch comes complete with 600 A bushings.
3. Switch has a color-coded gauge to indicate correct gas pressure.
4. Switch is approved for 4 kV, 12 kV, and 16 kV applications installed in vaults.
5. Refer to the DOM Manual, Section SW-5, for inspection requirements of gas switches prior to installation.
6. Staggered bushing configuration provides reduced elbow interference.
7. Not to be installed in SOE structures.

Table SE 259–2: 38 kV Top-Connected Staggered Bushing RAG Switches, 2-, 3-, 4-, 5-, and 6- Way, 3Ø, 600 A, 25,000 A Symmetrical

Number of Ways	Rated Voltage (kV)	Material Number (SAP Number)	G&W	
			A (in)	Weight (lb)
2-W	38	—	35	750
3-W	38	10181724	45	900
4-W	38	10181726	55	1200
5-W[a/]	38	10200394	66	1400
6-W[a/]	38	—	76	1600

[a/] Top-End Connected, For Replacement Projects Only

Note(s):
1. Switch has an all-welded stainless steel tank, with porthole viewing windows.
2. Switch comes complete with 600 A bushings.
3. Switch has a color-coded gauge to indicate correct gas pressure.
4. Switch is approved for 25 kV and 33kV applications installed in vaults.
5. Refer to the DOM Manual, Section SW-5, for inspection requirements of gas switches prior to installation.
6. Staggered bushing configuration provides reduced elbow interference.
7. Not to be installed in SOE structures.

Scope SE 259.2 Typical Installation Procedures for Top-Connected Gas-Filled RA-Type Ground (RAG) Switches in Vaults

1.0 General

This standard outlines the minimum installation requirements for the placement of top-connected gas-filled switches in vaults.

NOTE

Since this type of switch can float when exposed to water within the structure, it must always be secured to the structure. It is essential that the following installation procedures be followed to provide for the operation and maintenance of the switch, and cable terminations.

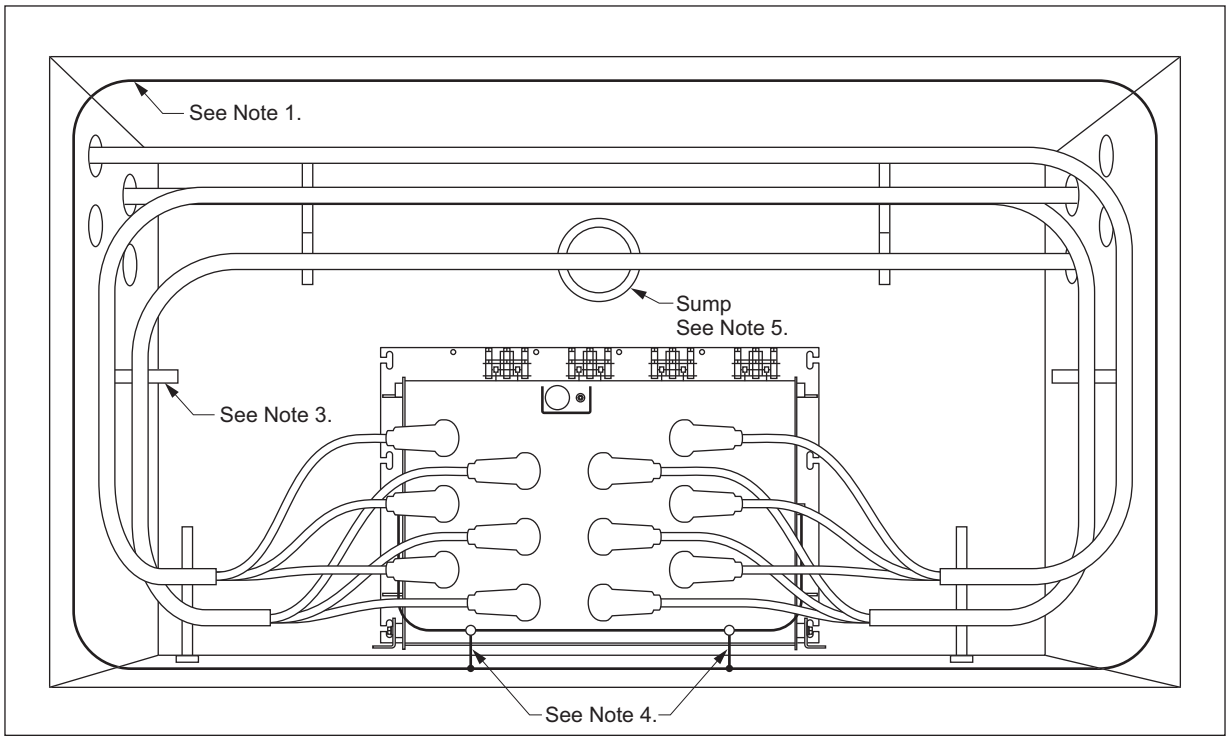
2.0 Vaults

2.1 Preferred placement of a gas switch in a new or existing vault shall be on the structure wall, or secured to the structure floor when wall mounting is not feasible. The switch may have to be offset from the center line of the vault access opening to obtain sufficient clearance from the switch operating handles to the vault ladder. Switches are supplied with four wall mounting brackets. Secure the switch to the wall using all four brackets employing four 1/2-inch stainless steel wedge style concrete stud anchors (SAP 10072180). When the switch is to be floor mounted it must be secured to the structure floor to prevent the switch from floating. The switch is supplied with two bottom mounted support channels with 9/16-inch holes for floor mounting. The front hole of one channel and (1) the rear hole of the opposite channel, or (2) the corresponding wall bracket should be used to secure the switch with 1/2-inch stainless steel wedge style concrete stud anchors, as a minimum. Switches have support channels which extend outside the tank bottom, each switch shall be secured at all four locations. Since structure floors are not always flat or level, care must be taken not to place any undue stress on the switch. Stainless steel washers should be used as shims under the bottom support channels to provide a flat surface for securing the switch. See RS 100 for additional anchor material information and installation instructions.

2.2 Ground the cable concentric wires, and the switch tank to the vault 4/0 copper ground/neutral per the material and installation requirements of GR 100.

Scope SE 259.3 Typical Installations for Top-Connected RAG Switch in Vaults

Figure SE 259–2: G&W 4-Way RAG Switch in Vault



Note(s):

1. Attach 4/0 bare copper ground/neutral bus to furnished 1/2-inch threaded “J” bolts at top of both ends of enclosure.
2. Attach a bronze 1/2-inch threaded split bolt grounding connector (SAP 10111589) to the bronze grounding inserts at top of both ends of the enclosure. Connect the 4/0 Cu ground boss to the grounding connector with #2 str Cu wire.
3. Cable support hooks and racks (See RS 100).
4. Attach 4/0 bare copper to all grounding bosses on the switch. Connect switch 4/0 to structure ground at two locations using 4/0 bare copper.
5. 13" diameter, 13" deep sump.

SE 260 Pad-Mounted RAM Gas Switches — 600 A

Scope SE 260.1 Typical Installation Procedures for 2- Through 6-Way Pad-Mounted RAM Gas Switches on Equipment Slab Boxes

1.0 General

This standard outlines the minimum installation requirements for the placement of Pad-Mounted RAM Gas Switches on Equipment Slab Boxes.

NOTE

The switch cabinet enclosure can be installed separately from the switch tank. It is essential that the following installation procedures be followed to provide for the operation and maintenance of the switch, and cable terminations.

2.0 4'-6" X 7' Equipment Slab Box for 2-Way Pad-Mounted RAM Gas Switches (Refer to UGS SS 536)

2.1 Prior to cable pulling and make up, remove the beam for maximum working space. Align the face of the switch tank to the back edge of the cable opening. Center the switch tank to the center of the cable opening to allow enough clearance for cable shaping and terminating. The switch tank legs will line up over the four rear unistrut embedments. Secure the switch tank separately to the pad unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). All necessary cable shaping, make up, and terminating should be performed prior to installing the switch cabinet. (See Figure SE 260–4 [Sheet 8] for preferred cable layout). Place the removable beam in the slot, and secure it to the pad with the furnished countersunk machine screws. Place the switch cabinet enclosure over the switch tank and secure it to the four front unistrut embedments with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP 10117403).

2.2 Attach all cable concentric wires and the switch tank to the structure 4/0 neutral/ground bus per the material and installation requirements of GR 100.

3.0 7' X 8' Equipment Slab Box for 2-, 3-, and 4-Way Pad-Mounted RAM Gas Switches (Refer to UGS SS 537)

3.1 For placement of the above gas switches align the face of the switch tank to the tapered back edge of the cable opening. Center the switch tank to the center of the cable opening to allow enough clearance to shape and terminate cable. The switch tank legs will line up over the four rear unistrut embedments. Secure the switch tank to the unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). It is suggested that all necessary cable shaping, make up, and terminating be completed before setting the switch cabinet (see Figure SE 260–5.1 [Sheet 9]) for preferred cable layout). Place the switch cabinet enclosure over the switch tank and secure it to the four front unistruts with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP 10117403). When using a 2-way Gas switch, steel security plates (see Figure SE 260–5.3 [Sheet 9]) must be installed over each end of the cable opening prior to installing the switch cabinet enclosure (SAP 10117405 or SAP 10117406).

When using a 3-Way Gas Switch manufactured prior to 2013, steel security plates (See Figure SE 260-5.3) must be installed over each end of the cable opening prior to installing the switch cabinet enclosure (SAP 10117405 or SAP 10117406).

3.2 Attach a 4/0 bare copper neutral/ground bus to the furnished 1/2-inch threaded “J” bolts at the top of both ends of the structure or enclosure. Install the bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of the structure. Interconnect the neutral/ground bus to the split bolt connector with #2 str copper wire at both end locations. Attach all cable concentric wires to the 4/0 copper bus. Ground the switch tank to the 4/0 copper neutral/ground bus with #2 str copper. Ground cabinet enclosure to switch tank by attaching #2 str copper wire from ground lug on switch face to ground lug on inside front of cabinet enclosure.

4.0 8' X 10' Equipment Slab Box for 5-Way Pad-Mounted RAM Gas Switches (Refer to UGS SS 538)

4.1 When mounting the gas switch, align the face of the switch tank to the tapered back edge of the cable opening. Center the switch tank to coincide with the center of the cable opening to allow enough clearance to shape and terminate cable. The switch tank legs should line up over the four rear unistrut embedments. Secure the switch tank to the unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). Complete all the necessary cable shaping, make up, and termination before setting the switch cabinet. Place the switch cabinet enclosure over the switch tank and secure it to the four unistruts with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP 10117403).

Attach a 4/0 bare copper neutral/ground bus to the furnished 1/2-inch threaded “J” bolts at the top of both ends of the structure or enclosure. Install the bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of the structure. Interconnect the neutral/ground bus to the split bolt connector with #2 str copper wire at both end locations. Attach all cable concentric wires to the 4/0 copper bus. Ground the switch tank to the 4/0 copper neutral/ground bus with #2 str copper. Ground the cabinet enclosure to the switch tank by attaching #2 str copper wire from ground lug on the switch face to ground lug on inside front of cabinet enclosure. See GR Section for additional grounding requirements.

FOR REFERENCE ONLY

5.0 10' X 12' Equipment Slab Box for 5- and 6-Way Pad-Mounted RAM Gas Switches (Refer to UGS SS 539)

5.1 When mounting the 6-Way Pad-Mounted Gas Switch align the face of the switch tank to the tapered back edge of the cable opening. Center the switch tank to the center of the cable opening to allow enough clearance to shape and terminate cable. The switch tank legs should line up over the four rear unistrut embedments. Secure the switch tank to the unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). Complete all the necessary cable shaping, make up, and termination before setting the switch cabinet. Place the switch cabinet enclosure over the switch tank and secure it to the four front unistruts with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP 10117403).

Attach a 4/0 bare copper neutral/ground bus to the furnished 1/2-inch threaded “J” bolts at the top of both ends of the structure or enclosure. Install the bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of the structure. Interconnect the neutral/ground bus to the split bolt connector with #2 str copper wire at both end locations. Attach all cable concentric wires to the 4/0 copper bus. Ground the switch tank to the 4/0 copper neutral/ground bus with #2 str copper. Ground the cabinet enclosure to the switch tank by attaching #2 str copper wire from ground lug on the switch face to ground lug on inside front of cabinet enclosure. See GR Section for additional grounding requirements.

6.0 7' x 14' x 11' Tub-Style Structure with Modified Top Type I for 4-, 5-, and 6-Way Pad-Mounted RAM Gas Switches

6.1 When mounting the 4-, 5-, or 6-Way Pad-Mounted Gas Switch align the face of the switch tank to the tapered back edge of the cable opening. Center the switch tank to the center of the cable opening to allow enough clearance to shape and terminate cable. The switch tank legs should line up over the four rear unistrut embedments. Secure the switch tank to the unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). Complete all the necessary cable shaping, make up, and termination before setting the switch cabinet. Place the switch cabinet enclosure over the switch tank and secure it to the four front unistruts with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP 10117403).

Attach a 4/0 bare copper neutral/ground bus to the furnished 1/2-inch threaded “J” bolts at the top of both ends of the structure or enclosure. Install the bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of the structure. Interconnect the neutral/ground bus to the split bolt connector with #2 str copper wire at both end locations. Attach all cable concentric wires to the 4/0 copper bus. Ground the switch tank to the 4/0 copper neutral/ground bus with #2 str copper. Ground the cabinet enclosure to the switch tank by attaching #2 str copper wire from ground lug on the switch face to ground lug on inside front of cabinet enclosure. See GR Section for additional grounding requirements.

Scope SE 260.2 Dimensions for Pad-Mounted SF6 Gas Type RAM Switches – Units Manufactured after 2013

Figure SE 260–1: Pad-Mounted SF6 Gas Type RAM Switches - Dimensions

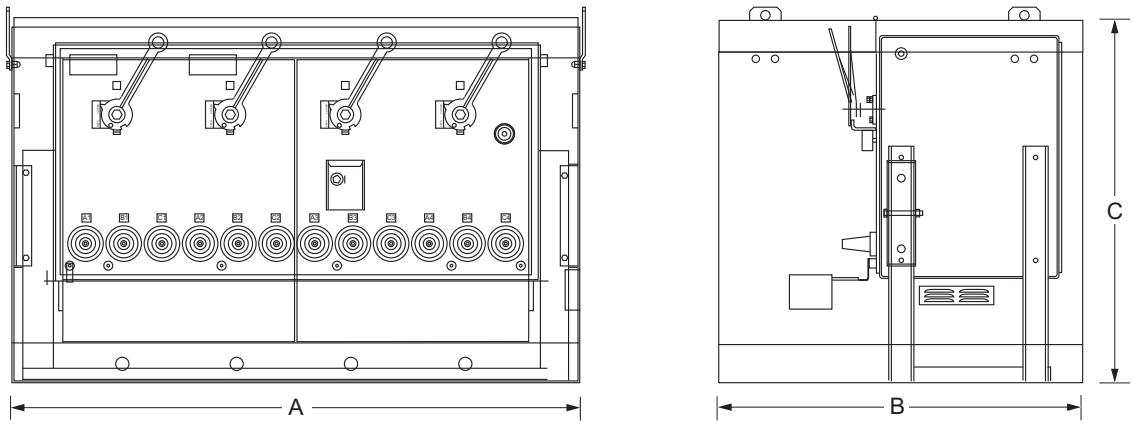


Table SE 260–1: 2- through 6-Way 17 kV Pad-Mounted RAM Gas Switch Dimensions

Pad-Mounted Gas Switches (with Cabinet)	Dimensions (in)			
	G&W[1/]			
	Replacement Cabinet	A	B	C
2-Way SAP 10106404	SAP 10106416	48	48.5	50
3-Way SAP 10106408	SAP 10106421	69.5	48.5	50
4-Way SAP 10106415	SAP 10106420	84.5	48.5	50
5-Way SAP 10200144	—	100	48.5	50
6-Way SAP 10168078	—	100.5	46	50

[1/] G&W Switches manufactured prior to 2013 have smaller cabinet dimensions. Refer to Table SE 260-3. G&W Switches manufactured after 2013 have provisions for remote rigging with extended mounting brackets. Refer to Figure SE 260-1.

Note(s):
1. The pad-mounted gas switches are used to provide above surface switching capabilities. They are to be used as the preferred method instead of top connected gas switches in subsurface enclosures or PME type switches where space limitations will not allow access from more than one side.
2. The switches come complete with 600A bushings and are rated at 600A continuous duty.
3. Switches are provided with a color-coded gauge to indicate correct gas pressure.
4. The switches are approved for 4, 12, and 16 kV applications. The switches are to be installed on appropriate equipment slab boxes. Refer to UGS Manual, SS Section for pad and equipment slab box requirements.
5. One 200 A tap may be stacked on each 600 A cable termination. (See Figure SE 260–6.1, TP 150, and JJ 660).
6. Refer to DOM manual, Section SW-5, for inspection requirements of gas switches prior to installation.

Table SE 260–2: 38kV Pad-Mounted RAM Gas Switch Dimensions

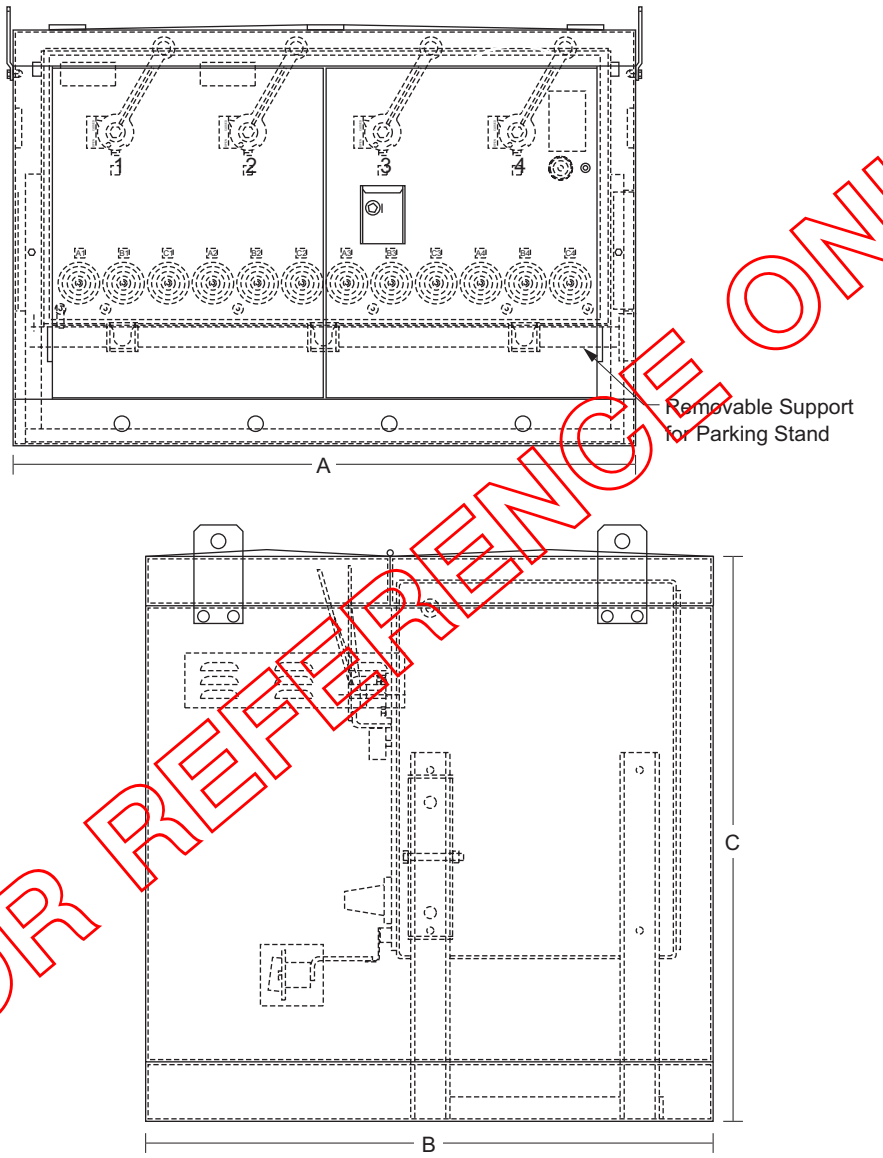
Pad-Mounted Gas Switch (with Cabinet)	Dimensions (in), Weight (lbs) and Recommended Structure					
	G&W					
	Replacement Cabinet	A	B	C	Weight (lbs)	Recommended Structure
3-Way SAP 10106470	—	67	48-1/2	46-1/2	1600	7' x8' SS 537

Note(s):

1. The switches come complete with 600A bushings and are rated at 600A continuous duty.
2. Switches are provided with a color-coded gauge to indicate correct gas pressure.
3. The switches are approved for 25 kV and 33 kV applications. The switches are to be installed on appropriate equipment slab boxes. Refer to UGS Manual, SS Section for pad and equipment slab box requirements.
4. One 200 A tap may be stacked on each 600 A cable termination. (See Figure SE 260–6.1, TP 150, and JJ 660).
5. Refer to DOM manual, Section SW-5, for inspection requirements of gas switches prior to installation.
6. 38 kV 3-way pad-mounted RAM gas switches manufactured prior to 2013 do not have provisions for remote rigging and have a cabinet dimension of 55" x 46" x 50".

Scope SE 260.3 Dimensions for Pad-Mounted SF6 Gas Type RAM Switches

Figure SE 260–2: Pad-Mounted SF6 Gas Type RAM Switches - Dimensions



FOR REFERENCE ONLY

Figure SE 260–3: 2-, 3-, and 4-Way Front Connected Pad-Mounted RAM Gas Switches

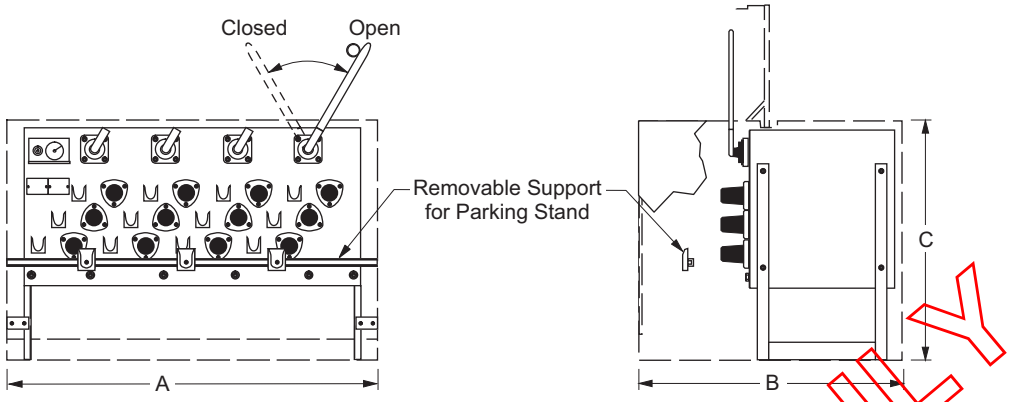


Table SE 260–3: 2- through 6-Way 17 kV Pad-Mounted RAM Gas Switch

Pad-Mounted Gas Switches (with Cabinet)	Dimensions (in)											
	Joslyn				G&W					Powell — ESCO			
	Replacement Cabinet	A	B	C	Replacement Cabinet	A	B	C	Weight (lbs)	Replacement Cabinet	A	B	C
2-Way SAP 10106404	SAP 10106419	41	46	45	SAP 10106416	40.5	46	50	890	SAP 10106439	43	48	48
3-Way SAP 10106408	SAP 10106418	58.5	46	45	SAP 10106421	55.5	46	50	1300	SAP 10106440	57.5	48	48
4-Way SAP 10106415	SAP 10106417	72	46	45	SAP 10106420	70.5	46	50	1600	SAP 10106441	72	48	48
5-Way SAP 10168071	—	—	—	—	N/A	85.5	46	50	2000	—	—	—	—
6-Way SAP 10168078	—	—	—	—	N/A	100.5	46	50	2400	—	—	—	—

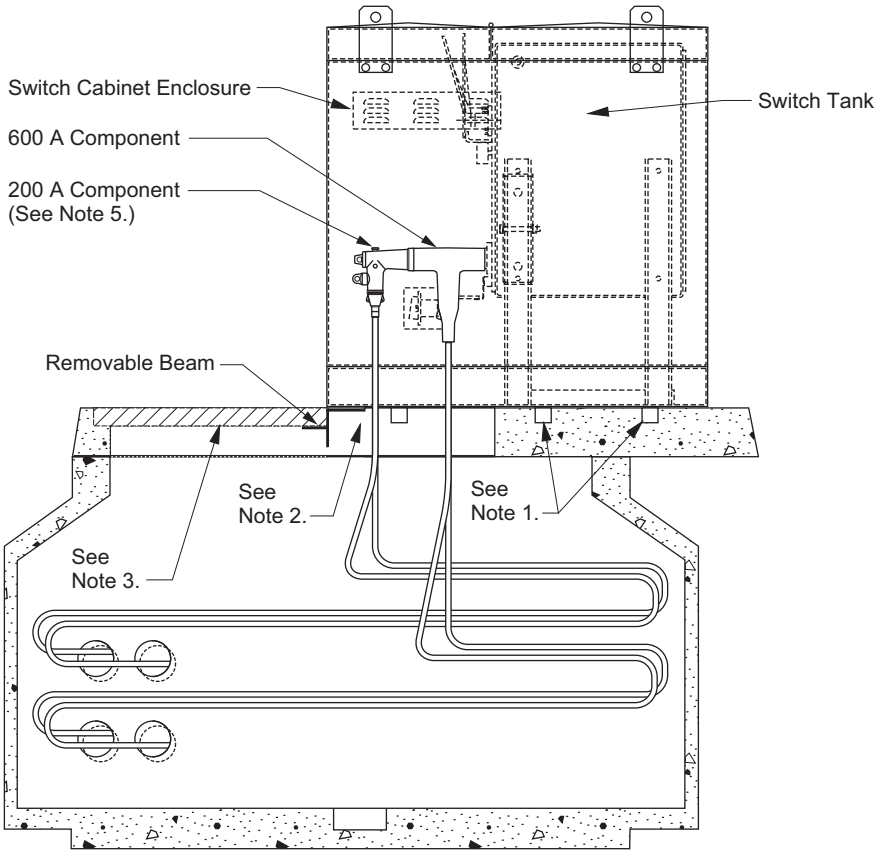
FOR REFERENCE ONLY

= For Reference Only

7. The new pad-mounted gas switches are used to provide above surface switching capabilities. They are to be used as the preferred method instead of top connected gas switches in subsurface enclosures or PME type switches where space limitations won't allow access from more than one side.
8. The switches come complete with 600A ESNA bushings and are rated at 600A continuous duty.
9. Switches are provided with a color-coded gauge to indicate correct gas pressure.
10. The switches are approved for 4, 12, and 16 kV applications. The switches are to be installed on appropriate equipment slab boxes. Refer to UGS Manual, SS Section for pad and equipment slab box requirements.
11. One 200 A tap may be stacked on each 600 A cable termination. (See Figure SE 260–5.1 [Sheet 9], TP 150, and JJ 660).
12. Refer to DOM manual, Section SW-5, for inspection requirements of gas switches prior to installation.

Scope SE 260.4 Typical Installation Procedures for 2-Way Pad-Mounted RAM Gas Switch on a 4'-6" x 7' Pad with 3' x 5' Pull Box

Figure SE 260–4: 2-Way Pad-Mounted RAM Gas Switch on a 4'-6" x 7' Pad with 3' x 5' Pull Box Preferred Cable Layout



Note(s):

1. Unistruts embedded in six locations of the pad to separately secure gas switch tank and switch cabinet.
2. Cable opening with 18" x 28" clear opening to allow stacking one 200 A tap on each 600 A component.
3. Enclosure is furnished with one 24" x 36" polymer concrete cover and a removable steel beam to provide for additional working space.
4. For new installations, 200 A load-break elbows are required. For existing 200 A dead-break elbows, replace 200 A dead-break elbows with 200 A load- break elbows during apparatus replacement due to failure, end of life, or upgrade of equipment.

Scope SE 260.5 Typical Installation Procedures for Pad-Mounted RAM Gas Switches on Slab Boxes

Figure SE 260–5: Typical Installation of 4-Way Pad-Mounted RAM Gas Switch on a Pad with 4' x 7' x 5' Pull Box Preferred Cable Layout

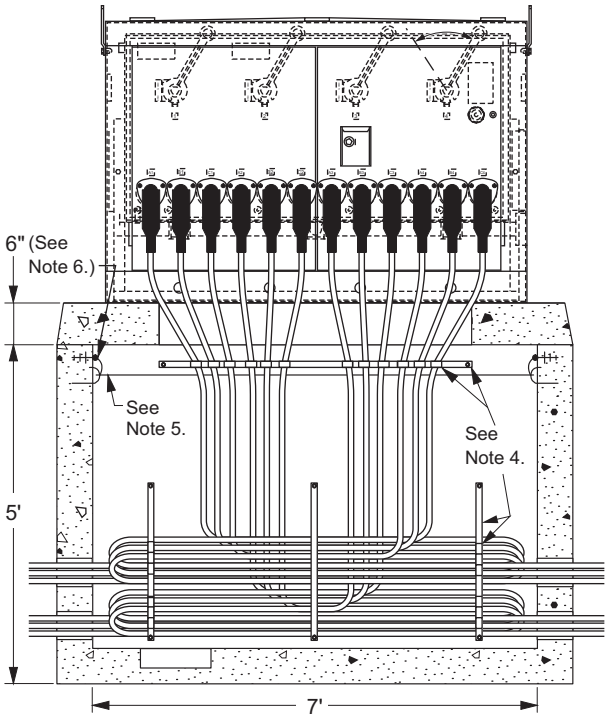


Figure SE 260–5.1

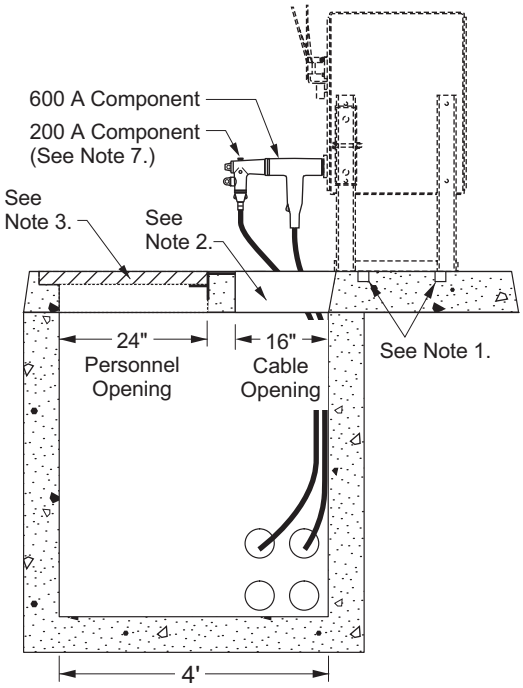


Figure SE 260–5.2

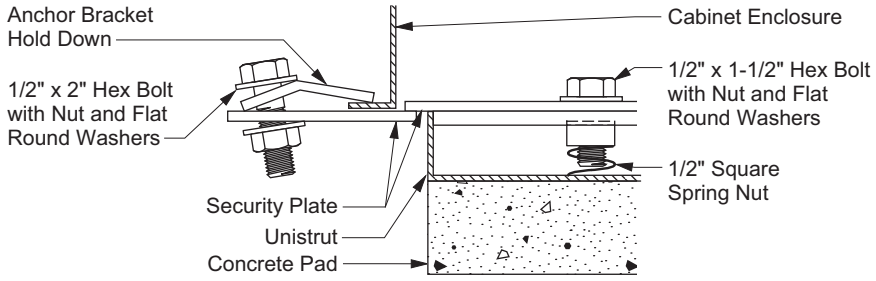
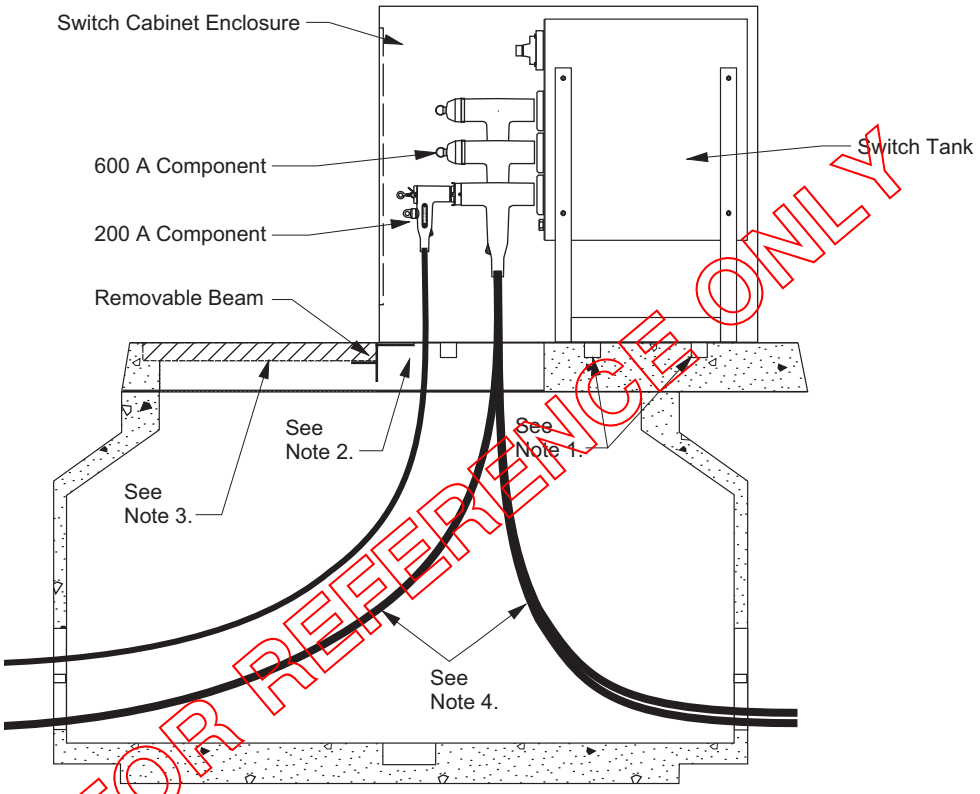


Figure SE 260–5.3: Anchor Bracket/Security Plate Detail

Note(s):

1. Unistrut embedments in six locations of the pad for separately securing gas switch tank and cabinet.
2. Cable opening with 16" x 56" clear opening to allow stacking one 200A tap on each 600A component.
3. Enclosure is furnished with two 24" x 36" polymer concrete covers, and a removable steel beam to provide a 24" x 72" personnel access.
4. Cable racks, support hooks, and tie-wraps. (See RS 110)
5. Attach 4/0 Cu neutral/ground bus to furnished 1/2-inch threaded “J” bolts at top of both ends of the enclosure.
6. Attach a bronze 1/2-inch threaded split bolt grounding connector (SAP 10111624) to the bronze grounding inserts at top of both ends of the enclosure. Connect the 4/0 Cu grounding connector with #2 str Cu.
7. For new installations, 200 A load-break elbows are required. For existing 200 A dead-break elbows, replace 200 A dead-break elbows with 200 A load- break elbows during apparatus replacement due to failure, end of life, or upgrade of equipment.

Figure SE 260–6: 2-Way SF_6 Gas Filled Pad-Mounted RAM Switch on a 4'-6" x 7' Pad with 3' x 5' Pull Box Preferred Cable Layout



FOR REFERENCE ONLY

Note(s):

1. Unistruts embedded in six locations of the pad to separately secure SF_6 switch tank and switch cabinet.
2. Cable opening with 18" x 28" clear opening to allow stacking one 200A tap on each 600A component.
3. Enclosure is furnished with one 24" x 36" polymer concrete cover and a removable steel beam to provide for additional working space.
4. When using the 2-way SF_6 switch, the primary cable should be limited to two runs of 350 kcmil and one run of 1/0 kcmil or smaller.

Figure SE 260–7: Typical Installation of 4-Way SF6 Gas Filled Pad-Mounted RAM Switch on a 4'-6" x 7' Pad with 3' x 5' Pull Box Preferred Cable Layout

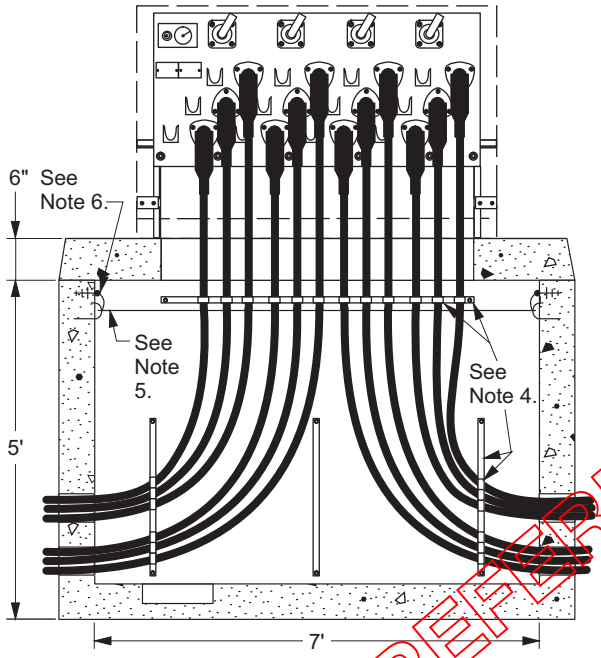


Figure SE 260–7.1

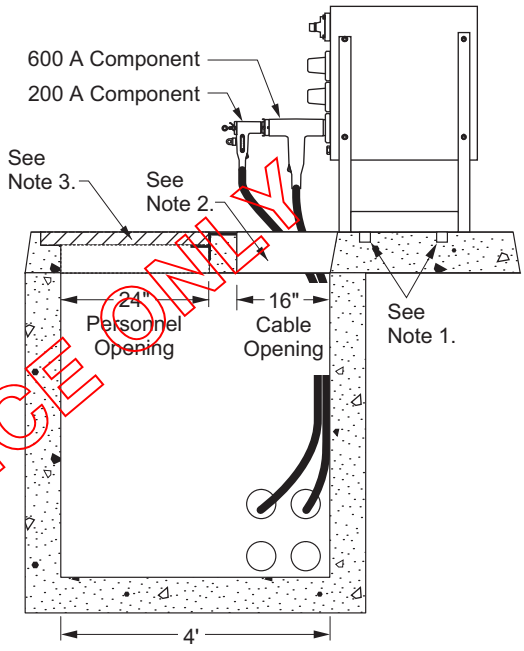


Figure SE 260–7.2

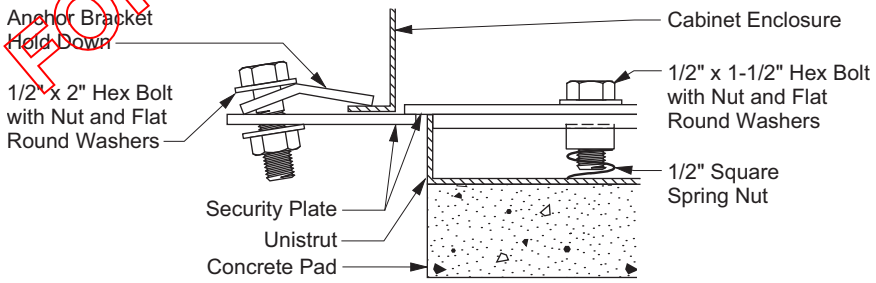


Figure SE 260–7.3: Anchor Bracket/Security Plate Detail

FOR REFERENCE ONLY

Note(s):

1. Unistrut embedments in six locations of the pad for separately securing SF_6 switch tank and cabinet.
2. Cable opening with 16" x 56" clear opening to allow stacking one 200A tap on each 600A component.
3. Enclosure is furnished with two 24" x 36" polymer concrete covers, and a removable steel beam to provide a 24" x 72" personnel access.
4. Cable racks, support hooks, and tie-wraps. (See RS 110)
5. Attach 4/0 Cu neutral/ground bus to furnished 1/2-inch threaded “J” bolts at top of both ends of the enclosure.
6. Attach a bronze 1/2-inch threaded split bolt grounding connector (SAP 10111624) to the bronze grounding inserts at top of both ends of the enclosure. Connect the 4/0 Cu grounding connector with #2 str Cu.

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SE 261 Pad-Mounted RAG Gas Switch — 600 A

Scope SE 261.1 Typical Installation Procedures for Pad-Mounted S&C and G&W RAG Gas Switch

1.0 General

This standard outlines the minimum installation requirements for the placement of Pad-Mounted S&C and G&W RAG Gas Switches on Equipment Slab Boxes.

NOTE: The switch cabinet enclosure can be installed separately from the switch tank. It is essential that the installation procedures be followed to provide for the operation and maintenance of the switch, and cable terminations.

2.0 7' X 8' Equipment Slab Box, For G&W Pad-Mounted RAG Gas 2-Way, 3-Way, or 4-Way Switches with Internal Ground Positions (Refer to Table SE 261-1, Table SE 261-2 and UGS SS 537)

2.1 For Installation of G&W Pad-Mounted SF6 Gas 2-Way, 3-Way, or 4-Way RAG Switches, on existing 7’ x 8’ equipment slab box only. Refer to Table SE 261-1 and Table SE 261-2 for further details.

When mounting the gas switch, align the face of the switch tank to the tapered back edge of the cable opening. Center the switch tank to coincide with the center of the cable opening to allow enough clearance to shape and terminate cable. The switch tank legs should line up over the four rear unistrut embedments. Secure the switch tank to the unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). The switch cabinet enclosure may be removed to aid with installation of cable and components. Complete all the necessary cable shaping, make up, and terminations. Secure the switch cabinet enclosure to the four unistruts with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP10117403).

Attach a 4/0 bare copper neutral/ground bus to the furnished 1/2-inch threaded “J” bolts at the top of both ends of the structure or enclosure. Install the bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of the structure. Interconnect the neutral/ground bus to the split bolt connector with #2 str copper wire at both end locations.

Attach all cable concentric wires to the 4/0 copper bus. Ground the switch tank to the 4/0 copper neutral/ground bus with 2-4/0 str copper. Ground the cabinet enclosure to the switch tank by attaching #2 str copper wire from ground lug on the switch face to ground lug on inside front of cabinet enclosure. See GR 100 for additional grounding requirements.

3.0 8' X 10' Equipment Slab Box, For Pad-Mounted RAG Gas 2- and 3- and 4-Way Switches (Refer to Table SE 261-1, Table SE 261-2 and UGS SS 538)

3.1 When mounting the RAG gas switch, align the face of the switch tank to the tapered back edge of the cable opening. Center the switch tank to coincide with the center of the cable opening to allow enough clearance to shape and terminate cable. The switch tank legs should line up over the four rear unistrut embedments. Secure the switch tank to the unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). The switch cabinet enclosure may be removed to aid with installation of cable and components. Complete all the necessary cable shaping, make up, and terminations. Secure the switch cabinet enclosure to the four unistruts with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP 10117403).

Attach a 4/0 bare copper neutral/ground bus to the furnished 1/2-inch threaded “J” bolts at the top of both ends of the structure or enclosure. Install the bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of the structure. Interconnect the neutral/ground bus to the split bolt connector with #2 str copper wire at both end locations.

Attach all cable concentric wires to the 4/0 copper bus. Ground the switch tank to the 4/0 copper neutral/ground bus with 2-4/0 str copper. Ground the cabinet enclosure to the switch tank by attaching #2 str copper wire from ground lug on the switch face to ground lug on inside front of cabinet enclosure. See GR 100 for additional grounding requirements.

When using the 2- or 3-Way RAG gas switch with Ground, steel security plates (SAP 10117406, Figure SE 261-5) must be installed over each end of the cable opening prior to installing the switch cabinet enclosure.

4.0 10' X 12' Equipment Slab Box For Pad-Mounted RAG Gas 5-Way and 6-Way Switches With Internal Ground Positions (Refer to Table SE 261-1, Table SE 261-2 and UGS SS 539)

4.1 When mounting the RAG gas switch, align the face of the switch tank to the tapered back edge of the cable opening. Center the switch tank to the center of the cable opening to allow enough clearance to shape and terminate cable. The switch tank legs should line up over the four rear unistrut embedments. Secure the switch tank to the unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). The switch cabinet enclosure may be removed to aid with installation of cable and components. Complete all the necessary cable shaping, make up, and terminations. Secure the switch cabinet enclosure to the four front unistruts with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP 10117403).

Attach a 4/0 bare copper neutral/ground bus to the furnished 1/2-inch threaded “J” bolts at the top of both ends of the structure or enclosure. Install the bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of the structure. Interconnect the neutral/ground bus to the split bolt connector with #2 str copper wire at both end locations.

Attach all cable concentric wires to the 4/0 copper bus. Ground the switch tank to the 4/0 copper neutral/ground bus with 2-4/0 str copper. Ground the cabinet enclosure to the switch tank by attaching #2 str copper wire from ground lug on the switch face to ground lug on inside front of cabinet enclosure. See GR 100 for additional grounding requirements.

When using a S&C 5-Way Pad-Mounted RAG Gas Switch with Integral Ground, steel security plates (SAP 10117405 or 10117406, see Figure SE 261-5, must be installed over each end of the cable openings prior to installing the switch cabinet enclosure.

5.0 7' x 14' x 11' Tub-Style Structure with Modified Top Type I for 4-, 5-, and 6- Way Pad- Mounted RAG Gas Switches (Refer to UGS SS 541.1)

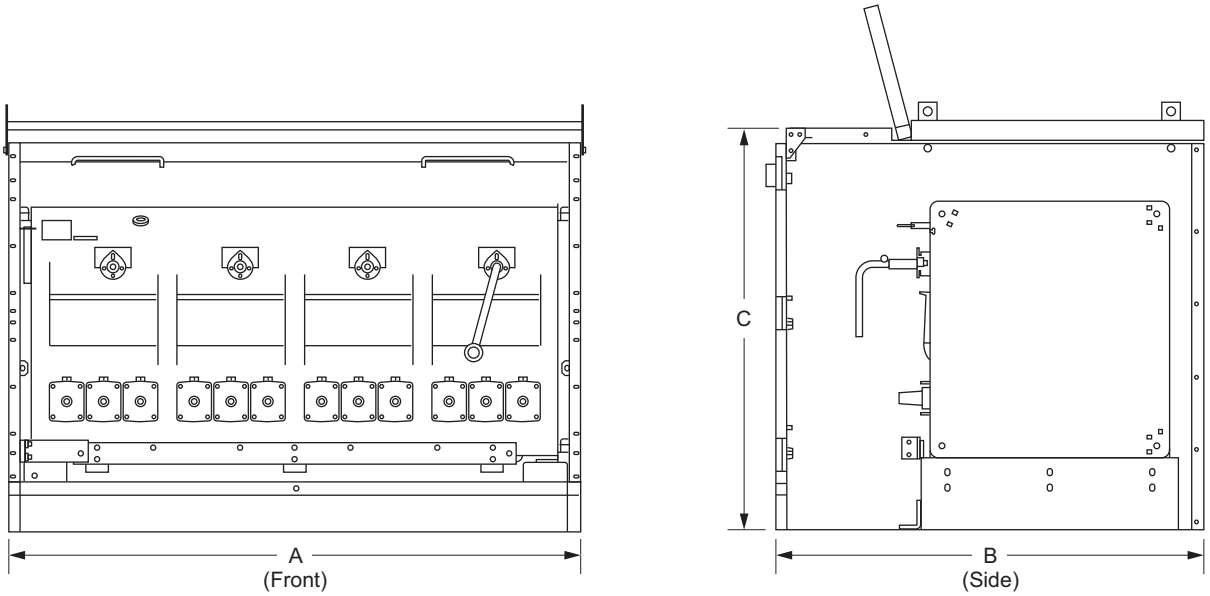
5.1 When mounting the 4-, 5-, or 6-Way Pad-Mounted RAG Gas Switch, align the face of the switch tank to the tapered back edge of the cable opening. Center the switch tank to the center of the cable opening to allow enough clearance to shape and terminate cable. The switch tank legs should line up over the four rear unistrut embedments. Secure the switch tank to the unistruts with four 2" x 5" galvanized anchor brackets (SAP 10117402). The switch cabinet enclosure may be removed to aid with installation of cable and components. Complete all the necessary cable shaping, make up, and terminations. Secure the switch cabinet enclosure to the four front unistruts with four 1-1/2" x 2-5/8" galvanized anchor brackets (SAP 10117403).

Attach a 4/0 bare copper neutral/ground bus to the furnished 1/2-inch threaded “J” bolts at the top of both ends of the structure or enclosure. Install the bronze split bolt connector (SAP 10111624) into the cast-in 1/2-inch threaded grounding insert at both ends of the structure. Interconnect the neutral/ground bus to the split bolt connector with #2 str copper wire at both end locations.

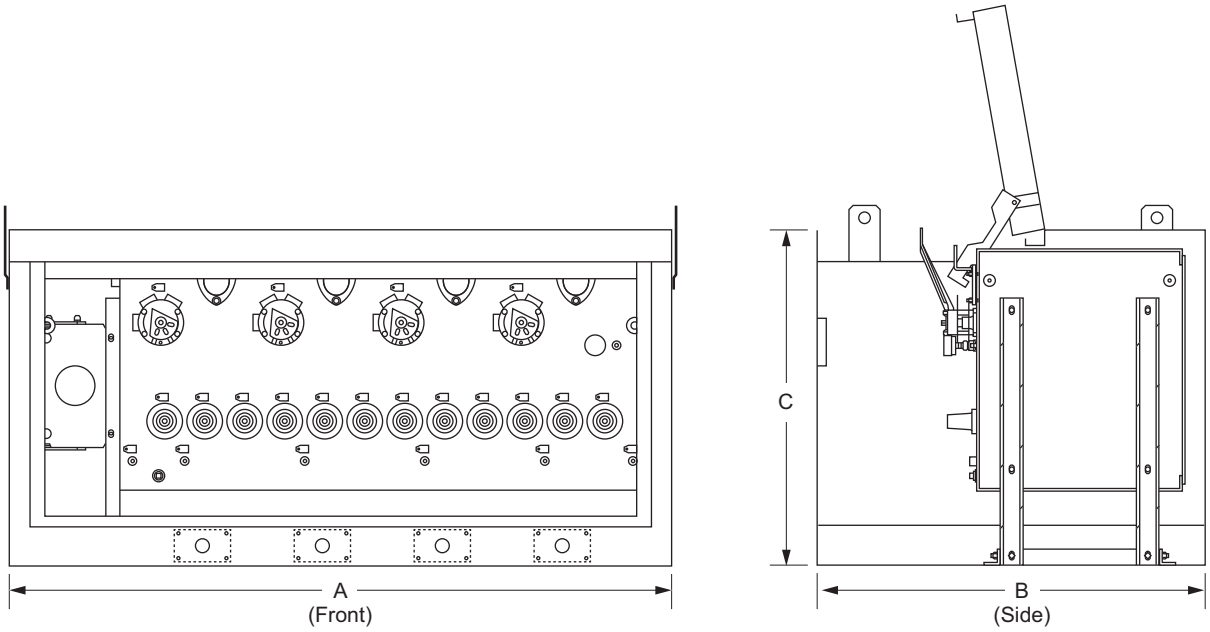
Attach all cable concentric wires to the 4/0 copper bus. Ground the switch tank to the 4/0 copper neutral/ground bus with 2-4/0 str copper. Ground the cabinet enclosure to the switch tank by attaching #2 str copper wire from ground lug on the switch face to ground lug on inside front of cabinet enclosure. See GR 100 for additional grounding requirements.

Scope SE 261.2 Switch Dimensions for 2-, 3-, 4-, 5-, and 6-Way Pad-Mounted S&C and G&W RAG Gas Switch

Figure SE 261–1: S&C and G&W Pad-Mounted 4-Way RAG Gas Switches (Front and Side View)



S&C 4-Way Pad-Mounted RAG Gas Switch (Front and Side View)



G&W 4-Way Pad-Mounted RAG Gas Switch (Front and Side View)

Table SE 261–1: 2- through 6-Way 17 kV Pad-Mounted RAG Gas Switch — Dimensions

Pad-Mounted Gas Switch (with cabinet)	Dimensions (in) and Weight (lbs)										Recommended Structure[a/]	Retrofit Structure (G&W Only)
	S&C					G&W						
	Replacement Cabinet	A	B	C	Weight (lbs)	Replacement Cabinet	A	B	C	Weight (lbs)		
2-Way SAP 10181718[b/]	—	69	58	55	825	—	53	49	42	1300	8' x 10' (SS 538)	7'x8' (SS 537)
3-Way SAP 10181709	—	69	58	55	1100	—	68	49	42	1600	8' x 10' (SS 538)	7'x8' (SS 537)
4-Way SAP 10200145	—	79	58	55	1350	—	83	49	42	1900	8' x 10' (SS 538)	7'x8' (SS 537)
5-Way SAP 10181712	—	84	58	55	1650	—	98	49	42	2200	10' x 12' (SS 539)	—
6-Way SAP 10181721	—	100	58	55	1900	—	113	49	42	2550	10' x 12' (SS 539)	—

[a/] Structure recommended for new installations; see retrofit structure column (Table SE 261-1) for switch compatibility when using existing structure

[b/] 2-Way submersible RAG switches manufactured prior to 2014 are equipped with switching provisions on position 1 only. Refer to DOM SW-5 2-Way RAG switch schematic drawings for additional details.

Note(s):

1. The Pad-mounted gas switches provide above surface switching and grounding capabilities. They are to be used as the preferred method instead of top connected gas switches in subsurface enclosures or PME type switches where space limitations won't allow access from more than one side.
2. Refer to DOM manual Section SW-5, for inspection requirements of gas switches prior to installation.

Table SE 261–2: 2- through 6-Way 38 kV Pad-Mounted RAG Gas Switch — Dimensions

Pad-Mounted Gas Switch (with cabinet)	Dimensions (in) and Weight (lbs)					Recommended Structure[a/]	Retrofit Structure
	G&W						
	Replacement Cabinet	A	B	C	Weight (lbs)		
2-Way SAP 10200284	—	53	49	42	1300	8' x 10' (SS 538)	7'x8' (SS 537)
3-Way SAP 10183661	—	68	49	42	1600	8' x 10' (SS 538)	7'x8' (SS 537)
4-Way SAP 10183662	—	83	49	42	1900	8' x 10' (SS 538)	7'x8' (SS 537)
5-Way SAP 10200017	—	98	49	42	2300	10' x 12' (SS 539)	—
6-Way SAP 10200015	—	113	49	42	2750	10' x 12' (SS 539)	—

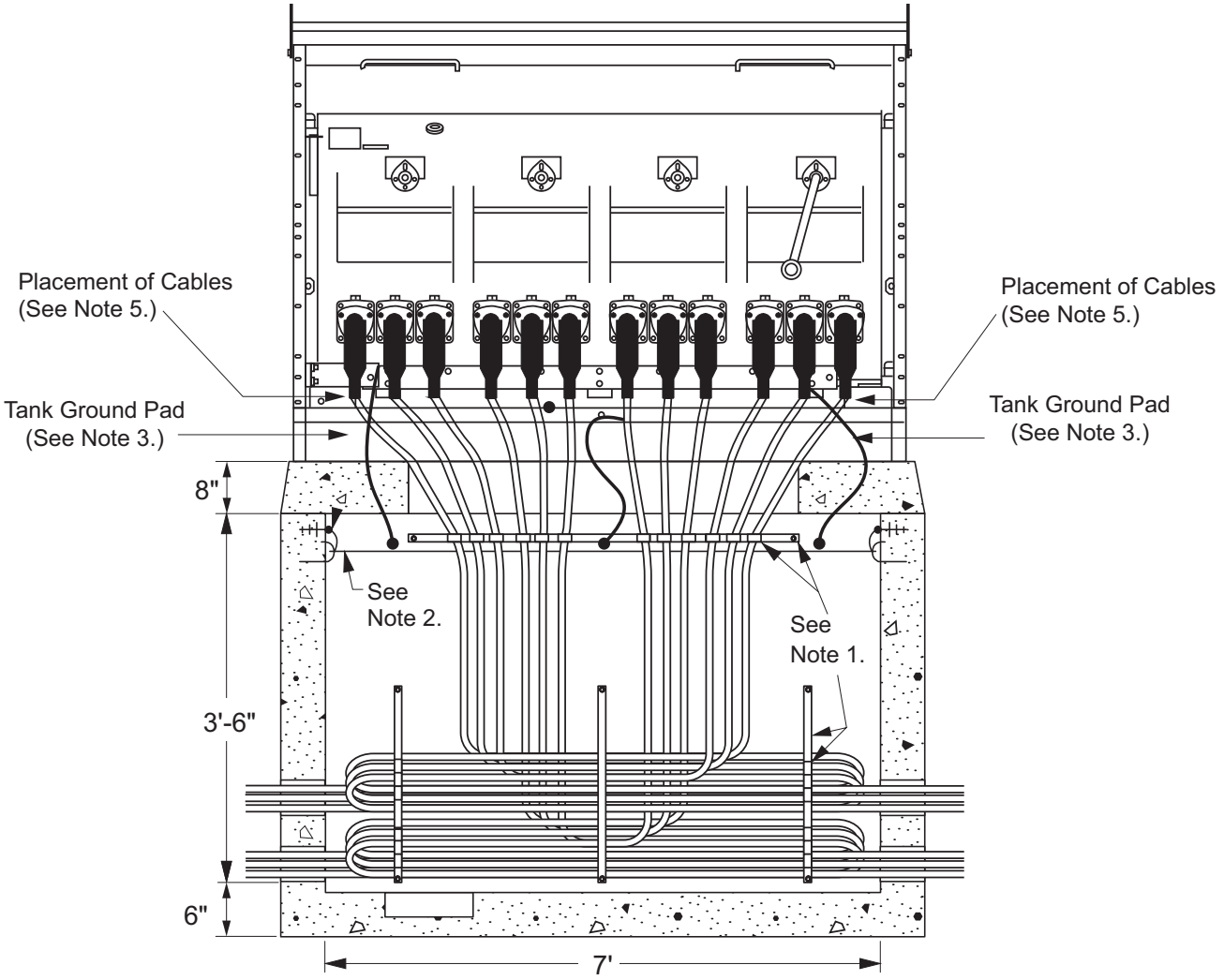
[a/] Structure recommended for new installations; see retrofit structure column (Table SE 261-1) for switch compatibility when using existing structure.

Note(s):

1. The Pad-Mounted gas switches provide above surface switching and grounding capabilities. They are to be used as the preferred method instead of top connected gas switches in subsurface enclosures or PME type switches where space limitations won't allow access from more than one side.
2. Refer to DOM manual section SW-5, for inspection requirements of gas switches prior to installation.
3. Switches are approved for 25 kV and 33 kV pad-mount installation applications.

Scope SE 261.3 Installation detail for Pad-Mounted RAG Gas Switches on Slab Boxes

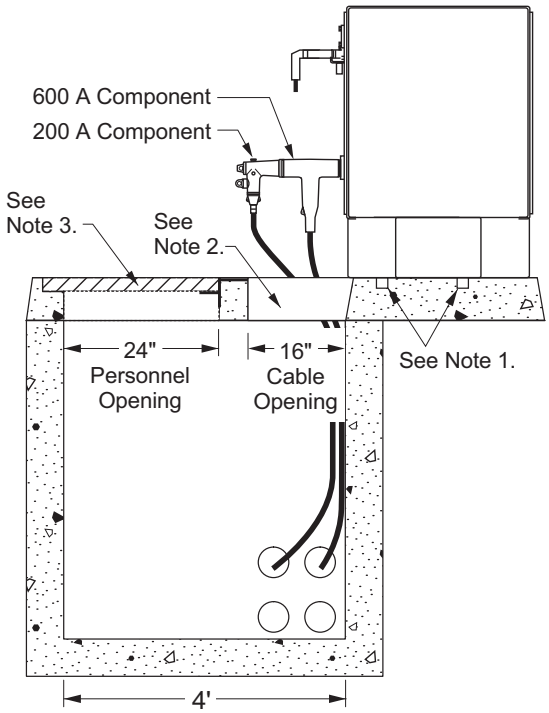
Figure SE 261–2: 4-Way Pad-Mounted RAG SF6 Gas Switch on a 8' x 10' Pad with 4' x 7' x 3'-6" Pull Box Preferred Cable Layout, Front View (S&C Unit)



Note(s):

1. Cable racks, support hooks, and tie-wraps. (See RS 110)
2. Attach 4/0 Cu neutral/ground bus to furnished 1/2-inch threaded “J” bolts at top of both ends of the enclosure.
3. Ground the switch tank to the 4/0 copper neutral/ground bus with 4/0 str copper terminated to switch tank using the Tank ground pad.
4. Whenever possible, the switch cabinet enclosure shall be secured to the concrete structure.
5. When possible, smaller cables shall be installed on the outside positions and larger cables shall be mounted on the inner positions.

Figure SE 261–3: 4-Way Pad-Mounted RAG SF6 Gas Switch on a 8' x 10' Pad" with 4 x 7' x 3'-6" Pull Box Preferred Cable Layout (Side View)



Note(s):

1. Unistrut embedments in six locations of the pad for separately securing gas switch tank and cabinet.
2. Cable opening with 16" x 56" clear opening to allow stacking one 200A tap on each 600A component. (See Figure SE 261-3, TP 134, TP 136, TP 150, and JJ 660).
3. Enclosure is furnished with two 24" x 36" polymer concrete covers, and a removable steel beam to provide a 24" x 72" personnel access.
4. The switches come complete with 600A apparatus bushings and are rated at 600A continuous duty.
5. Refer to DDS-6 for maximum number of cable runs for 2-,3-,4-,5-, and 6-Way Pad-Mounted Gas Switches.
6. Switches are provided with a color-coded gauge to indicate correct gas pressure.

Figure SE 261–4: Anchor Bracket/Cabinet Mounting

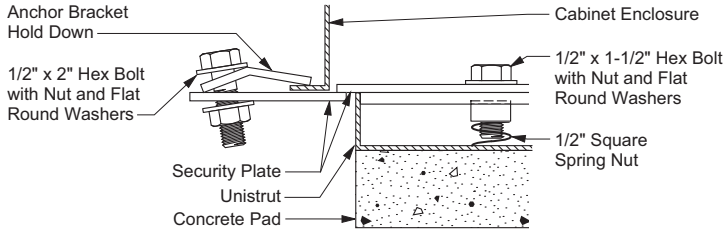
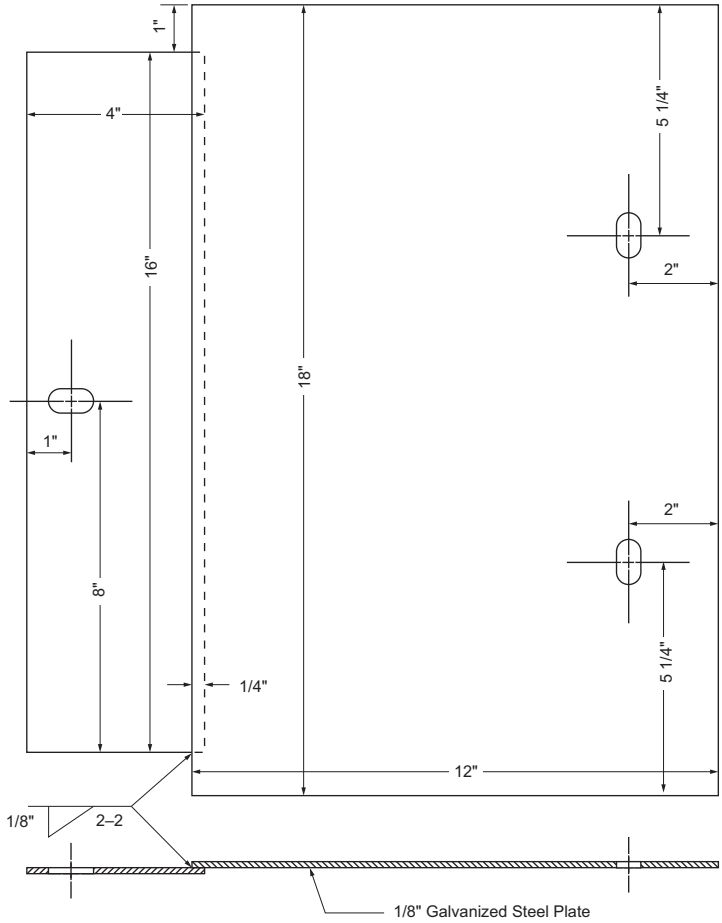
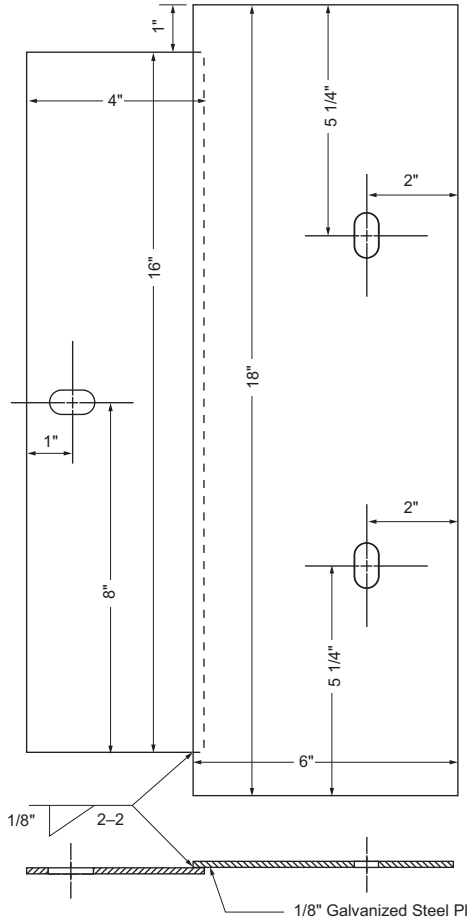


Figure SE 261–5: Steel Security Plates



12" x 18" x 1/8" Steel Security Plate (SAP 10117406).
Refer to SE 261 Sections 2, 3 and 4.



6" x 18" x 1/8" Steel Security Plate (SAP 10117405).
Refer to SE 261 Sections 2, 3 and 4.

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SE 270 Automated PME Switches

Scope SE 270.1 Installation Procedures for Automated PME Switches

1.0 General Information

PME dead front elbow connected pad-mounted switchgear are rated for 14.4 kV Nominal, 17 kV maximum, and 95 kV Breakdown Insulation Level voltages. The current rating for PME switch operators is 600A. Special distinguishing features for the PME switch operators include 600A Cyproxy bushings, termination compartment ground rods, and the auxiliary low voltage and switch operator compartments. The auxiliary low voltage compartment (LVC) contains an RTU, a Metricom radio, a radome type antenna, and optional provisions for external 120 VAC source. The LVC will also contain the Schweitzer relay and fault indicator (mounted at the viewing window in the LVC door). When ordering the PME-10 and PME-11 where only one switch compartment is automated with a switch operator (SO), be advised that unless otherwise specified, the SO is mounted to Compartment 2 as a default. Special lifting tabs have been designed into the PME cabinet to assist in shipping and handling of the cabinet. Additional distinguishing features of the PME operator include a special penta-latch door latching system with accommodation for a 3/8 inch shackle, fiberglass reinforced polyester barriers, nameplate and warning signs, and a special window for providing a visual check of switch blade position.

Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

2.0 Installation

Site Preparation

2.1 In accordance with the TDBU Underground Structures (UGS) manual, pre-installation setup should include proper site preparation. A suitable modification should be made to the underground conductor which allows for proper termination of three-phase conductors in the PME cabinet. General site modification will include ground excavation, underground conduit conversion to 90 degree elbow sweeps and back-fill plus earth compaction.

2.2 Foundation platform installation, re-grouting and cosmetic landscape repair shall complete the site preparation. Minimum perimeter clearances for safe work area requirements around the PME enclosure are 8 foot and 3 foot offsets from the long and short sides of the enclosure respectively. The concrete foundation shall be leveled so that the total slope rise or fall as measured across the platform diagonals does not exceed 1/8 inch. Poured-in-place concrete foundations shall not have local surface level variations greater than ±1/8 inch. An uneven surface can impart stress to the PME cabinet which can cause binding in moving parts such as enclosure doors. Note that a special optional installation may require that a third conduit stub be added to the standard Source and Load stubs for 120 VAC external accessory supply.

Mechanical Installation

2.3 At the installation site, the PME should be inspected for any signs of damage. Perform an external inspection of the cabinet noting any serious scratches or dents. Using the Penta-Latch socket wrench, open the four cabinet doors and perform an inspection of the interior of the cabinet compartments. Penta-Latch operated doors can be opened by rotating the penta head actuator approximately 60 degrees counter clockwise until a distinctive click is heard. Once the door is free to open, it should

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be secured in place using the built in prop-rods to ensure worker safety and prevent damage to equipment. Compartments to be inspected are the Fuse Termination Compartment or Load Side Compartment-1 in a PME-3, and the Switch Termination Compartment or Source Side Compartment-2 for a PME-3, the low voltage compartment, and the Type PM Switch Operator compartment.

2.4 For an Automated PME containing the fault indication option, three (3) uninstalled current sensors and their respective wiring harness should be located inside one of the compartments. These will be later installed into Compartment-2 around the primary Source conductor.

2.5 A PME-3 unit weighs approximately 1,370 pounds. PME-9, PME-10, and PME-11 units weigh approximately 2,500 pounds. Four foot or longer hoist slings of equal lengths should be used to hoist the PME cabinet. Hoist slings shorter than this length may over-stress the cabinet. Prior to attaching the hoist slings, an inspection of the lifting tabs should be made to ensure that they are firmly bolted to the PME cabinet enclosure. The hoist slings should be arranged so as to distribute the lifting forces equally between the lifting tabs. Sudden starts and stops should be avoided. For the PME-3, the cabinet should be placed on the UGS platform with Compartment-2 situated over the Source side primary stub-out. It is important that Compartment-2 be the Source side dead end as, once primaries are connected to the installed PME, typical installations will have accessories and battery chargers powered off of a voltage sensor capacitive coupler which is connected to the Compartment-2 side bus of the PME cabinet.

2.6 After centering the PME on the concrete platform, tighten the four 4-5/8-inch Edison supplied anchor bolts against the S&C supplied anchor bracket thereby compressing the enclosure foundation tabs between the anchor bracket and the S&C supplied resilient closed-cell platform gasket.

2.7 In the event that the gasket cannot compensate for an uneven concrete foundation, apply grout to the concrete platform as required to level the surface properly. Any grout which is applied should be recessed enough to allow for caulking.

Electrical Installation

2.8 Apply all applicable grounding procedures and safe work practices when terminating cables.

NOTE Steps 2.9 through 2.12 are for an Automated PME with fault indication option.

2.9 Remove the current sensors, wiring harness, and hardware from the box titled, S&C Current Sensors. Connect the current sensors to the wiring harness in accordance with the included instruction set in the box and the S&C wiring schematic.

2.10 After conductor cables (IC 112) have been cut to length, install one 600:5 current sensor on each of the Compartment-1 Load primary conductors by slipping the current sensors over the ends of the primary conductors. Note that each current sensor has a unique magnitude ratio and phase angle shift. Both of these values must be recorded on a S&C provided yellow card along with the compartment number and phase on which the sensors have been installed. The yellow card can be found in the S&C Installation and Operation Information Kit.

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2.11 All three of the current sensors must be installed around the high-voltage cable with the polarity marks in the up position where the magnitude ratio and phase angles are visible.

2.12 Secure the current sensors to the high-voltage conductor using the provided plastic wire ties. Note that the current sensor can be mounted above or below the point on the primary wire where the concentric ground wires are bent back from the rubber primary wire insulation. In the case where it is mounted below this point, the concentric ground wires and the terminator drain wire must be brought back through the current sensor. In the case where it is mounted above the bend back point, neither the concentric ground wires nor the terminator drain wire must be brought through the current sensor. The terminator wire is a single strand of the concentric neutral wire bundle that is connected to a fastening hole on the rubber elbow.

2.13 As an alternative, the current sensors can be installed on the primary conductors after the primary conductors have been terminated with elbow connectors. To implement this alternative method, remove the 1/4 inch, #20 gap nut on each of the current sensors and, by carefully stretching the current sensors access gap open, install the current sensors around the appropriate high-voltage cable. Caution should be taken to ensure that the pairing matches the assignments made on the yellow card. Replace and tighten the gap nuts on the three current sensors.

2.14 Terminate the primary conductors with the proper 600 A pre-molded rubber elbow connectors, see JJ 660.

2.15 Terminate the cables with the elbows per the elbow manufacturers instructions and in accordance with Edison Distribution Construction Standards.

2.16 Connect the primary conductors concentric-neutral ground wires to the structure 4/0 ground/neutral bus rather than to the copper ground bars in the PME. Ensure that enough slack is left in the concentric-neutral wires to allow for movement of the primary-conductor cables from the bushings to the parking stands.

2.17 Connect each copper ground bus in the ground pads inside the PME to the structure 4/0 ground/neutral bus with 4/0 str copper wire. The PME grounding bars may be used for personal grounds.

NOTE

For an Automated PME with the fault indication option, the system consists of three 600:5 C.T.s, a fault relay, and target flag indicator visible through Low Voltage Compartment door. When the C.T.s sense over 1,000 A current the fault relay turns the target flag from white to red and prompts the PME control to alarm the DCMS system. The red target flag will reset to white in 2 to 4 hours after three phase of greater than 10 A returns. Specify F1 if target window is not desired and F2 if target window is desired when ordering this accessory.

Completion

2.18 Ensure that the enclosure doors open and close without any binding.

2.19 Inspect the PME cabinet for level and adjust cabinet shimming as required.

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2.20 Apply a caulk to the entire external perimeter of the PME cabinet. Manufacturer recommendation is a room temperature vulcanizing (RTV) silicone rubber compound. Inside the compartments of the enclosure, apply a suitable sealing compound (such as Semkit or IPlug Kit) to fill the space between the conduit and the electrical cables to seal the PME against moisture, rodent, and insect intrusion.

2.21 All unused conduits should be capped or plugged with a suitable sealing compound (including 120 VAC external source conduit if not used).

2.22 Remove the lifting tabs and bolts to allow for plugging of the blind-tapped holes.

2.23 Check the interior of each of the PME compartments for foreign materials and tools then sweep the interior compartments clear of garbage and debris. Wipe the interior of the compartments clean with a clean damp cloth.

2.24 To ensure enclosure integrity, refinish any scratches or abrasions with S&C red-oxide primer (Catalog Number 9999-061) and touch up finish (Catalog Number 9999-058 Olive Green and Catalog Number 9999-080 light gray finish). Properly prepare the surface before painting by cleaning to remove any oil or grease then sanding to feather finish.

2.25 When preparing to energize the PME, communicate to the local switching center the status and intentions. If required, set up the switch position as desired using the manual handle crank in the SO control cabinet. With the coupling mechanism engaged, insert the manual handle crank and apply torque in the indicated direction until a snap-over occurs. Ensure that the switch position indicator in the SO control enclosure now indicates proper switch orientation. Restore the manual handle crank to its storage hangers. Place the controls in LOCAL and NON-AUTO. Energize the PME.

End Point Test

2.26 Implement DAP.EPT.001 or DAP.EPT.011 to verify local and remote operational and control features on the installation.

FOR REFERENCE ONLY

Figure SE 270–1: Installation Procedures for Automated PME Switches

Figure SE 270–1.1: Low Voltage Compartment (LVC)

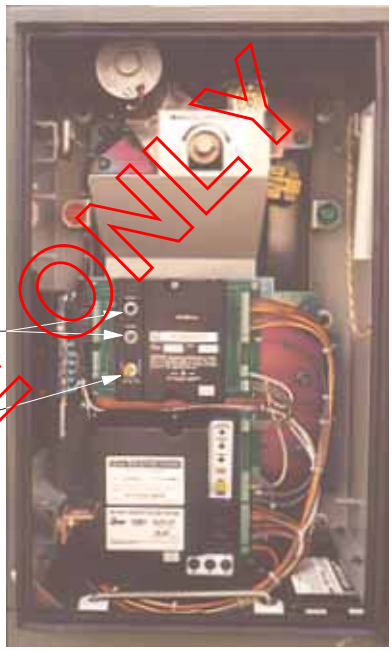

Figure SE 270–1.2: Switch Operator (SO)

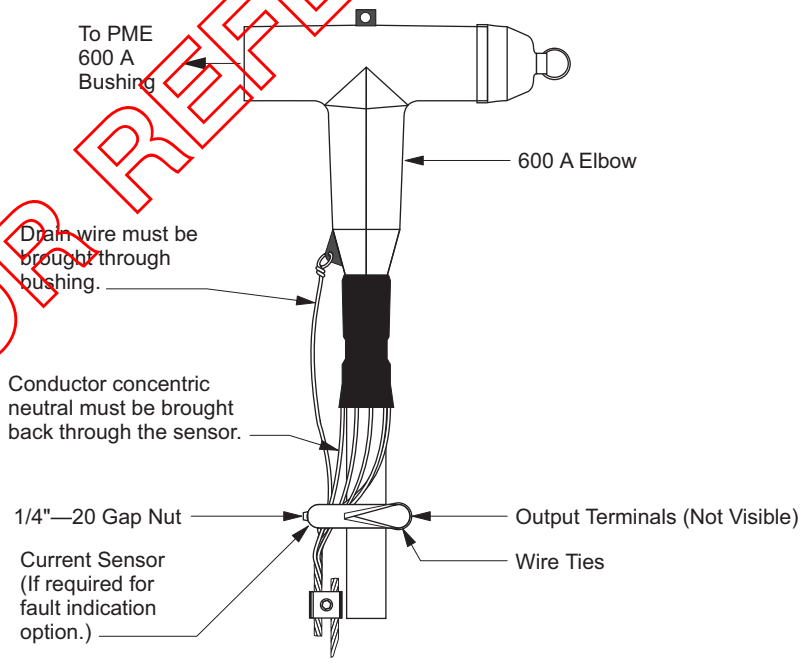

Figure SE 270–1.3: Concentric Neutral and Terminator Drain Wire Configuration (Sensor placed around cable's grounded concentric neutral)

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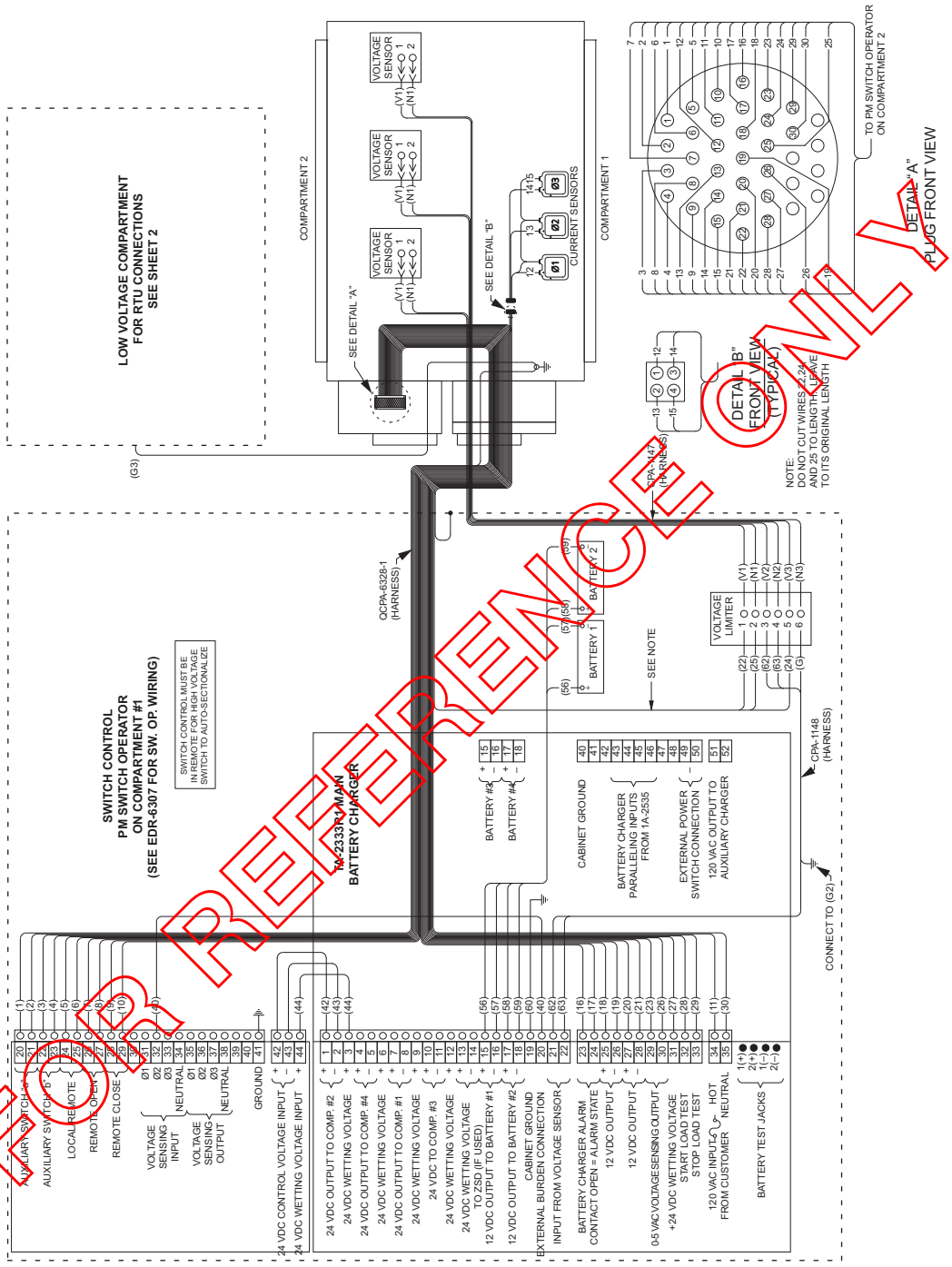
Scope SE 270.2 Interconnection Wiring Diagram S&C Remote Supervisory Pad-Mounted Gear with One (1) PM Switch Operator, Option Y4

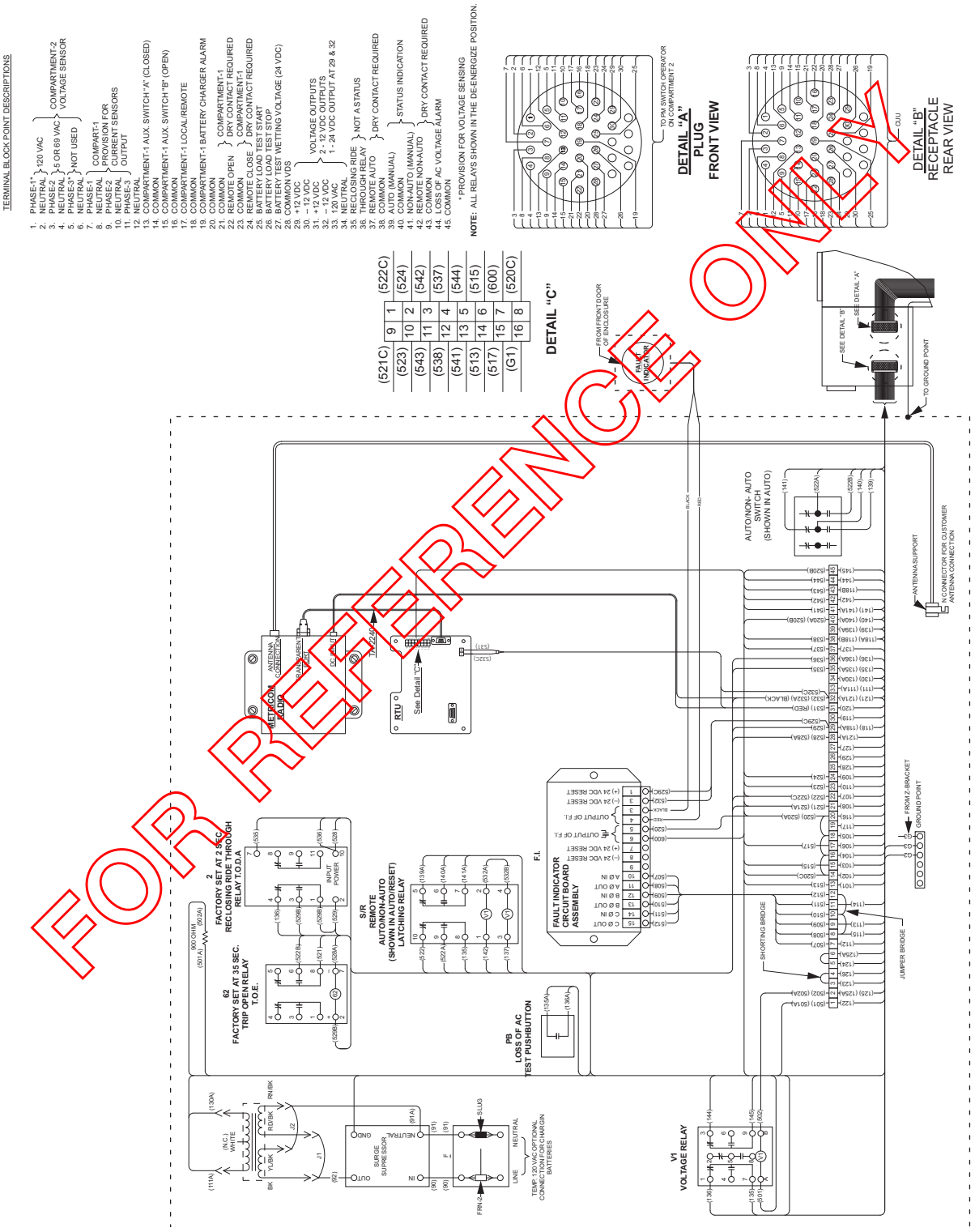
Figure SE 270–2: Interconnection Wiring Diagram S&C Remote Supervisory Pad-Mounted Gear with One (1) PM Switch Operator, Option Y4



Note(s):

1. Full size wiring diagram located within switch operator instruction manual on inside of cabinet door.

Figure SE 270–3: Interconnection Wiring Diagram S&C Remote Supervisory Pad-Mounted Gear with One (1) PM Switch Operator, Option Y4



FOR REFERENCE ONLY

Note(s):

1. Full size wiring diagram located within switch operator instruction manual on inside of cabinet door.

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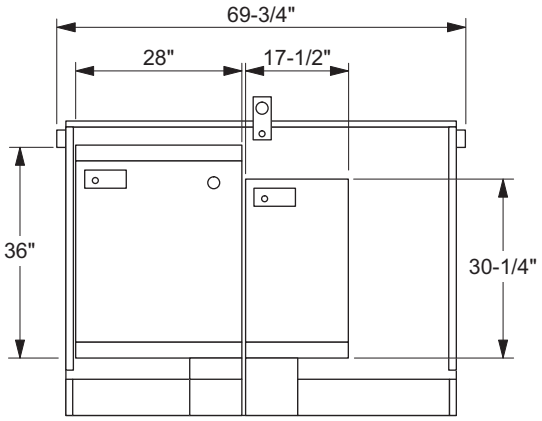
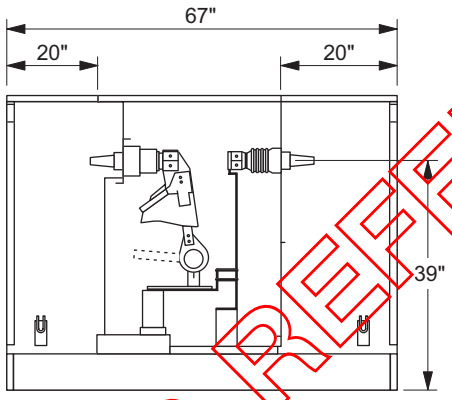
Scope SE 270.3 **S&C Pad-Mounted Gear Remote Supervisory Model PME-3 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL**

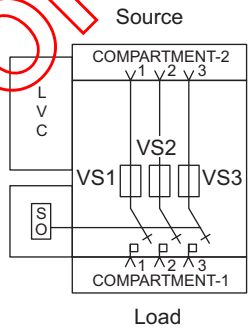
Figure SE 270–4: S&C Pad-Mounted Gear-Model Remote Supervisory Model PME-3 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL



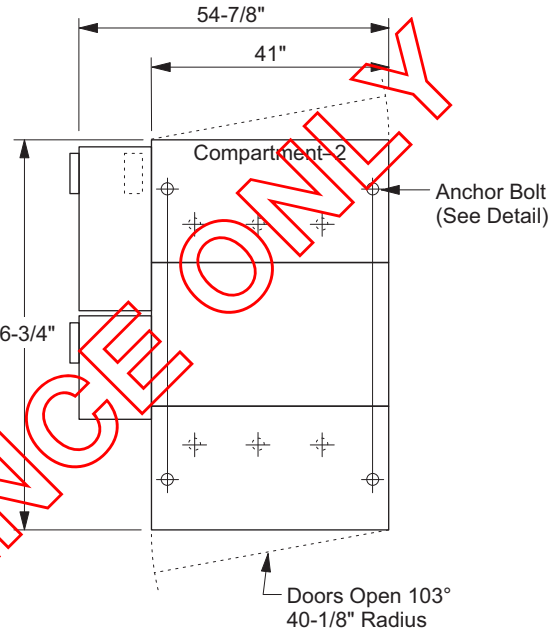
L.H. Side View



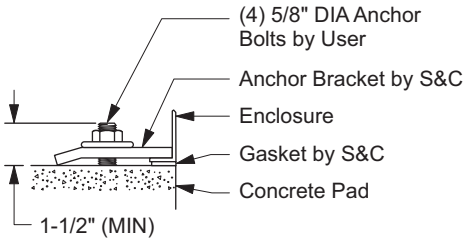
PME-3 Cross Section



Connection Diagram



Anchor Bolt Plan



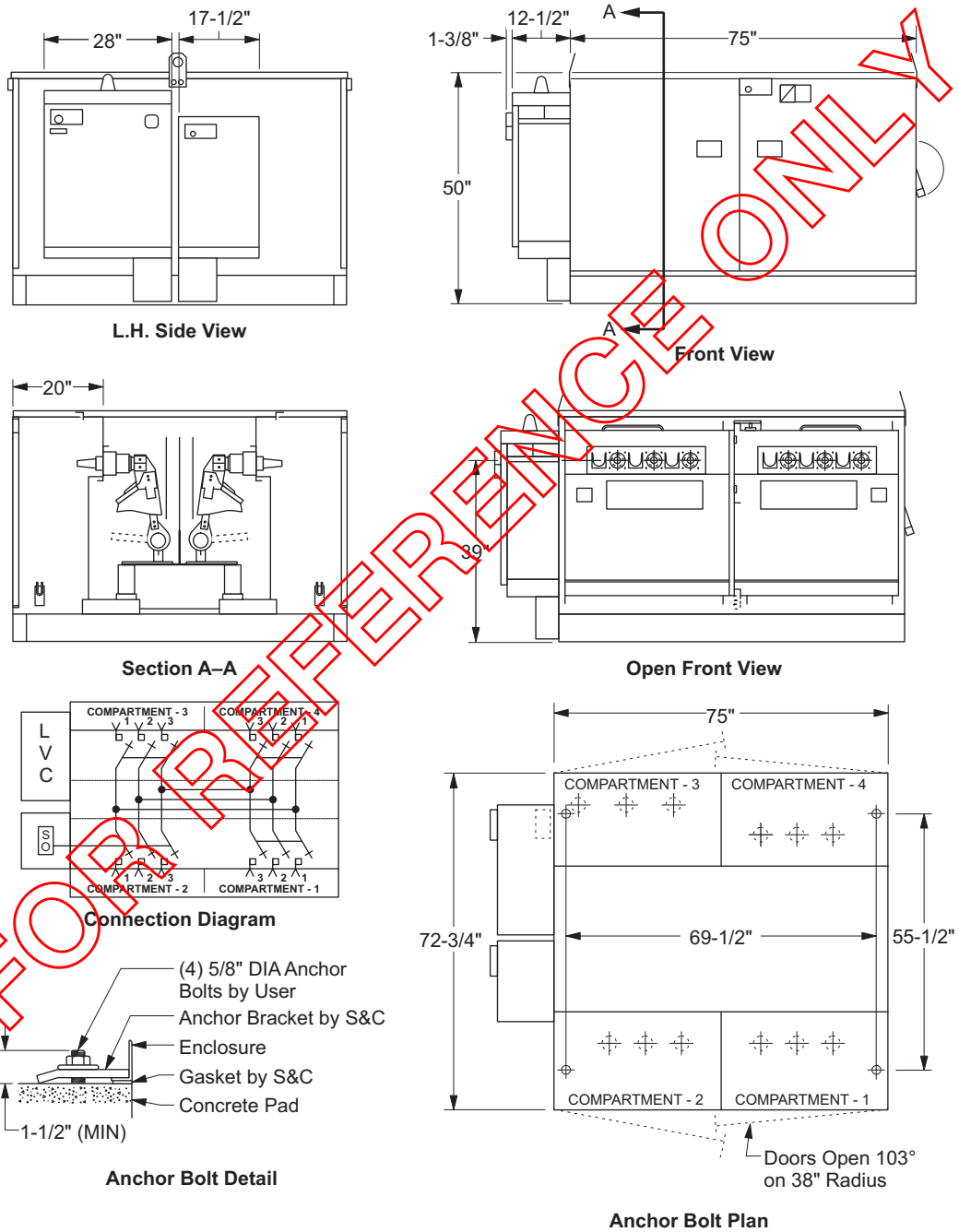
Anchor Bolt Detail

FOR REFERENCE ONLY

Note(s):
1. PME-3 unit weighs approximately 1,370 pounds.

Scope SE 270.4 **S&C Pad-Mounted Gear Remote Supervisory Model PME-10 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL**

Figure SE 270–5: S&C Pad-Mounted Gear Remote Supervisory Model PME-10 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL

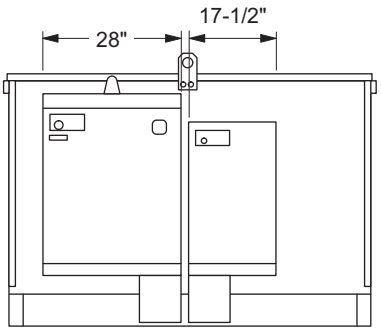


FOR REFERENCE ONLY

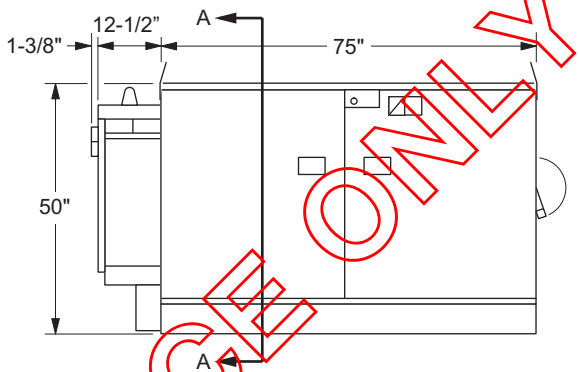
Note(s):
1. PME-10 unit weighs approximately 2,500 pounds.

Scope SE 270.5 **S&C Pad-Mounted Gear Remote Supervisory Model PME-11 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL**

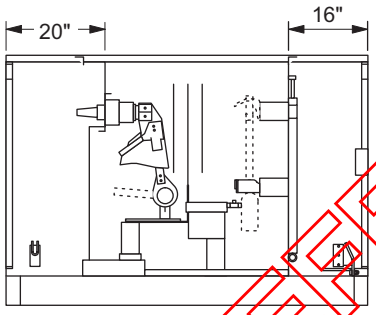
Figure SE 270–6: S&C Pad-Mounted Gear Remote Supervisory Model PME-11 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL



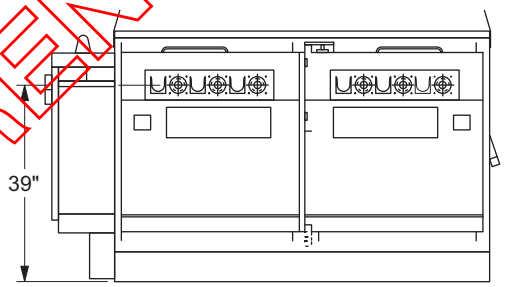
L.H. Side View



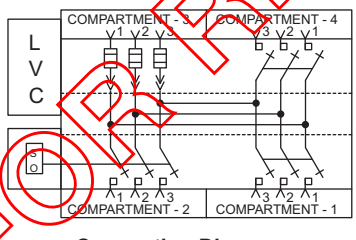
Front View



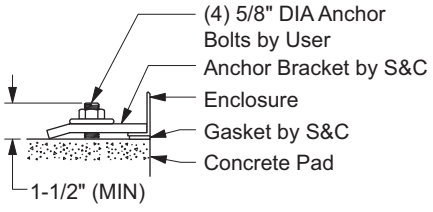
Section A–A



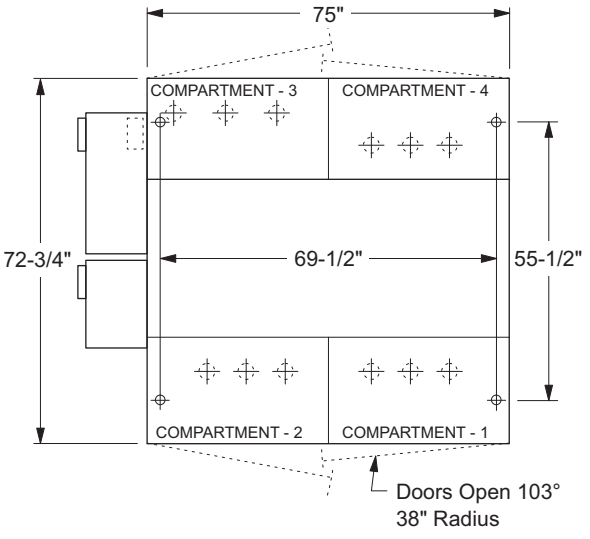
Open Front View



Connection Diagram



Anchor Bolt Detail



Anchor Bolt Plan

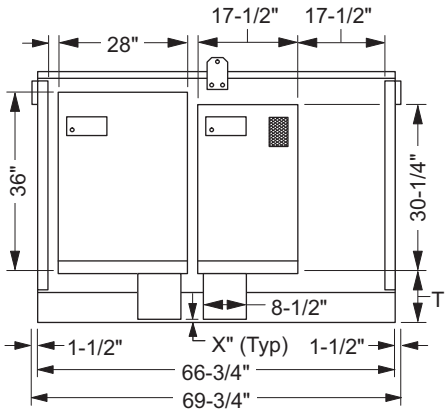
Note(s):
1. PME-11 unit weighs approximately 2,500 pounds.

FOR REFERENCE ONLY

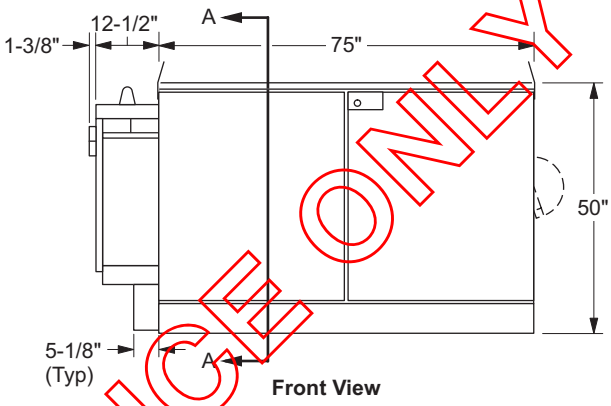
Scope SE 270.6 **S&C Pad-Mounted Gear Remote Supervisory Model PME-9 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL**

Figure SE 270–7: S&C Pad-Mounted Gear Remote Supervisory Model PME-9 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL

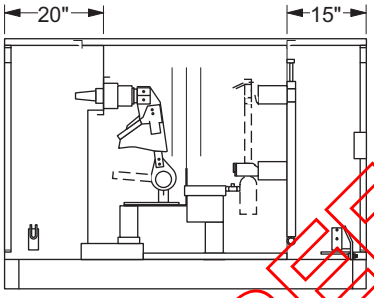
FOR REFERENCE ONLY



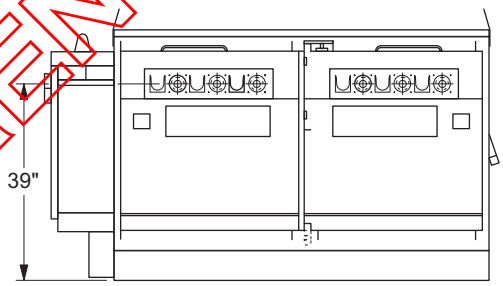
Side View



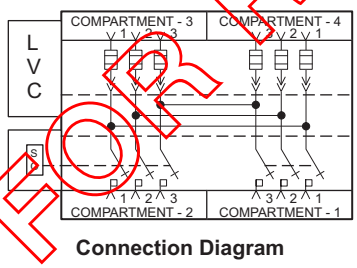
Front View



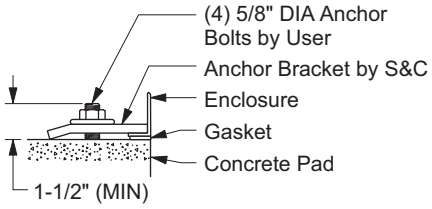
Section A-A



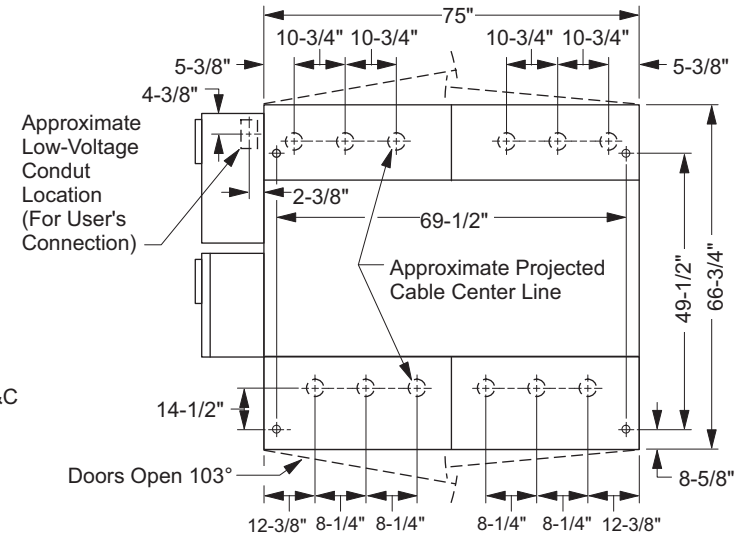
Open Front View



Connection Diagram



Anchor Bolt Detail

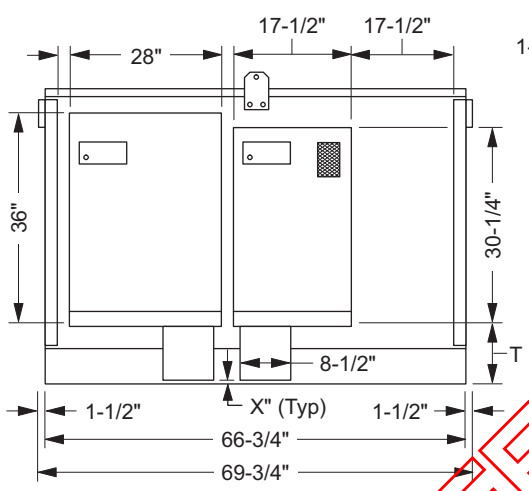


Anchor Bolt Plan

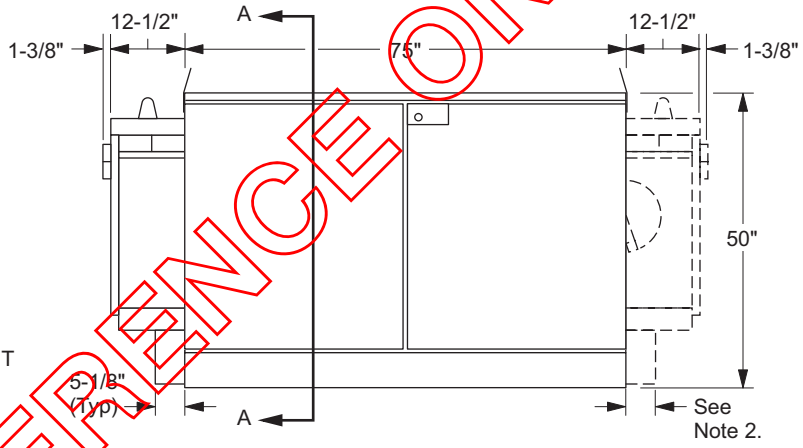
Note(s):
1. PME-9 unit weighs approximately 2,500 pounds.

Scope SE 270.7 **S&C Pad-Mounted Gear Remote Supervisory Model PME-9, -10, and -11 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL**

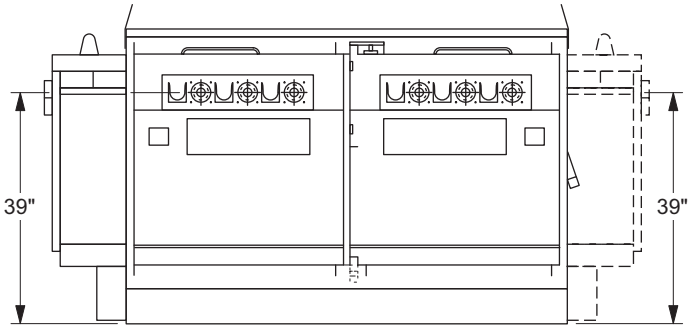
Figure SE 270–8: S&C Pad-Mounted Gear Remote Supervisory Model PME-9, -10, and -11 14.4 kV Nominal, 17 kV Maximum, 95 kV BIL



Side View



Front View



Open Front View

FOR REFERENCE ONLY

Note(s):
1. PME-9, -10, and -11 units weigh approximately 2,500 pounds.
2. Typical dimensions of PME-9, -10, and -11 with two switch operators.

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SE 275 Installation Procedure for Cleaveland/Price PAD with Motor Operator on S&C PMH or PME Switchgear

Scope SE 275.1 Installation Procedure for Retrofitting S&C PMH or PME Switchgear as a Remote Controlled Switch (RCS)

1.0 General Information

1.1 The S&C PMH or PME Switchgear has from 2 to 4 switched ways where each three-phase switched way has a gang-operated, three-pole switch. The S&C PMH or PME Switchgear is rated 17 kV maximum, and their weights range from approximately 740 to 1975 pounds depending on switch model. Each switched way is rated at 600 A load dropping.

1.2 A Cleaveland/Price Padmount Automated Distribution (PAD) Controller with Motor Operator can be retrofitted to any switched position on S&C's PMH or PMEo Switchgear.

A. Both the Controller and the Motor Operator Assembly of the Cleaveland/Price PAD are housed in a common enclosure.

B. A Motor Installation Mounting Kit is provided for new installations.

C. The Motor Operator is coupled directly to a manual operating position of the S&C PMH or PME switch.

D. The Motor Operator can be decoupled from the switch position by operating a slide-handle mounted at the bottom of the motor and inside the PAD enclosure.

E. Do not install a PAD control on a PMH or PME position in a way that may block full access to the manhole cover to the underground structure.

F. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, attachment 12 for further details on test requirements.

G. Mark the RCS control enclosure on the left-top corner to identify RCS number and automated position (Ex. RCS1234 Pos 1). Use approved reflective yellow letters and numbers on black background.

H. For a PME-10 or PME-11, only one PAD can be installed on each side due to spacing limitations in between operating handles. This restricts the maximum automated positions to two on a PME-10 or PME-11.

I. For a PMH-10 or PMH-11, two PADs may be installed on the same side. This allows for all positions to be automated.

1.3 A dedicated source of 120 VAC is required to power the PAD Controller.

A. See TX 300 for dedicated control power transformer installation procedure.

B. The control transformer shall be connected to the line side of the primary source to the S&C PMH or PME switchgear.

C. The secondary neutral shall be grounded to the structure ground system at the control transformer.

1. On the 12 kV or 16 kV to 120 VAC single phase, pad-mount control transformer, the secondary neutral ground is grounded at the transformer neutral terminal. See TX-300 and Figure 285-7 for more details.

2. On the 12 kV and 16 kV to 120 VAC single phase, submersible control transformer, the secondary neutral ground is grounded at one of the 3 way connector bar inside the vault. See TX-300 and Figure 285-8 for more details.

D. Conduit is required for the 120 VAC control power wiring in the PMH and PME compartment, and the conduit shall be grounded as shown in Figure SE 275–6 and Figure SE 275–8 .

E. A voltage source sign is required to be placed at the location where the control transformer is switched and at the location of the control transformer itself.

Figure SE 275–1: RCS Voltage Source Sign (SAP 10135323)

F. For PME 9, PME 10, and PME 11 installations on 4-wire circuits, using a phase-to-phase transformer may cause a ferroresonant condition. To avoid this condition, an alternate phase-to-ground transformer shall be used. (See DUG TX 300 for SAP numbers of alternate phase-to-ground transformers)

G. PME 9, PME 10, and PME 11 may be fitted with up to two (2) PAD controllers powered from one dedicated control power transformer.

H. For PMEs with both an automated TIE and MID switch operators, the dedicated control power transformer shall be connected to the line side or source of the automated MID position.

1.4 Material Information

For new and replacement installations, SAP 10107155 provides the complete PAD controller with integral motor operator and mounting kit.

Table SE 275–1: SAP Numbers — New and Replacement Installations

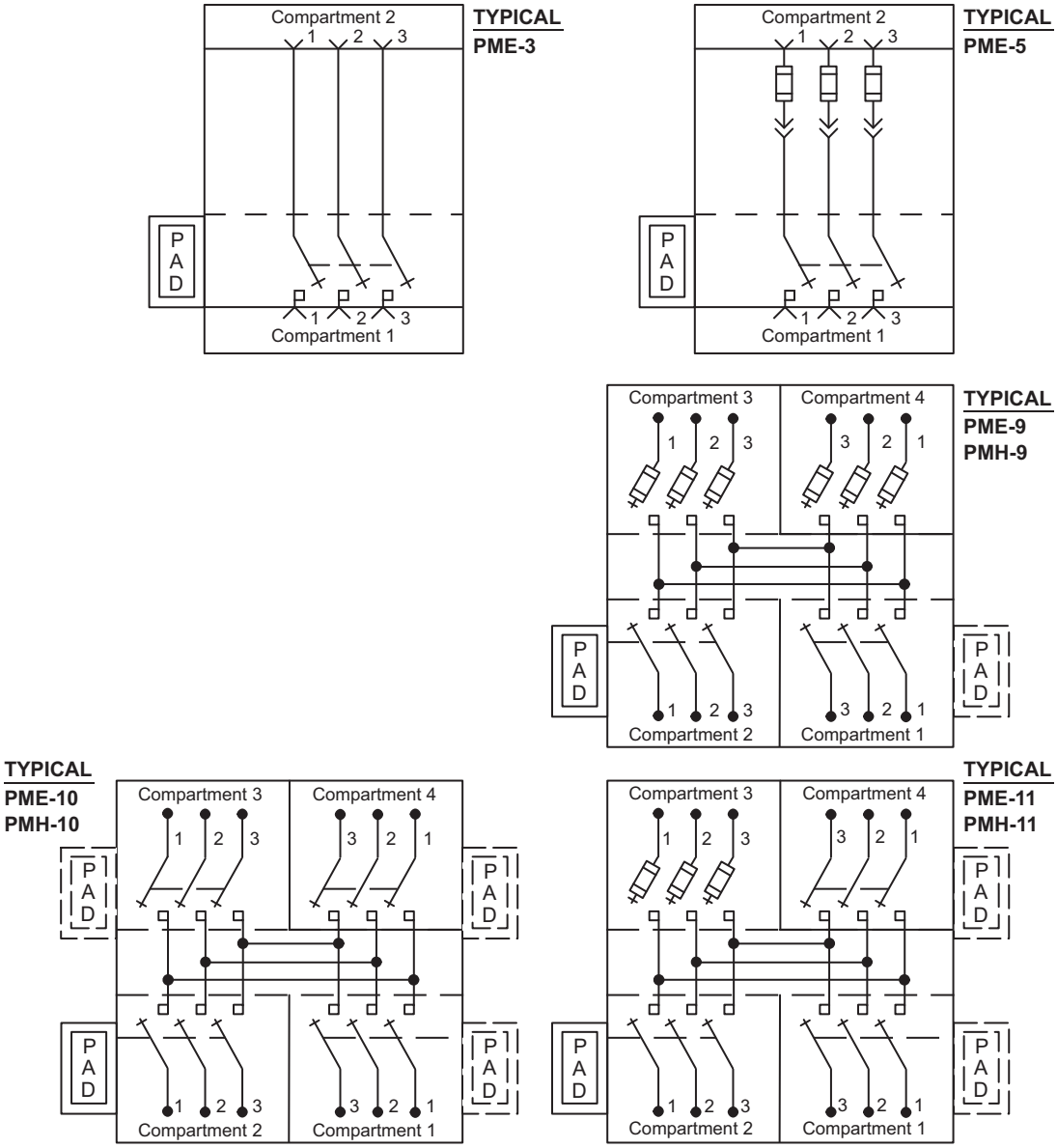
Description	SAP Number
PAD Controller with Motor Operator, and Mounting Kit	10107155
Conduit Kit (See Table SE 275–2 [Sheet 3].)	10112611
1" Liquid-Tight Flexible Conduit (minimum 8 feet)	10112557
RCS Voltage Source Sign	10135323

Table SE 275–2: SAP Numbers for Conduit Kit (SAP 10112611)

Item	Description	Quantity	SAP Number
1	45° Elbow Connector for 1" Liquid-Tight Flexible Conduit	2	10112633
2	1" Conduit Sealing Gasket	2	10113149
3	1" Galvanized Steel Conduit Coupling	1	10113083
4	45° Elbow Connector for 1" Liquid-Tight Flexible Conduit with Grounding Lug	1	10112609
5	Straight Connector for 1" Liquid-Tight Flexible Conduit	1	10112627

2.0 Switchgear Layouts and Possible PAD Locations

Figure SE 275–2: Cleaveland/Price PAD Controller and Motor Mechanism Retrofitted to One or More Positions of S&C PMH or PME Switchgear

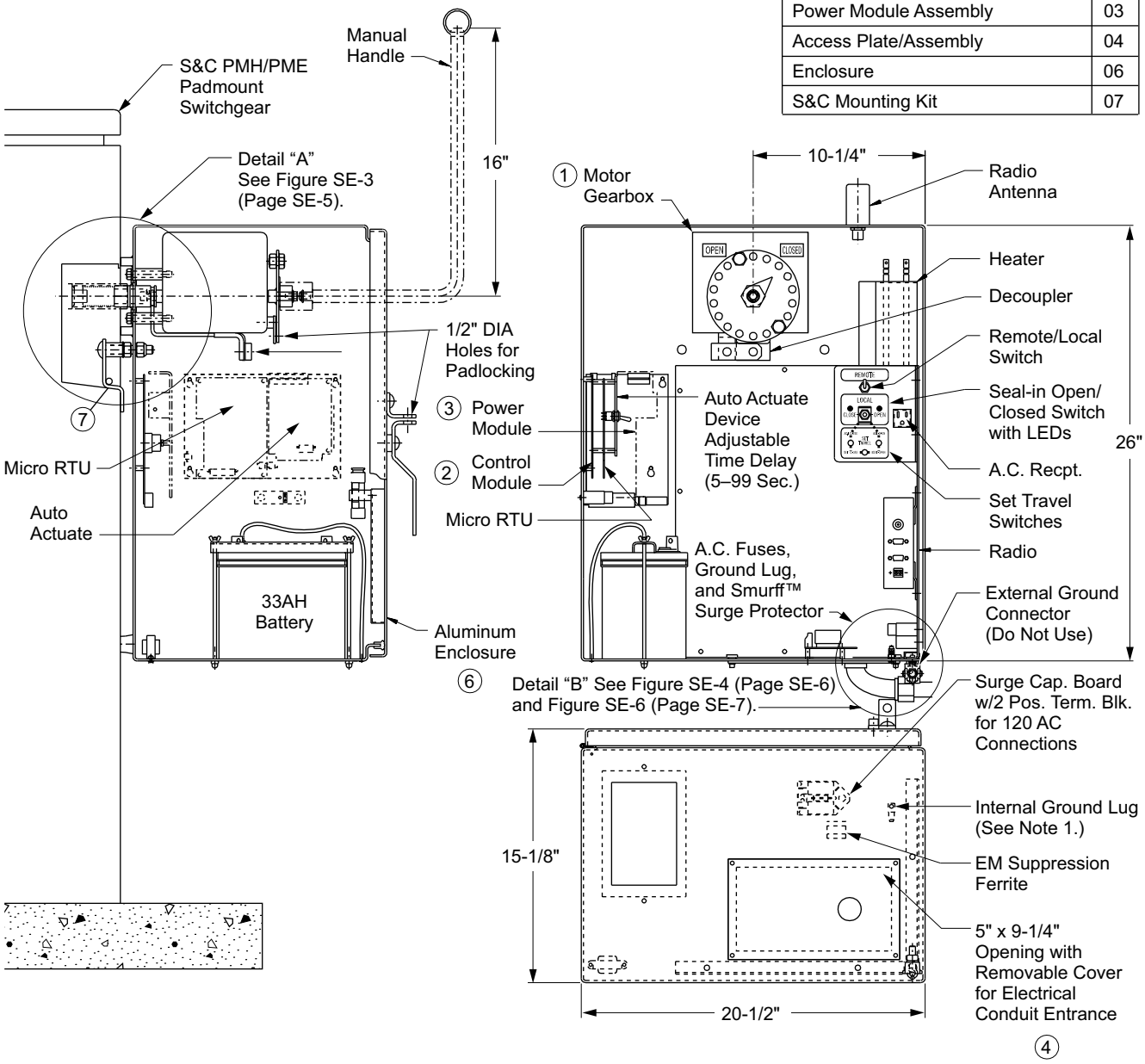


Note(s):

1. Only one PAD can be installed on each side of PME-10 and PME-11 Switchgear because of manual handle spacing.
2. Remove the door from the operating handle compartment on the side of PMH or PME cabinet at the switch position that is to be automated. Grind off the welds holding the door to make the hinge rod smooth and clean (preferred method), or hack saw through the hinge rod to allow use of the retaining rod provided in the installation kit (alternate method). Follow manufacturer's instructions for installation of the mounting bracket. See Figure SE 275–4 .
3. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, attachment 12 for further details on test requirements.

Figure SE 275–3: Cleaveland/Price PAD Controller and Motor Mechanism

Description	
Main Assembly	01
Control Module Assembly	02
Power Module Assembly	03
Access Plate/Assembly	04
Enclosure	06
S&C Mounting Kit	07

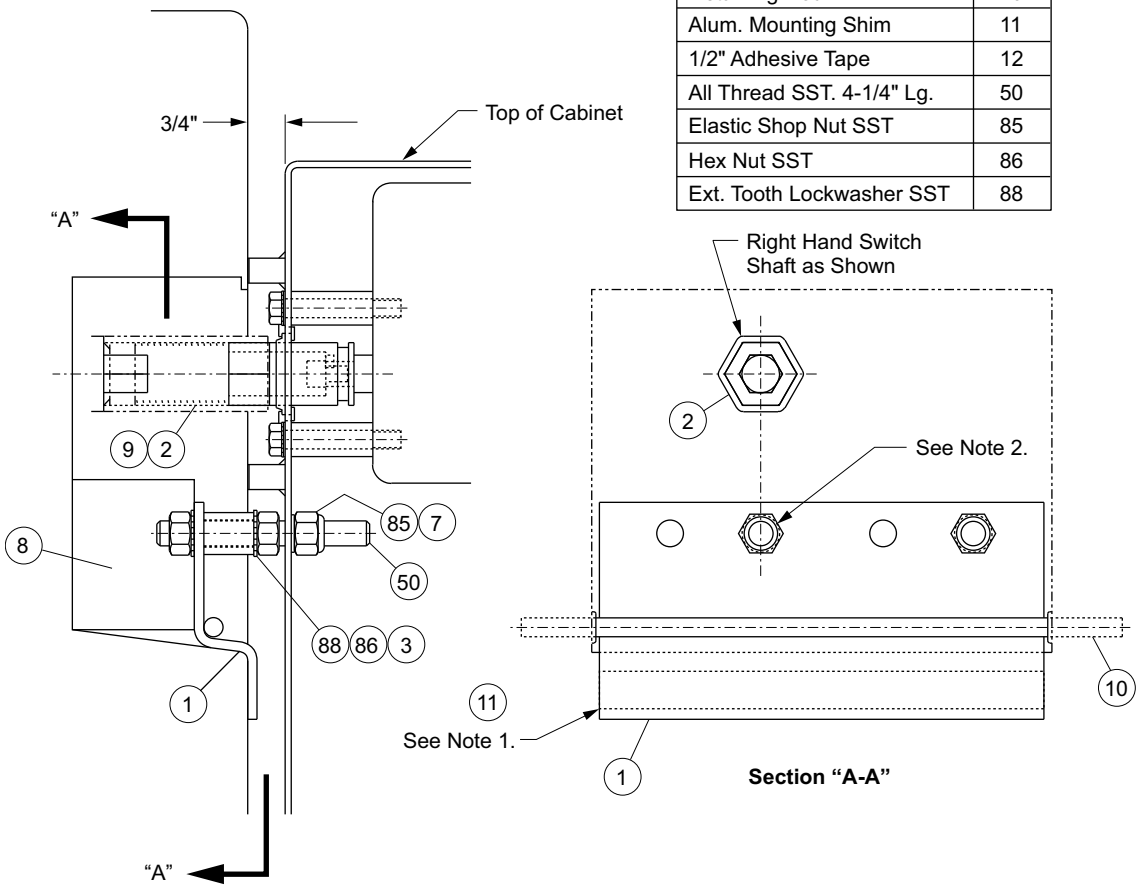


Note(s):

1. Ground PAD cabinet with minimum #6 bare solid copper wire (SAP 10109324) to the ground lug provided inside cabinet.
2. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Figure SE 275–4: Detail "A": Mounting Kit Installation on S&C PME/PMH Switchgear

Description	Item
Mounting Bracket	01
Decoupler Sleeve	02
Spacer 1" Lg.	03
1/2" Nylon Washer	07
Foam Block	08
Compression Spring	09
Retaining Rod	10
Alum. Mounting Shim	11
1/2" Adhesive Tape	12
All Thread SST. 4-1/4" Lg.	50
Elastic Shop Nut SST	85
Hex Nut SST	86
Ext. Tooth Lockwasher SST	88



Note(s):

1. When the top edge of the mounting bracket is pulled out tight, the mounting bolts should not fall below horizontal, that is, the bolts should be perpendicular to the switchgear cabinet. If not horizontal or perpendicular, use aluminum shim provided in mounting kit and install shim as shown in the figure.
2. One mounting bolt should be directly under the switch operating shaft and should be on the same vertical centerline with the operating shaft.
3. If using the existing door hinge as a retaining rod, then discard the Item #10 retaining rod provided in the mounting kit.
4. After installation, if feet are not making contact with switch enclosure because of distortion, add shims (H14) as necessary. Adhesive squares (H15) are used to adhere shims in place. Adhesive squares can also be used to secure feet to face of switch enclosure.
5. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Figure SE 275–5: Detail "B": PME Electrical Conduit Installation to PAD Cabinet

Figure SE 275–6: Continuation of Electrical Conduit Installation Inside PME

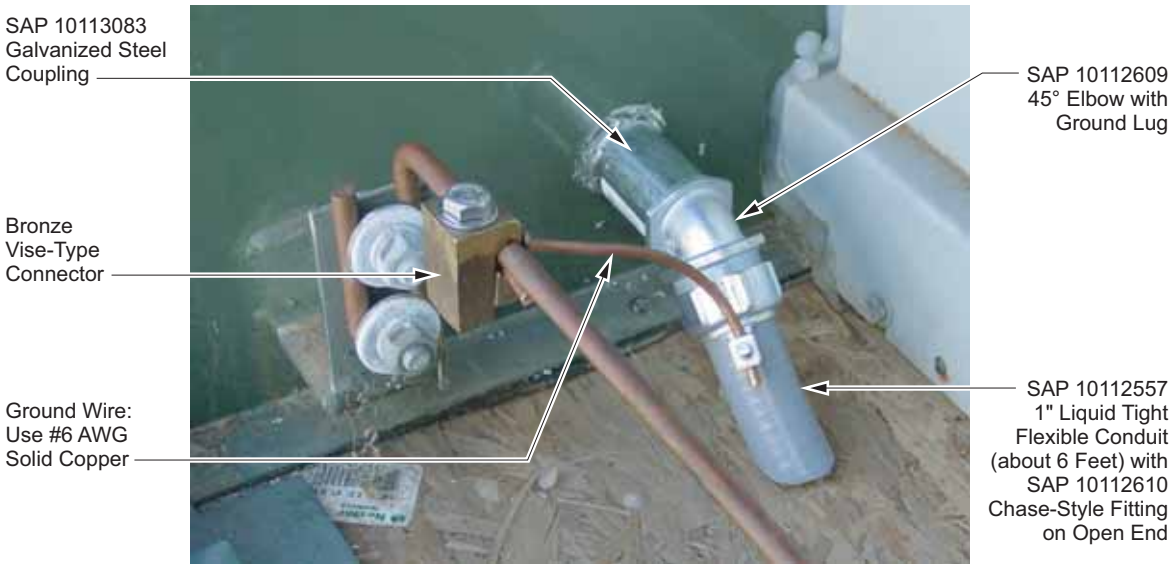


Figure SE 275–7: Detail "B": PMH Electrical Conduit Installation to PAD Cabinet

Figure SE 275–8: Continuation of Electrical Conduit Installation inside PMH

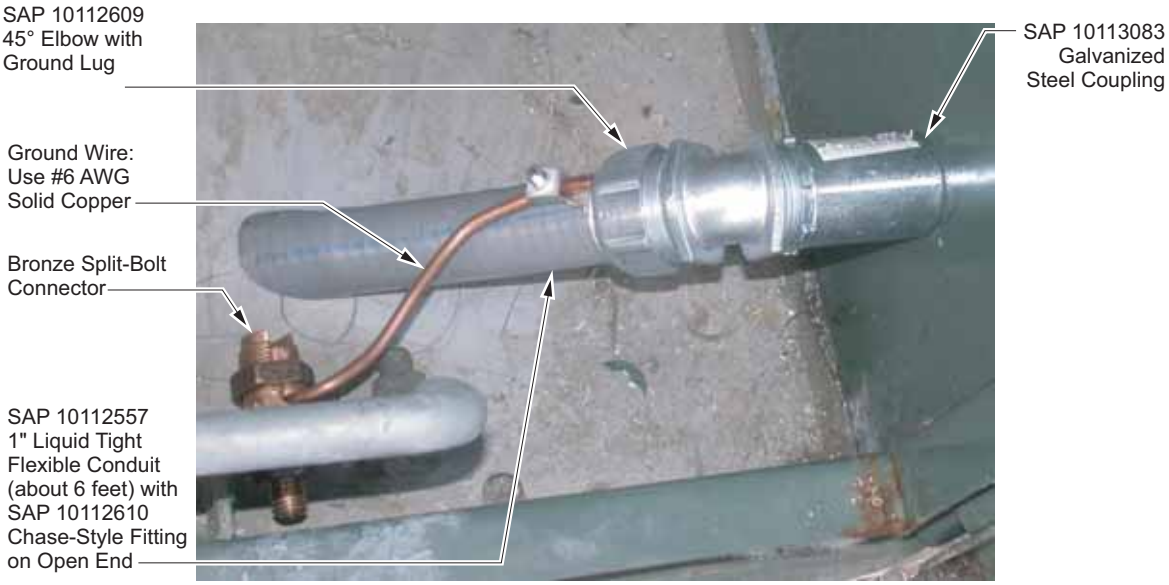
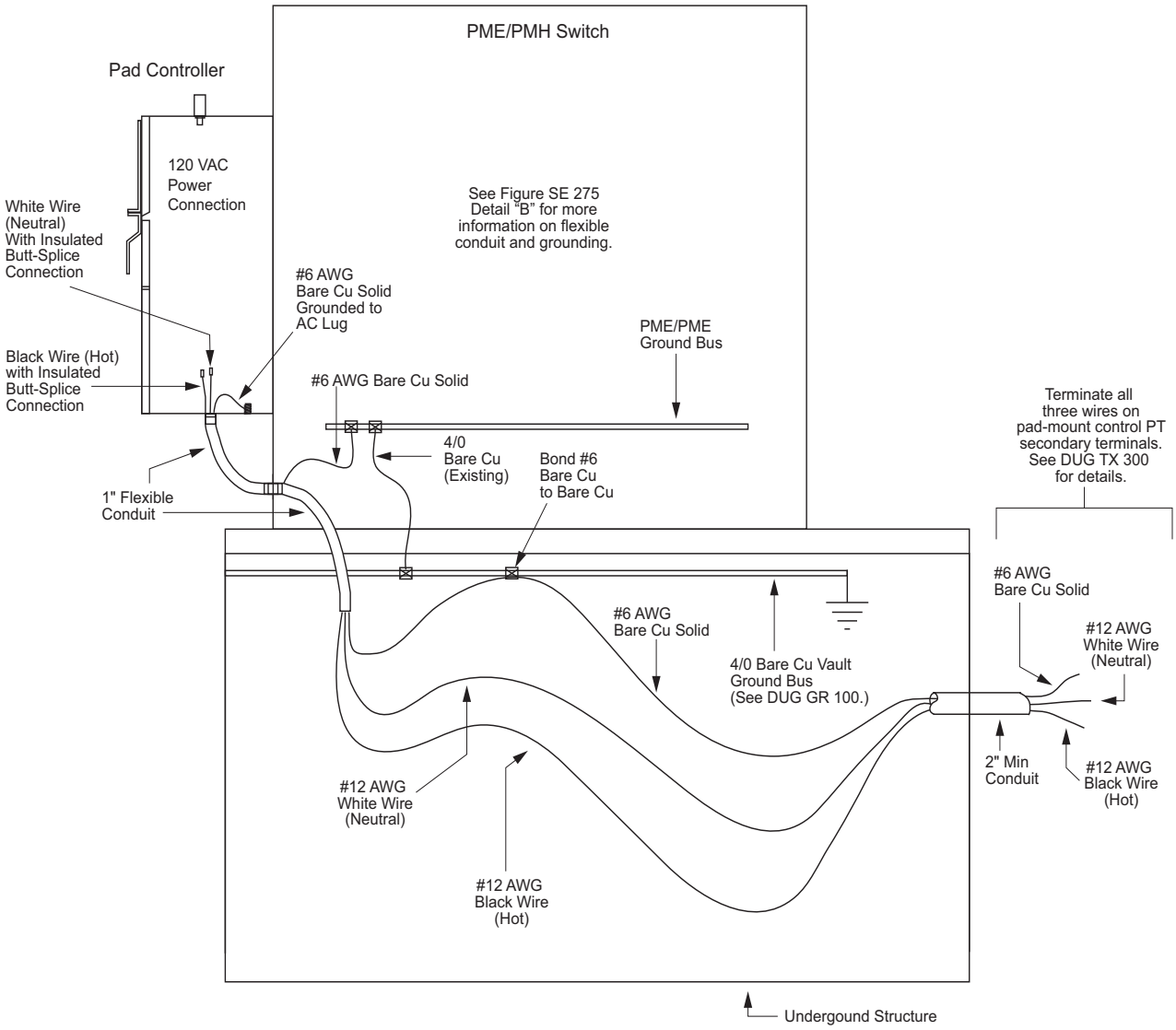


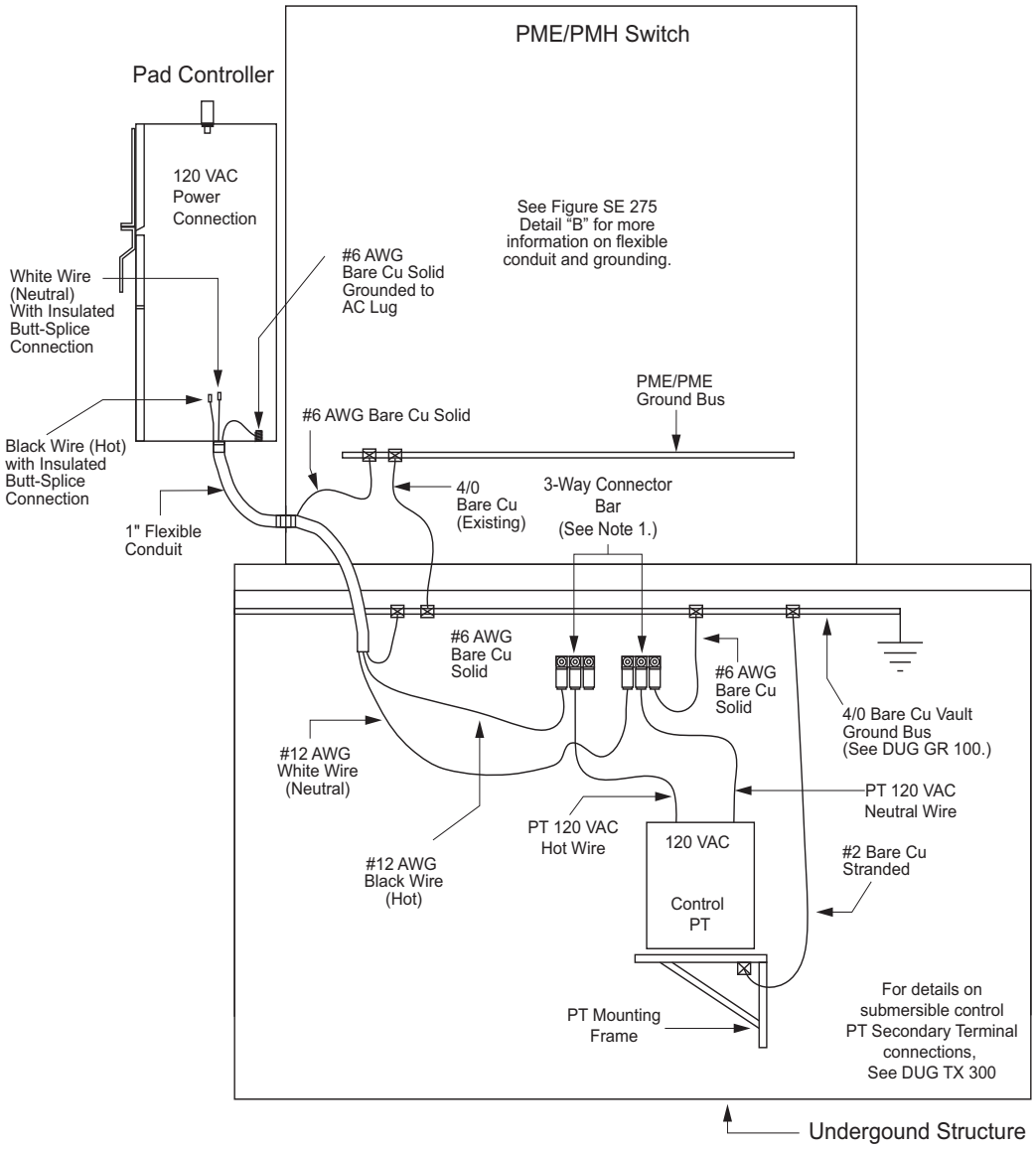
Figure SE 275–9: PAD Retrofit on PME/PMH – 120 Volt Secondary Wiring Diagram – Pad-mount CPT Method



Note(s):

1. Ground PAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324).
2. Terminate #12 AWG white wire, #12 AWG black wire and #6 bare solid Cu from PAD to dedicated pad-mounted control transformer. See TX-300 for details on transformer connections.
3. The control power (120 VAC) is to be provided to the RCS controller by a dedicated control transformer connected to primary on the source/line side of the PME/PMH switch.
4. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Figure SE 275–10: PAD Retrofit on PME/PMH – 120 Volt Secondary Wiring Diagram – Submersible CPT Method



Note(s):

1. Use submersible 3 way connectors (SAP 10181501) for 120 VAC connections required from the PAD cabinet to the transformer.
2. Ground PAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the underground structure ground bus.
3. On submersible transformers (ABB), coil and seal the end of the unused secondary terminal with mastic covered by 3M 33 Vinyl Electrical Tape. See Scope 285.6 and TX-300 for details.
4. The control power (120 VAC) is to be provided to the RCS controller by a dedicated control transformer connected to primary on the source/line side of the PME/PMH switch.
5. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

SE 280 Installation Procedure for Elastimold Molded Vacuum Remote Controlled Switch

Scope SE 280.1 Installation Procedure for Elastimold Molded Vacuum Remote Controlled Switch (RCS)

1.0 General Information

1.1 The Elastimold Molded Vacuum Switch (MVS) is a three-phase, gang-operated, 2-way switch. It is rated 27 kV maximum, 125 kV Basic (Impulse) Insulation Level (BIL), 600 A loadbreak, and 12.5 kA Symmetrical Short Circuit Duty. It weighs approximately 100 pounds and can be mounted in any position. Each switch includes a 24 VDC submersible motor operator that is connected by a control cable to a remote surface-mounted control cabinet supplied by Cleaveland/Price, Inc.

1.2 One submersible Cleaveland Price motor operator is retrofitted to a Molded Vaccum Switch by Elastimold (MVS manufacturer).

A. A Cleaveland/Price Underground Automated Distribution (UAD) controller is contained in an aboveground pad-mounted cabinet and is connected to the standard motor operator (without auxiliary connection) by a control cable. Although, this UAD's design is very similar to an UAD used on a G&W gas switch, they both have separate SAP numbers.

B. Construction crew shall coordinate the installation of new, relocated, and updated RCS with Distribution Automation Engineering in order to perform an end point test (EPT) and commission unit in service. Refer to DOM SW-11, attachment 12 for further details on test requirements.

1.3 A dedicated source of 120 VAC is required to power the UAD controller:

A. See TX 300 for dedicated control power transformer installation procedure.

B. The control transformer shall be connected to the line side of the primary source to the MVS.

C. The secondary neutral shall be grounded to the structure ground system at the control transformer.

1. On the 12 kV or 16 kV to 120 VAC single phase, pad-mount control transformer, the secondary neutral ground is grounded at the transformer neutral terminal. See TX-300 and Figure 285-7 for more details.

2. On the 12 kV and 16 kV to 120 VAC single phase, submersible control transformer, the secondary neutral ground is grounded at one of the 3 way connector bar inside the vault. See TX-300 and Figure 285-8 for more details.

D. A voltage source sign is required to be placed at the location where the control transformer is switched and on the control transformer itself.

Figure SE 280–1: RCS Voltage Source Sign (SAP 10135323)

E. Single phase switching for phase-to-phase transformers may result in ferroresonance. An alternate phase-to-ground transformer may be applied to mitigate ferroresonance on 4-wire circuits. (See DUG TX 300 for SAP numbers of alternate phase-to-ground transformers.)

2.0 Material Information

For new installations, both SAP 10106394 and SAP 10107153 are required. These two codes must be ordered together to alert the supplier to ship a complete unit with the motor operator attached and calibrated as shown in Figure SE 280–2 (Sheet 3).

Table SE 280–1: SAP Numbers — New Installations

Description	SAP Number
Switch and Motor Operator	10106394
UAD Controller	10107153
RCS Voltage Source Sign	10135323
Control Cable Extension (20 feet)1/	10107171
Control Cable Extension (40 feet)1/	10107172
Control Cable Extension (60 feet)1/	10107173

1/ The total length of the motor control cable shall not exceed 125 feet. The UAD motor is supplied with a non-detachable 65-foot control cable, therefore the maximum length for use of a control cable extension is 60 feet.

3.0 Dimensions

Figure SE 280–2: Elastimold Molded Vacuum Remote Controlled Switch (RCS) — Top View

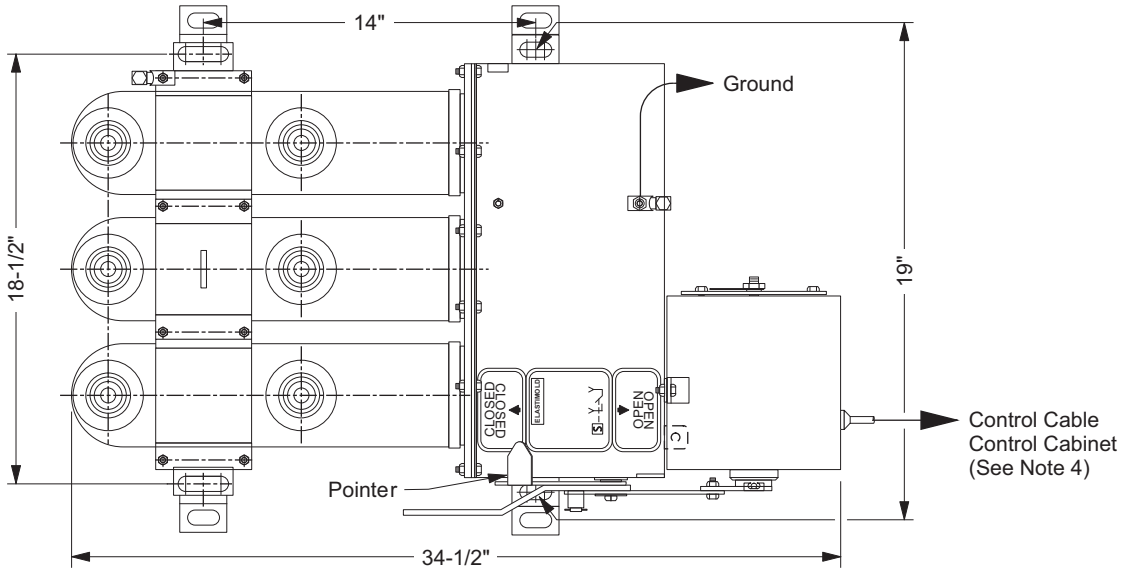
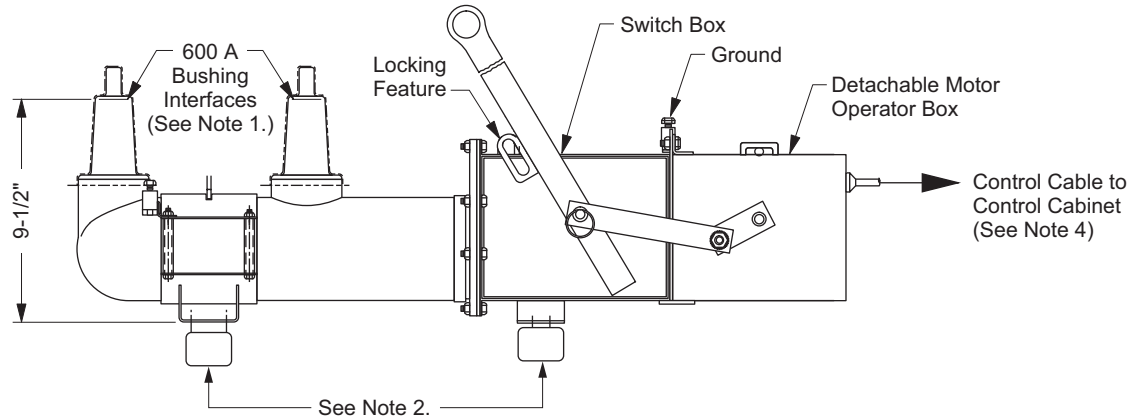


Figure SE 280–3: Elastimold Molded Vacuum Remote Controlled Switch (RCS) — Side View



Note(s):

1. Install no more than two bushing extensions. See JJ 660.
2. See Figure SE 280–4 (Sheet 4) and Figure SE 280–5 (Sheet 4).
3. Install rigging hogeyes/anchors as required for manual operation of the switch.
4. The motor operator is provided with a 65-foot cable to connect to the UAD cabinet. If additional length is required, one 20-foot extension (SAP 10107171), one 40-foot extension (SAP 10107172), or one 60-foot extension (SAP 10107173) may be added. DO NOT exceed a total length of 125 feet of control cable from motor to UAD cabinet.
5. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

4.0 Bracket Installation and Dimensions for Vacuum Remote Controlled Switch (RCS)

Figure SE 280–4: Elastimold Bracket Installation for Vacuum Remote Controlled Switch (RCS)

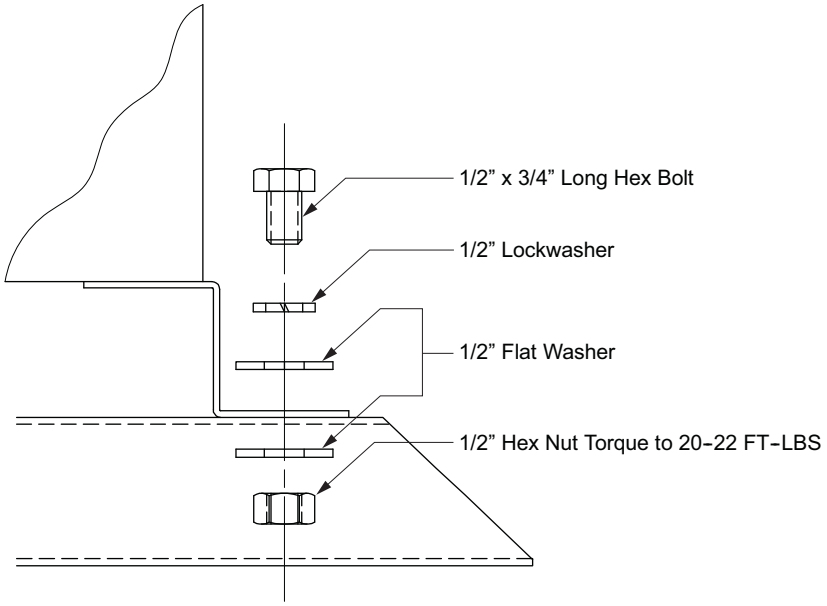
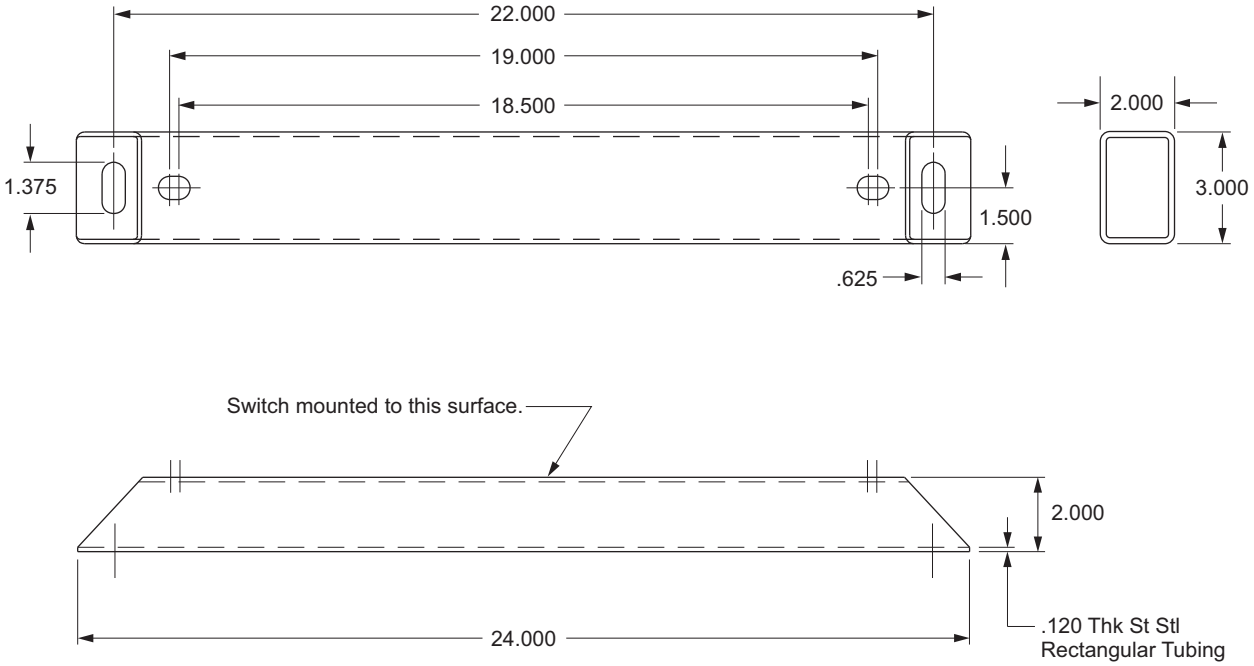
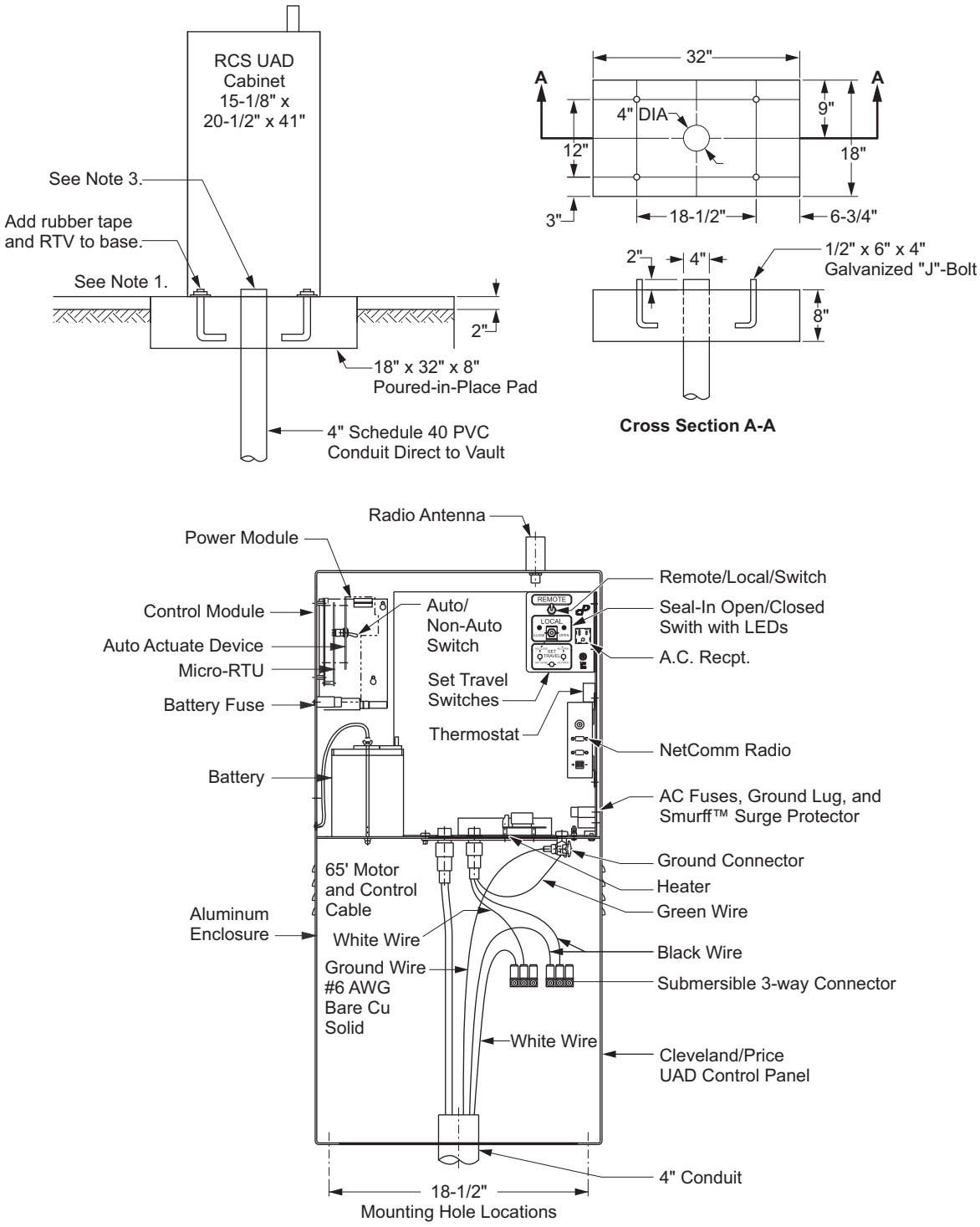


Figure SE 280–5: Elastimold Bracket Dimensions for Vacuum Remote Controlled Switch (RCS)



Scope SE 280.2 Installation of Underground Automated Distribution (UAD) Cabinet

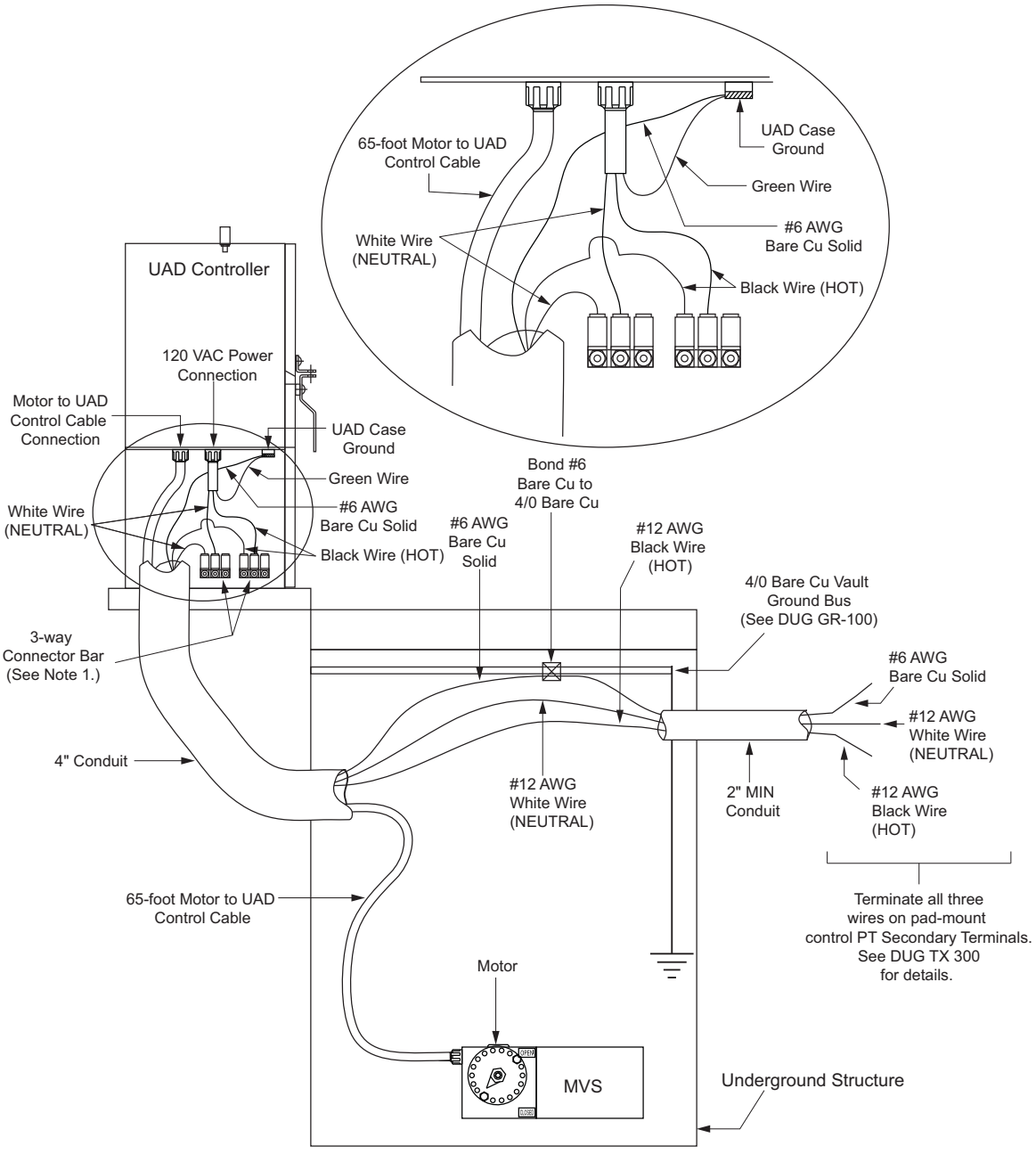
Figure SE 280–6: RCS UAD Cabinet Installation — Dimensions and Connections



Note(s):

1. Distance between vent and UAD control cabinet may vary. UAD cabinet door should not face ventpipe or street traffic lane.
2. Four-inch conduit to be installed below vent coping. Depth may vary. Conduit may also be run directly to vault.
3. 120 VAC to be provided to RCS from a dedicated control transformer connected to primary source side of switch. For control power, use #12 AWG white and #12 AWG black copper wire.
4. Apply duct seal to close conduit openings in UAD cabinet. See CW 105
5. Ground switch and UAD cabinet with minimum #6 bare copper from vault ground using ground lugs provided.
6. Install no more than two bushing extensions. See JJ 660.
7. Use submersible 3-way connectors for 120 VAC connection. See wiring diagram in Figure SE 280-7 and SE 280-8.
8. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, attachment 12 for further details on test requirements.

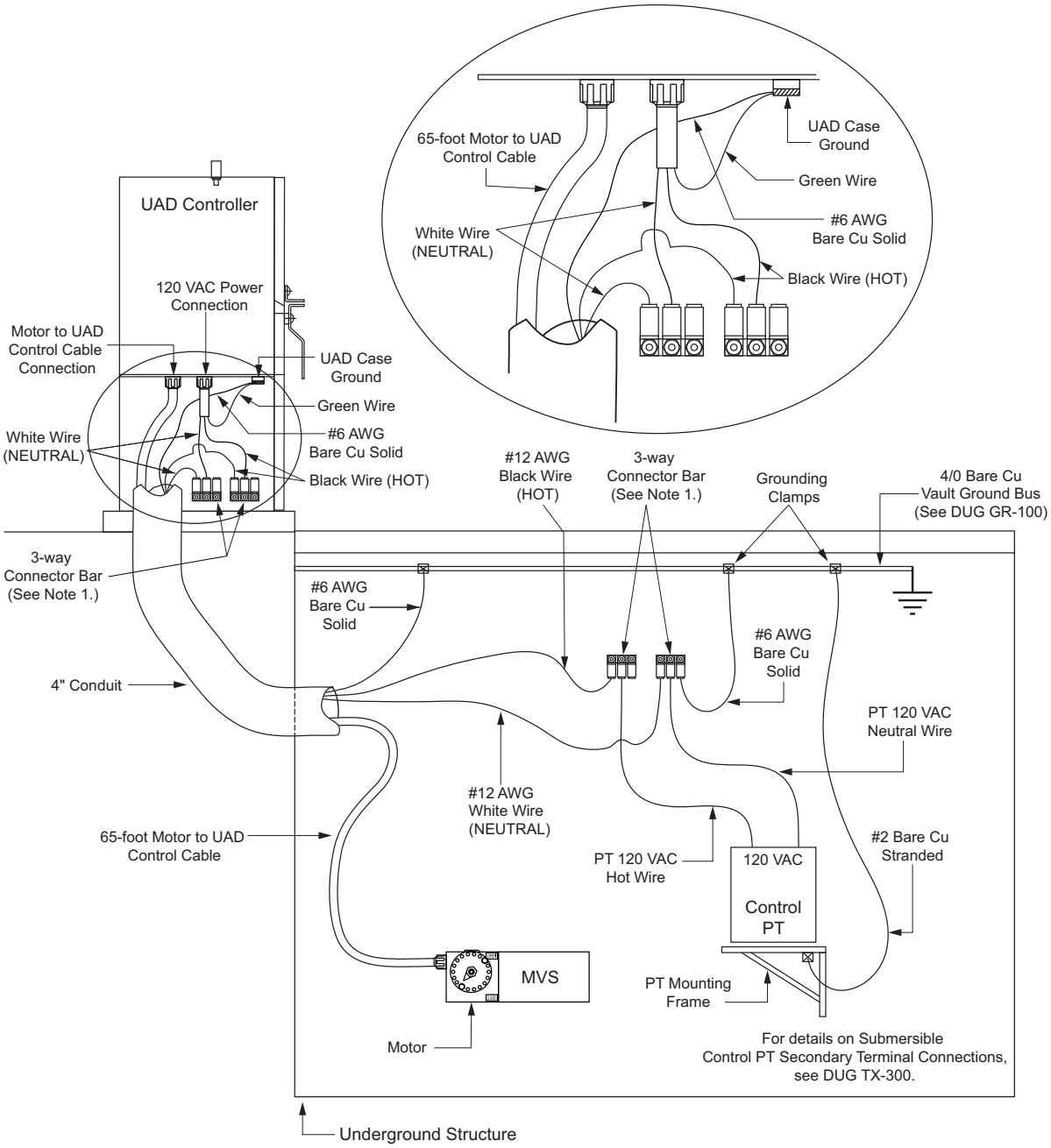
Figure SE 280–7: MVS 120 Volt Secondary Wiring Diagram – Pad-Mounted CPT Method



Note(s):

1. Use submersible 3-way connectors (SAP 10181501) for 120 VAC connections required from the UAD cabinet to the transformer.
2. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the underground structure ground bus.
3. Terminate #12 AWG white wire, #12 AWG black wire and #6 bare solid Cu from UAD to dedicated pad-mounted control transformer. See TX-300 for details on transformer connections.
4. The control power (120 VAC) is to be provided to the RCS controller by a dedicated control transformer connected to primary on the source/line side of the gas switch.
5. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Figure SE 280–8: MVS 120 Volt Secondary Wiring Diagram – Submersible CPT Method

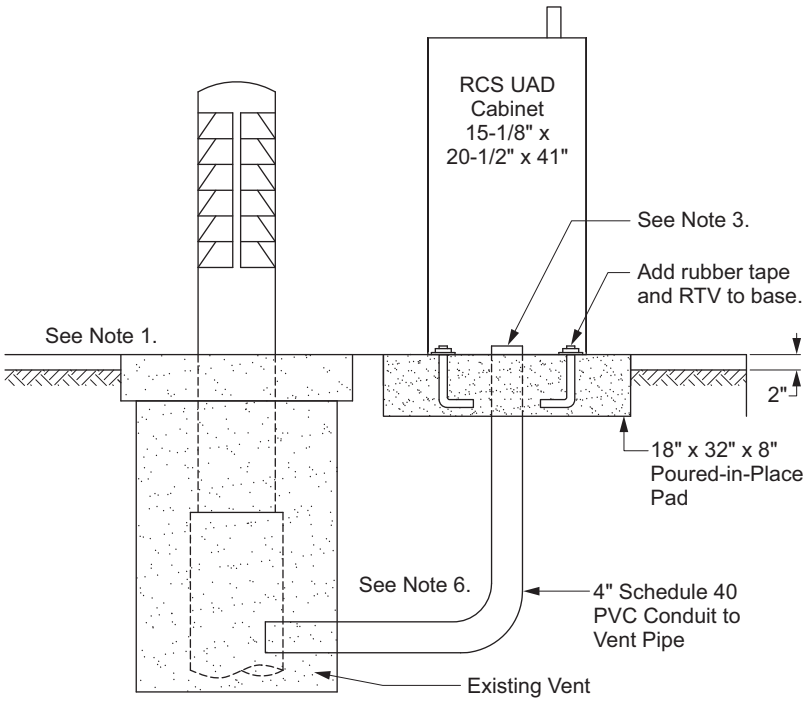


Note(s):

1. Use submersible 3 way connectors (SAP 10181501) for 120 VAC connections required from the UAD cabinet to the transformer.
2. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the underground structure ground bus.
3. On submersible transformers (ABB), coil and seal the end of the unused secondary terminal with mastic covered by 3M 33 Vinyl Electrical Tape. See TX-300 for details.
4. The control power (120 VAC) is to be provided to the RSC controller by a dedicated control transformer connected to primary on the source/line side of the switch.
5. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Scope SE 280.3 Alternate Installation of Underground Automated Distribution (UAD) Cabinet

Figure SE 280–9: Alternate RCS UAD Cabinet Installation — Dimensions and Connections



Note(s):

1. Confirm that the vent pipe chosen is not equipped with a vault blower. Feed pull rope down the other vent pipe if this is found to be the situation.
2. Ensure that pull rope goes all the way from UAD to vault.
3. If the vent pipe present is made of steel, and the lid is welded shut, replace vent pipe. See VE 225.
4. Distance between vent and UAD control cabinet may vary. UAD cabinet door should not face vent pipe or street traffic lane.
5. 120 VAC to be provided to RCS from available AC on source side of switch. Use #8 copper, jacketed 2-conductor (SAP 10109555).
6. Apply duct seal to close conduit openings in UAD cabinet. See CW 105.
7. Ground switch and UAD cabinet with minimum #4 bare copper from vault ground using ground lugs provided.
8. Install no more than two bushing extensions. See JJ 660.
9. Install sump pump in wet vault. See CW 200.
10. Use underground connector SAP 10118144 for 120 VAC connections.
11. Ensure that the end of the 3" PVC conduit is flush with the PVC vent pipe to prevent cable binding during installation.
12. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

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SE 285 Installation Procedure for Cleaveland/Price UAD and Motor Operator on G&W Gas Switch

Scope SE 285.1 Installation Procedure for Retrofitting a G&W RAM-Type SF_6 Gas-Filled Switch as a Remote Controlled Switch (RCS)

1.0 General Information

1.1 The G&W RAM-type SF_6 gas-filled switch has from two to six ways where each three-phase way has a gang-operated, three-pole switch. G&W RAM gas switches are available at ratings of 27 kV or 38 kV maximum and 600 Amp loadbreak. These switches can be pad-mounted for above ground applications or mounted on the wall or on the floor of a subsurface structure for submersible applications.

1.2 DO NOT automate G&W RAM-type SF_6 gas-filled switches that are installed in Surface Operable Enclosures (SOEs).

1.3 A maximum of two submersible Cleaveland/Price motor operator(s) can be retrofitted to any position on one G&W RAM-type SF_6 gas-filled switch.

A. A Cleaveland/Price Underground Automated Distribution (UAD) controller is contained in an aboveground pad-mounted cabinet and is connected to the motor operator(s) by a control cable(s).

B. A pressure sensor is installed on the gas fill port at the top of the G&W RAM-type SF_6 gas-filled switch to provide a safety interlock that prevents motor operations under a low gas pressure condition in the G&W switch.

C. On **submersible** G&W RAM-type SF_6 gas switches, a G&W manual handle extension (SAP 10107162) must be installed on all non-automated positions to the left of the motor operator. For example, in a 4-way switch, if Position 4 is retrofitted with the motor operator, then Positions 3, 2, and 1 will require the G&W manual handle extension. Refer to figures in section 3.0 “Dimensions and Connections.”

D. On **pad-mounted** G&W RAM-type SF_6 gas-filled switches, the G&W manual handle extension (SAP 10107162) **IS NOT REQUIRED**. Any position can be automated, as the space between the switch positions provides adequate operating clearance for the remaining handles without the use of the G&W manual handle extension.

E. On **pad-mounted** G&W RAM-type SF_6 gas-filled switches, a pressure sensor extension cable (SAP 10178899) is required when retrofitting a motor operator to Position 1 on a 5-way switch, and to Positions 1 or 2 on a 6-way switch.

F. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, attachment 12 for further details on test requirements.

G. Mark the RCS control enclosure on the left-top corner to identify RCS number and automated position (Ex. RCS1234 Pos 1). Use approved reflective yellow letters and numbers on black background.

1. For dual UADs mark the left and right top corners of the enclosure to correspond to the side of the controls associated with the respective automated positions. See Figure SE 285-1.

Figure SE 285–1: Dual UAD Enclosure with Marked RCS Number and Respective Automated Positions

Note(s):
1. Figure shows an RCS with a Dual UAD where controls on the left hand side operate position 1 on the switch and controls on the right hand side operate position 3 on the switch.

1.4 A dedicated source of 120 VAC is required to power the UAD controller:

A. See TX 300 for dedicated control power transformer installation procedure.

B. The control transformer shall be connected to the line side of the primary source to the G&W RAM-type SF_6 gas-filled switches.

C. The secondary neutral shall be grounded to the structure ground system at the control transformer.

1. On the 12 kV or 16 kV to 120 VAC single phase, pad-mount control transformer, the secondary neutral ground is grounded at the transformer neutral terminal. See TX-300 and Figure 285-7 for more details.

2. On the 12 kV and 16 kV to 120 VAC single phase, submersible control transformer, the secondary neutral ground is grounded at one of the 3 way connector bar inside the vault. See TX-300 and Figure 285-8 for more details.

D. A voltage source sign is required to be placed at the location where the control transformer is switched or de-energized (for example a switch position) and on the control transformer itself.

Figure SE 285–2: RCS Voltage Source Sign (SAP 10135323)

E. Single phase switchinig for phase-to-phase transformers may result in ferroresonance. An alternate phase-to-ground transformer may be applied to mitigate ferroresonance on 4-wire circuits. (See DUG TX 300 for SAP numbers of alternate phase-to-ground transformers.)

2.0 Material Information

For new installations, SAP 10107087 provides the complete UAD controller, motor operator with control cable, and mounting kit with pressure switch and its pigtail connecting cable. If a replacement UAD controller is needed, also order new motor operator with control cable.

Table SE 285–1: SAP Numbers — New Installations

Description	SAP (One Way UAD)	SAP[1/] (Two Way UAD)
UAD controller, motor operator with 65-foot control cable, and mounting kit including pressure switch	10107087	10107184
Pressure Sensor Extension Cable (6.5 feet)	10178899	10178899
RCS Voltage Source Sign	10135323	10135323
Manual Handle Extension	10107162	10107162
Control Cable Extension (20 feet)[2/]	10107171	10107171
Control Cable Extension (40 feet)2/	10107172	10107172
Control Cable Extension (60 feet)2/	10107173	10107173

[1/] Dual UADs require one motor operator with auxiliary cable for connection of low gas pressure sensor and one motor operator without auxiliary cable connection. Both motors are supplied with the UAD assembly under SAP 10107184.

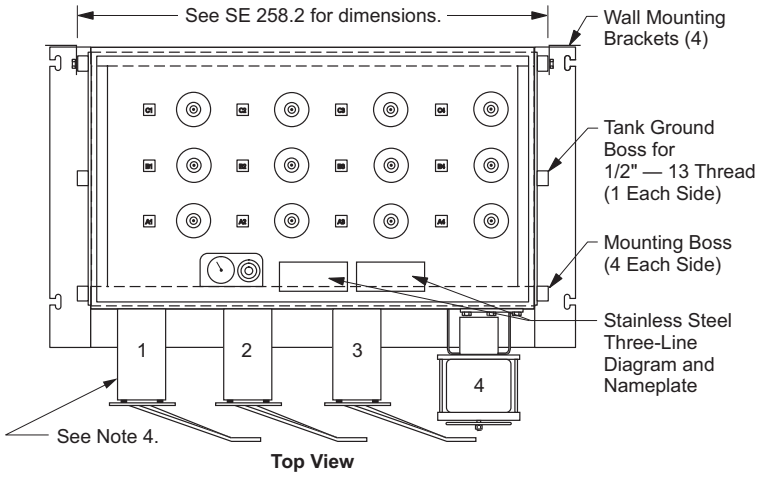
[2/] The total length of the motor control cable shall not exceed 125 feet. The UAD motor is supplied with a non-detachable 65-foot control cable, therefore the maximum length for use of a control cable extension is 60 feet.

Note(s):

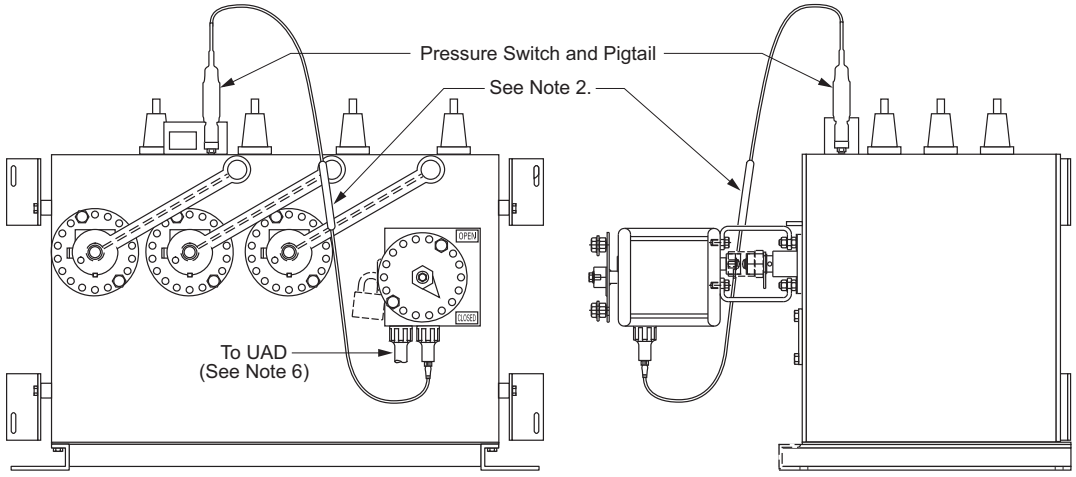
1. For replacement part and material SAP numbers refer to DOM SW-11.

3.0 Dimensions and Connections

Figure SE 285–3: Cleaveland/Price Motor Operator Retrofitted to Position 4 with a Manual Handle Extension Installed on Positions 3, 2, and 1 of a Submersible G&W RAM-Type SF_6 Gas-Filled Switch



Top View

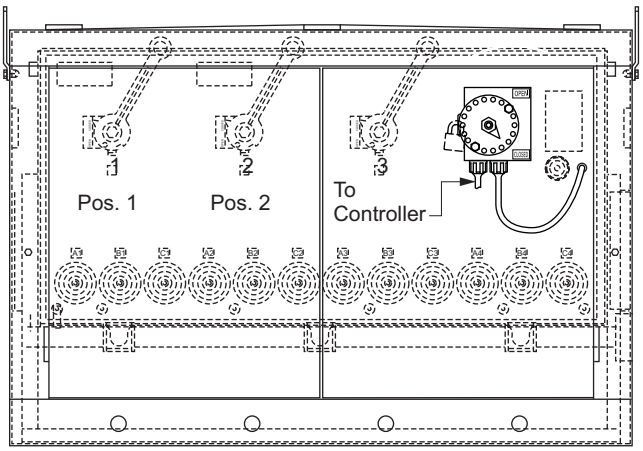


Front View **Side View**

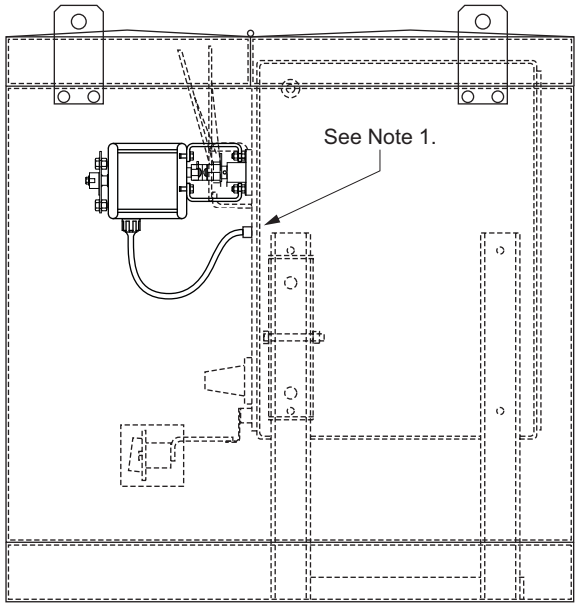
Note(s):

1. A pressure switch is installed on the gas fill port of the G&W RAM-type SF_6 gas-filled switch and connected by way of a pigtail to the motor operator to provide a safety interlock that prevents motor operation for low gas pressure.
2. Apply 3 layers of tape using 33/23/33 taping method (see DUG SE 285, Scope SE 285.6) where the pressure switch pigtail plugs into the motor operator auxiliary function cable.
3. Apply loctite to the Schrader valve and hand tighten pressure switch sensor to the switch as required in the installation instructions.
4. The G&W manual handle extension will be required for all positions to the left of the motor operator on submersible G&W RAM-type SF_6 gas-filled switches.
5. Rigging for manual switching will be altered on a position that a motor operator or manual handle extension is mounted. Confirm existing rigging hogeyes/anchors will accommodate for the additional spacing created from the motor operator or manual handle extension. If necessary, install new rigging hogeyes/anchors.
6. The motor operator is provided with a 65-foot cable to connect to the UAD cabinet. If additional length is required, one 20-foot extension (SAP 10107171), one 40-foot extension (10107172), or one 60-foot extension (SAP 10107173) may be added. Do not exceed a total length of 125 feet of control cable from motor to UAD cabinet.

Figure SE 285–4: Cleaveland/Price Motor Operator Retrofitted to Position 4 on a Pad-Mounted G&W RAM-Type SF_6 Gas-Filled Switch



Front View

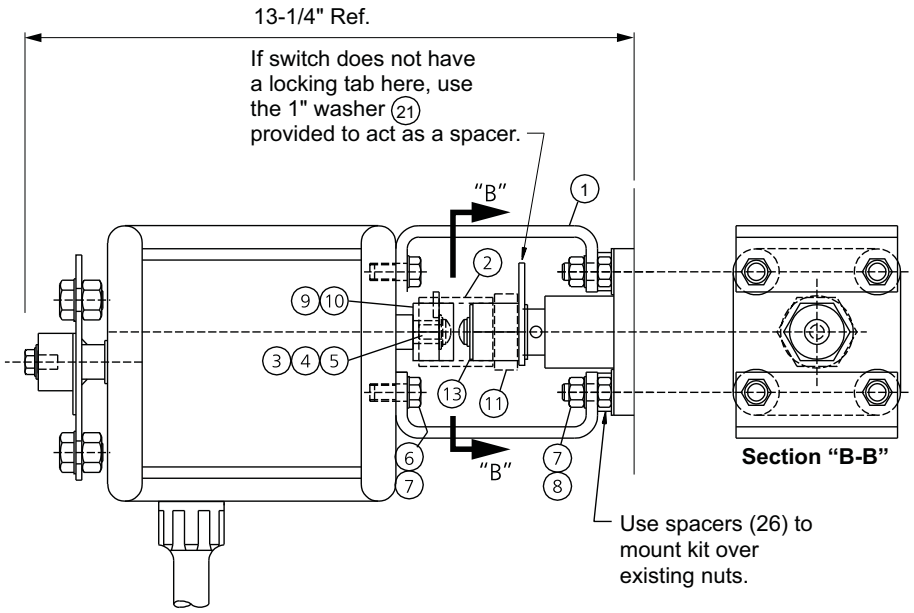


Side View

Note(s):

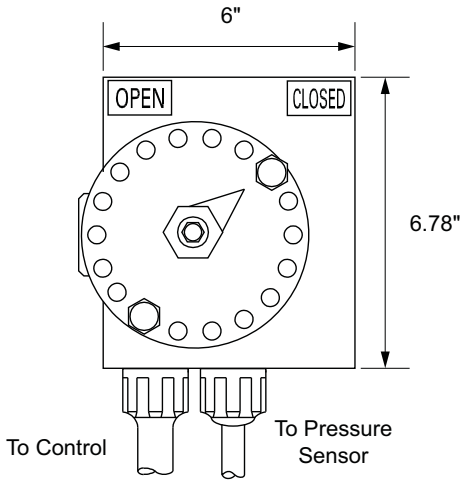
1. A pressure sensor is installed on the gas fill port of the G&W RAM-type SF_6 gas-filled switch and connected by way of a pigtail to the motor operator to provide a safety interlock that prevents motor operation for low gas pressure.
2. Apply loctite to the Schrader valve and hand tighten pressure switch sensor to the switch as required in the installation instructions.
3. When automating pad-mounted G&W RAM-type SF_6 gas-filled switches, the G&W manual handle extension (SAP 10107162) **IS NOT REQUIRED** for pad-mounted installations. Any position can be automated, as the space between the switch position provides adequate operating clearance for the remaining handles without the use of the G&W manual handle extension.
4. When automating pad-mounted G&W RAM-type SF_6 gas-filled switches, a pressure switch extension cable (SAP 10178899) may be required. The pressure switch extension cable is required when retrofitting a Cleaveland/Price Motor Operator to Position 1 on a 5-way switch, and to Positions 1 or 2 on a 6-way switch.
5. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Figure SE 285–5: Cleaveland/Price Motor Operator for G&W RAM-Type SF_6 Gas-Filled Switch



Side View

Description	Item
Mounting Bracket	01
Slider Coupler	02
Self-Lock Screw 5/16-18 x 1/2"	03
External Tooth Lock Washer: SST	04
Flat Washer: SST	05
Hex Head Bolt: SST	06
External Tooth Lock Washer: SST	07
Hex Nut: SST	08
Coupling Nut	09
1/8" x 1/2" Lg Roll Pin: SST	10
Retaining Clip	11
Brass Washer	13
Flat Washer SST	21
Spacer 0.415 Lg SST	26

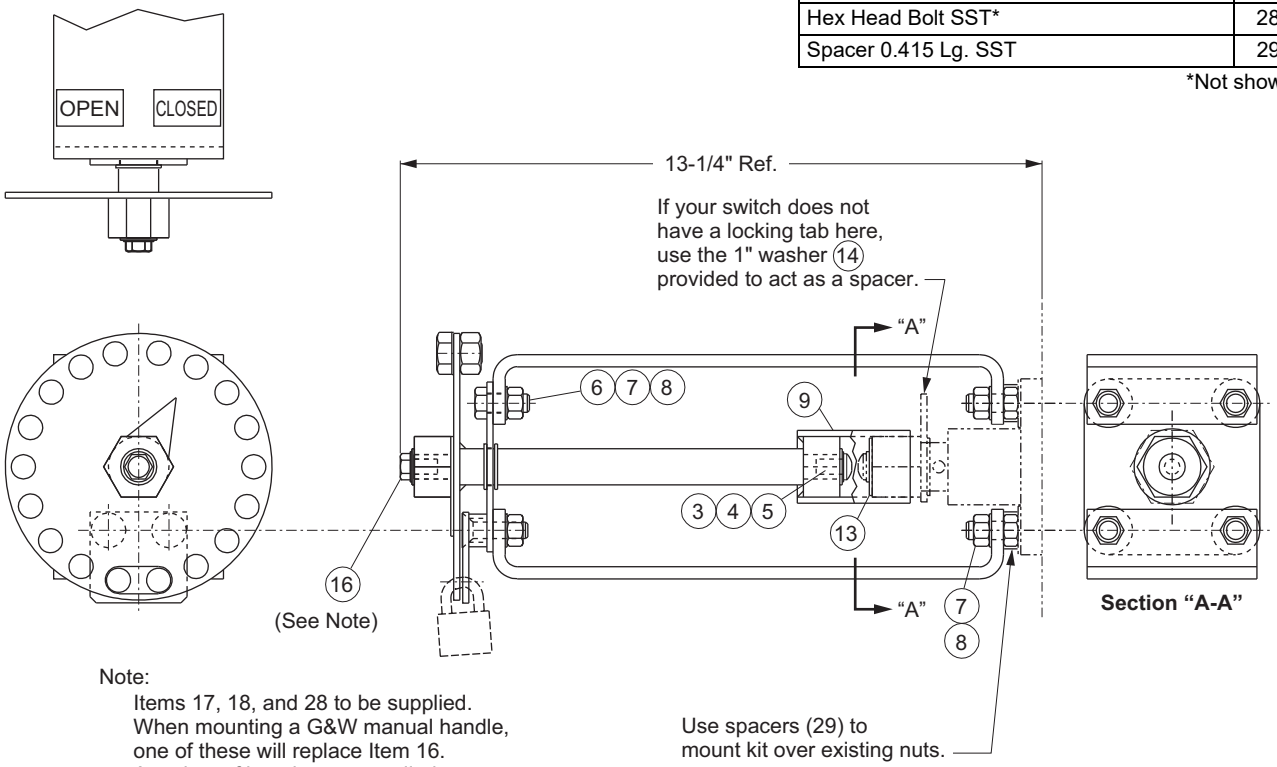


Front View

Figure SE 285–6: Cleaveland / Price Motor Operator Manual Handle Extension for Submersible G&W RAM-Type SF_6 Gas-Filled Switch

Description	Item
Self-Lock Button Head 5/16 — 18 x 1/2”	03
External Tooth Lock Washer: SST	04
Flat Washer: SST	05
Hex Head Bolt: SST	06
External Tooth Lock Washer: SST	07
Hex Nut: SST	08
Coupler	09
Brass Washer	13
Flat Washer SST	14
Hex Head Bolt SST	16
Hex Head Bolt SST*	17
Hex Head Bolt SST*	18
Hex Head Bolt SST*	28
Spacer 0.415 Lg. SST	29

*Not shown



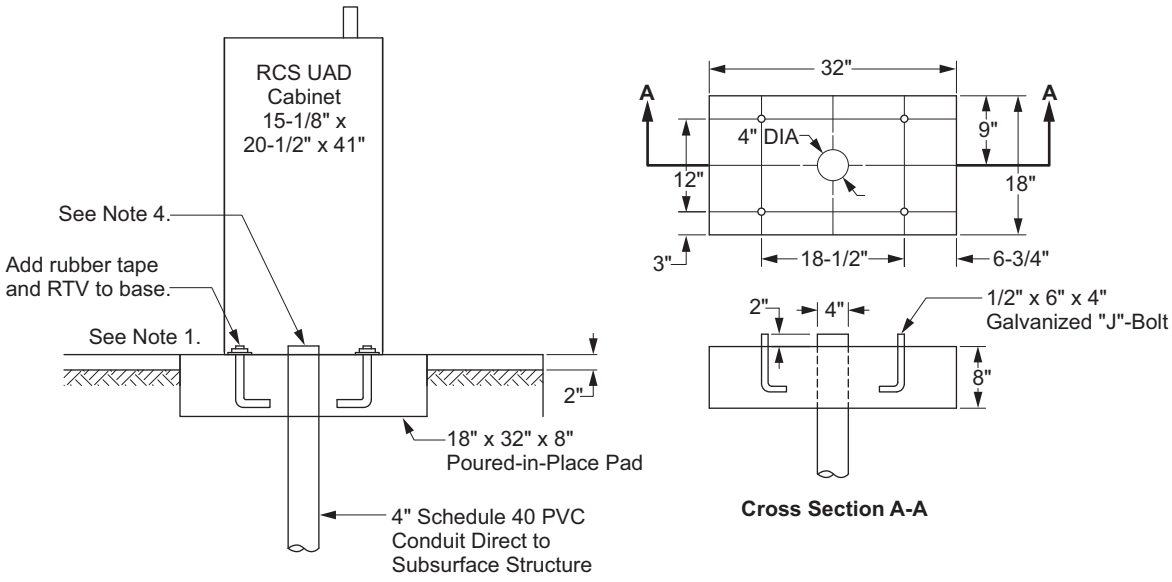
Note:
Items 17, 18, and 28 to be supplied. When mounting a G&W manual handle, one of these will replace Item 16. A variety of lengths are supplied because of the different thicknesses of G&W handles that exist.

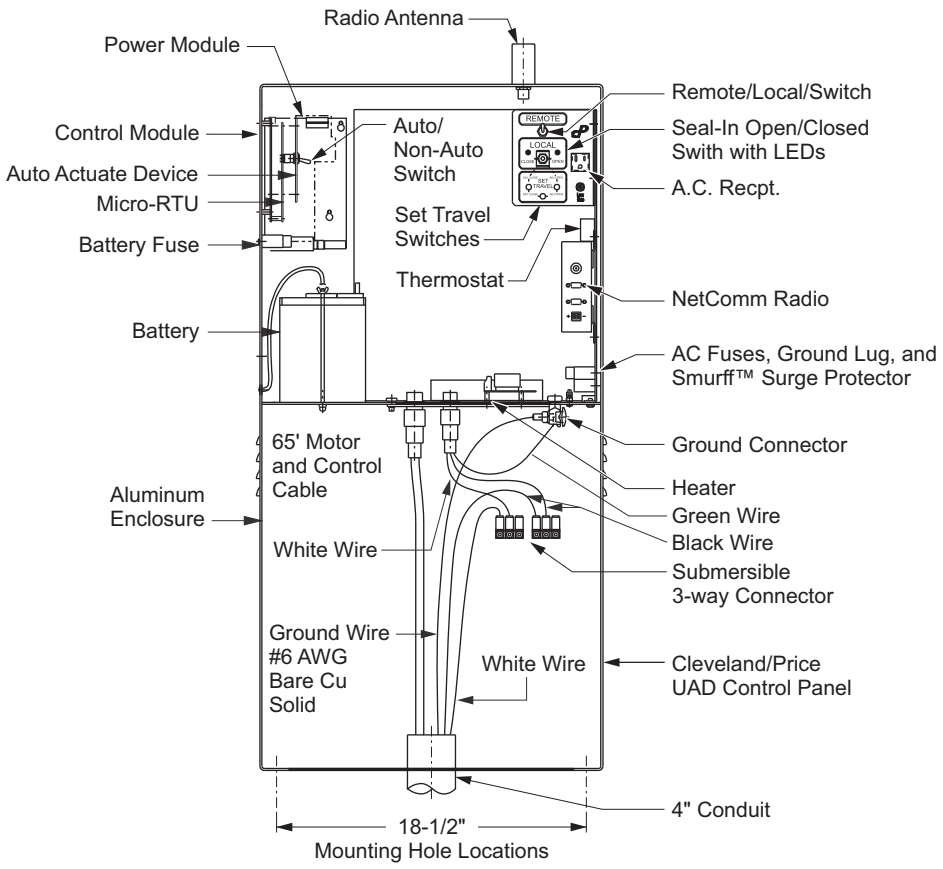
Note(s):

1. The G&W manual handle extension (SAP 10107162) will be required for all positions to the left of the motor operator on submersible G&W RAM-type SF_6 gas-filled switches.
2. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Scope SE 285.2 Installation of Underground Automated Distribution (UAD) Controller Cabinet

Figure SE 285–7: Preferred RCS UAD Cabinet Installation — Dimensions and Connections

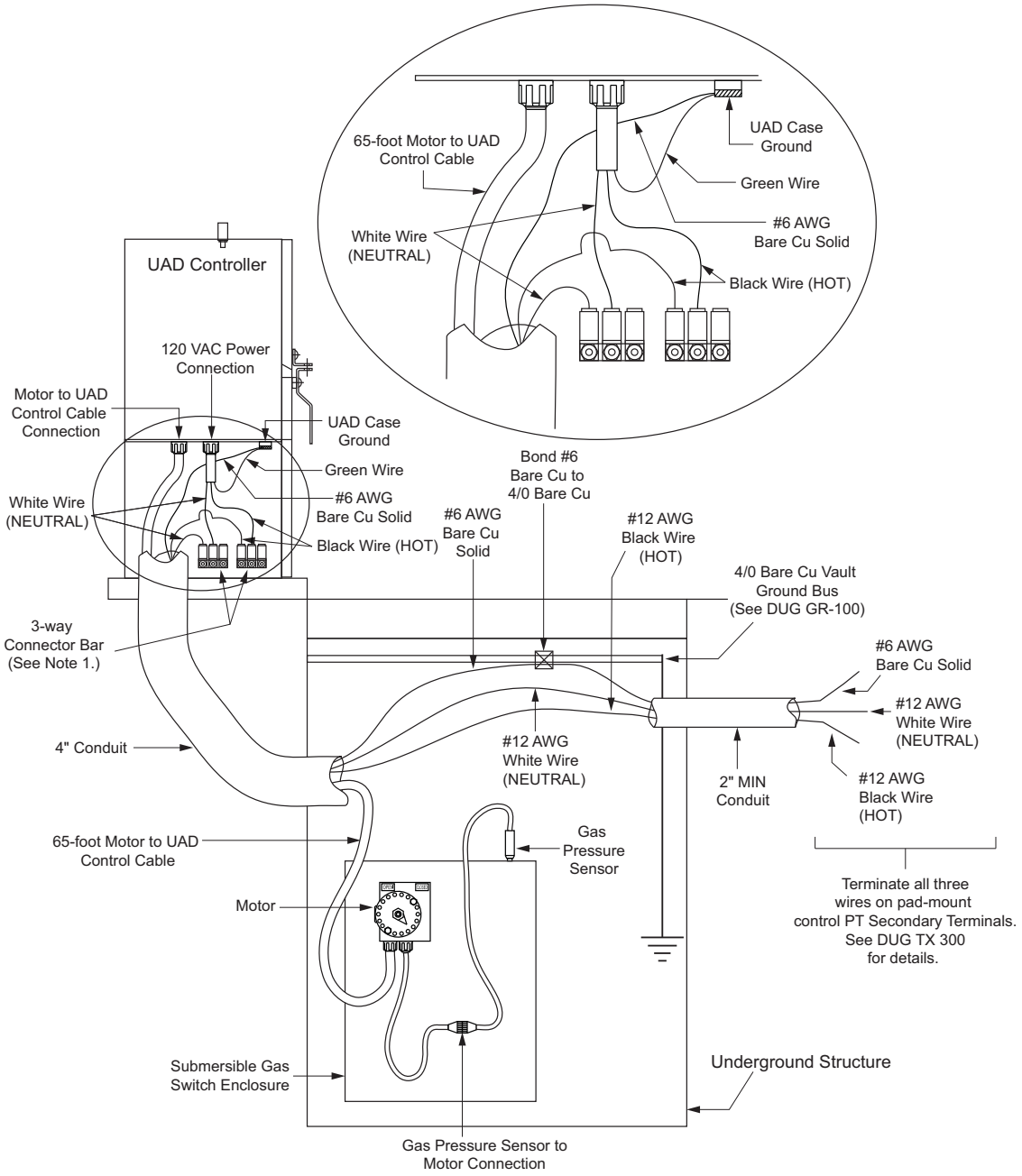




Note(s):

1. UAD cabinet door should NOT face vent pipe or street traffic lane.
2. 120 VAC to be provided to RCS controller from a dedicated control transformer connected to primary on source side of switch. For control power, use #12 AWG white and #12 AWG black copper wire.
3. Apply duct seal to close conduit opening in UAD cabinet. See CW 105.
4. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the vault ground bus.
5. Use submersible 3-way connectors SAP 10181501 for 120 VAC connections. See Figure SE 285–7and Figure SE 285–8 for wiring diagram.
6. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.Refer to DOM SW-11, attachment 12 for further details on test requirements.

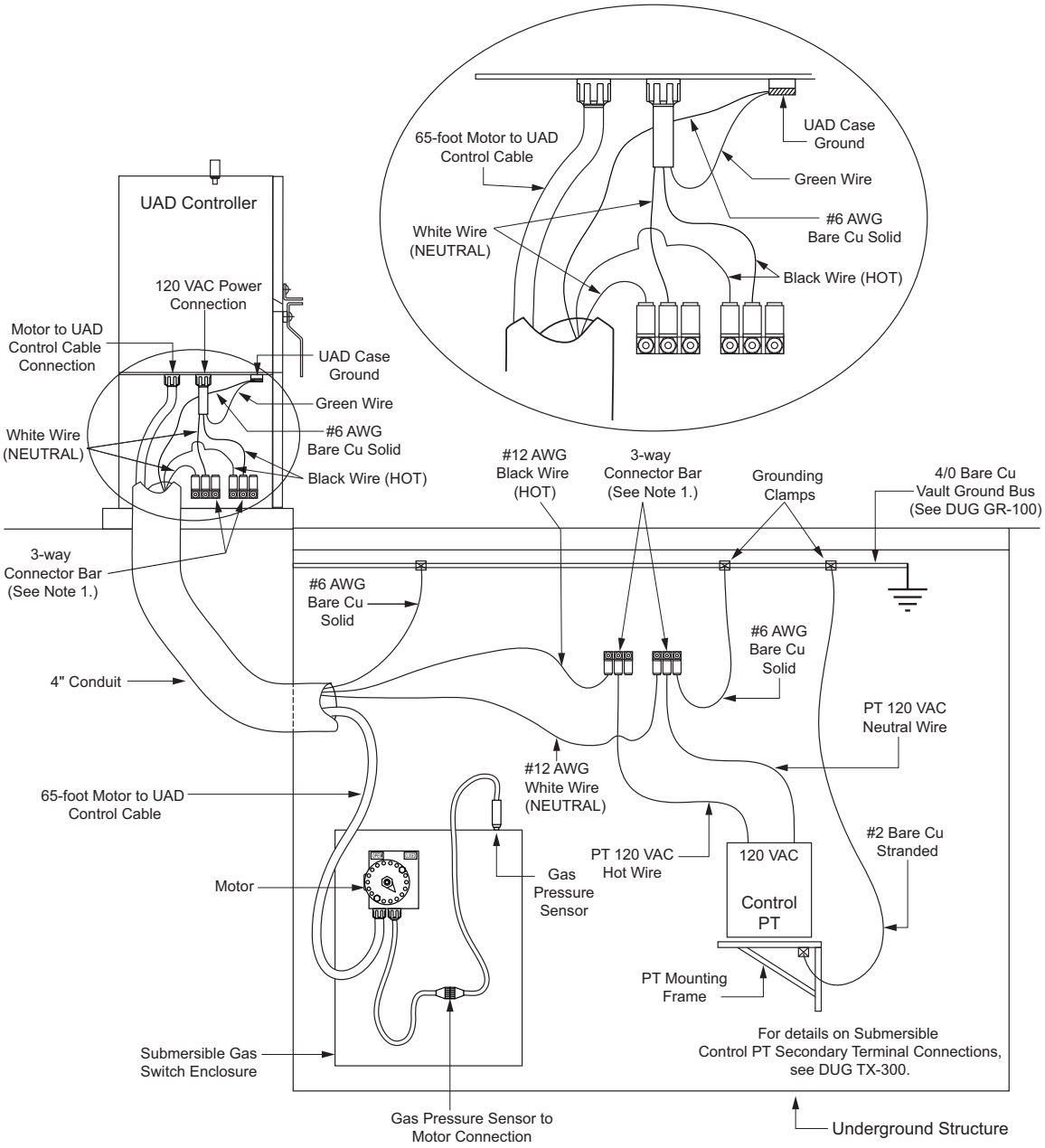
Figure SE 285–8: G&W Gas Switch 120 Volt Secondary Wiring Diagram – Pad-Mounted CPT Method



Note(s):

1. Use submersible 3 way connectors (SAP 10181501) for 120 VAC connections required from the UAD cabinet to the transformer.
2. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324).
3. Follow procedures for taping of the pressure sensor switch to motor connection as specified on Scope SE 285.6.
4. Terminate #12 AWG white wire, #12 AWG black wire and #6 bare solid Cu from UAD to dedicated pad-mounted control transformer. See TX-300 for details on transformer connections.
5. The control power (120 VAC) is to be provided to the RCS controller by a dedicated control transformer connected to primary on the source/line side of the gas switch.
6. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Figure SE 285–9: G&W Gas Switch 120 Volt Secondary Wiring Diagram – Submersible CPT Method

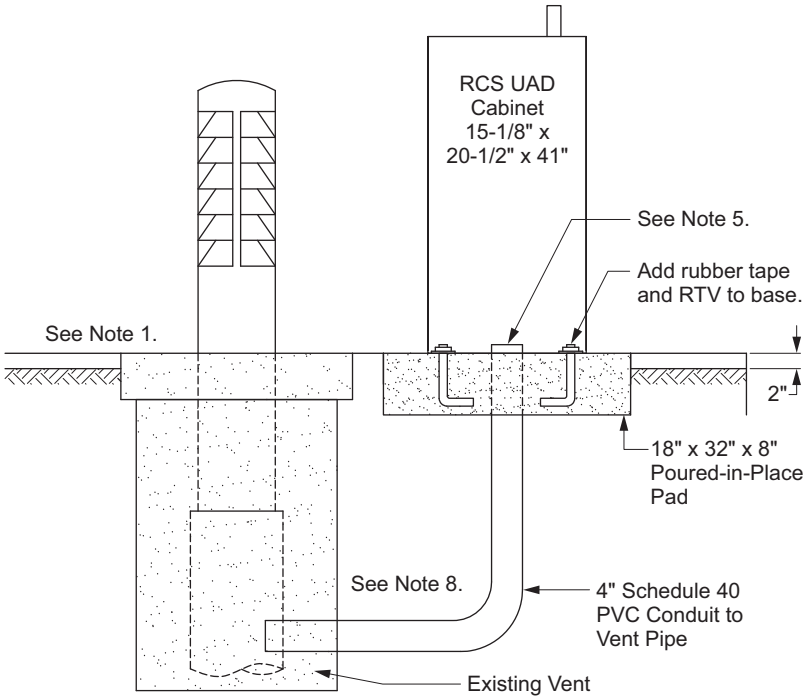


Note(s):

1. Use submersible 3 way connectors (SAP 10181501) for 120 VAC connections required from the UAD cabinet to the transformer.
2. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the underground structure ground bus.
3. On submersible transformers (ABB), coil and seal the end of the unused secondary terminal with mastic covered by 3M 33 Vinyl Electrical Tape. See Scope 285.6 and TX-300 for details.
4. The control power (120 VAC) is to be provided to the RSC controller by a dedicated control transformer connected to primary on the source/line side of the gas switch.
5. Follow procedures for taping of the pressure sensor switch to motor connection as specified on Scope SE 285.6.
6. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Scope SE 285.3 Alternate Installation of Underground Automated Distribution (UAD) Controller Cabinet

Figure SE 285–10: Alternate RCS UAD Cabinet Installation — Dimensions and Connections



Note(s):

1. Confirm that the vent pipe chosen is not equipped with a vault blower. Feed pull rope down the other vent pipe if this is found to be the situation.
2. Ensure that pull rope goes all the way from UAD to vault.
3. If the vent pipe present is made of steel, and the lid is welded shut, replace vent pipe. See VE 225.
4. Distance between vent and UAD control cabinet may vary. UAD cabinet door should NOT face vent pipe or street traffic lane.
5. Apply duct seal to close conduit opening in UAD cabinet. Refer to CW105.
6. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the vault ground bus.
7. Distance between vent and UAD control cabinet may vary. UAD cabinet door should not face vent pipe or street traffic lane.
8. Ensure that the end of the 4" PVC conduit is flush with the PVC vent pipe to prevent cable binding during installation.
9. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Scope SE 285.4 Preferred Installation of Underground Automated Distribution Two-way (Double-UAD) Controller Cabinet

Figure SE 285–11: Preferred RCS Double-UAD Cabinet Installation—Dimensions and Connections

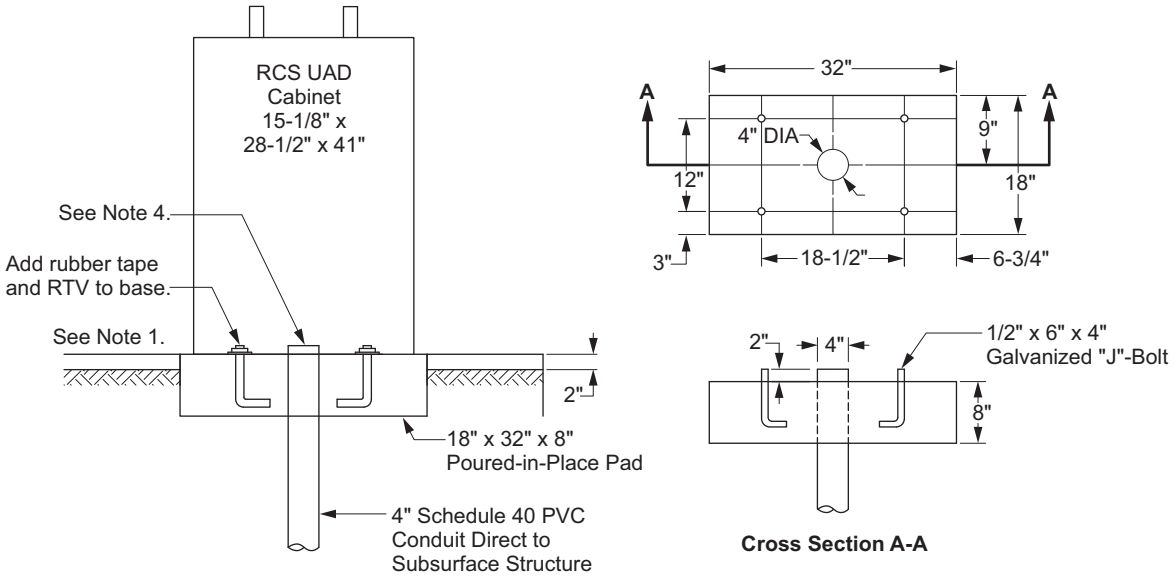
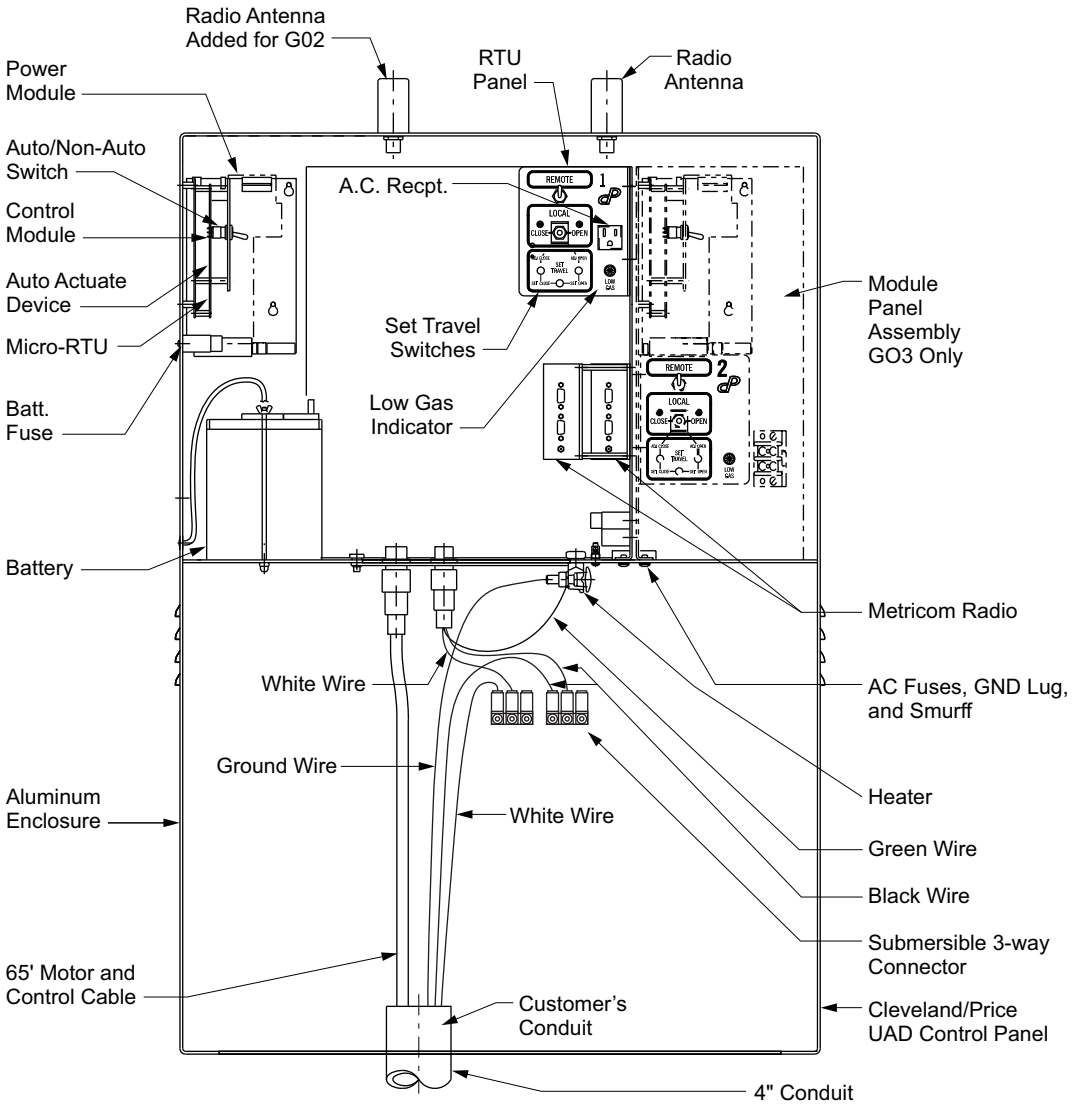


Figure SE 285–12: Cabinet Details

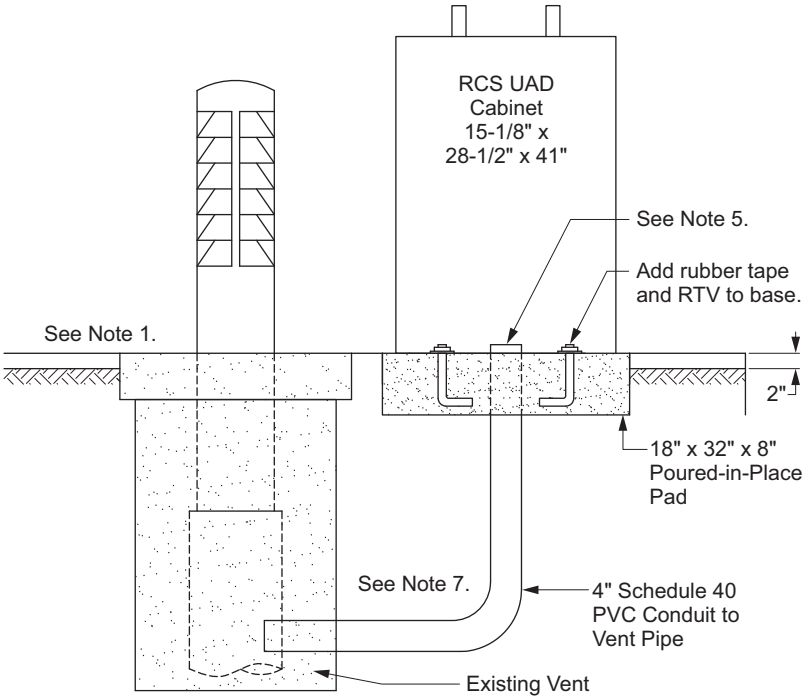


Note(s):

1. UAD cabinet door should NOT face vent pipe or street traffic lane.
2. Ensure that pull rope goes all the way from UAD to the subsurface structure.
3. 120 VAC to be provided to RCS controller from a dedicated control transformer connected to primary on source side of switch. For control power, use #12 AWG white and #12 AWG black copper wire.
4. Apply duct seal to close conduit opening in UAD cabinet. Refer to CW 105.
5. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the vault ground bus.
6. Use submersible 3-way connectors SAP 10181501 for 120 VAC connections.
7. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, attachment 12 for further details on test requirements.

Scope SE 285.5 Alternate Installation of Underground Automated Distribution Two-Way (Double-UAD) Controller Cabinet

Figure SE 285–13: Alternate RCS Double-UAD Cabinet Installation-Dimensions and Connections

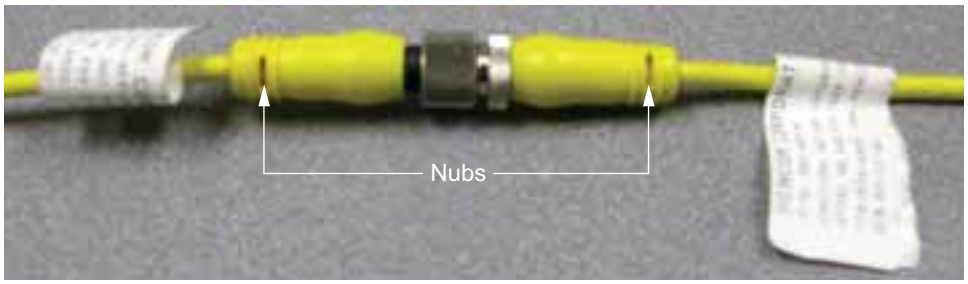


Note(s):

1. Confirm that the vent pipe chosen is not equipped with a vault blower. Feed pull rope down the other vent pipe if this is found to be the situation.
2. If the vent pipe present is made of steel, and the lid is welded shut, remove the top of the vent tube and place a permanent, but removable, lid in place of the removed steel top.
3. If replacing the vent pipe is required, refer to VE 225.
4. Distance between vent and UAD control cabinet may vary. UAD cabinet door should NOT face vent pipe or street traffic lane.
5. Apply duct seal to close conduit opening in UAD cabinet. Refer to CW 105.
6. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the vault ground bus.
7. Ensure that the end of the 4" PVC conduit is flush with the PVC vent pipe to prevent cable binding during installation.
8. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, attachment 12 for further details on test requirements.

Scope SE 285.6 33/23/33 Taping Method for UAD Pressure Switch Connector

1. Connect the pressure switch pigtail to the motor auxiliary function cable.



2. Reverse layer of 33 Tape (SAP 10116918)

   Apply a reverse layer of 33 electrical tape (adhesive side up) extending 1" beyond the ends of the connectors, overlapping by 1/2 tape width. (Adhesive side of tape should face outward so it does NOT stick to the connectors).

3. Middle layer of 23 Rubber Splicing (Self-fusing) Tape (SAP 10116970)

   Apply 23 Rubber Splicing Tape over the reverse layer of 33 electrical tape, extending 1" beyond the first layer on both ends. While taping, stretch and overlaop by 1/2" tape width.

4. Final layer of 33 Tape

   Apply a final layer of 33 electrical tape (adhesive side down) extending 1" beyond the layer of 23 Rubber Splicing Tape on both ends, overlapping by 1/2" tape width.

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SE 286 Installation Procedure for Cleaveland/Price UAD and Motor Operator on Submersible G&W Gas-Filled RAG Switch

Scope SE 286.1 Installation Procedure for Retrofitting a Top-Connected Gas-Filled RA-Type Ground (RAG) Switch in Vaults as a Remote Controlled Switch (RCS)

1.0 General Information

1.1 The Top-Connected Gas-Filled RAG Switches are available in two to six way switching configurations where each three-phase way has a gang-operated, three-pole switch. Top-Connected G&W RAG gas switches are rated for 17 kV or 38 kV maximum voltage, 600 Amp load-break switching capability and can be mounted on the wall or on the floor of a subsurface structure

1.2 DO NOT automate G&W RAG-type SF_6 gas-filled switches that are installed on Pad-mounted Enclosures (PM).

1.3 A maximum of two submersible Cleaveland/Price motor operators can be retrofitted to any position on one G&W RAG-type SF_6 gas-filled switch.

A. A Cleaveland/Price Underground Automated Distribution (UAD) controller is contained in an above ground pad-mounted cabinet and is connected to the motor operator(s) by a control cable. The UAD controller is powered from an AC Power cable fed from underground structure into the pad-mounted UAD cabinet.

B. A pressure sensor is installed on the gas fill port at the top of the G&W RAG-type SF_6 gas-filled switch to provide a safety interlock that prevents motor operations under a low gas pressure condition in the G&W switch. The pressure sensor connects from the gas fill port at the top of the G&W RAG-type SF_6 gas-filled switch to low pressure gas connector located on the bottom of the Cleaveland/Price motor.

C. On submersible G&W RAG-type SF_6 gas switches, handle extensions are NOT required on non-automated G&W RAG switch positions for CPI UAD Motor Operator for RAG application.

D. Distribution construction shall contact the Distribution Automation Hot line when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, Attachment 12 for further details on test requirements.

E. Mark the RCS control enclosure on the left-top corner to identify RCS number and automated position (Ex. RCS1234 Pos. 1). Use approved reflective yellow letters and numbers on black background. Refer to DUG TX 160 for equipment labeling requirements.

F. The RAG position to be automated is required to be in the CLOSED position prior to installation of the CPI RAG Automation hardware.

1.4 A dedicated 120 VAC source is required to power the UAD controller:

A. See TX 300 for dedicated control power transformer installation procedure.

B. The control transformer shall be connected to the line side of the primary source to the G&W RAG-type SF_6 gas-filled switches.

C. The secondary neutral shall be grounded to the structure ground system at the control transformer.

1. On the 12 kV or 16 kV to 120 VAC single phase, pad-mount control transformer, the secondary neutral ground is grounded at the transformer neutral terminal. See TX-300 and Figure SE 286–14 for more details.

D. A voltage source sign is required to be placed at the location where the control transformer is switched or de-energized (for example a switch position) and on the control transformer itself.

Figure SE 286–1: RCS Voltage Source Sign (SAP 10135323)

E. Single phase switching for phase-to-phase transformers may result in ferro-resonance. An alternate phase-to-ground transformer may be applied to mitigate ferro-resonance on 4-wire circuits. (See DUG TX 300 for SAP numbers of alternate phase-to-ground transformers.)

2.0 Material Information

The Cleaveland/Price UAD and Motor Operator Kit For RAG Switch Kit provides the complete UAD controller, motor operator with control cable, and mounting kit with pressure switch and connecting cables. Refer to Table SE 286P-1 for description of components included in kit. The kit is compatible with both Submersible RAG Versions (Removable and Non-Removable Hub Disk Designs, refer to Section 3.0 for additional details).

Table SE 286–1: SAP Numbers — New Installations

Description	SAP (One Way UAD)	SAP (Two Way UAD)
UAD RAG controller, motor operator(s) with 65-foot control cable, and mounting kit including pressure switch[a/]	10204672	10210612
RCS Voltage Source Sign	10135323	10135323
100' UAD RAG Motor Control Cable	10210228	10210228
150' UAD RAG Motor Control Cable	10210229	10210229

[a/] The UAD motor is supplied with a standard 65-foot control cable.

Note(s):
1. For replacement parts and material SAP numbers, refer to DOM SW-11.

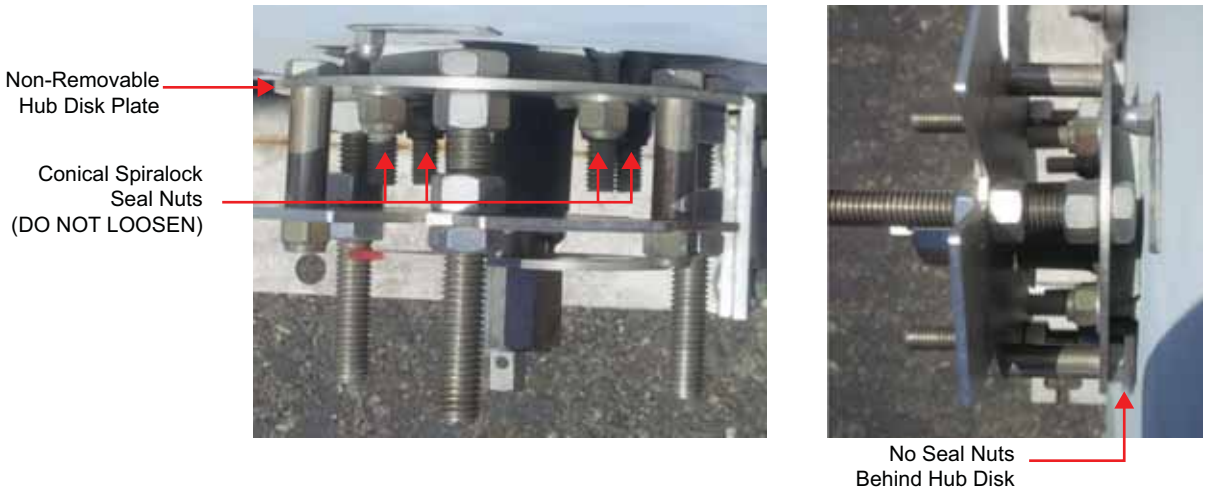
3.0 Identification of G&W Submersible RAG Switch Vintage and Automation Installation

It is critical to identify the G&W RAG Switch vintage prior to proceeding with removal of RAG Switch assembly hardware. There are two types of RAG switch vintages; an older version with a 'Permanent Non-Removable Hub Disk Assembly' and a newer version with a 'Removable Hub Disk Assembly'. Refer to Figures SE 286-2 and SE 286-5 to determine the version of G&W RAG switch.

3.1 Submersible G&W RAG switches with Non-Removable Hub Disk Assembly

Submersible G&W RAG switches manufactured prior to 2014 feature a non-removable Hub Disk plate, with Conical Spiralock Seal Nuts in front of the Hub Disk plate that provide the gas seal for the SF_6 gas inside the switch tank. The non-removable Hub Disk assembly does not have seal nuts behind the hub disk. Therefore, do not loosen or remove the Conical Spiralock Seal Nuts securing the Hub Disk plate, as this will compromise the ability of the switch to hold the SF_6 gas pressure and will cause a gas leak. Refer to Figure Figure SE 286–2 for additional details on location of the Hub Disk and Conical Spiralock Seal Nuts.

Figure SE 286–2: Submersible G&W RAG Switch with Non-Removable Hub Disk Type Design (Pre-2014 Vintage)



Top View: RAG Switch Non-removable Hub Disk Type

Right Side View: RAG Switch Non-Removable Hub Disk Type

NOTE

It is important to identify the type of Non-Removable Hub Disk Assembly on the switch. On one version of the hub disk, the non-removable stop bolts show in Figure 286-3 will mount through the motor mounting brackets. On the other version, three of the hub disk stop bolt are removable as shown in Figure SE 286-4.

Figure SE 286–3: Non-Removable Hub Disk with Non-Removable Stop Bolts

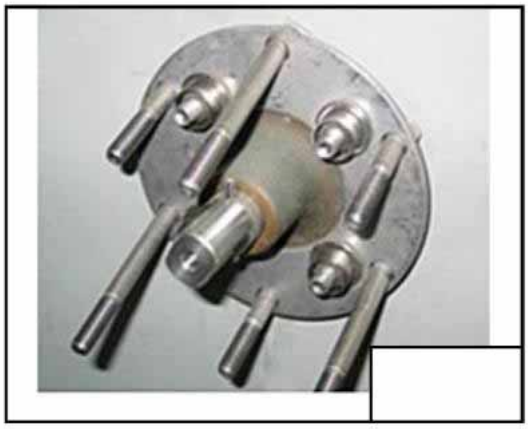
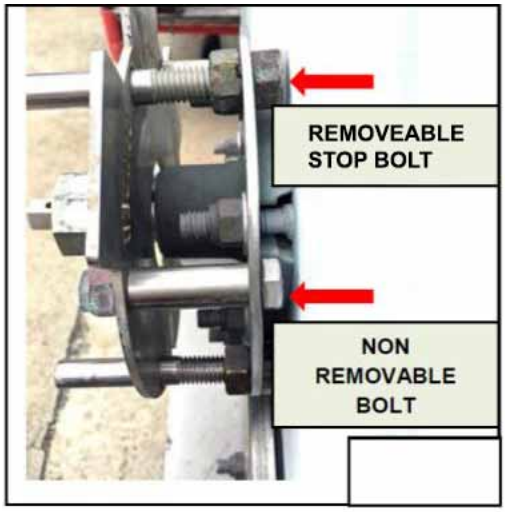


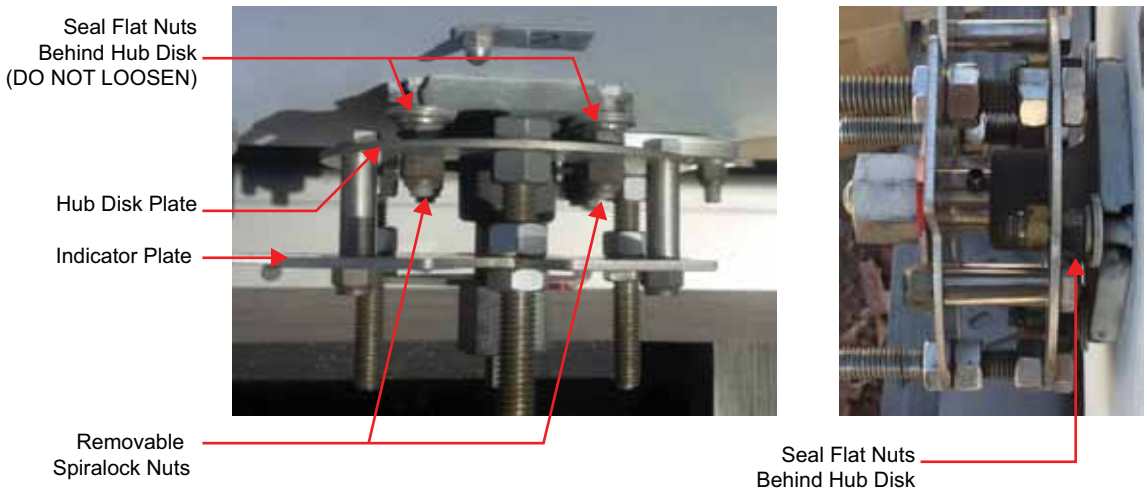
Figure SE 286–4: Top Right View of Non-Removable Hub Disk with Removable Stop Bolts



3.2 Submersible G&W RAG switches with Removable Hub Disk Assembly

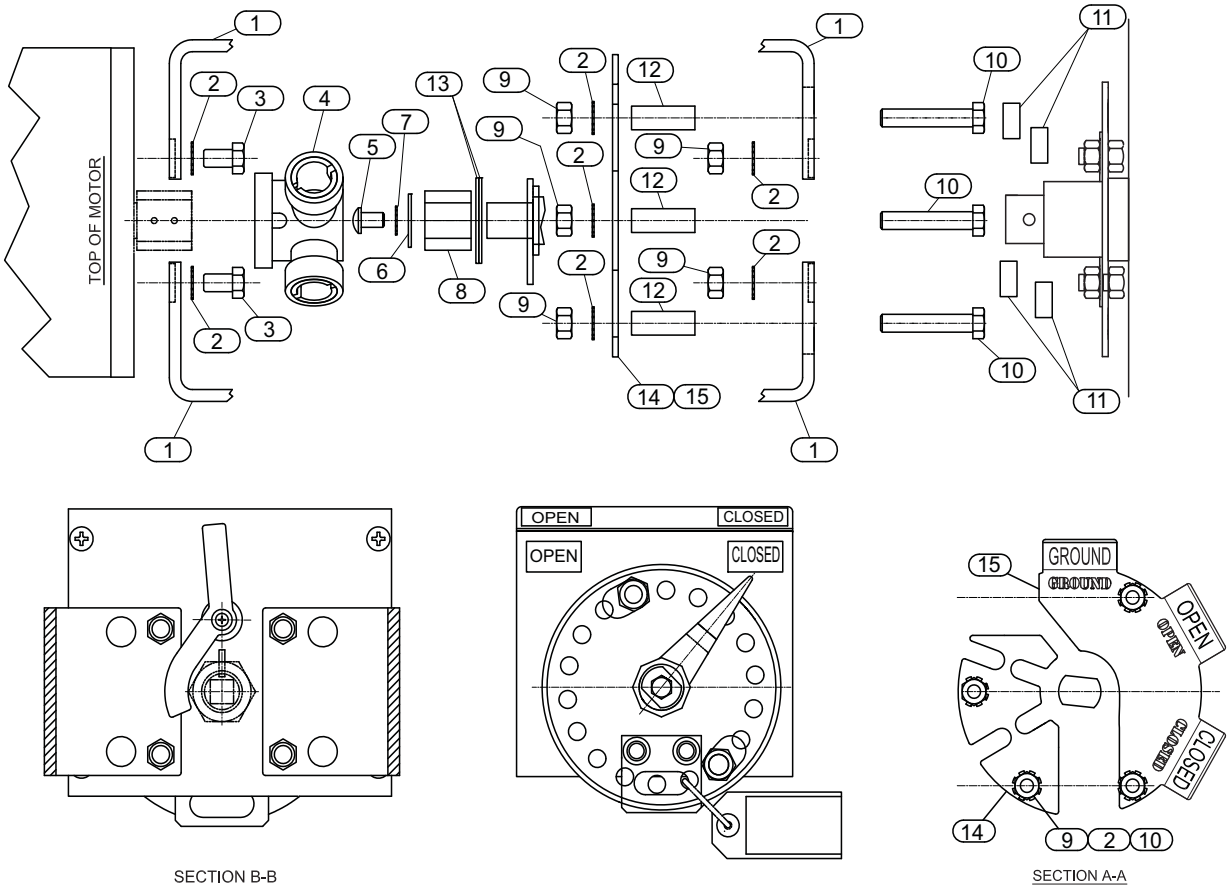
G&W RAG switches manufactured after 2014 feature a removable Hub Disk Plate design, with Seal Flat Nuts located behind the Hub Disk Plate, which provide the seal for the SF_6 gas. DO NOT LOOSEN or remove the Seal Flat Nuts behind the lock assembly plate, as this will compromise the ability of the switch to hold SF_6 gas. Refer to Figure SE 286P-5 for additional details on location of the lock assembly plate and critical SF_6 seal Flat Nuts.

Figure SE 286–5: Submersible G&W RAG Switch Lock Assembly with Removable Hub Disk Type Design



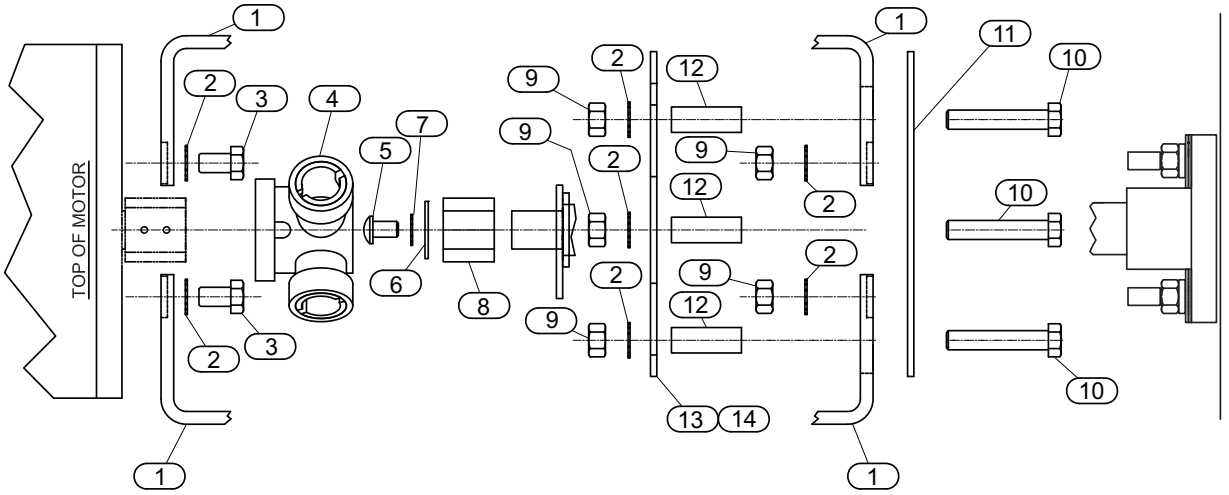
4.0 Dimensions and Connections

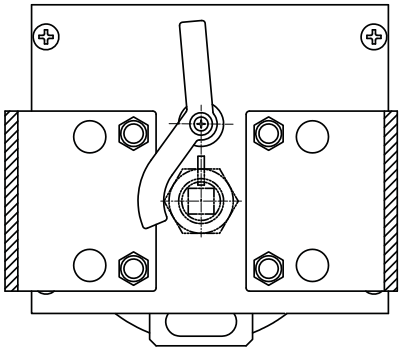
Figure SE 286–6: Cleaveland/Price Motor Operator and Mounting Details for G&W RAG-Type Non-Removable Hub Disk SF_6 Gas-Filled Switches Manufactured Prior to 2014



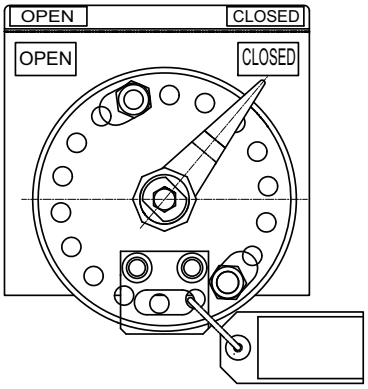
Description	Item No.
RAG UAD Motor Mounting Bracket	1
3/8" External Tooth Lock Washer	2
3/8"-16 x .625" Hex Head Bolt	3
Sliding Coupler	4
5/16"-18 x .5" Self-Locking Screw	5
Brass Washer	6
5/16" External Tooth Lock Washer	7
Decoupler Nut	8
3/8"-16 Hex Nut	9
3/8"-16 x 2" Hex Head Bolt	10
.415" Stainless Steel Motor Spacers	11
1.375" Stainless Steel Spacers	12
1/2" Stainless Steel Washers	13
Rear Locking Bracket Plate	14
Rear Switch Position Bracket	15

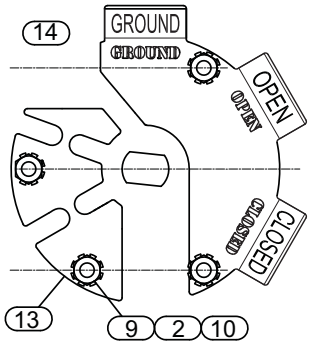
Figure SE 286–7: Cleaveland/Price Motor Operator and Mounting Details for G&W RAG-Type Removable Hub Disk SF_6 Gas-Filled Switches Manufactured after 2014





SECTION B-B

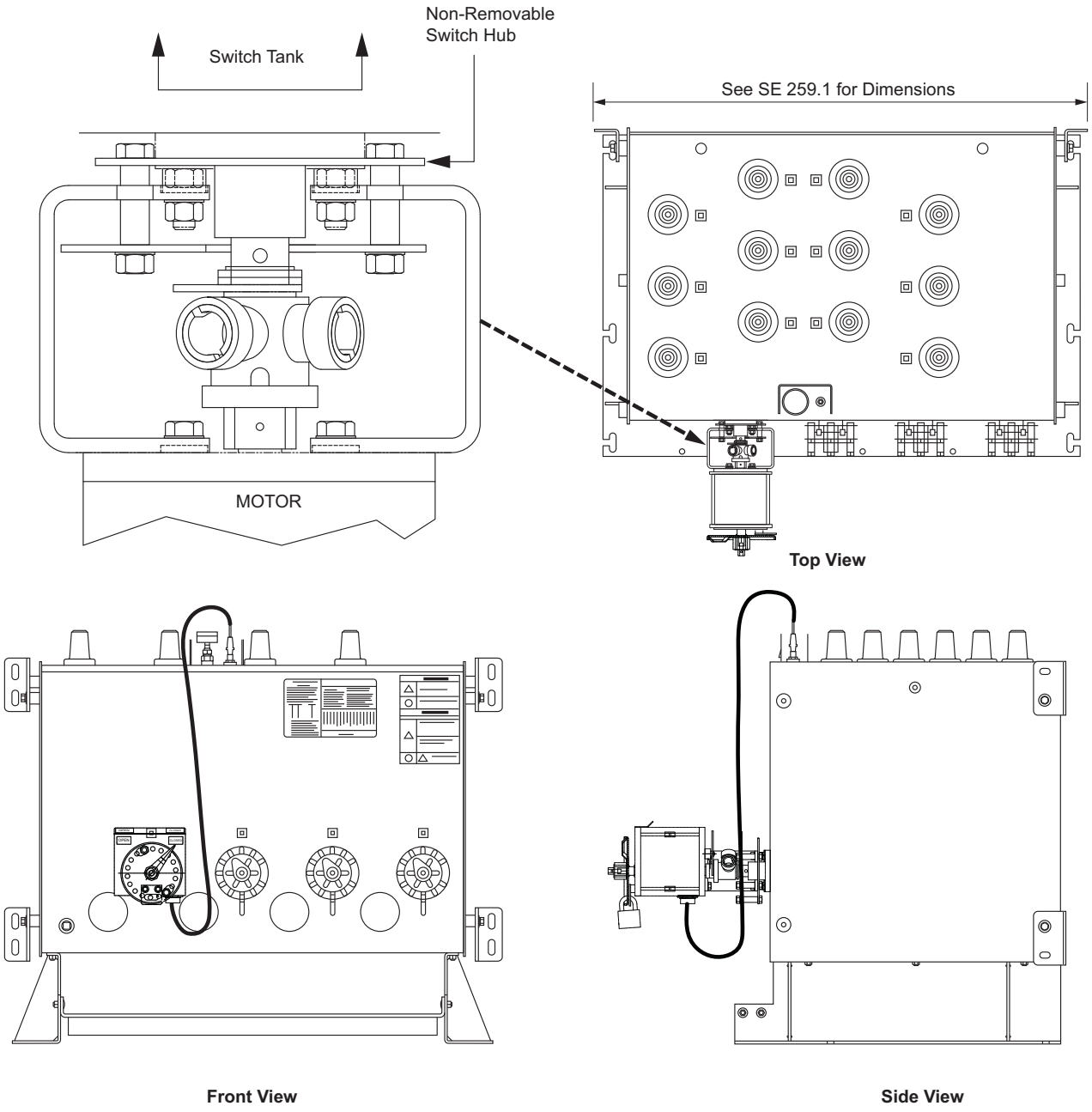




SECTION A-A

Description	Item No.
RAG UAD Motor Mounting Bracket	1
3/8" External Tooth Lock Washer	2
3/8"-16 x .625" Hex Head Bolt	3
Sliding Coupler	4
5/16"-18 x .5" Self-Locking Screw	5
Brass Washer	6
5/16" External Tooth Lock Washer	7
Decoupler Nut	8
3/8"-16 Hex Nut	9
3/8"-16 x 2" Hex Head Bolt	10
CPI Spacer Plate	11
1.375" Stainless Steel Spacers	12
Rear Locking Bracket Plate	13
Rear Switch Position Bracket	14

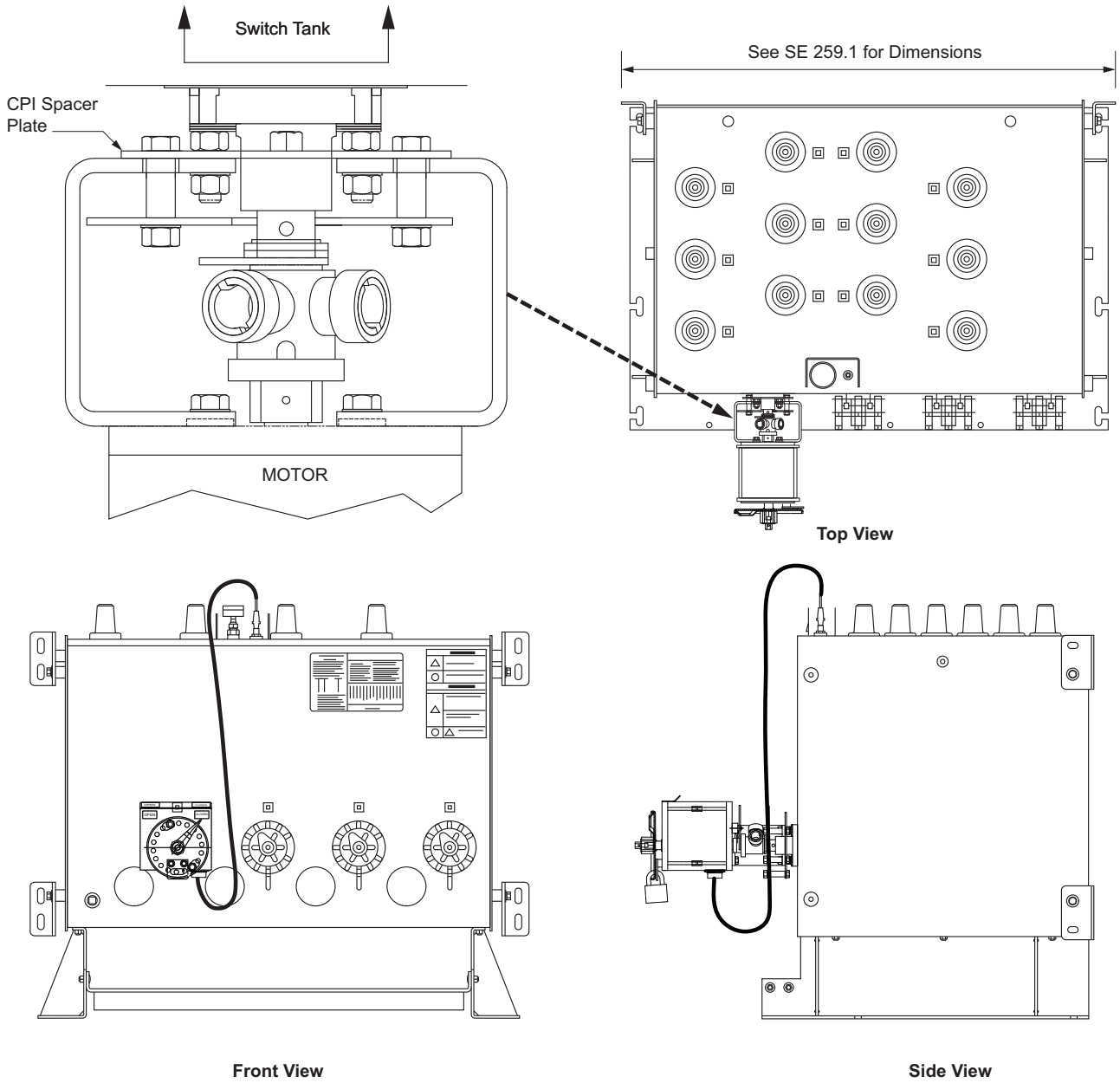
Figure SE 286–8: Typical Cleaveland Price Motor Operator Installed on Submersible G&W RAG-Type Gas-Filled Switches Manufactured Prior to 2014 (Non-Removable Hub Disk)



Note(s):

1. A pressure switch is installed on the gas fill port of the G&W RAG-type SF_6 gas-filled switch and connected to the motor operator to provide a safety interlock that prevents motor operation under a low gas pressure condition.
2. Apply loctite to the Schrader valve and hand tighten pressure switch sensor to the switch as required in the installation instructions
3. Rigging for manual switching will be altered on a position that a motor operator is mounted. Confirm existing rigging hog eyes/anchors will accommodate for the additional spacing created from the motor operator. If necessary, install new rigging hog eyes/anchors.
4. The motor is provided with a 65-foot cable to connect to the UAD cabinet.

Figure SE 286–9: Typical Cleaveland Price Motor Operator Installed on Submersible G&W RAG-Type Gas-Filled Switches Manufactured after 2014 (Removable Hub Disk)



Note(s):

1. A pressure switch is installed on the gas fill port of the G&W RAG-type SF_6 gas-filled switch and connected to the motor operator to provide a safety interlock that prevents motor operation under a low gas pressure condition.
2. Apply loctite to the Schrader valve and hand tighten pressure switch sensor to the switch as required in the installation instructions
3. Rigging for manual switching will be altered on a position that a motor operator is mounted. Confirm existing rigging hog eyes/anchors will accommodate for the additional spacing created from the motor operator. If necessary, install new rigging hog eyes/anchors.
4. The motor is provided with a 65-foot cable to connect to the UAD cabinet.

Scope SE 286.2 Verifying Installation of Sliding Coupler

Verify the sliding coupler can move freely between the switch operating shaft and the alignment pins on the UAD motor operating shaft, refer to Figure SE 286–10. This is accomplished by rotating the decoupler status lever in a counter-clockwise direction (as viewed from front of motor, refer to Figure SE 286–11) and moving the sliding coupler back and forth between the coupler nut on the motor and the coupler nut on the switch output shaft, using the UAD handle, refer to Figure SE 286–12. Verify the pins on the UAD motor operating shaft align with the flange on the sliding coupler. If all steps have been verified, the installation of the motor assembly is successful.

Figure SE 286–10: Sliding Coupler Flange and UAD Motor Alignment Pins

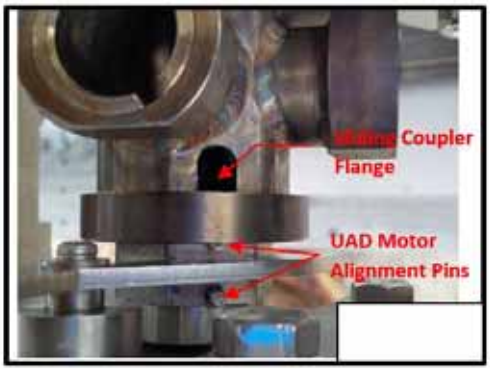


Figure SE 286–11: Sliding Coupler Movement and Decoupler Status Lever

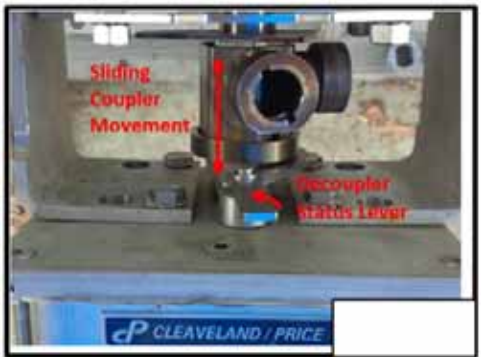
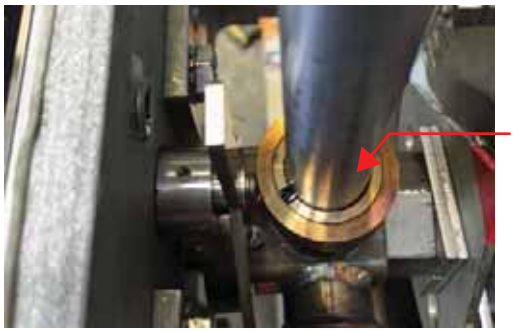
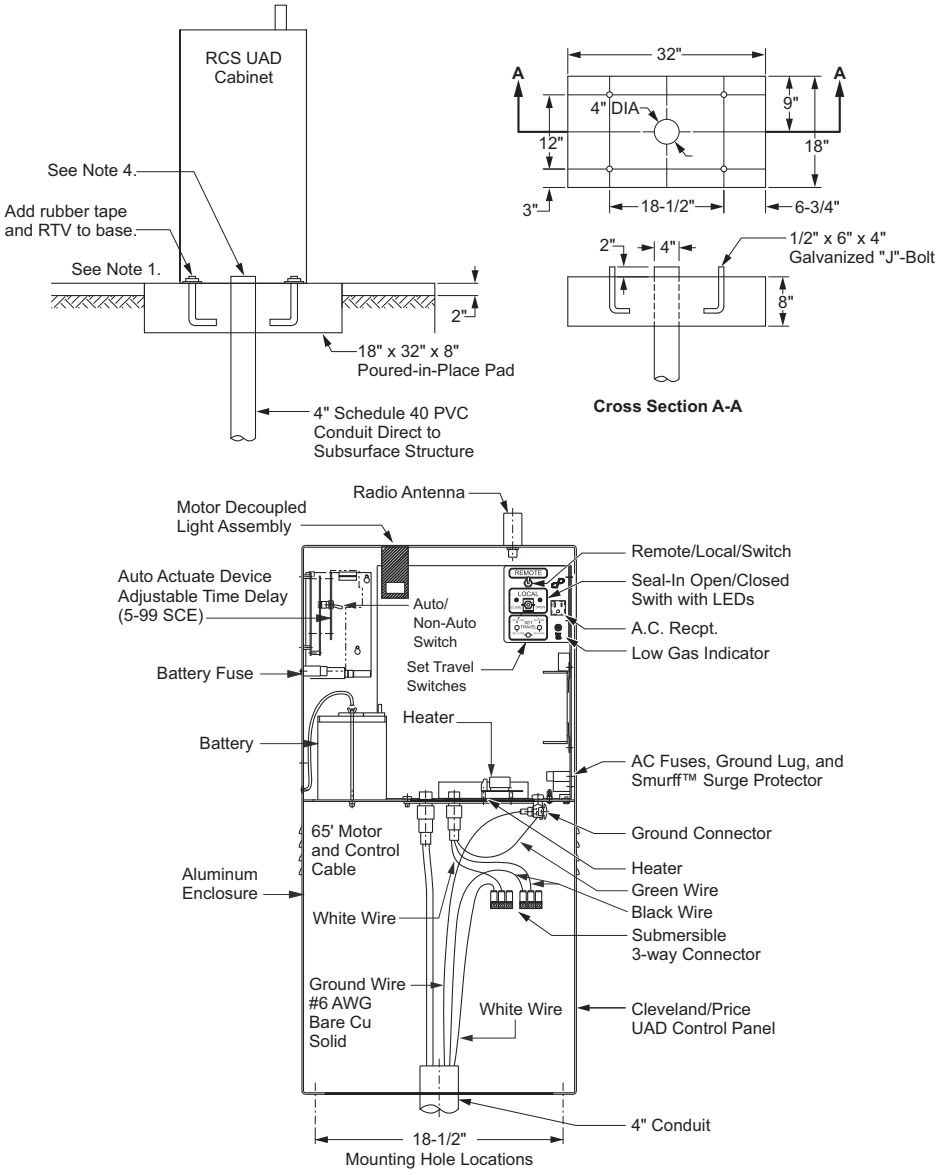


Figure SE 286–12: Manual Handle Inserted in Sliding Coupler



Scope SE 286.3 Installation of Underground Automated Distribution (UAD) Controller Cabinet

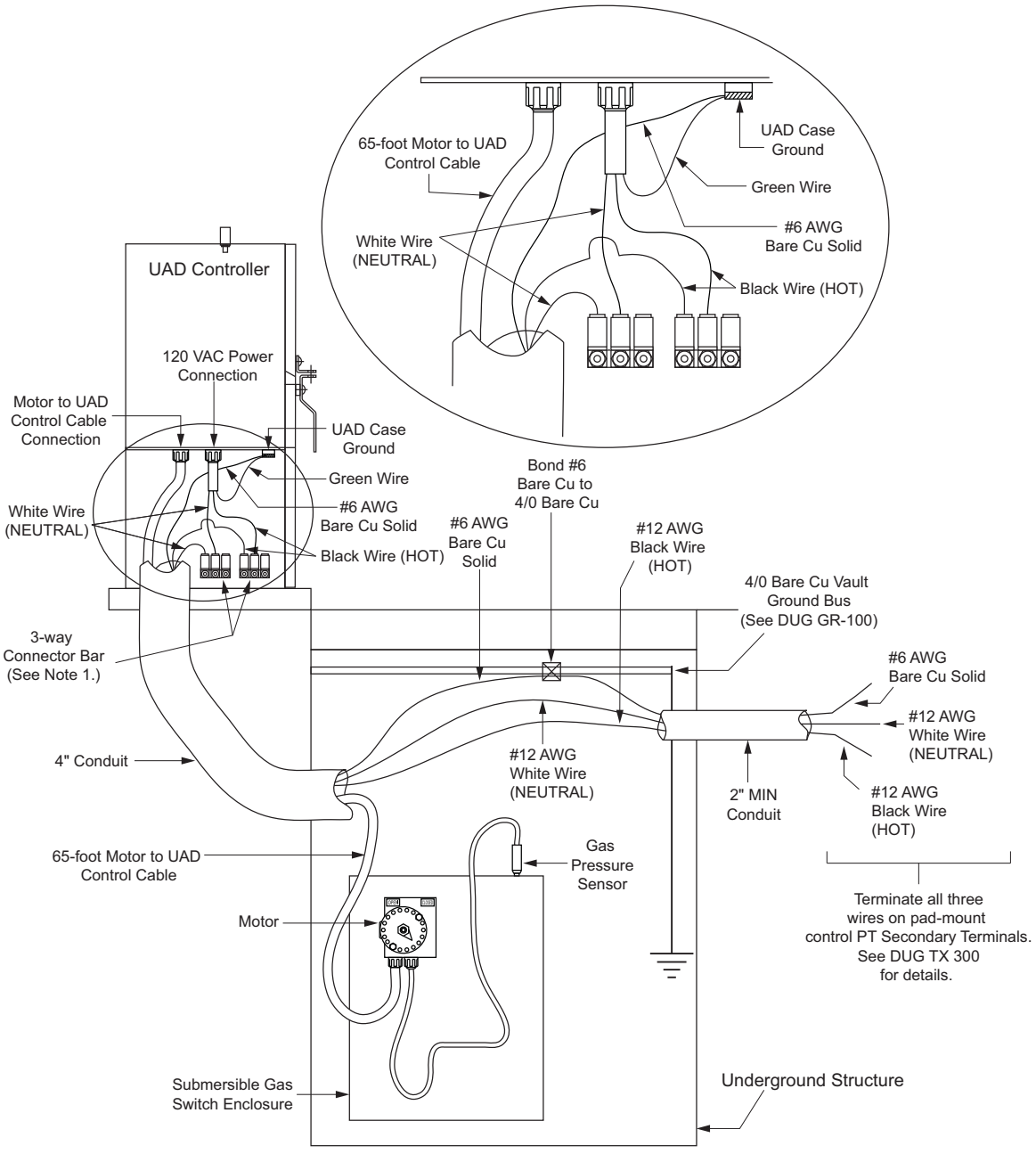
Figure SE 286–13: Preferred RCS UAD Cabinet Installation — Dimensions and Connections



Note(s):

1. UAD cabinet door should NOT face vent pipe or street traffic lane.
2. 120 VAC to be provided to RCS controller from a dedicated control transformer connected to primary on source side of switch. For control power, use #12 AWG white and #12 AWG black copper wire.
3. Apply duct seal to close conduit opening in UAD cabinet. See CW 105.
4. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the vault ground bus.
5. Use submersible 3-way connectors SAP 10181501 for 120 VAC connections. See Figure SE 286–14 and Figure SE 286–15 for wiring diagram.
6. Distribution construction shall contact the Distribution Automation Hot line when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, attachment 12 for further details on test requirements.

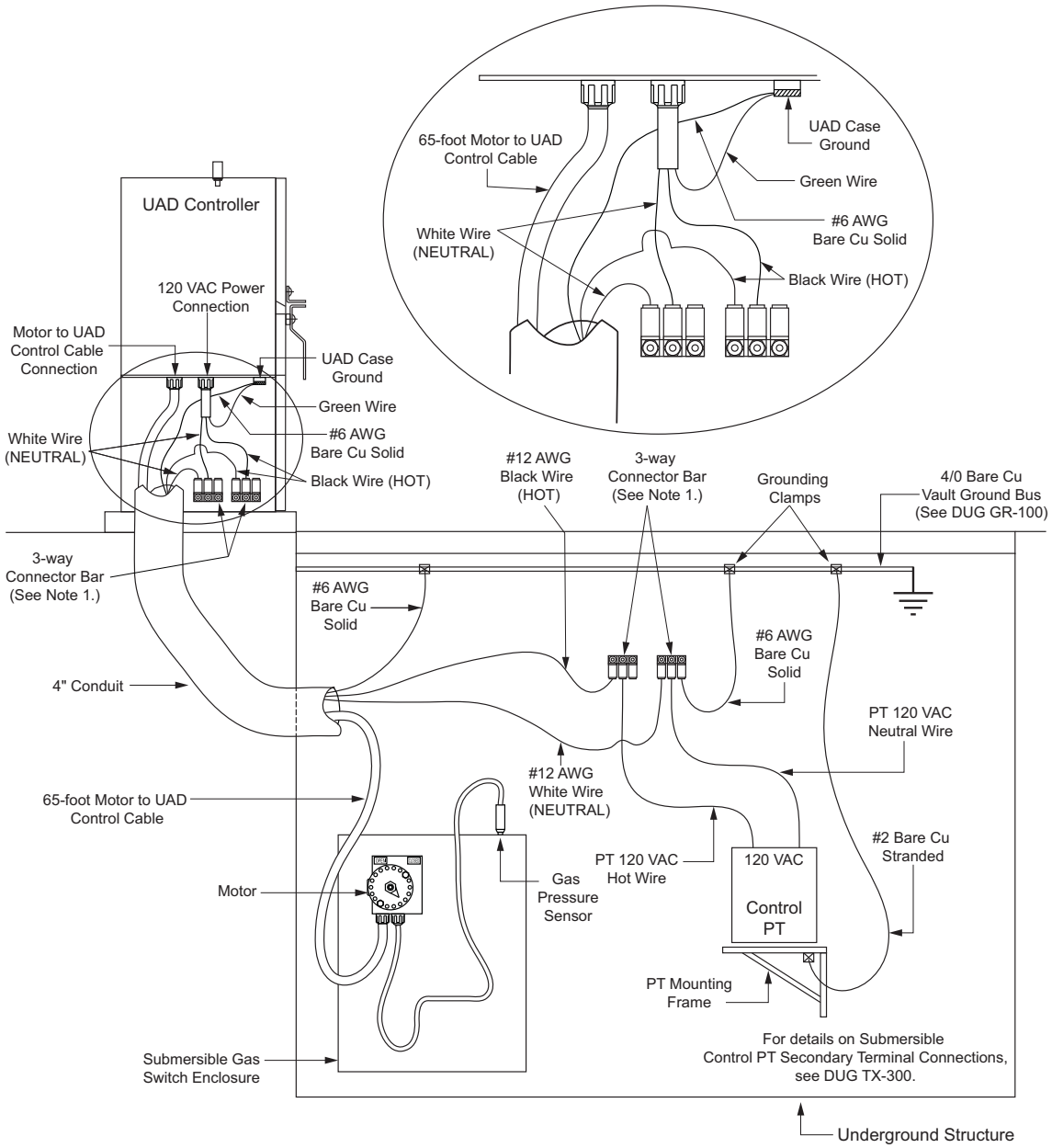
Figure SE 286–14: G&W RAG Gas Switch 120 Volt Secondary Wiring Diagram – Pad-Mounted CPT Method



Note(s):

1. Use submersible 3 way connectors (SAP 10181501) for 120 VAC connections required from the UAD cabinet to the transformer.
2. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324).
3. Terminate #12 AWG white wire, #12 AWG black wire and #6 bare solid Cu from UAD to dedicated pad-mounted control transformer. See TX-300 for details on transformer connections.
4. The control power (120 VAC) is to be provided to the RCS controller by a dedicated control transformer connected to primary on the source/line side of the gas switch.
5. Distribution construction shall contact the Distribution Automation Hot line when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

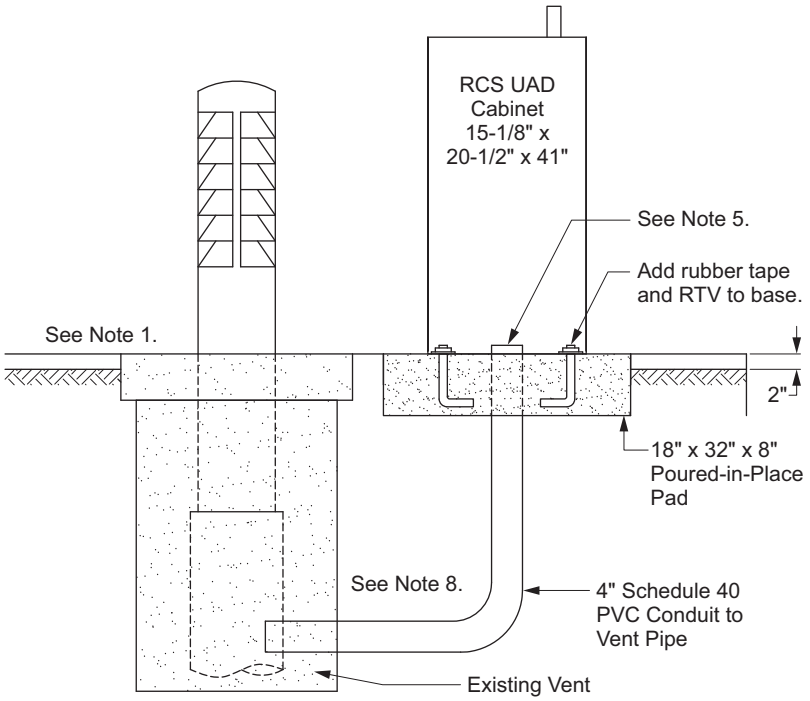
Figure SE 286–15: G&W RAG Gas Switch 120 Volt Secondary Wiring Diagram – Submersible CPT Method



Note(s):

1. Use submersible 3 way connectors (SAP 10181501) for 120 VAC connections required from the UAD cabinet to the transformer.
2. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the underground structure ground bus.
3. On submersible transformers (ABB), coil and seal the end of the unused secondary terminal with mastic covered by 3M 33 Vinyl Electrical Tape. See Scope 285.6 and TX-300 for details.
4. The control power (120 VAC) is to be provided to the RSC controller by a dedicated control transformer connected to primary on the source/line side of the gas switch.Distribution construction shall contact the Distribution Automation Hot line when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Figure SE 286–16: Alternate RCS UAD Cabinet Installation — Dimensions and Connections



Note(s):

1. Confirm that the vent pipe chosen is not equipped with a vault blower. Feed pull rope down the other vent pipe if this is found to be the situation.
2. Ensure that pull rope goes all the way from UAD to vault.
3. If the vent pipe present is made of steel, and the lid is welded shut, replace vent pipe. See VE 225.5.
4. Distance between vent and UAD control cabinet may vary. UAD cabinet door should NOT face vent pipe or street traffic lane.
5. Apply duct seal to close conduit opening in UAD cabinet. Refer to CW150
6. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the vault ground bus.
7. Distance between vent and UAD control cabinet may vary. UAD cabinet door should not face vent pipe or street traffic lane.
8. Ensure that the end of the 4" PVC conduit is flush with the PVC vent pipe to prevent cable binding during installation.
9. Distribution construction shall contact the Distribution Automation Hot line when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

Scope SE 286.4 Preferred Installation of Underground Automated Distribution Two-Way (Double-UAD) Controller Cabinet

Figure SE 286–17: Preferred RCS Double-UAD Cabinet Installation – Dimensions and Connections

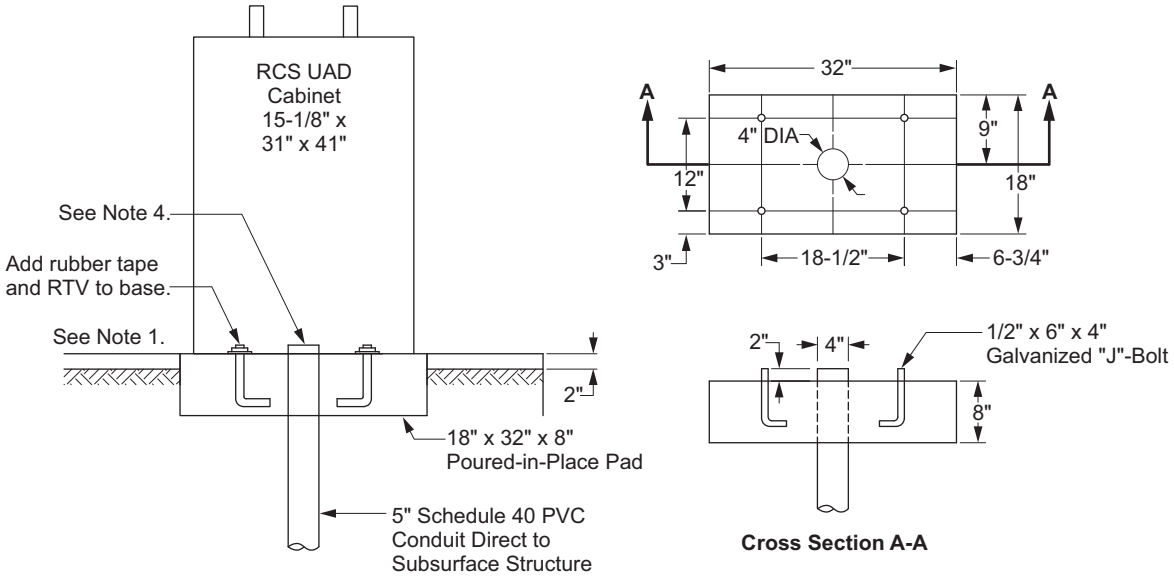
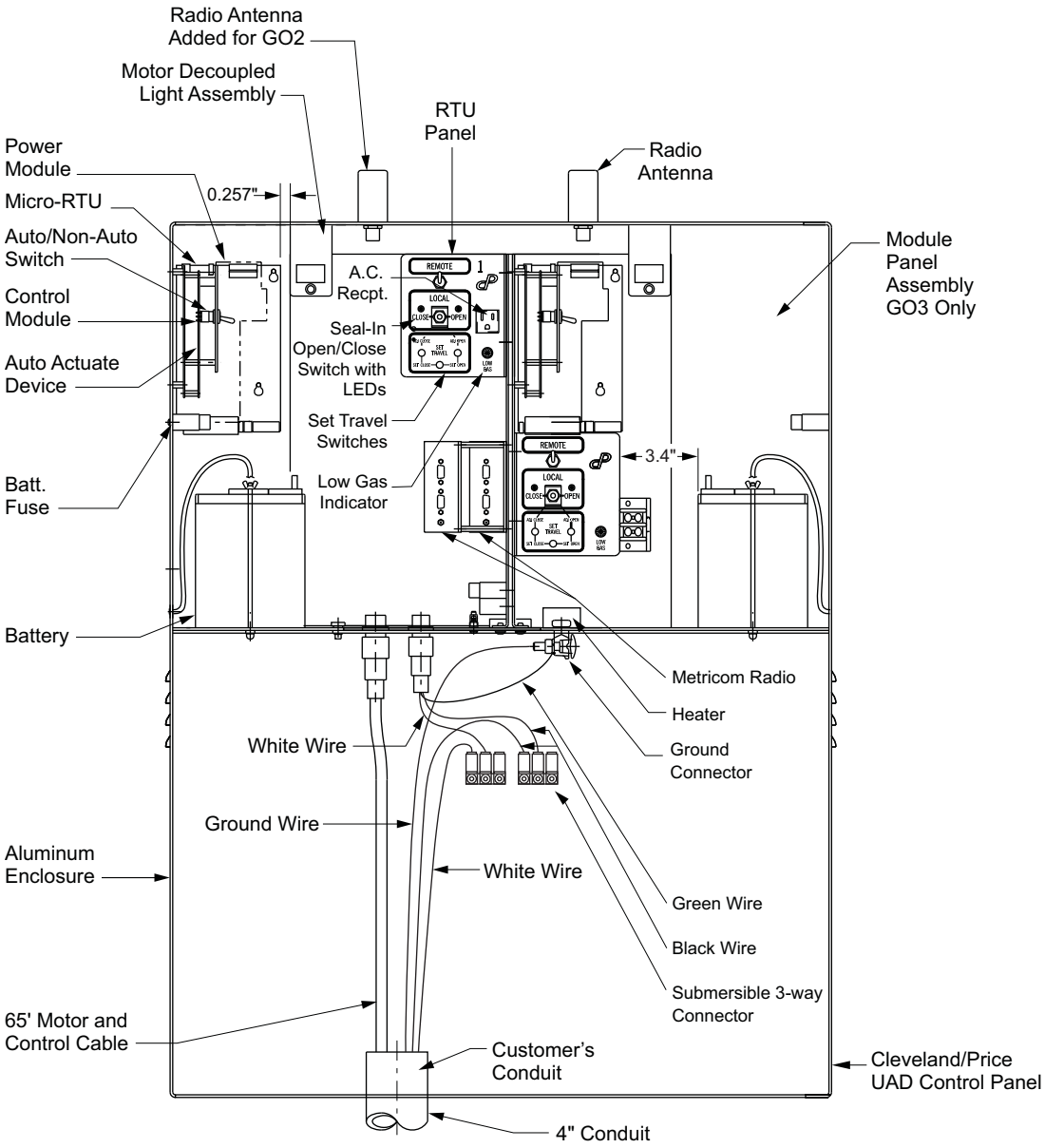


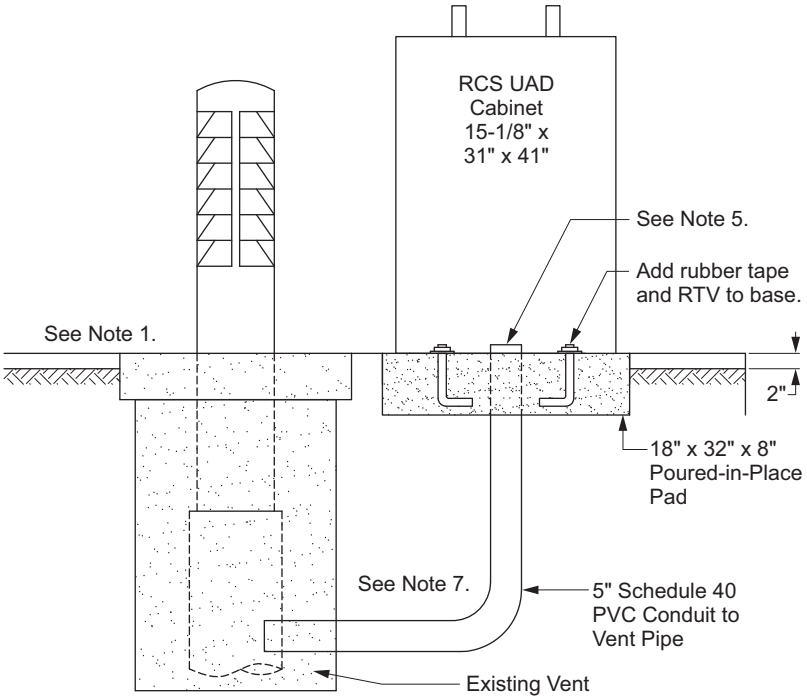
Figure SE 286–18: RCS Double-UAD Cabinet Details



Note(s):

1. UAD cabinet door should NOT face vent pipe or street traffic lane.
2. Ensure that pull rope goes all the way from UAD to the subsurface structure.
3. 120 VAC to be provided to RCS controller from a dedicated control transformer connected to primary on source side of switch. For control power, use #12 AWG white and #12 AWG black copper wire.
4. Apply duct seal to close conduit opening in UAD cabinet. Refer to CW 105.
5. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the vault ground bus.
6. Use submersible 3-way connectors SAP 10181501 for 120 VAC connections.
7. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, attachment 12 for further details on test requirements.

Figure SE 286–19: Alternate RCS RAG Double-UAD Cabinet Installation - Dimensions and Connections



Note(s):

1. Confirm that the vent pipe chosen is not equipped with a vault blower. Feed pull rope down the other vent pipe if this is found to be the situation.
2. Ensure that pull rope goes all the way from UAD to vault.
3. If the vent pipe present is made of steel, and the lid is welded shut, replace vent pipe. SeeVE 225.
4. Distance between vent and UAD control cabinet may vary. UAD cabinet door should NOT face vent pipe or street traffic lane.
5. Apply duct seal to close conduit opening in UAD cabinet. Refer to CW 105.
6. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the vault ground bus.
7. Distance between vent and UAD control cabinet may vary. UAD cabinet door should not face vent pipe or street traffic lane.
8. Ensure that the end of the 4" PVC conduit is flush with the PVC vent pipe to prevent cable bending during installation.
9. Distribution construction shall contact the Distribution Automation Hot line when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

SE 287P Installation Procedure for G&W and Motor Operator on Submersible G&W Gas-Filled RAG Switch Pilot

Scope SE 287P.1 Installation Procedure for Retrofitting a Top-Connected Gas-Filled RA-Type Ground (RAG) Switch in Vaults as a Remote Controlled Switch (RCS)

1.0 General Information

1.1 The Top-Connected Gas-Filled RAG Switches are available in two to six way switching configurations where each three-phase way has a gang-operated, three-pole switch. Top-Connected G&W RAG gas switches are rated for 17 kV or 38 kV maximum voltage, 600 Amp loadbreak switching capability and can be mounted on the wall or on the floor of a subsurface structure

1.2 DO NOT automate G&W RAG-type SF6 gas-filled switches that are installed in Surface Operable Enclosures (SOEs).

1.3 G&W RAG Automation can only be installed on 3-way and 4-way G&W RAG gas switches.

1.4 At this time, only one submersible G&W motor operator can be retrofitted to one position of a G&W RAG-type SF6 gas-filled switch.

A. A G&W RAG controller is contained in an above ground pad-mounted cabinet and is connected to the motor operator(s) by a control cable. The controller is powered from an AC power cable fed from underground structure into the pad-mounted cabinet.

B. A pressure sensor is installed on the gas fill port at the top of the G&W RAG-type SF6 gas-filled switch to provide a safety interlock that prevents motor operations under a low gas pressure condition in the G&W switch. The pressure sensor connects from the gas fill port at the top of the G&W RAG-type SF6 gas-filled switch to low pressure gas connector located on the bottom of the G&W motor.

C. On submersible G&W RAG-type SF6 gas switches, handle extensions are required to operate any position on the G&W RAG switch (automated or non-automated). Handle extensions are removable and shall only be installed when operating the intended position. Handle extensions shall be placed on the hook on the front mounting bracket when not in use.

D. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request. Refer to DOM SW-11, attachment 12 for further details on test requirements.

E. Mark the RCS control enclosure on the left-top corner to identify RCS number and automated position (Ex. RCS1234 Pos 1). Use approved reflective yellow letters and numbers on black background. Refer to DUG TX 160 for equipment labeling requirements.

F. The RAG position to be automated is required to be in the OPENED position prior to installation of the G&W RAG Automation hardware.

PILOT

1.5 A dedicated source of 120 VAC is required to power the G&W Automation controller:

A. See TX 300 for dedicated control power transformer installation procedure.

B. The control transformer shall be connected to the line side of the primary source to the G&W RAG-type SF6 gas-filled switches.

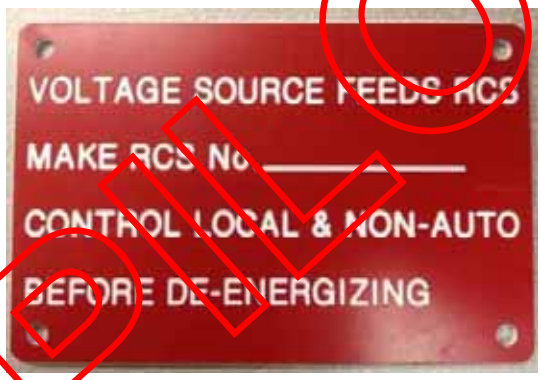
C. The secondary neutral shall be grounded to the structure ground system at the control transformer.

1. On the 12 kV or 16 kV to 120 VAC single phase, pad-mount control transformer, the secondary neutral ground is grounded at the transformer neutral terminal. See TX-300 and Figure SE 287P–21 or more details.

2. On the 12 kV and 16 kV to 120 VAC single phase, submersible control transformer, the secondary neutral ground is grounded at one of the 3 way connector bar inside the vault. See TX-300 and Figure SE 287P–21 for more details.

D. A voltage source sign is required to be placed at the location where the control transformer is switched or de-energized (for example a switch position) and on the control transformer itself.

Figure SE 287P–1: RCS Voltage Source Sign (SAP 10135323)



PILOT

E. Single phase switching for phase-to-phase transformers may result in ferroresonance. An alternate phase-to-ground transformer may be applied to mitigate ferroresonance on 4-wire circuits. (See DUG TX 300 for SAP numbers of alternate phase-to-ground transformers.)

2.0 Material Information

For pilot installations, the G&W Motor Operator Kit For RAG Switch Kit provides the complete kit including the controller, motor operator with control cable, linkage assembly, mounting kit with pressure switch and connecting cables. Refer to Table SE 287P-1 for description of components included in kit.

Table SE 287P–1: SAP Numbers – New Installations

Description	SAP
RAG controller, motor operator with 105-foot control cable, and mounting kit including pressure switch for 3-way RAG Switch	10210863
RAG controller, motor operator with 105-foot control cable, and mounting kit including pressure switch for 4-way RAG Switch	10210865

Note(s):

1. For pilot support for replacement parts, contact Apparatus Strategies.
2. A voltage source sign (SAP 10135323) is required to be placed at the location where the control transformer is switched or de-energized (for example a switch position) and on the control transformer itself.

3.0 G&W RAG Automation Installation

STEP 1. Follow All SCE APM rules and SCE safety practices when working in Underground structures.

STEP 2. Verify the RAG switch position to be automated is in the OPEN position.

STEP 3. Install the Low Pressure Warning Device (LPWD).

- Locate the LPWD and the Schrader Valve on the top of the switch. Remove the protective cap on the Schrader Valve, install and hand tighten the LPWD over the Schrader Valve.

Figure SE 287P–2: LPDW and Schrader Valve

PILOT

STEP 4. Install New Gauge Guard

- There are two variations of the existing gauge guard (existing guard with andwithout lid)
- Secure Retaining Clamp by tightening bolt with a 1/2" socket.

Figure SE 287P–3: Guard Option A - Existing Guard with Lid

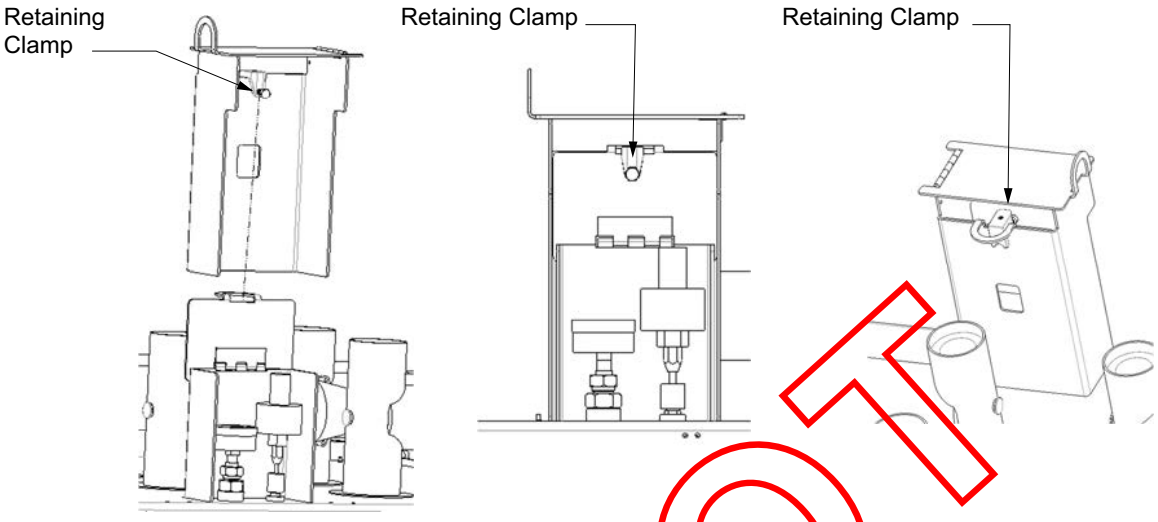
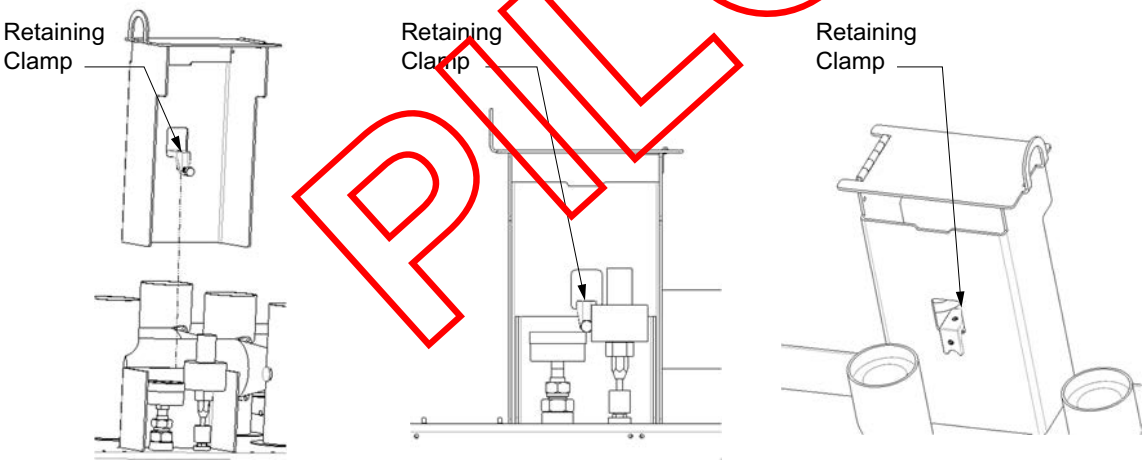


Figure SE 287P–4: Guard Option B - Existing Guard without Lid

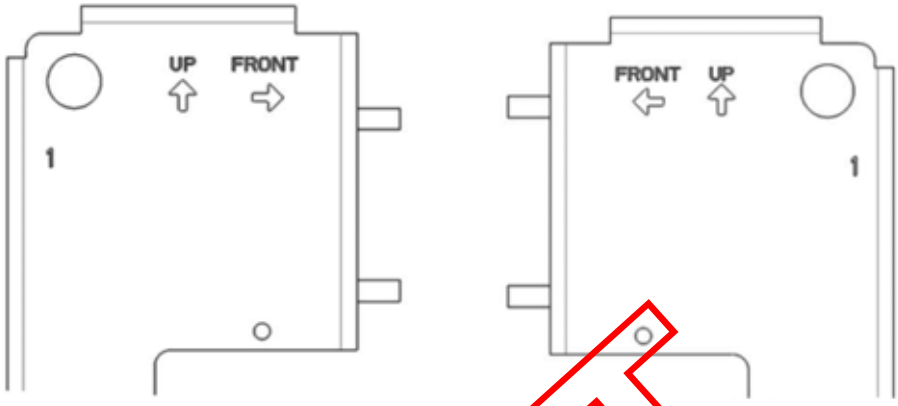


PILOT

STEP 5. Install Side Mounting Brackets.

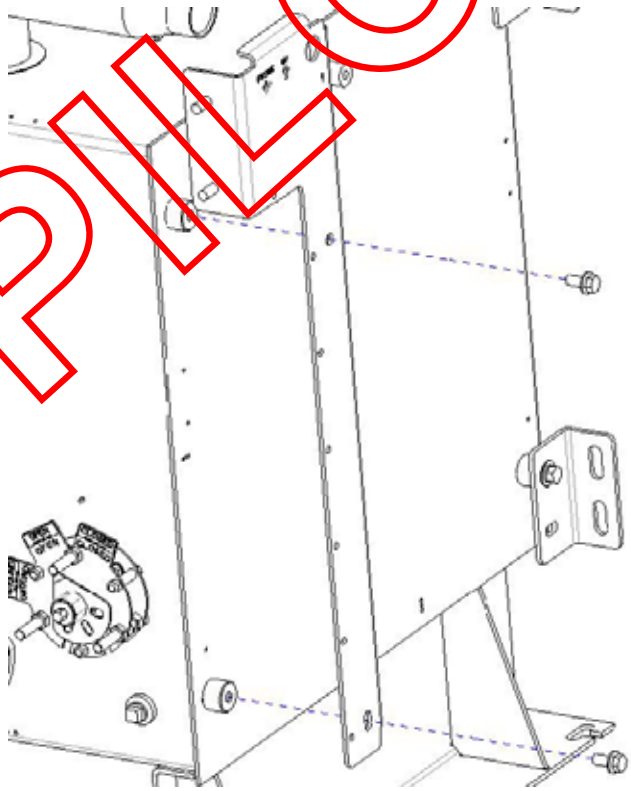
- Locate the Side Mounting Brackets (both brackets have orientation markings to help identify the side of the switch they are to be installed).

Figure SE 287P–5: Side Mounting Brackets with Identification



- Use two (2) 1/2" – 13 flange bolts per bracket and install the brackets to the welded bosses on the side of the switch tank. Tighten each bolt securely.

Figure SE 287P–6: Side Mounting Bracket Installation

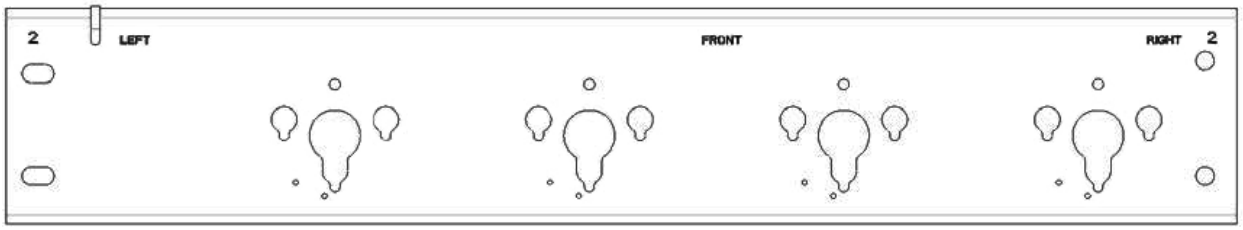


PILOT

STEP 6. Install Front Mounting Bracket

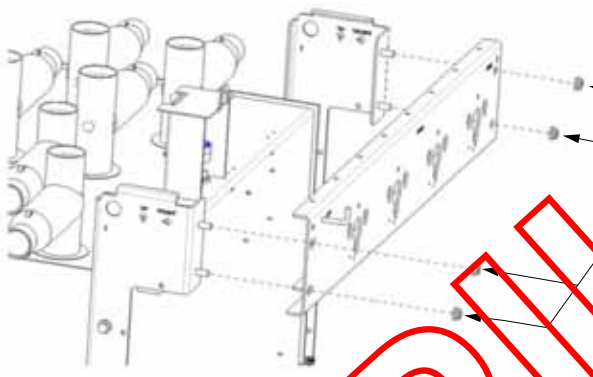
- Locate the Front Mounting Bracket. The bracket has orientation markings to help identify orientation.

Figure SE 287P–7: Front Mounting Bracket with Identification



- Use four (4) 1/2"-13 flange nuts and install the mounting bracket to the studs on the front mounting bracket and tighten each nut securely.

Figure SE 287P–8: Motor Operator Front Mounting Bracket Installation

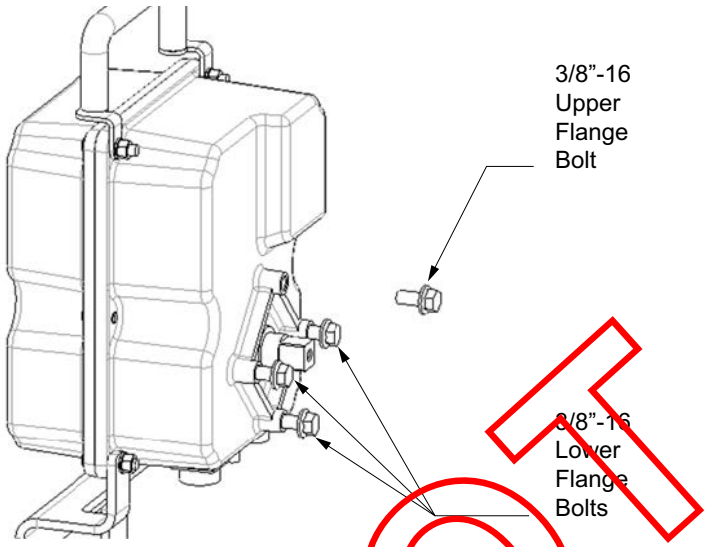


PILOT

STEP 7. Install Motor Operator.

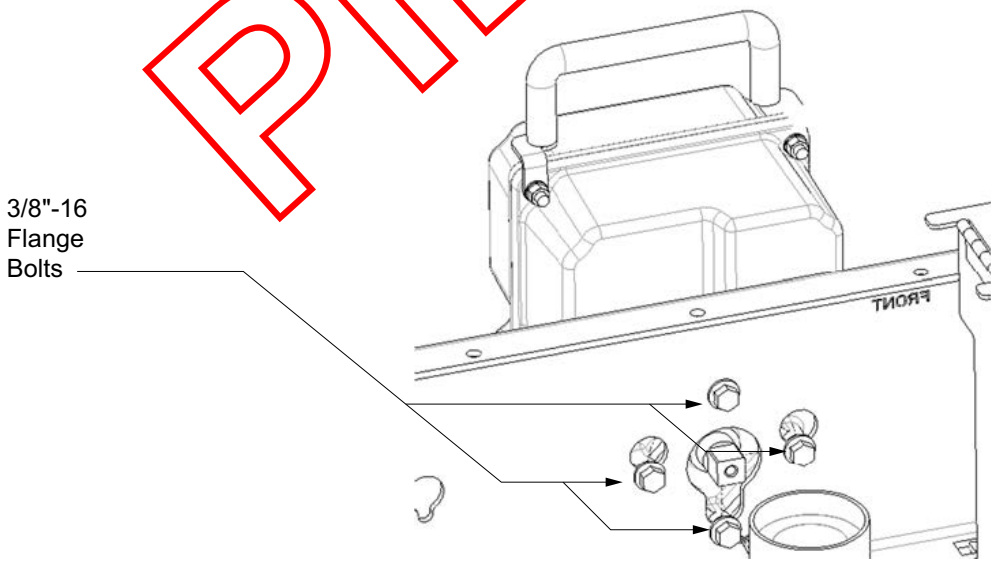
- Remove 3/8" -16 upper flange bolt. Ensure that the three (3) lower flange bolts have been loosened to have at least 1/4" clearance.

Figure SE 287P–9: Close-up of Motor Operator with Attached Flange Bolts



- Motor operator is to be installed on the Front Mounting Bracket above the automated position. Guide the flange bolts into the keyed slots on the Front Mounting Bracket and drop into place.
- The flange bolts will hold the Motor Operator in place. Reinstall the upper flange bolt by hand and tighten with a 9/16" deep well socket.

Figure SE 287P–10: Motor Operator Installation onto Front Mounting Bracket

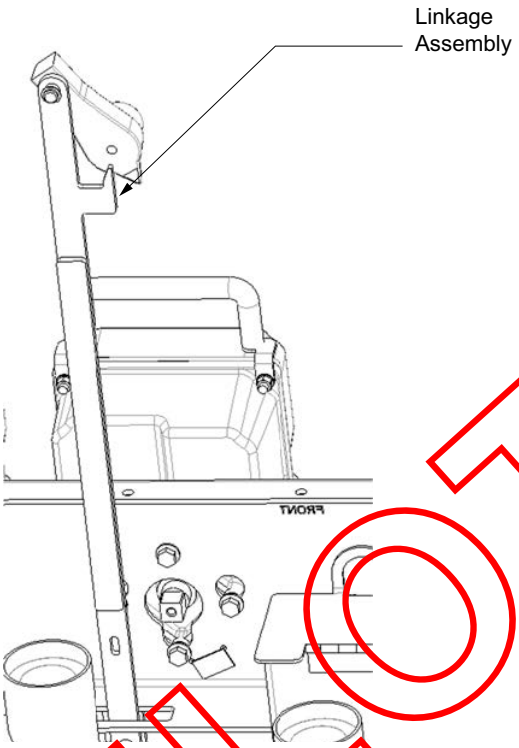


PILOT

STEP 8. Install the Linkage Assembly

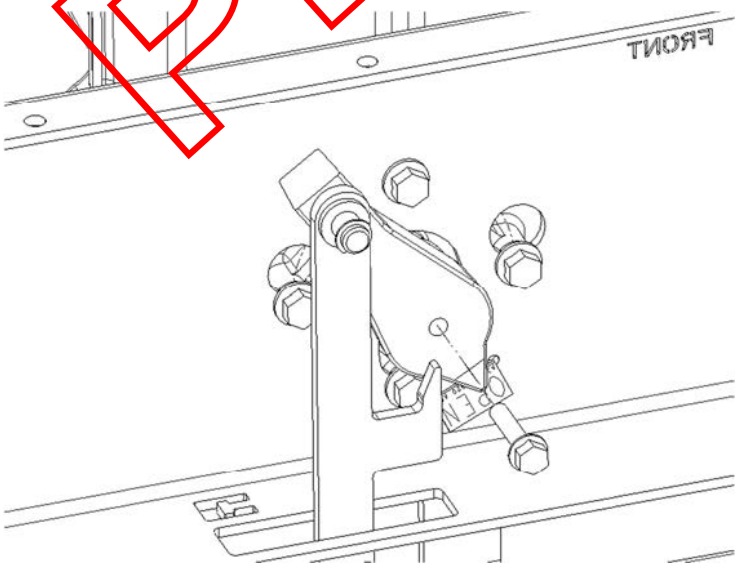
- Slide Linkage Assembly though the channel located on Front Mounting Bracket.

Figure SE 287P–11: Assembly of the Linkage Assembly through the slotted channel



- Install the Linkage Assembly to the square shaft such that the red indicator arrow is pointing towards the OPEN label. Install the 5/16" -18 flange bolt and tighten with 1/2"socket.

Figure SE 287P–12: Correct assembly of the Motor Drive Arm

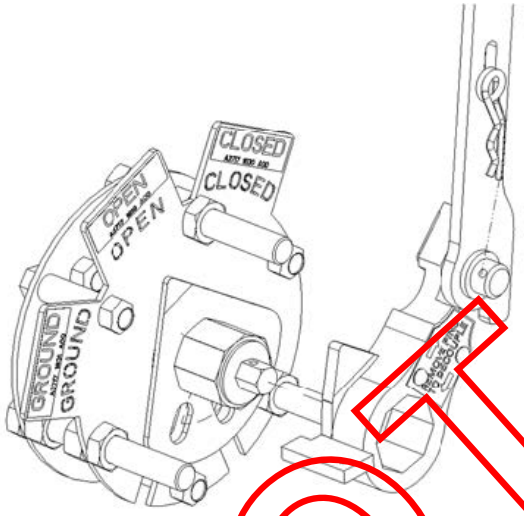


PILOT

STEP 9. Install the Switch Drive Arm

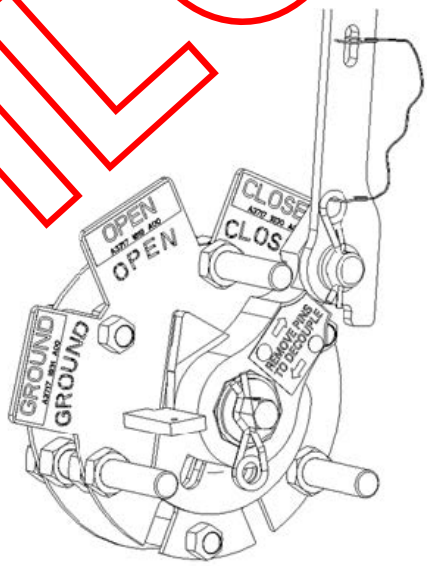
- Install the Switch Drive Arm over the nut on the lock assembly. The Red Indicator arrow on the Switch Arm Drive should be in line with the Indicator Plate of the lock assembly and secure the Switch Drive Arm to the nut using a cotter pin.

Figure SE 287P–13: Assembly of the Switch Drive Arm



- Connect the Switch Drive Arm to the Linkage Assembly using the Clevis and Cotter Pin.

Figure SE 287P–14: Correct Assembly of the Switch Drive Arm



PILOT

STEP 10. Install the Control and Low Pressure Warning Device Cables

- The Control Cable is a keyed 32 pin connector. Line up the keyed slot of the cable connector with the Motor Operator connecter and quarter turn the cable clasp until it locks into place. Do not force the cable into place.

Figure SE 287P–15: Control Cable (Left) and Connector on the Motor Operator (Right)

- The LPWD is a keyed 5 pin connector. Line up the keyed slot of the cable connector with the Motor Operator connecter and quarter turn the cable clasp until it locks into place. Do not force the cable into place.

Figure SE 287P–16: LPWD Connector on the Cable (Left) and LPWD Connector on Motor Operator (Right)

PILOT

NOTE

A third connector is mounted on the motor operator for future application. This third connection is capped.

STEP 11. Secure excess cable

- Secure excess cable using the 3/8” round holes on front and side mounting brackets with cables ties. Cable tie provisions are available on both front and side mounting brackets.

Figure SE 287P–17: Cable Tie provision on the Side Mounting Bracket

Figure SE 287P–18: Cable Tie Provision on the Top Flange of the Front mounting Bracket

PILOT

Figure SE 287P–19: Examble of Finished Cable Tie Installation

STEP 12. Installing the Motor Control

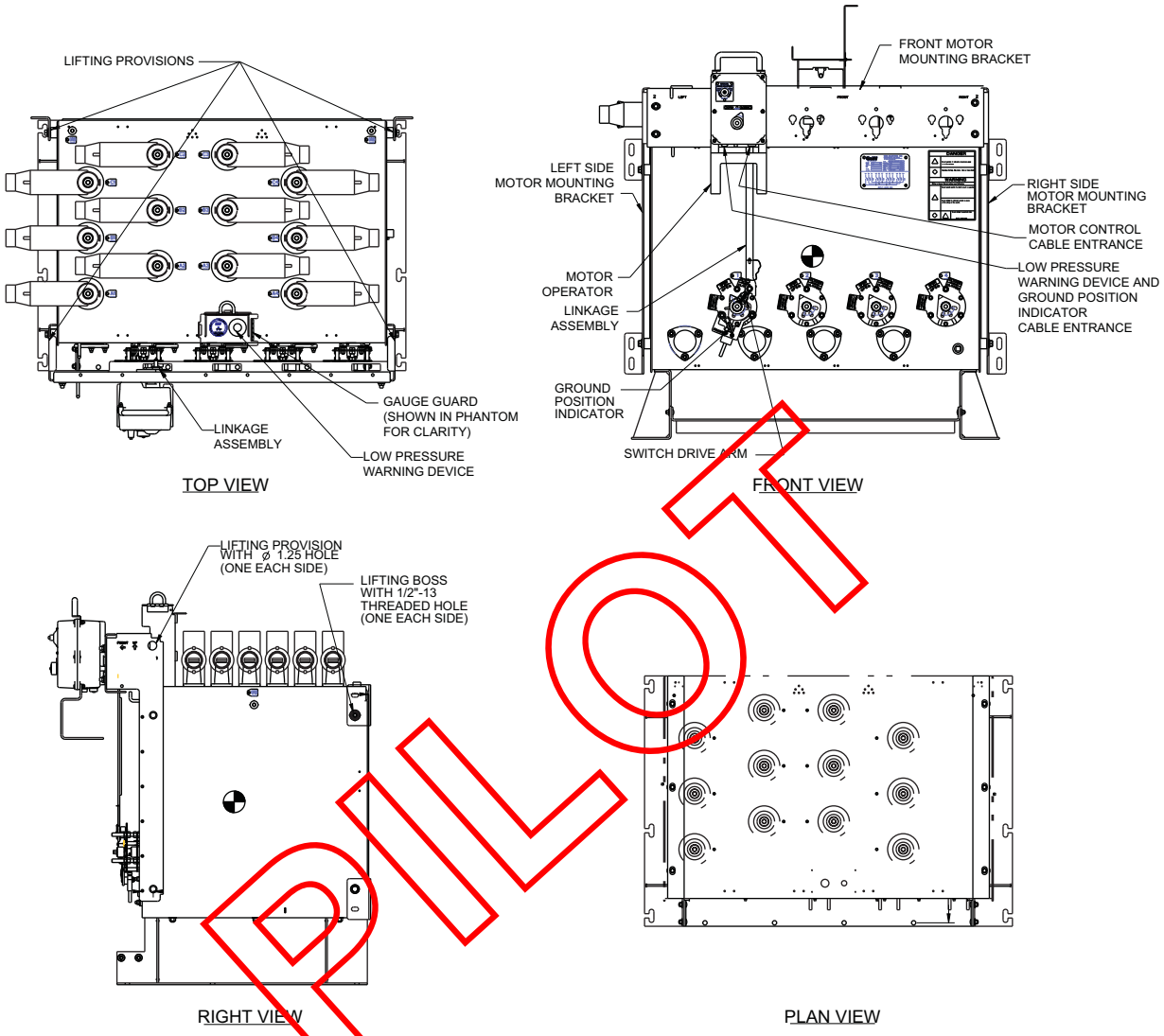
- The Motor Control included 1.5” diameter holes for lifting provisions. The unit weights approximately 200 lbs without the batteries.

Note(s):

1. A pressure switch is installed on the gas fill port of the G&W RAG-type SF6 gas-filled switch and connected to the motor operator to provide a safety interlock that prevents motor operation under a low gas pressure condition.
2. Apply loctite to the Schrader valve and hand tighten pressure switch sensor to the switch as required in the installation instructions
3. Rigging for manual switching will be altered on a position that a motor operator or manual handle extension is mounted. Confirm existing rigging hogeyes/anchors will accommodate for the additional spacing created from the motor operator or manual handle extension. If necessary, install new rigging hogeyes/anchors.
4. The motor is provided with a 105-foot cable to connect to the G&W Automation cabinet.

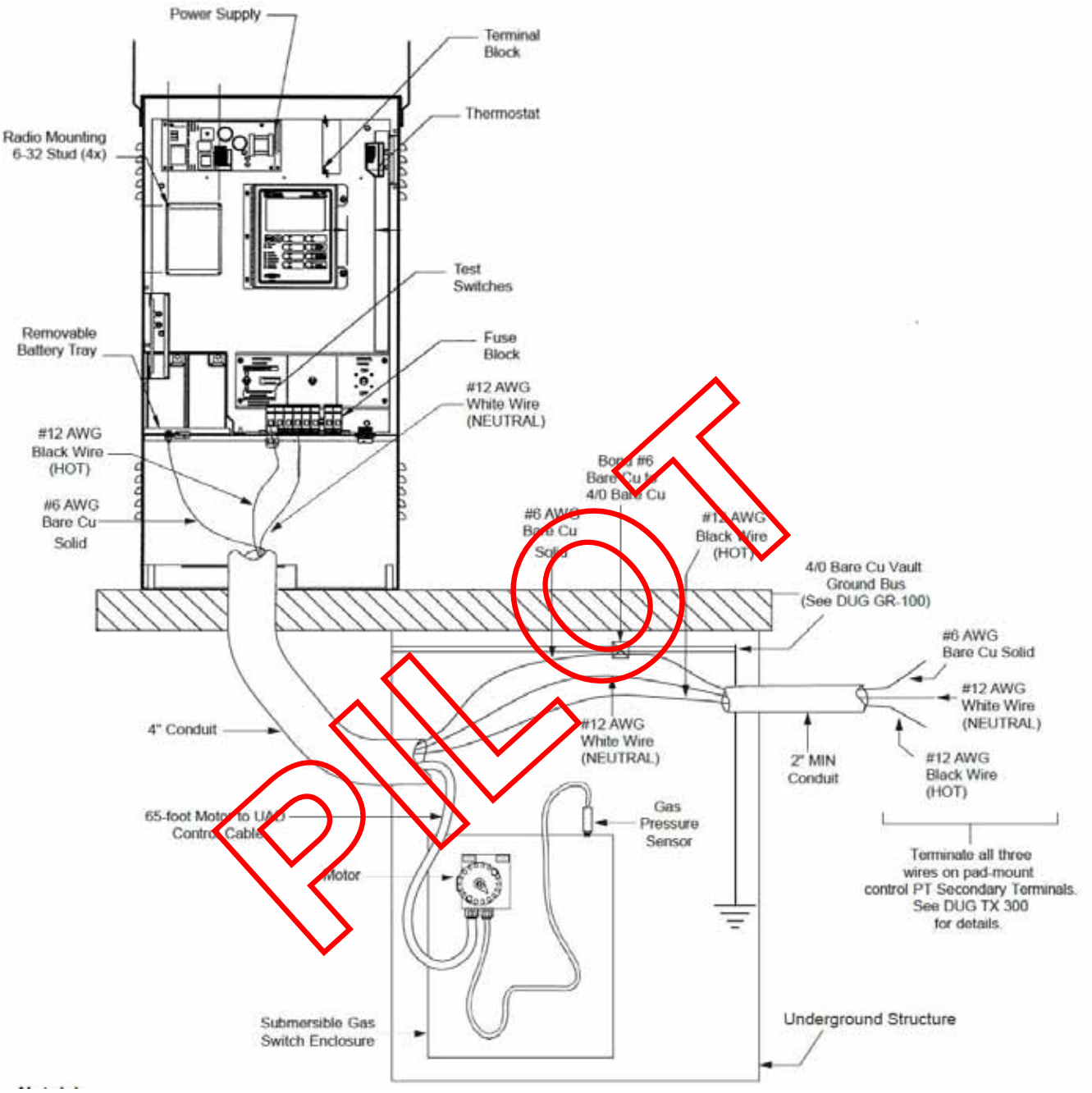
PILOT

Figure SE 287P–20: Typical G&W Motor Operator Installed on Submersible G&W RAG-Type Gas-Filled Switches (4-Way Installation Shown)



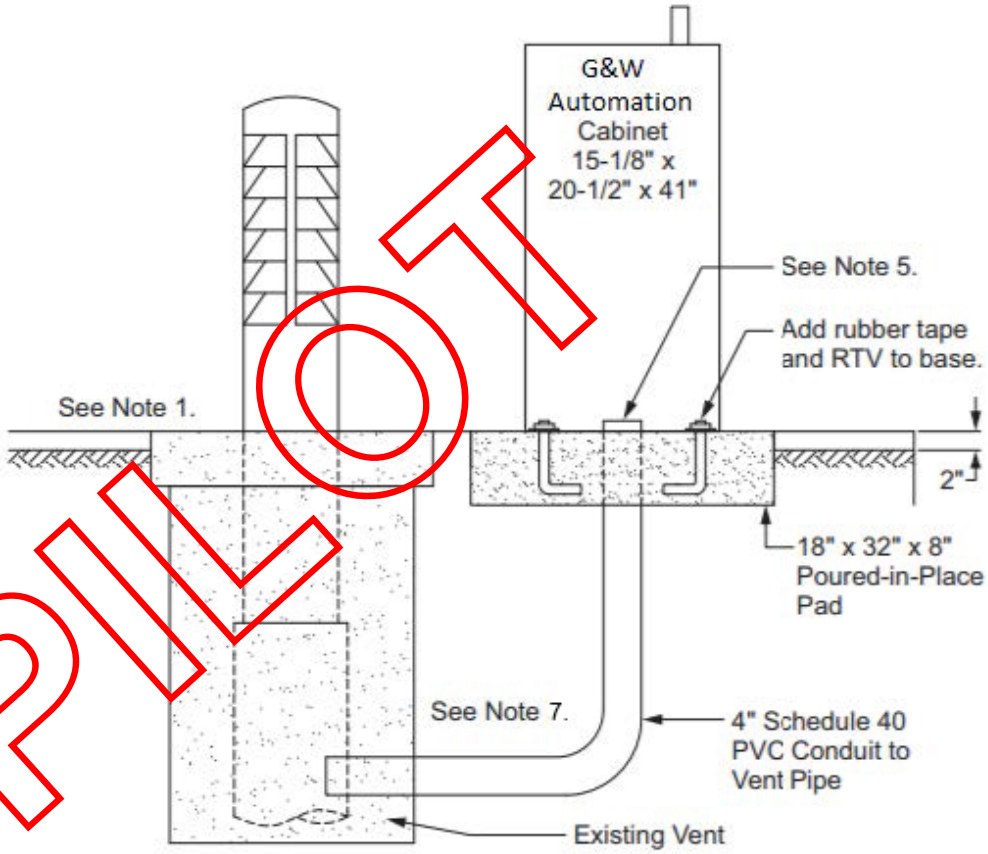
PILOT

Figure SE 287P–21: G&W RAG Gas Switch 120 Volt Secondary Wiring Diagram – Submersible CPT Method



PILOT

Figure SE 287P–22: Alternate G&W Automation Cabinet Installation — Dimensions and Connections



PILOT

Note(s):

1. Confirm that the vent pipe chosen is not equipped with a vault blower. Feed pull rope down the other vent pipe if this is found to be the situation.
2. Ensure that pull rope goes all the way from G&W Automation Cabinet to vault.
3. If the vent pipe present is made of steel, and the lid is welded shut, replace vent pipe. See VE 225.5.
4. Distance between vent and G&W Automation control cabinet may vary. Control cabinet door should NOT face vent pipe or street traffic lane.
5. Apply duct seal to close conduit opening in control cabinet. Refer to CW150
6. Ground UAD cabinet at the grounding lug provided with minimum #6 bare copper wire (SAP 10109324), and connect to the vault ground bus.
7. Ensure that the end of the 4" PVC conduit is flush with the PVC vent pipe to prevent cable binding during installation.
8. Distribution construction shall contact the Distribution Automation Hot line when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

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Testing Devices
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Standard	Title
TD 100	Installation of Fault Indicator on Underground Cables
TD 100.1	Installation of Fault Indicator on Underground Cables
TD 100.2	Installation of Fault Indicator in Padmount Switch Cabinets
TD 100.3	Installation of Fault Indicators in a Polyethylene Standpipe Vent
TD 100.4	Installation of Fault Indicators in Standpipe Vent
TD 100.5	Optional Method for Installation of Fault Indicators in PVC Standpipe Vents
TD 100.6	Installation of Fault Indicators in Surface Operable Parkway Enclosure
TD 100.7	Installation of Fault Indicators in Vaults without Standpipe Vent
TD 120	Installation of Remotely Indicating Faulted Circuit Indicator in Underground Remotely Controlled Switches
TD 120.1	Installations of Faulted Circuit Indicators on Remotely Controlled Switches
TD 130P	Underground Remote Fault Indicator (UG RFI) Pilot
TD 130P.1	Installation of PDP Submersible SLT (SMART Load Tracker LM LFD) System
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TD 131	Power Delivery Products Reporter (PDP) / SLT Remote Fault Indicator (RFI) for Padmount Switches and UG Switches (Vent Pipe)
TD 131.1	Installation of PDP Reporter SLT (Smart Load Tracker LM LFD) on Padmount Switches and UG Switches (Vent Pipe)

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TD 100 Installation of Fault Indicator on Underground Cables

Scope TD 100.1 Installation of Fault Indicator on Underground Cables

1.0 General Description

Fault indicators (FI) are placed on a cable to indicate that fault current has passed through that point. When it senses a fault it displays a flashing red LED (Light Emitting Diode) or a red flag.

Fault indicators are phase-current sensing devices which trigger a visual indication once a specified current threshold is exceeded. FIs are highly reliable, but are very much dependent on the fault magnitude and duration, which varies from each and every location in the circuit. Therefore, they may not work in some situations where fault duties are not high enough and/or long enough to trip the FI unit.

Fault indicators are self-powered with long-life lithium batteries and bright LEDs for both day and night visibility. FIs should operate for 20 years or more and are generally replaced every 20 years, based on the manufacturer's date stamped in the FI body.

2.0 Installation and Operation

Fault indicators are generally installed on each cable such that the concentric neutral wire is not enclosed by the closed core current sensor. These FIs may be installed with a grip-all hot stick or with other approved work methods. Separation between fault indicators shall not be less than 2.5 inches. FIs should not be installed over concentric wires or metallic cable sheath in the ground return path of underground cables. Underground FIs will not work on paper-insulated, lead-covered (PILC) cable.

Although each device has its own flashing indicator LED, it is desirable in most cases to have remote indication (at convenient locations) that can display visual indications outside of the structure, or transmitted by radio. If the display is mounted outside of the structure, the FIs transmit the flashing light through a 3-to-1 fiber optic cable assembly. The cable has three leads, one for each phase FI. The three leads transmit light to one display that is mounted at a conveniently visible location in the structure. The FI can be reset manually with a test/reset magnet; otherwise, it will automatically reset after four hours.

3.0 Selection

3.1 Fixed-Trip Fault Indicators

Underground FIs are fixed-trip units, and are available in four discrete trip ratings: 200 A, 400 A, 600 A, and 800 A. Trip rating shall be selected for at least twice the circuit's five year projected peak load determined by Field Engineering. This prevents erroneous operation from momentary inrush during load pickup. These fault indicators shall be used for permanent applications only. They shall not be used as tools.

FOR REFERENCE ONLY

FOR REFERENCE ONLY

Table TD 100–1: Fixed-Trip Fault Indicators

5-Year Projected Peak Load	Trip Rating	SAP Number
100 A	200 A	10100887
200 A	400 A	10100888
300 A	600 A	10100889
400 A	800 A	10100890
3-to-1 Fiber Optic Cable, 6 Feet (SAP 10100870) 3-to-1 Fiber Optic Cable, 30 Feet (SAP 10100871) 3-to-1 Fiber Optic Cable, 60 Feet (SAP 10100911) Test/Reset Magnet (SAP 10147888) Replacement Lexan (SAP 10100921)		

3.2 Automatic (Self-Adjusting) Fault Indicators

The automatic FI used for underground applications is the Load Tracker with Load Memory. The Load Tracker with Load Memory has a minimum trip of 200 A. For load currents below 80 A, the minimum trip will remain at the default value of 200 A. Above 80 A, the unit will automatically adjust the trip setpoint upward in accordance with the load current levels. This FI samples and stores the load current to memory at regular intervals. If there is an extended outage, the FI will not simply revert back to the default minimum trip of 200 A upon re-energization, but will retain up to 72 hours the last setpoint stored in the load memory before the outage. The Load Tracker with Load Memory will be used for permanent installations only and should not be used as a tool.

Table TD 100–2: Automatic (Self-Adjusting) Fault Indicators

FI Model	Trip Rating	SAP Number
Load Tracker with Load Memory	Self-Adjusting / 200 A MIN Trip	10170766
3-to-1 Fiber Optic Cable, 6 Feet (SAP 10100870) 3-to-1 Fiber Optic Cable, 30 Feet (SAP 10100871) 3-to-1 Fiber Optic Cable, 60 Feet (SAP 10100911) Replacement Lexan (SAP 10100921)		
Test/Reset Magnet (SAP 10147888)		

Figure TD 100–1: Load Tracker with Load Memory

4.0 General

4.1 Underground fault indicators will normally be installed on primary synthetic cable at a switch termination or T-tap.

4.2 The remote indicators can be installed at the following locations:

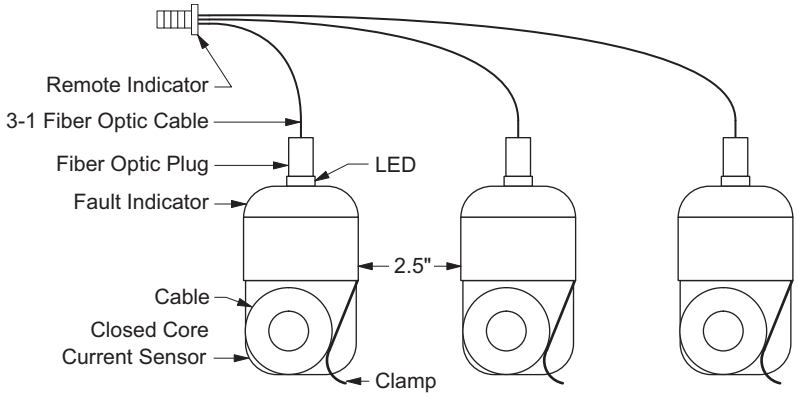
A. In a padmount cabinet, see Scope TD 100.2 (Sheet 4).

B. In vent pipes, see Scope TD 100.4 (Sheet 6).

C. Below the view window of a surface operable structure cover, see Scope TD 100.6 (Sheet 8).

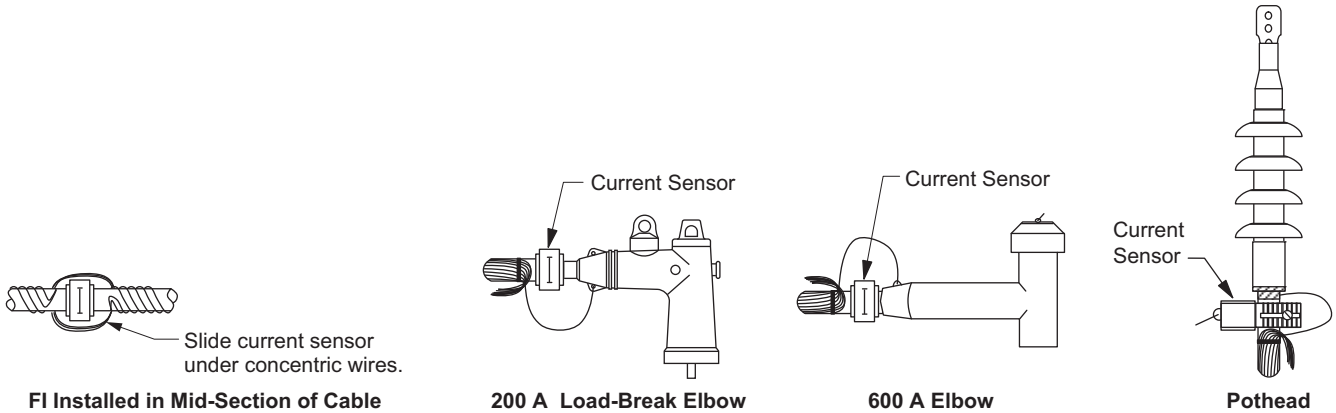
D. Near the access to a vault, see Scope TD 100.7 (Sheet 9).

Figure TD 100–2: Installation of Remote Indicator



4.3 The fault indicator current sensing element shall be installed on the cable under the concentric wires as shown in Figure TD 100–3 (Sheet 3).

Figure TD 100–3: Installation of Sensing Element



FI Installed in Mid-Section of Cable | **200 A Load-Break Elbow** | **600 A Elbow** | **Pothead**

Note(s):
1. Sensors will not operate properly on PILC cable.
2. Other types of existing switch terminations shall be treated in a similar manner as shown above.

Scope TD 100.2 Installation of Fault Indicator in Padmount Switch Cabinets

Figure TD 100–4: Installation of Fault Indicator in Padmount Switch Cabinet

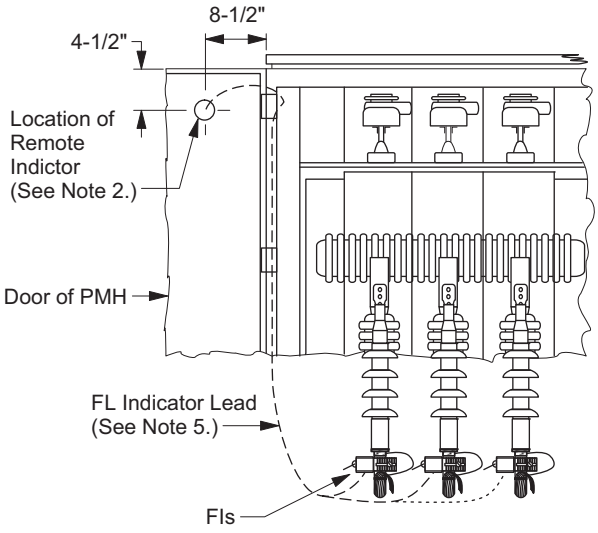


Figure TD 100–4.1: S&C PMH Switch Cabinet

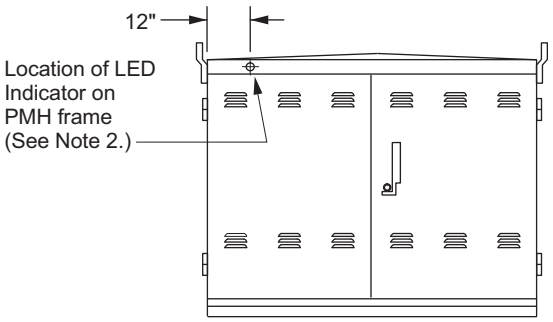


Figure TD 100–4.2: Scott PMH Switch Cabinet

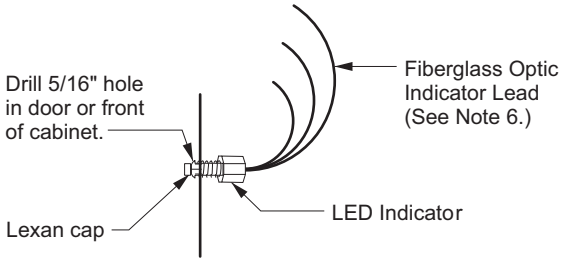


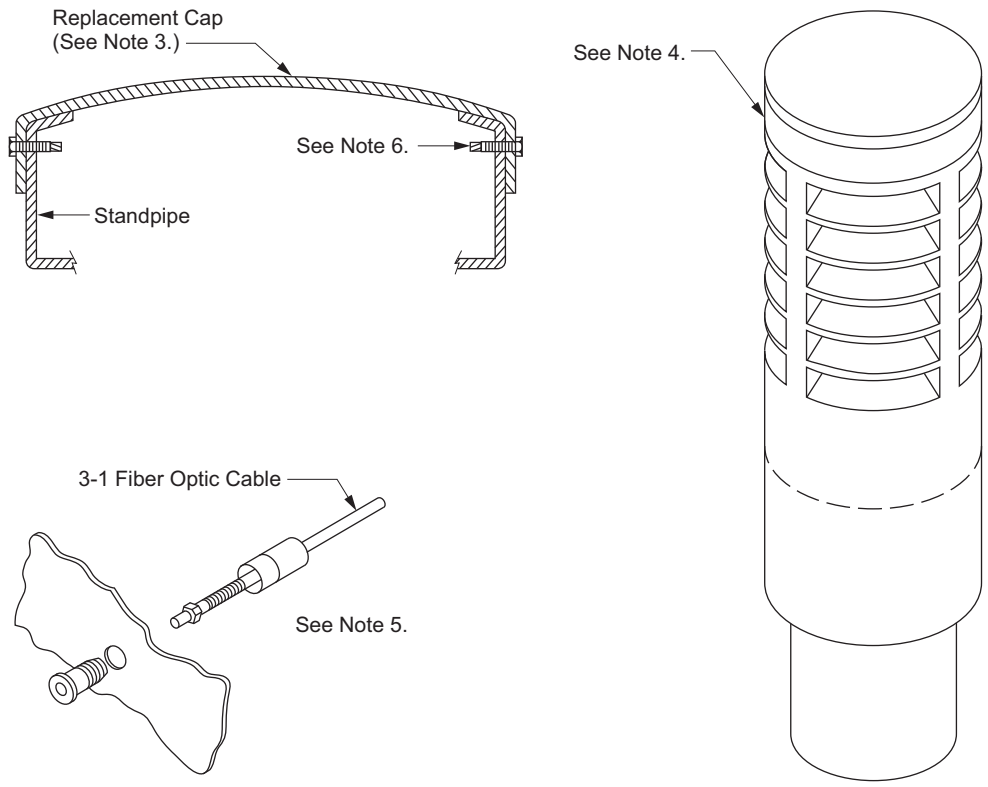
Figure TD 100–4.3: Remote Indicator

Note(s):

1. See Scope TD 100.1 (Sheet 1) for installation of the fault indicator current sensors on cables.
2. Locate the desired position of the remote indicator on the cabinet door or frame of cabinet as shown. Drill 5/16 inch hole. Use the same dimensions if the remote indicator is to be installed on the right hand side of the cabinet.
3. Install the “remote” indicator through the hole and secure it into place.
4. Insert the Lexan protector cap into the indicator.
5. Carefully route the remote indicator lead away from the energized primary compartment by attaching the lead to the wall of the cabinet with stick-on wire harnesses (SAP 10120724) and tie-wraps (SAP 10120722).
6. Excess fiber optic lead may be coiled, but not bent or kinked.

Scope TD 100.3 Installation of Fault Indicators in a Polyethylene Standpipe Vent

Figure TD 100–5: Installation of Fault Indicators in a Polyethylene Standpipe Vent



Note(s):
1. Use 3-1 fiber optic cable (6 feet, 30 feet, or 60 feet) for installations in standpipe vent.
2. See Scope TD 100.1 (Sheet 1) installation of fault indicator current sensors on cables.
3. Replacement vent caps can be ordered with the following chart.

Table TD 100–3: Replacement Vent Caps

Polyethylene Replacement Standpipe Cap	Standpipe Exterior Finish	SAP Number
8" Diameter Vent Duct	Granite (Gray)	10117595
10" Diameter Vent Duct	Sand Stone (Brown)	10117526

4. The top portion of the vent is molded to accept the adhesive from the Scotchlite labels. Take into consideration space for Scotchlite labels when locating indicator mounting positions.
5. Drill a 5/16-inch hole (for each indicator) on the wall of the standpipe or on the mounting surface. Snap fiber with plastic and fitting onto fault indicator. Insert front lens through 5/16-inch hole. Securely screw the “socket” onto the “front lens” as shown.
6. Secure the standpipe cap using four stainless steel screws through the replacement cap into the side wall of the standpipe vent.
7. Place Scotchlite labels on the standpipe, identifying the switch position locations of the fault indicators.
8. Excess fiber optic lead may be coiled, but not bent or kinked.

Scope TD 100.4 Installation of Fault Indicators in Standpipe Vent

Figure TD 100–6: Installation of Fault Indicators in a Standpipe Vent

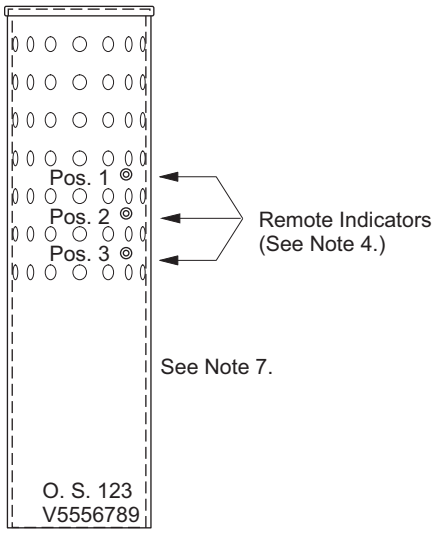


Figure TD 100–6.1

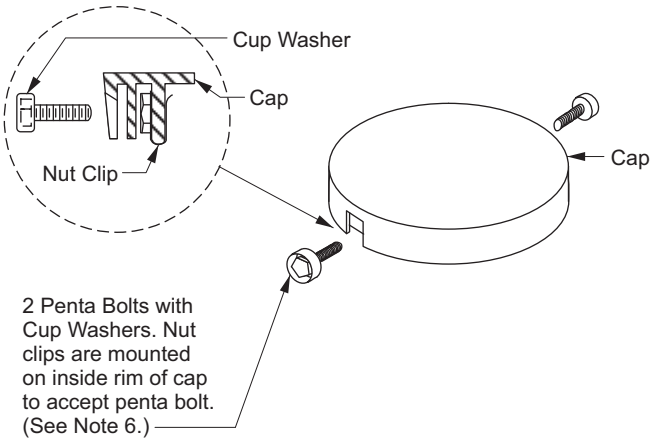


Figure TD 100–6.2

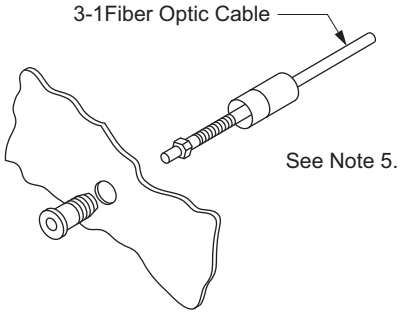


Figure TD 100–6.3

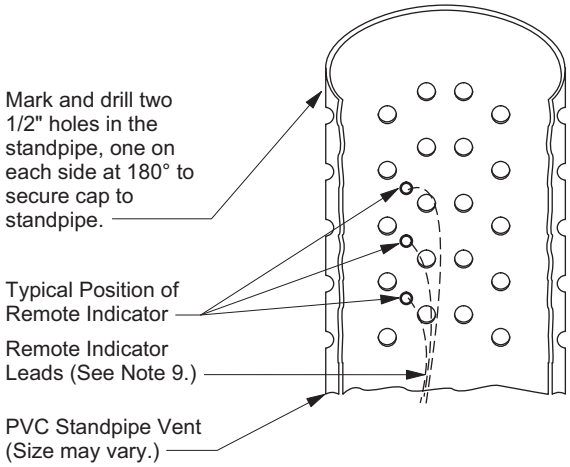


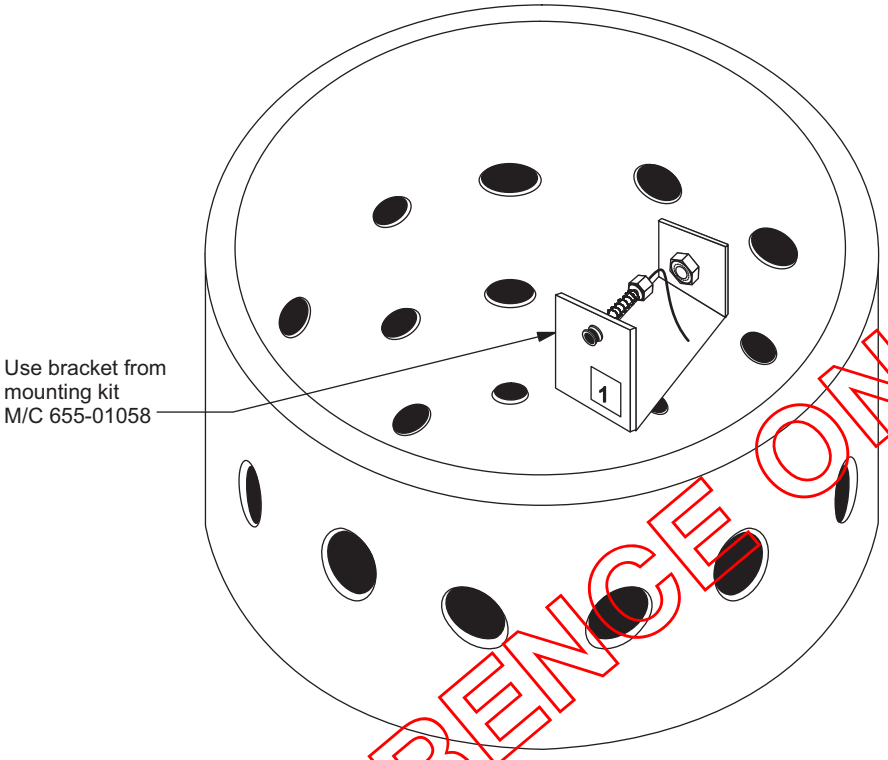
Figure TD 100–6.4

Note(s):

1. Use 3-1 fiber optic cable (6 feet, 30 feet, or 60 feet) for installations in standpipe vent.
2. See Scope TD 100.1 (Sheet 1) installation of fault indicator current sensors on cables.
3. Cut or pry off cap from existing standpipe vent, taking special care not to damage the standpipe vent. For 10-inch vent cap replacements see SAP 10117369. For 8-inch vent cap replacements see SAP 10117370.
4. Locate the desired mounting positions on the wall of the standpipe vent for the indicators.
5. Drill a 5/16-inch hole (for each indicator) on the wall of the standpipe or on the mounting surface. Snap fiber with plastic end fitting onto fault indicator. Insert front lens through 5/16-inch hole. Securely screw the “socket” onto the front lens, as shown.
6. To install the replaceable vent cap onto the standpipe vent, mark and drill two 1/2 inch holes at 180 degrees. Then, secure the replaceable cap using the penta bolts provided as shown.
7. Place Scotchlite labels on the standpipe, identifying the switch position locations of the fault indicators.
8. Excess fiber optic lead may be coiled, but not bent or kinked.

Scope TD 100.5 Optional Method for Installation of Fault Indicators in PVC Standpipe Vents

Figure TD 100–7: Optional Method for Installation of Fault Indicators in PVC Standpipe Vents



FOR REFERENCE ONLY

Note(s):

1. Install indicator through top hole on long side of bracket and snap into place, see Figure TD 100–7 (Sheet 7). Next, install Lexan protector cap into LED.
2. Drill a 17/64 inch hole at the desired mounting position in the plastic standpipe and insert the carriage bolt (threads toward inside of pipe).
3. Attach bracket to inside of standpipe on bolt and secure with plastic insert nut.
4. Place a one-inch Scotchlite label on bracket below indicator to identify switch position if required.

Scope TD 100.6 Installation of Fault Indicators in Surface Operable Parkway Enclosure

Figure TD 100–8: Installation of Fault Indicators in Surface Operable Parkway Enclosure

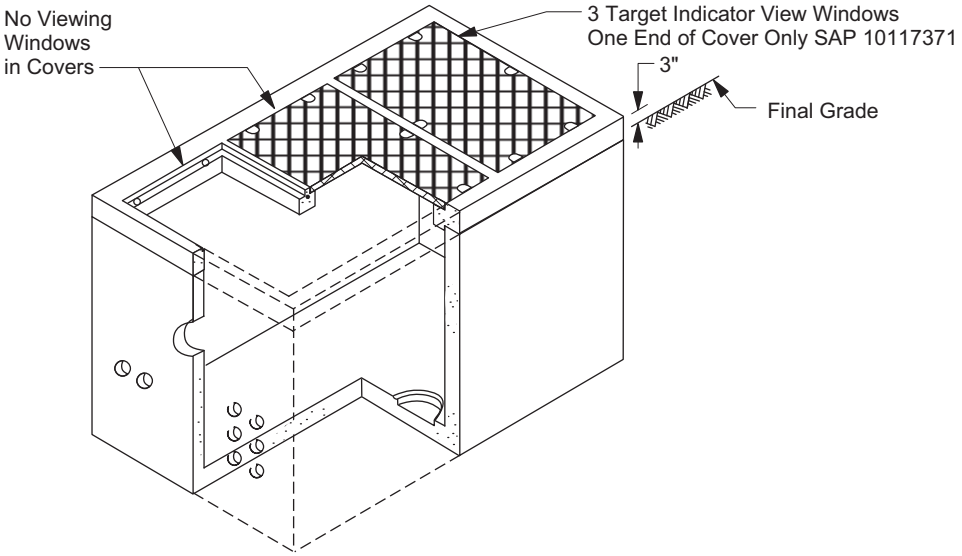


Figure TD 100–8.1: Surface Operable Parkway Enclosure

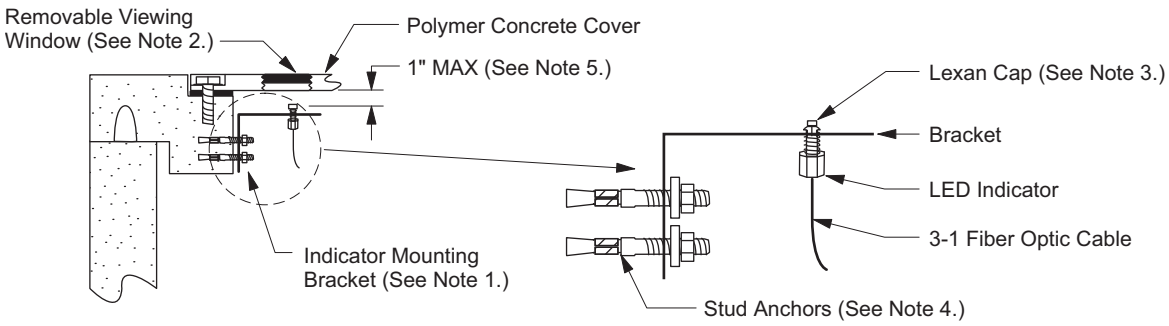


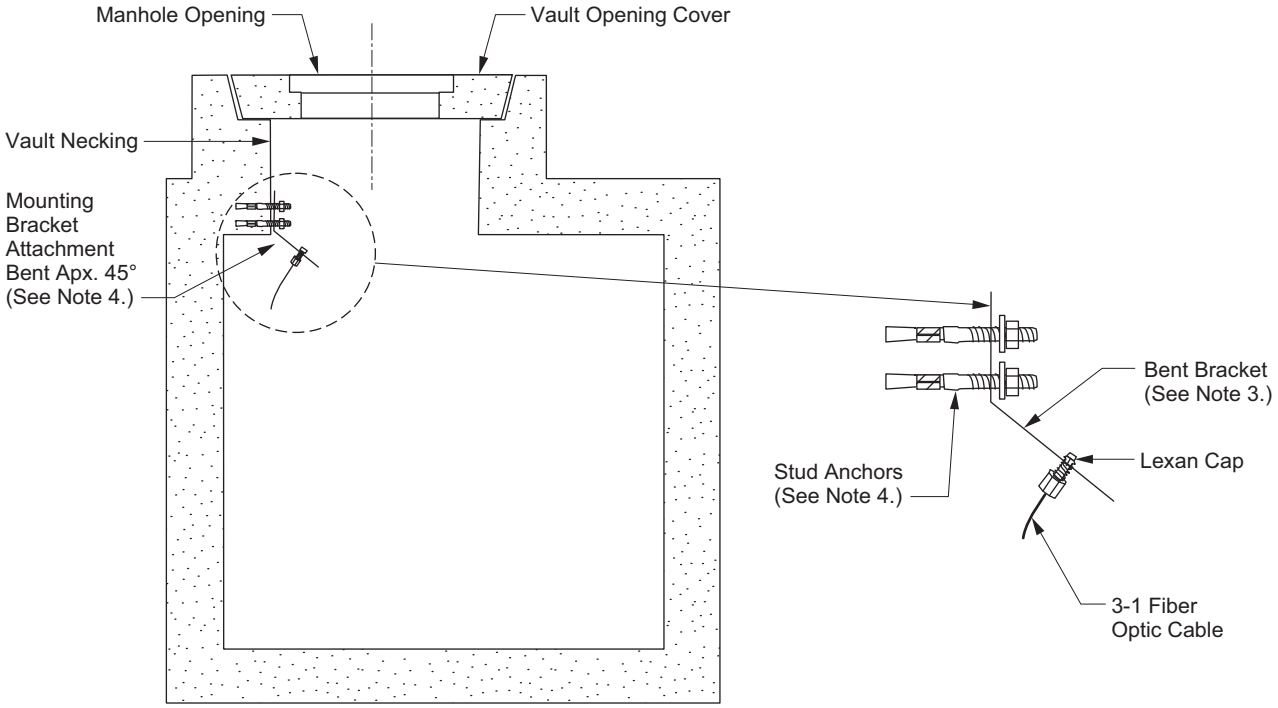
Figure TD 100–8.2: Installation of Fault Indicator

Note(s):

1. Use 3-1 fiber optic cable (6 feet, 30 feet, or 60 feet) and mounting bracket kit SAP 10117374 for installations in parkway enclosures. A replacement polymer concrete cover with viewing windows (SAP 10117371) is required for new and existing enclosures.
2. Viewing windows (Figure TD 100–8.1 [Sheet 8]) are transparent plastic to visually determine the operational condition of the fault indicator from the structure surface. The self-sealing threaded windows are provided with a molded-in penta-head nut to allow removal when window visibility is impaired.
3. Install the indicator into the “L” shaped mounting bracket as shown. Then insert the Lexan protective cap into the indicator.
4. For attachment of indicator mounting bracket in enclosure, use 1/4 inch wedge style concrete stud anchors furnished in bolt kit, or Edison stud anchor SAP 10072329. See RS 100 for anchor installation instructions.
5. Position the mounting bracket to structure so top of attached indicator is a maximum of one inch from bottom of cover.
6. See Scope TD 100.1 (Sheet 1) for installation of fault indicator current sensors on cables.
7. Excess fiber optic lead may be coiled, but not bent or kinked.

Scope TD 100.7 Installation of Fault Indicators in Vaults without Standpipe Vent

Figure TD 100–9: Installation of Fault Indicators in Vaults without Standpipe Vent



Note(s):

1. The installation of fault indicators in a vault without standpipe vents is not preferred because external viewing of the “LED” indicator is not possible.
2. Use 3-1 fiber optic cable (6 feet, 30 feet, or 60 feet) and mounting kit SAP 10117374 for installations in vaults.
3. Install the indicator on the bent indicator bracket (you must bend the bracket) as shown. Then insert the Lexan protective cap into the indicator.
4. Mount the bracket with 1/4 inch wedge style concrete stud anchors provided in the kit, or Edison stud anchor SAP 10072329, to the wall of the vault necking, so that the LED indicator is easily visible when the manhole cover is removed. See RS 100 for anchor installation instructions.
5. See Scope TD 100.1 (Sheet 1) for installation of fault indicator current sensors on cables.

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TD 120 Installation of Remotely Indicating Faulted Circuit Indicator in Underground Remotely Controlled Switches

Scope TD 120.1 Installations of Faulted Circuit Indicators on Remotely Controlled Switches

1.0 Installation Procedures

Note(s):
1. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon-Fri 7am-4pm. Available after hours/weekends upon request.

1.1 Apply Velcro to the Distribution Automation (DA) relay as shown in Figure TD 120–1 (Sheet 1) (M/C 060-00509 for hook kind; M/C 060-00525 for loop kind).

Figure TD 120–1: Velcro Application to Distribution Automation Relay

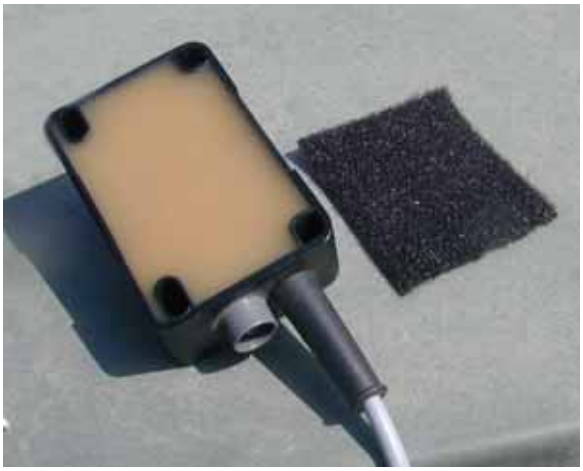


Figure TD 120–1.1: Before Velcro Application

Figure TD 120–1.2: After Velcro Application

1.2 Route the 3-to-1 fiber optic cable from the underground compartment/vault through the Remotely Controlled Switches (RCS) conduit. Apply Velcro to the back plate inside of the RCS cabinet and mount the Distribution Automation (DA) relay as shown in Figure TD 120–2 (Sheet 2).

Figure TD 120–2: Mounting of Distribution Automation Relay Inside RCS Cabinet

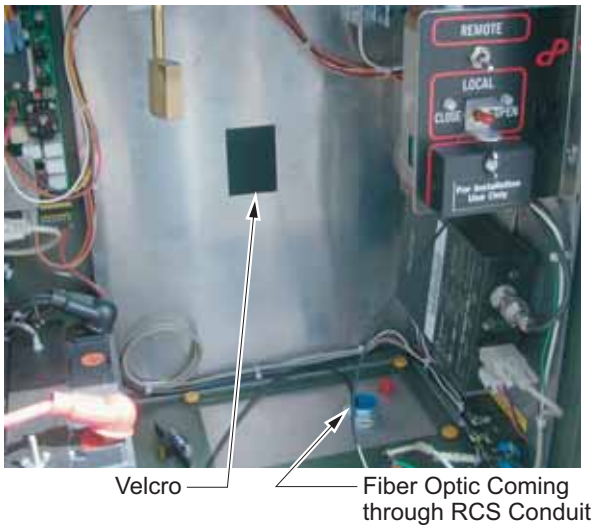


Figure TD 120–2.1: Velcro Application Inside RCS Cabinet

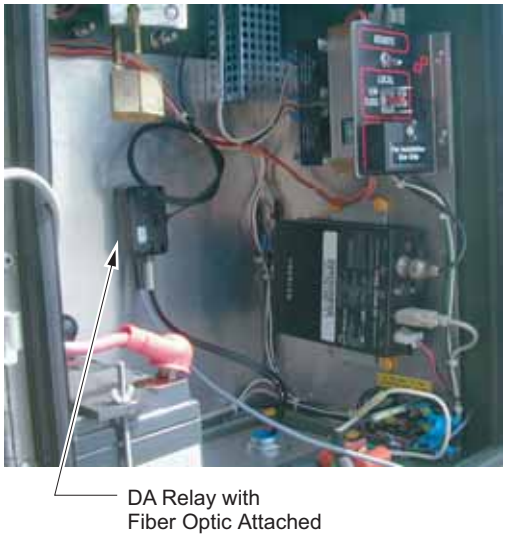


Figure TD 120–2.2: Mounting a DA Relay

1.3 Drill a 3/8" hole through the cabinet for the external indicator. The hole, when practical, shall be placed so that it faces the street. Use a rag to prevent metal shavings from entering sensitive electronic components inside the RCS cabinet (see Figure TD 120–3 [Sheet 2]).

Figure TD 120–3: Drilling for Indicator Installation

Figure TD 120–3.1: Covering of Electronic Components

Figure TD 120–3.2: Drilling through RCS Cabinet

1.4 Install the external fiber optic indicator as shown in Figure TD 120–4 (Sheet 3). Ensure that the fiber optic cables are clear of the motor operator components inside the RCS cabinet. Label the RFI as shown in Figure TD 120–4 (Sheet 3).

Figure TD 120–4: Indicator Installation

Figure TD 120–4.1: Close-Up of Indicator

Figure TD 120–4.2: Labeling of Indicator on Side of Cabinet

1.5 Connect the Universal FCI Interface Cable (M/C 403-01996) between the Remote Terminal Unit (RTU) and the Transparent Port of the radio and connect the DA relay power supply and interface cables as shown in Figure TD 120–6 (Sheet 4). Tighten all connections.

Figure TD 120–5: Universal Faulted Circuit Indicator (FCI) Interface Cable

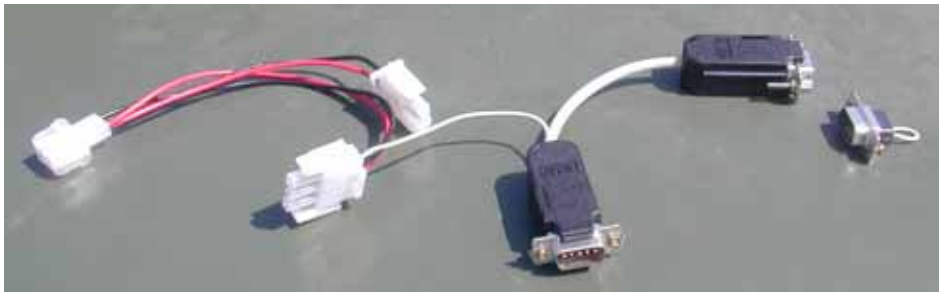


Figure TD 120–6: Universal Faulted Circuit Indicator Cable Installed Between Remote Terminal Unit and Transparent Port NetComm Radio

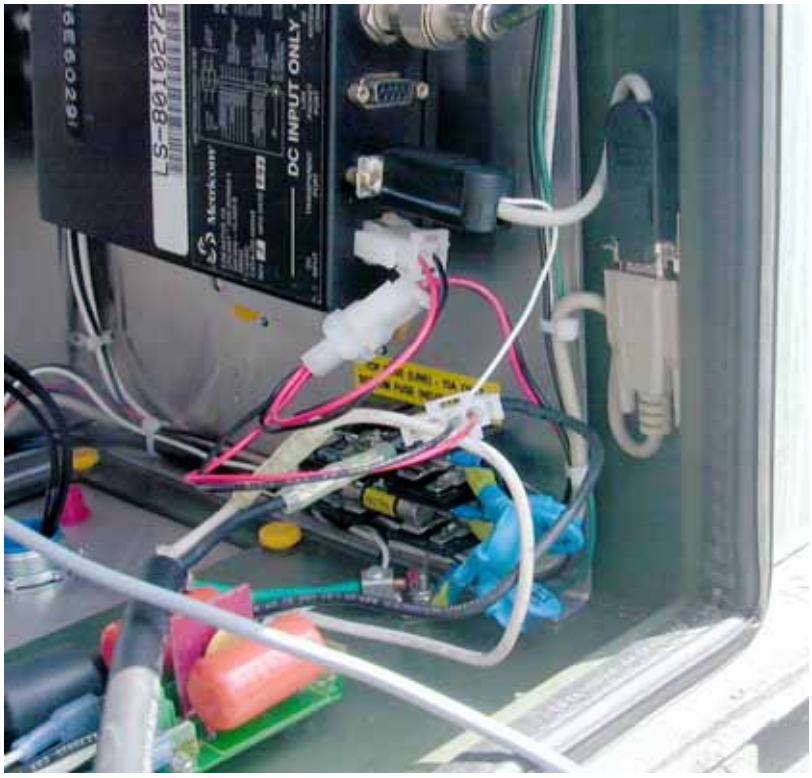
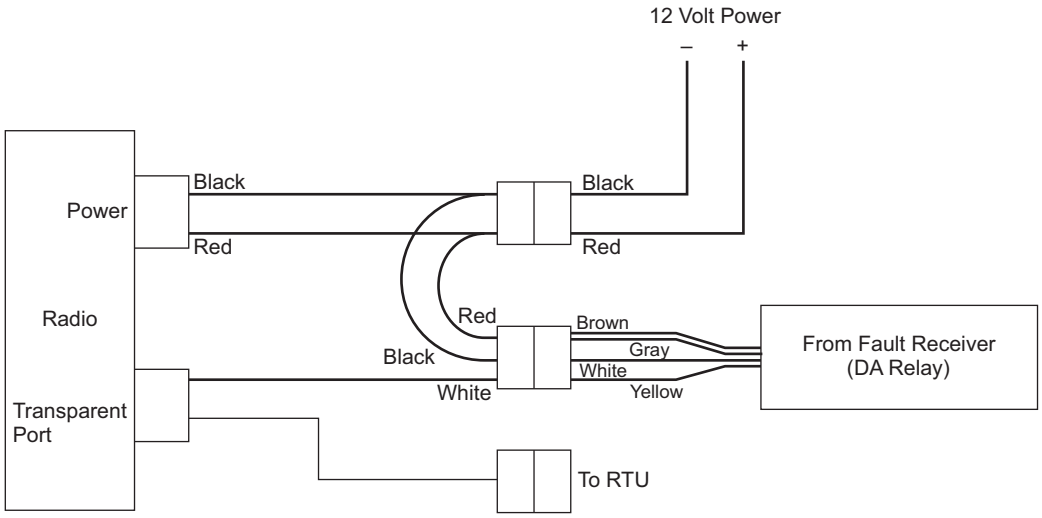
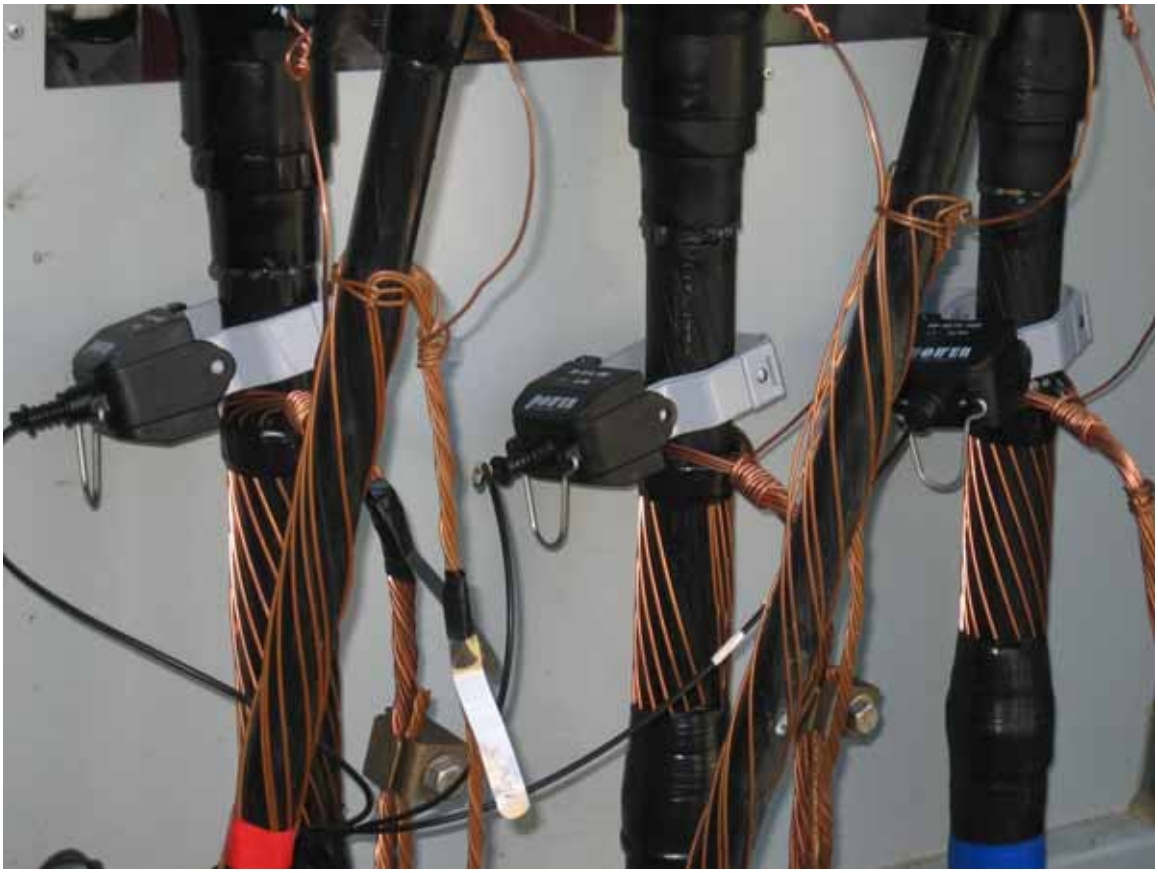


Figure TD 120–7: Wiring Diagram



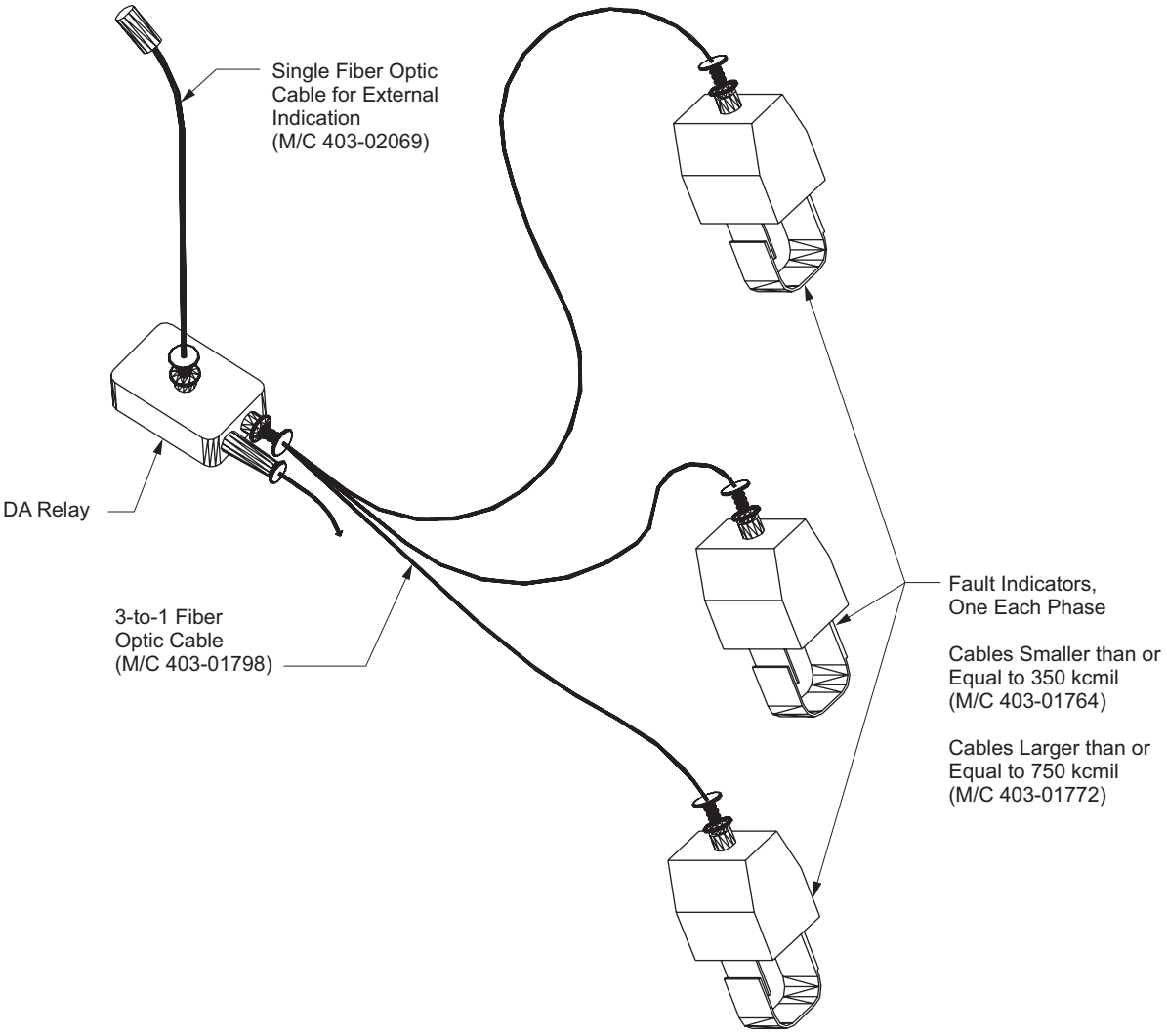
1.6 Install the FCIs on the cables as shown in Figure TD 120–8 (Sheet 5). The FCI must be installed under the concentric neutral of the cable. Connect one connector of the 3-to-1 fiber optic cable to each FCI.

Figure TD 120–8: Faulted Circuit Indicators Installed on Each Phase



1.7 Connect the 3-to-1 fiber optic cable and the single fiber optic cable to the DA relay as shown in Figure TD 120–9 (Sheet 6). Perform endpoint test per Apparatus procedures.

Figure TD 120–9: Fiber Optic Cable Installed on Faulted Circuit Indicator and Distribution Automation Relay



TD 130P Underground Remote Fault Indicator (UG RFI) Pilot

Scope TD 130P.1 Installation of PDP Submersible SLT (SMART Load Tracker LM LFD) System

1.0 General Description

This pilot is to explore and evaluate the capabilities of a fully submersible UG RFI sensor technology manufactured by Power Delivery Products (PDP) for applications on padmount switch, and vault installations.

The four submersible SLT model shall be installed in district(s): 33-Huntington Beach

Figure TD 130P–1: PDP Submersible SLT

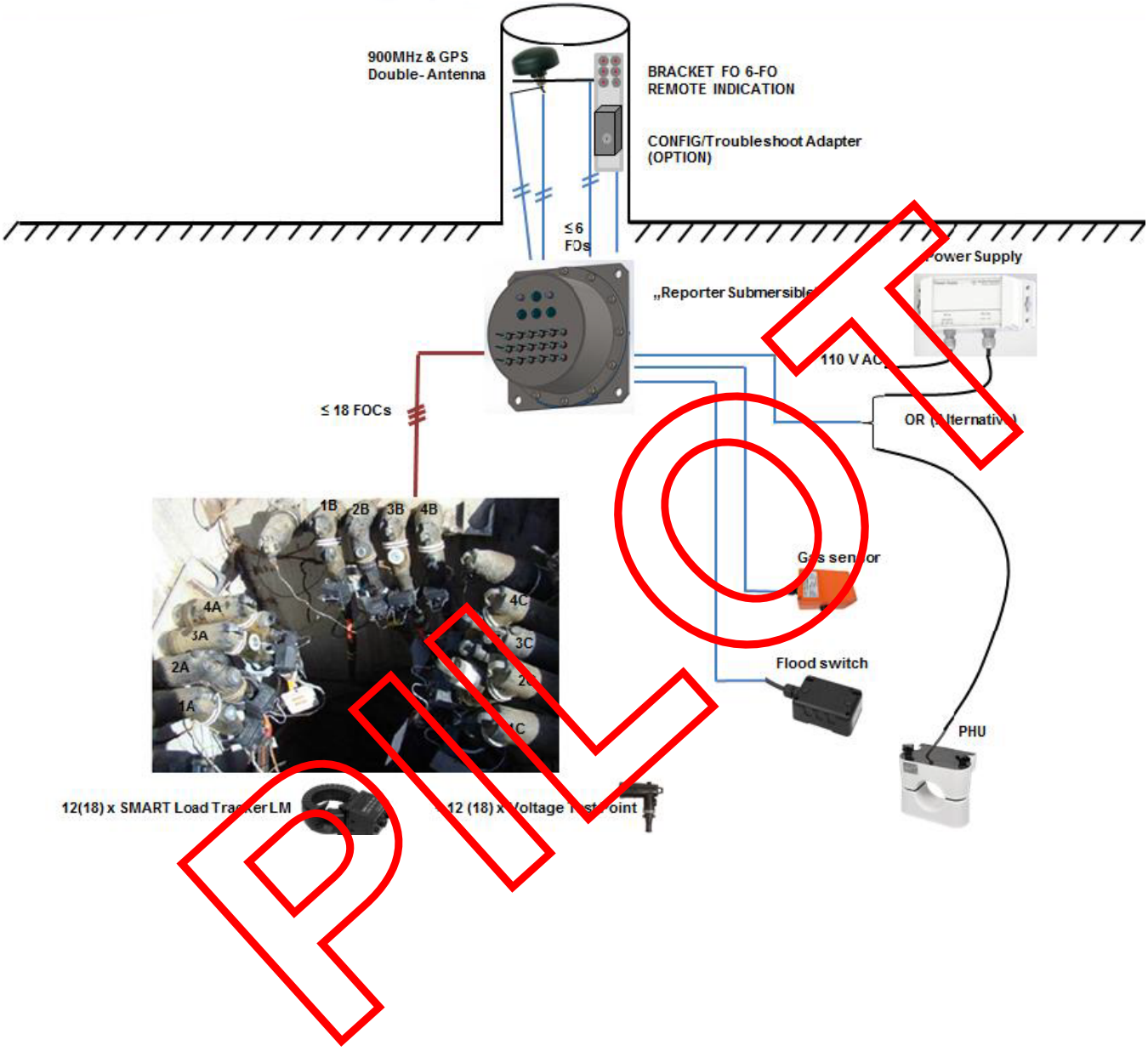
1.1 Submersible SLT Product Overview

The Submersible SLT is a monitoring device for the underground distribution system. It receives status information on up to 6 positions with 18 SMART Load Tracker LM LFD (Load Monitoring – Load Flow Direction) current sensors. The system uses fiber optic communication links between the SMART Load Tracker LM LFD and the Submersible SLT. The Submersible SLT converts the status information into the Distributed Network Protocol (DNP3) and communicates to DMS.

The Submersible SLT is powered from a rechargeable battery charged from an external power supply or a harvesting CT connected to a primary cable.

1.2 PDP Submersible SLT Accessories

Figure TD 130P–2: PDP Submersible SLT Accessories



PILOT

Figure TD 130P–3: SMART Load Tracker LM LFD

The SMART Load Tracker LM LFD is designed for underground distribution applications. It can be installed on energized underground distribution cables (up to 46kV L-L) and provides event based fault status information in addition to continuous circuit loading data. Installation can be performed while cable is carrying current.

The SMART Load Tracker LM LFD incorporates load tracking and load memory features enabling the unit to automatically set its trip rating in relation to peak load current. Once the unit detects fault current, above its trip rating, the SMART Load Tracker LM LFD communicates fault data, load current and status data to DMS. The SMART LT LFD is equipped with the connector for the Test Point Adapter. If the 200amp components is not available then hand tighten the blue cap to seal the connector.

NOTE

The Load Flow Direction feature is only applicable on the position that has the 200 amp test point adapter.

PILOT

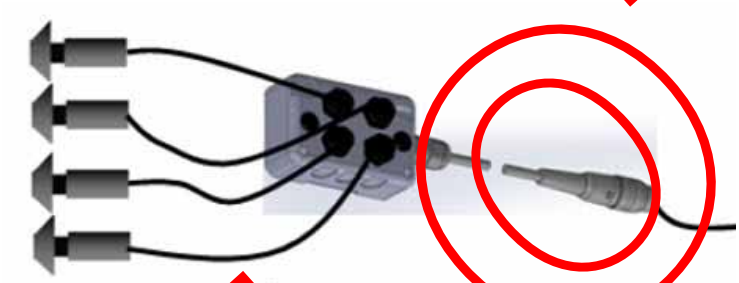
Figure TD 130P–4: Power Current Transformer

The power current transformer (harvesting CT) powers the Submersible SLT from the load current on the primary cable. It connects to the '**CT IN**' connector on the Submersible SLT. The primary line current must have at least 20 amps. The CT must be installed on safe-to-touch cable sections, anywhere over the concentrics of the cable.

Figure TD 130P–5: Power Supply 110 VAC

In installations where 110V AC is easily accessible the 'Power Supply 110V AC' unit can be used to power the Submersible SLT from the 110V AC as an alternative to the Power current transformer.

Figure TD 130P–6: 4-Way Remote Indication Display



The 4-Way Remote Indication Display uses bright LEDs to indicate the FCI Tripped status locally per position (set of 3 FCIs) to the vent pipe via fiber optical cable as commonly used with standalone Load Tracker.

Note(s):
1. This UG RFI sensor solution may be installed on distribution padmounted equipment or in vault.

1.3 Installation Procedure for PDP Submersible SLT

STEP 1. Phase ID the circuit to identify the A, B and C phase.

STEP 2. Document the serial number of the Submersible SLT in the RFI installation form.

STEP 3. Label each cable as Red, White, Blue or A, B and C phase according to the cable phase.

STEP 4. Install the Submersible SLT unit.

STEP 5. Install all three SMART Load Tracker LM LFD current sensors in the same orientation with the arrow indicating "B" point away from the switch.

PILOT

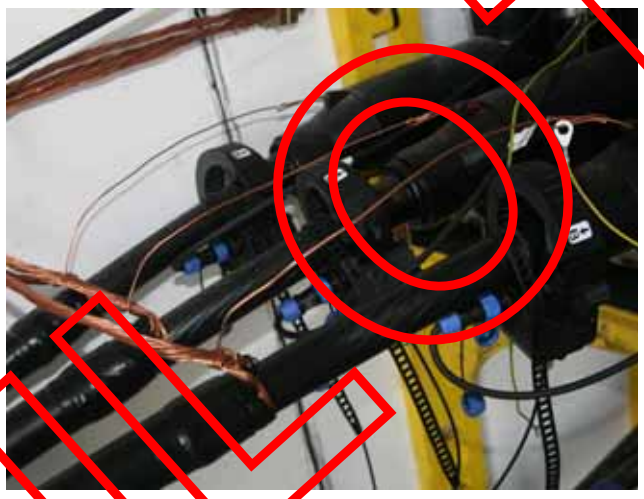
Figure TD 130P–7: SMART Load Tracker LM LFD Polarity Indicating Window

STEP 6. SMART Load Tracker LM LFD installation instruction:

a. Install the current sensor over cable between the concentric neutrals and the elbow.

b. Install the current sensor with arrow pointing away from the switch.

Figure TD 130P–8: SMART Load Tracker LM LFD Installation Details



STEP 7. Install the SLT Test Point Adapter.

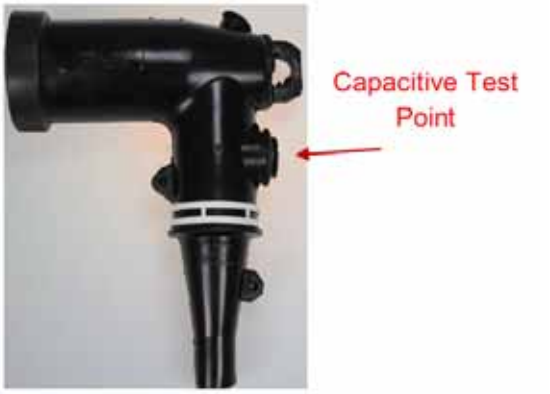
a. The SLT Test Point Adapter can be installed while circuit is energized.
The SLT Test Point Adapter only applies on 200amp component with test point.

b. Remove existing cover from the 200 amp capacitive test point on the elbow. Clean test point.

c. The SLT Test Point Adapter must be installed on the same phase with the SMART Load Tracker LM LFD.

PILOT

Figure TD 130P–9: Elbow Capacitive Test Point

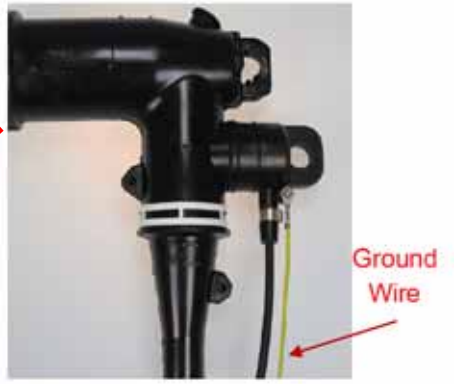


d. Put SLT Test Point Adapter onto the capacitive test point. Note: the adapter ring must be inserted into the test point adapter beforehand.

Figure TD 130P–10: Test Point Adapter Ring

e. Connect ground wire to the ground bus.

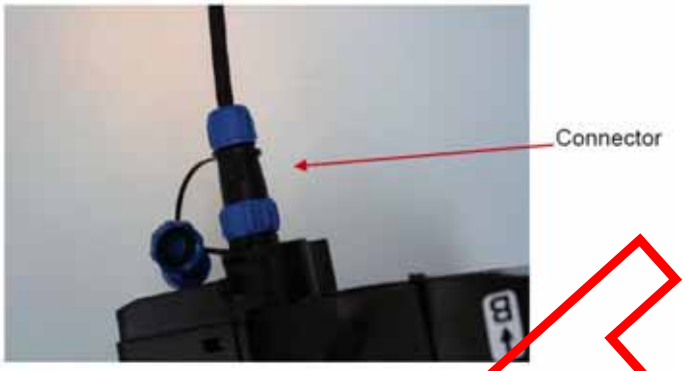
Figure TD 130P–11: Ground Wire



PILOT

f. Connect to SMART Load Tracker LM LFD

Figure TD 130P–12: SMART Load Tracker LM LFD Connector



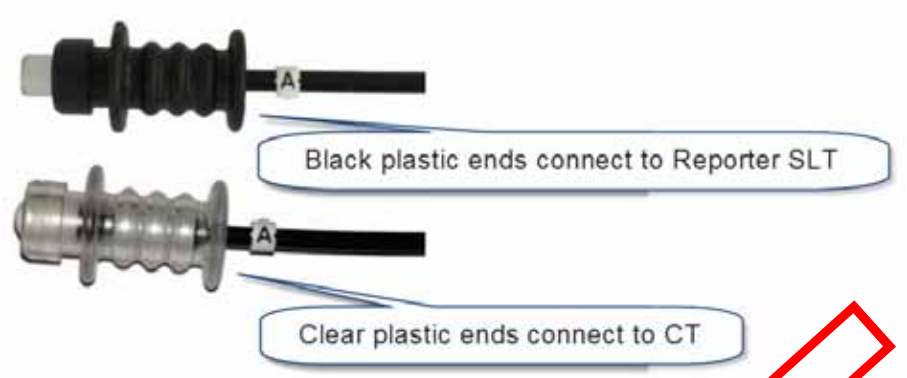
g. The SLT Test Point Adapter can be left permanently installed only when left connected to a SMART Load Tracker LM LFD.

Figure TD 130P–13: SLT Test Point Adapter Installation Example

PILOT

h. The Submersible SLT kit comes with Fiber-Optic cables for connection from the Submersible unit to the SMART Load Tracker LM LFD. The Fiber-Optic cable comes with two different ends, a clear plastic end and a black plastic end. The clear plastic end is connected to the SMART Load Tracker LM LFD and the black plastic end is connected to the Submersible SLT.

Figure TD 130P–14: Fiber Optic Cables



STEP 8. Complete the RFI installation form. One form per installation is required. All completed forms are to be submitted to Grid Technology & Modernization, Victor Tran via Pony Mail at "Westminster, Fenwick Plaza".

1.4 Application and Installation Examples

A. Padmount Switch installation

Figure TD 130P–15: Power Current Transformer

PILOT

Figure TD 130P–16: Reporter SLT Mounting

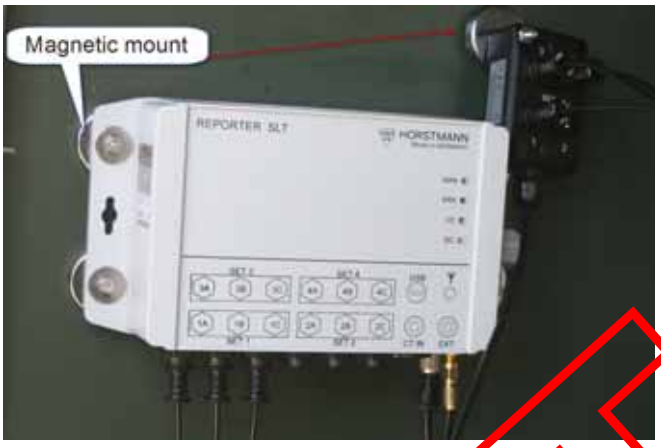


Figure TD 130P–17: Antenna Location

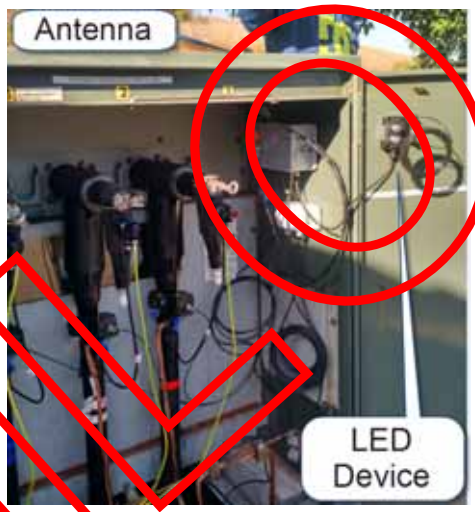


Figure TD 130P–18: LED Location on PME Door

PILOT

B. Vault with Vent Pipe

Figure TD 130P–19: Vent Pipe Mounting Bracket for Antenna

Figure TD 130P–20: Vent Pipe LED Mount and RFI Labeling

PILOT

Figure TD 130P–21: Louver Vent LED Mount

PILOT

Figure TD 130P–22: RFI Installation Form

UG REMOTE FAULT INDICATOR INSTALLATION FORM

Date:_____

District:_____ **UG RFI number & Position(s):** _____

Foreman:_____ **Phone:**_____

Circuit:_____ **Substation:**_____

Structure Number:_____ **Switch Number:**_____

Sensor Serial Number (Sticker): _____

Lat/Long: _____

Serial Number Sticker:	Power Current Transformer Sticker : Or Power Supply Sticker:

PILOT

Scope TD 130P.2 Installation of 3M Electrical Analytics Unit

1.0 General Description

This pilot is to explore and evaluate the capabilities of a UG RFI sensor technology manufactured by 3M Electrical Division for applications in vault installations.

The pilot installations shall only occur in the following district(s): 33-Huntington Beach

Figure TD 130P–23: 3M Electrical Analytics Unit

PILOT

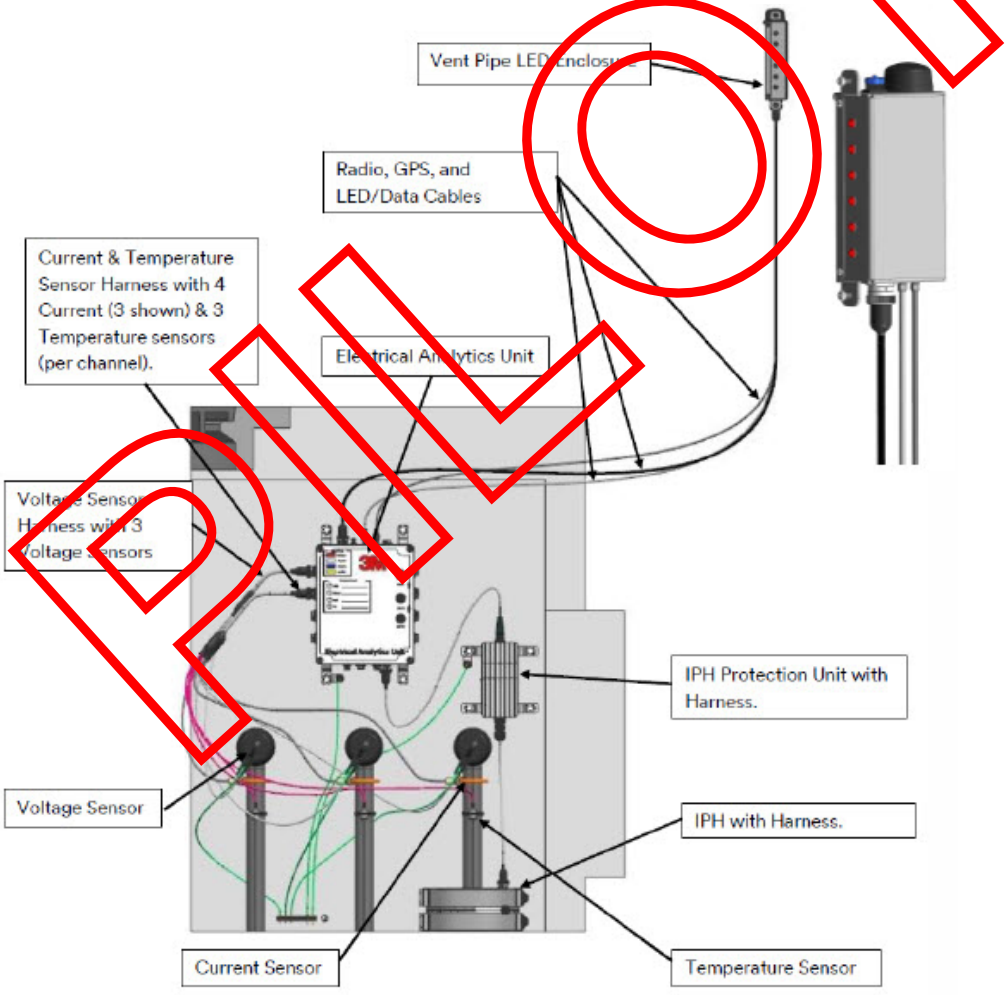
1.1 3M Electrical Analytics Unit Overview

The 3M Electrical Analytics Unit (EAU) sensing system is a monitoring device for the underground distribution. The device measures up to 6 positions with 18 rogowski coil devices. These coils can be connected to monitor single phase or three phase circuits. The 3M EA system can be applied on mainline or radial section. The 3M EAU is powered from a rechargeable battery charged from 110VAC or a harvesting CT Inductive Power Harvesting (IPH) connected to a primary cable.

1.2 3M EAU System Accessories

1. Electrical Analytics Unit Overview
2. Inductive Power Harvesting (IPH) core
   - IPH Protection Unit
   - Protection Unit Short-Circuit Cap
   - IPH Harness
3. Power cable for 110 VAC
4. Vent Pipe LED Enclosure
5. Rogowski Coils for Current Sensing
6. 600Amp Voltage Test Point Sensor
7. Cable Temperature Sensors
8. Neenah Manhole Covers with Integrated Antenna

Figure TD 130P–24: 3M Electrical Analytics Unit Overview



PILOT

Figure TD 130P–25: Power Current Transformer & Protection Unit

PILOT

The power current transformer (harvesting CT) powers the EAU module from the load current on the primary cable. It connects to the "**CT**" port connector on the EAU module. The primary line current must have at least 18amps. The CT must be installed on safe-to-touch cable sections.

1.3 Installation procedure for 3M EAU Components

STEP 1. Attach ground wire to the grounding location on the IPH Protection Unit and ground the unit to the equipment ground bus.

Figure TD 130P–26: IPH Protection Unit and Short-Circuit Cap

STEP 2. Connect the Short-Circuit Cap to the system port on the IPH Protection Unit.

STEP 3. Connect the supplied cable to IPH port on the protection unit.

WARNING The cable connecting the IPH and the Protection unit MUST NOT be disconnected while the system is energized or the IPH attached to the energized cable.

STEP 4. Connect the second end of the IPH cable assembly to the IPH.

WARNING The cable connecting the IPH and the Protection unit MUST NOT be disconnected while the system is energized or the IPH attached to the energized cable.

STEP 5. Carefully position the IPH around the primary cable (over the concentric).

STEP 6. Secure the IPH around the cable using the attached latches and supplied hose clamp.

STEP 7. Secure the IPH on the cable tray to prevent IPH movement along the length of primary cable.

STEP 8. Remove the Short-Circuit Cap from the IPH Protection Unit and connect the supplied harness assembly to the System Port.

NOTE Connector assembly is water tight ONLY if it is firmly tightened.

PILOT

Figure TD 130P–27: IPH Power Harness

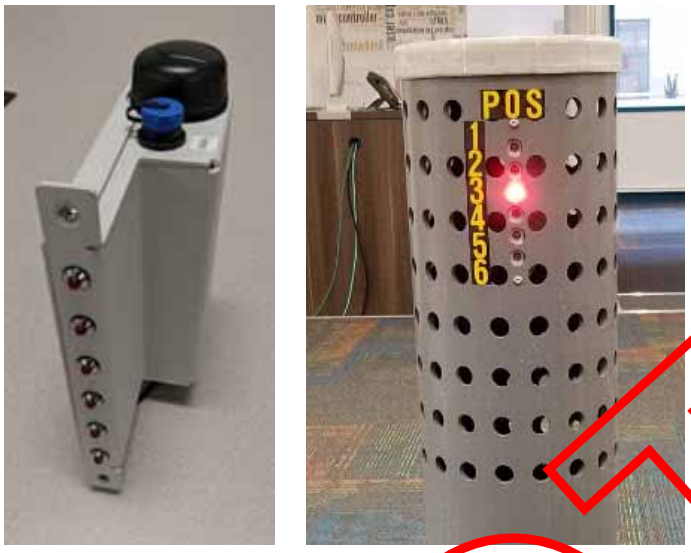
STEP 9. Connect the second end of the harness assembly to one of the EAU Power Ports.

Figure TD 130P–28: 110 VAC Power Cord

For direct power of 110VAC, use the supplied harness to connect to the EAU.

PILOT

Figure TD 130P–29: LED & Antenna Mount in Vent Pipe



Each LED is corresponded to the switch position. The state of each LED is triggered by the EAU system when it detects a fault on any of the three phases on the position. The LED has two parameters:

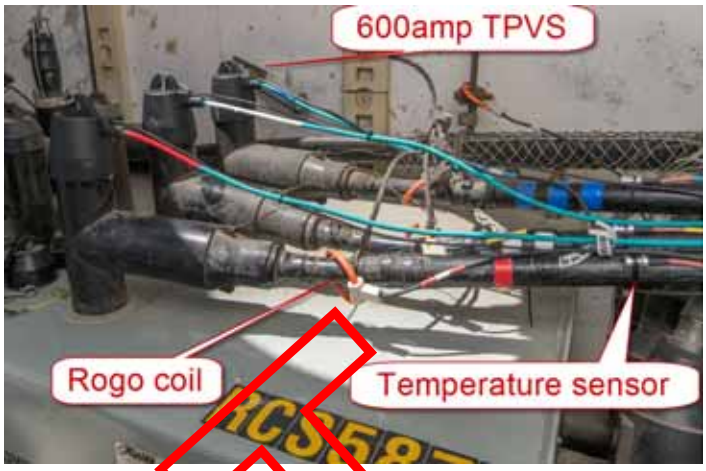
1. For a temporary fault the LED will have a slow flashing of 0.5 Hz.
2. For a permanent fault the LED will have a fast flashing of 2 Hz.

Figure TD 130P–30: Rogowski Coil

The rogowski coil is designed for underground distribution applications. It can be installed on energized underground distribution cables (up to 46kV L-L) and provides event based fault status information in addition to continuous circuit loading data. Installation can be performed while cable is carrying current.

PILOT

Figure TD 130P–31: 600 amp Voltage Test Point Sensor



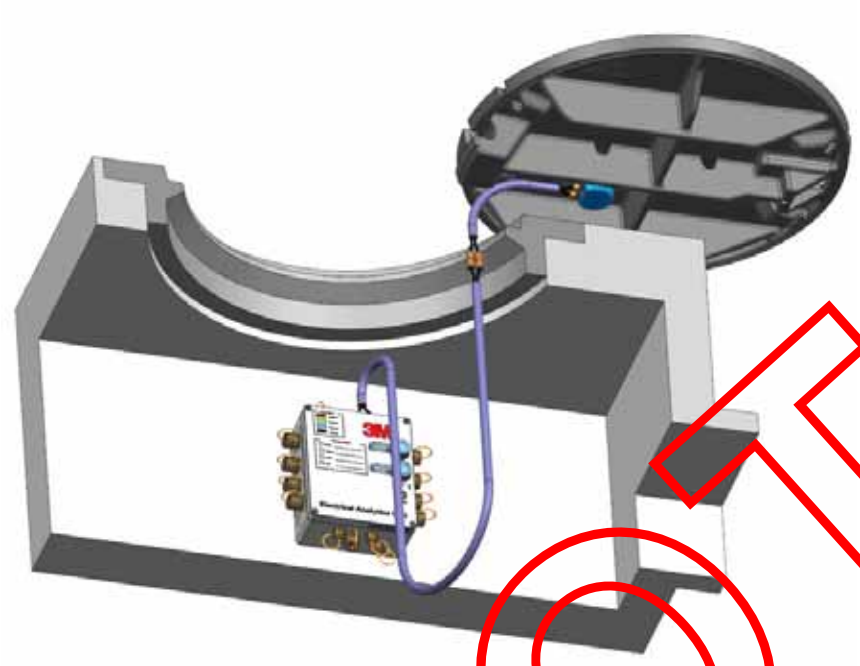
Voltage test point sensor is used to capture phase difference between voltage and current to determine bi-directional current flow. Voltage test point sensors can be installed while circuit is energized. Each installation will require three test point sensors installed on phase “A”, “B” and “C” on 600amp elbows. The three test point sensors are color coded with red, white and blue to maintain phase relationship.

Figure TD 130P–32: Cable Temperature Sensing Device

The cable temperature sensor comes in a set of three sensors for “A”, “B” and “C” phases. Each switch position being monitor will include one set of temperature sensor.

PILOT

Figure TD 130P–33: Neenah Manhole Covers with Integrated Antenna



In some instances a vault vent pipe may not be available for use. In those cases a Neenah manhole cover with integrated antenna shall be used.

PILOT

1.4 Installation steps for 3M Electrical Analytics Unit

STEP 1. Phase ID the circuit to identify the A, B, and C phase.

STEP 2. Document the serial number of the 3M EAU system in the RFI installation form.

STEP 3. Label each cable as Red, White, Blue or A, B, and C phase according to the cable phase.

STEP 4. Mount the 3M EAU system.

STEP 5. Install all three rogowski coils in the same orientation with the arrow pointing away from the switch.

STEP 6. Install all three 600 amp test point adapter

STEP 7. Install the 120 VAC power supply or the power current transformer

STEP 8. Install the LED enclosure in the vent pipe

STEP 9. Install the Taoglas antenna in the vent pipe

STEP 10. Once the power supply has been safely connected to the EAU and all sensor connections have been made, the unit is safe to power up. Press the On/Off button to power the unit.

NOTE

The system will take a few minutes to initialize. During initialization the On/Off LED will continue to blink. Once initialization is completed and system is ready, the On/Off LED will go solid.

PILOT

Figure TD 130P–34: RFI Installation Form

UG REMOTE FAULT INDICATOR INSTALLATION FORM

Date:_____

District:_____ UG RFI number & Position(s): _____

Foreman:_____ Phone:_____

Circuit:_____ Substation:_____

Structure Number:_____ Switch Number:_____

Sensor Serial Number (Sticker): _____

Lat/Long: _____

Serial Number Sticker:	Power Current Transformer Sticker : Or Power Supply Sticker:

PILOT

TD 131 Power Delivery Products Reporter (PDP) / SLT Remote Fault Indicator (RFI) for Padmount Switches and UG Switches (Vent Pipe)

Scope TD 131.1 Installation of PDP Reporter SLT (Smart Load Tracker LM LFD) on Padmount Switches and UG Switches (Vent Pipe)

1.0 General Description

The PDP Reporter SLT Padmount UG RFI is sensor technology manufactured by Horstmann for applications on padmount switches and UG switches (i.e. vent pipes).

The purpose of this system is to remotely monitor underground distribution circuits via the Distribution Management System (DMS) by capturing data on the circuit performance and condition of the lines, thereby allowing Engineering and Field Personnel to respond to equipment-related outages, overload conditions, troubleshooting, and reliability issues.

Figure TD 131–1: PDP Reporter SLT (SMART Load Tracker)

1.1 Reporter SLT Product Overview

The Reporter SLT is a remote fault indicator system for padmount and vent pipe installations that is used to monitor 4 positions switches.

1.2 PDP Reporter SLT Accessories

Figure TD 131–2: PDP Reporter SLT Accessories

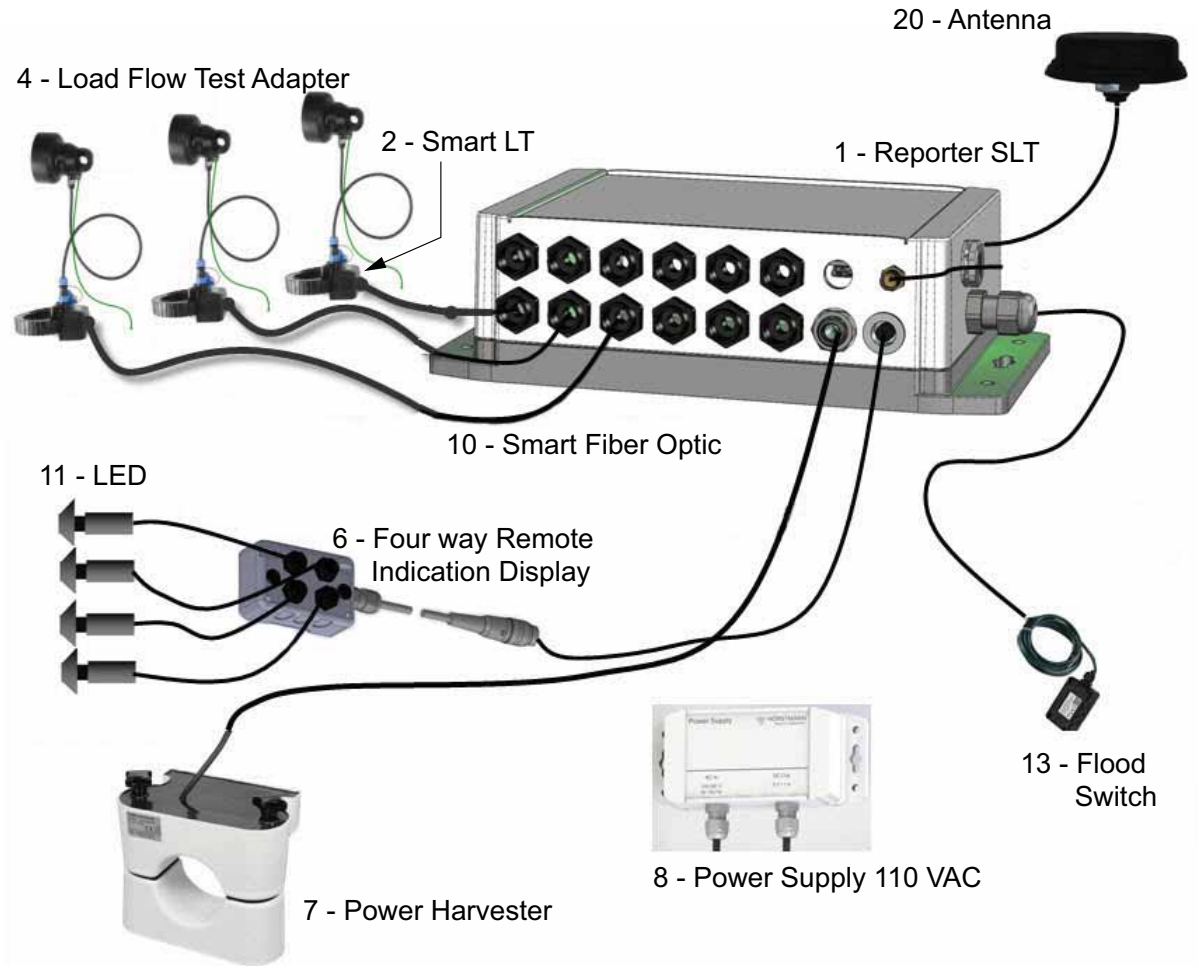


Figure TD 131–2.1: Non-louver Vent Pipe Mounting Bracket

Figure TD 131–2.2: Louver Vent Pipe Mounting Bracket

Figure TD 131–2.3: Rechargeable Battery

Table TD 131–1: UG RFI Padmount and Vent Pipe Replacement Components

Item #	SCE Catalog # or SAP #	Power Delivery Products Catalog #	Description
Reporter SLT Devices for Smart LT			
1	10209612	28-4310-003	Reporter SLT with L+G SBR (plastic enclosure)
Reporter SLT Devices for Smart LT			
2	10209608	42-3205-001	Smart Load Trackers - Load Flow
3	10212663	49-0510-002	Load Flow 60" Test Adapter (200Amp unit)
4	10212662	49-0510-012	Load Flow 60" Test Adapter (600Amp unit)
5	10213889	49-0510-022	4-Way Test Point Cable Harness for 3 Phase 200 A Test Adapter
6	10212961	49-0510-040	4-Way Test Point Cable Harness for 3 Phase 600 A Test Adapter
7	10212664	49-0510-060	6-way Test Point Cable Harness for 3 Phase 600 A Test Adapter
Reporter SLT Solution Accessories			
8	10209614	49-0708-000	4Way Remote Indication Display
Reporter SLT Power Supply Options			
9	10209613	49-6100-000	Power Harvester Unit (PHU) for Reporter SLT / 30 foot length. Use when 120 VAC is not available
10	10209689	49-7922-002	120 VAC Power Supply for Reporter SLT SCE / 30 foot length
Reporter SLT Fiber Optic Cables			
11	10212973	49-6007-520	Smart FO Cable (20 Feet, 3 Phases) / Pad
12	10212972	49-6007-540	Smart FO Cable (40 Feet, 12 Phases Bundle) / Vent
13	10209645	49-6007-108	External FO Cables (8 Feet, 1 Phase) / Pad
14	10213675	49-6007-103	External FO Cables (3 Feet, 1 Phase) / Vent
Reporter SLT Solution Accessories			
15	10212958	28-7910-017	Flood Switch for Reporter for Pad (40 foot lead)
16	10209618	49-6001-009	Magnet Cable Guides
17	10212968	28-9900-000	Reporter SLT Magnet Mounting Kit
18	10212957	28-9900-006	Reporter SLT vent pipe bracket (**Non** Louver Vent Pipe)
19	10209783	28-9900-007	Reporter SLT vent pipe bracket (Louver Vent Pipe)
20	10212971	49-7923-002	Reporter SLT Y-Adaptor 2x PHU
21	10213131	49-6002-103	Replacement Battery for Reporter SLT (Rechargeable battery)
3rd Party Equipment			
22	10209767	28-7910-024	Taoglas Remote Antenna (2 foot, GPS & 915 MHZ)
23	10212966	28-7910-025	Taoglas Remote Antenna (8 foot, GPS & 915 MHZ)

Figure TD 131–3: Smart Load Tracker LM LFD

The Smart Load Tracker LM LFD can be installed on energized underground distribution cables (up to 46kV L-L).

The Smart LT LFD is equipped with a connector for the Test Point Adapter. If 200 amp or 600 amp components are not available, hand tighten the blue cap to seal the connector.

Figure TD 131–4: Power Supply 110 VAC

In installations where 110 VAC is easily accessible, the “Power Supply 110 VAC” unit shall be used to power the Reporter SLT from the 110 VAC.

Figure TD 131–5: Power Harvesting Unit (PHU)

As an alternative to the 110VAC Power Supply, the power current transformer (harvesting CT) powers the Reporter SLT from the load current on the primary cable using two power current transformers with a Y-Adapter which connects to the 'CT IN' on the Reporter SLT. The primary line current must have at least 15 amps. The CT must be installed on safe-to-touch cable sections, anywhere over the concentric of the cable.

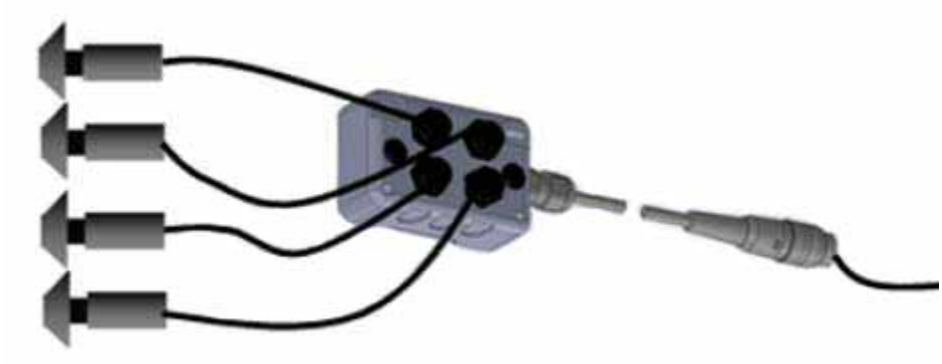
NOTE

The PHU is designed with an internal shunt resistor that allows the output cable to be disconnected from the Reporter SLT while the PHU is still being powered by primary line current. This eliminates the high voltage problem encountered with traditional CTs.

CAUTION

The PHU unit comes with two pieces that get connected around the cable. When installing the PHU unit and connecting the two pieces together it is important to keep hands/fingers clear from the core surfaces to prevent pinching of the hands/fingers due to the high electromagnetic filed that pulls the two pieces of the PHUs together.

Figure TD 131–6: 4-way Remote Indication Display



The 4Way Remote device uses bright LEDs to indicate the RFI tripped status.

1.3 Installation procedure for PDP Reporter SLT

STEP 1. Phase ID the circuit to identify phases A, B, and C.

STEP 2. Document the serial number of the Reporter SLT using the Asset Complete Data Capture (ACDC) App (QR Code).

STEP 3. Mount the Reporter SLT unit inside of padmount enclosure (See figure TD 131-8) or on vent pipe bracket (See figure TD 131-22).

STEP 4. Install the Smart Load Tracker with the arrow pointing away from the switch.

a. Install the current sensor over the cable between the concentric neutrals and the elbow.

b. Install all Smart Load Trackers

Figure TD 131–7: Smart Load Tracker LM LFD Polarity Indicating Arrow

Figure TD 131–8: Reporter SLT Smart Load Tracker LM LFD Installation Details

Figure TD 131–8.1: Applicagtion of Smart Load Tracker on Padmount Switches

Figure TD 131–8.2: Application of Smart Load Tracker on UG Switches

STEP 5. Install the SLT Test Point Adapter.

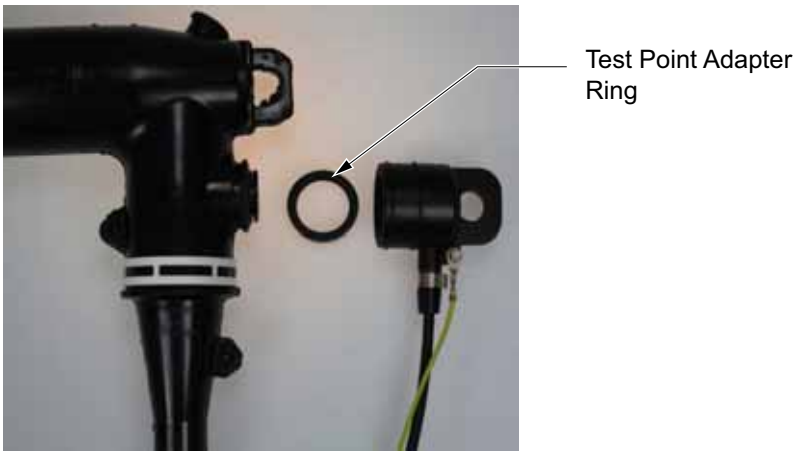
a. The SLT Test Point Adapter can be installed on 200 amp or 600 amp component with test point.

b. Remove existing capacitive test point cover from the 200 amp or 600 amp elbow.

c. The SLT Test Point Adapter must be installed on the same phase with the Smart Load Tracker LM LFD.

d. Ensure the Test Point Adapters are tightly attached.

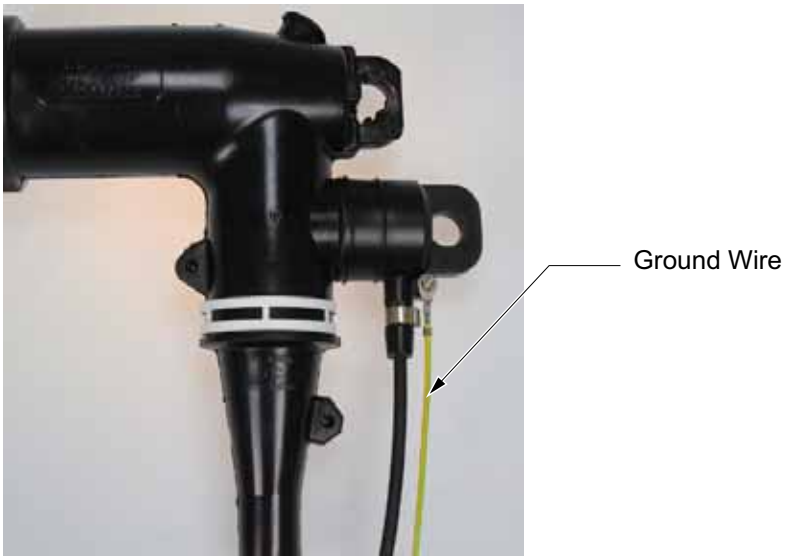
Figure TD 131–9: 200 A Elbow Test Point Adapter and O-ring



e. Note that the Test Point Adapter comes pre-equipped with an O-Ring to fit on Elastimold elbow. For elbows from all other manufactures, the O-Ring should be removed, flipped, and re-installed.

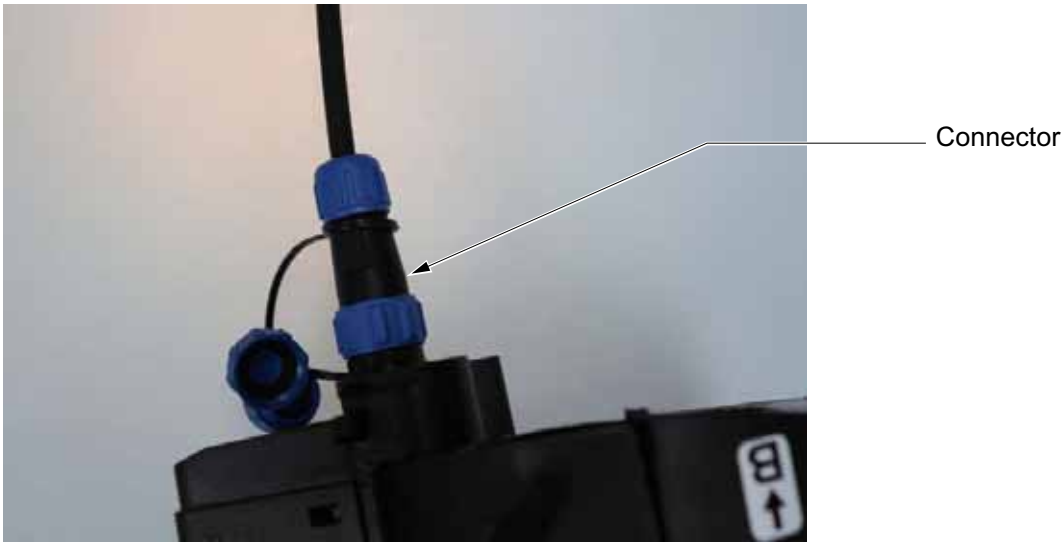
Figure TD 131–10: 600 A BIP

Figure TD 131–11: Ground Wire



f. Connect the ground wire to the ground bus.

Figure TD 131–12: Smart Load Tracker LM LFD Connector



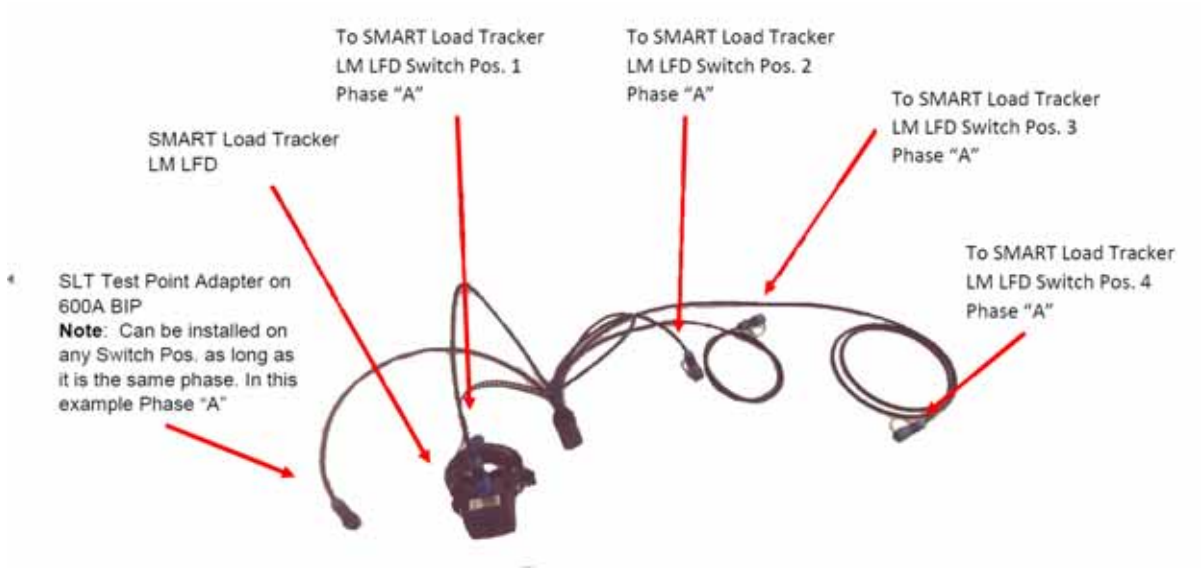
g. Connect the Test Point Adapter to Smart Load Tracker LM LFD.

NOTE

If the Test Point Adapter is not in use, tighten the attached blue cap to avoid water intrusion.

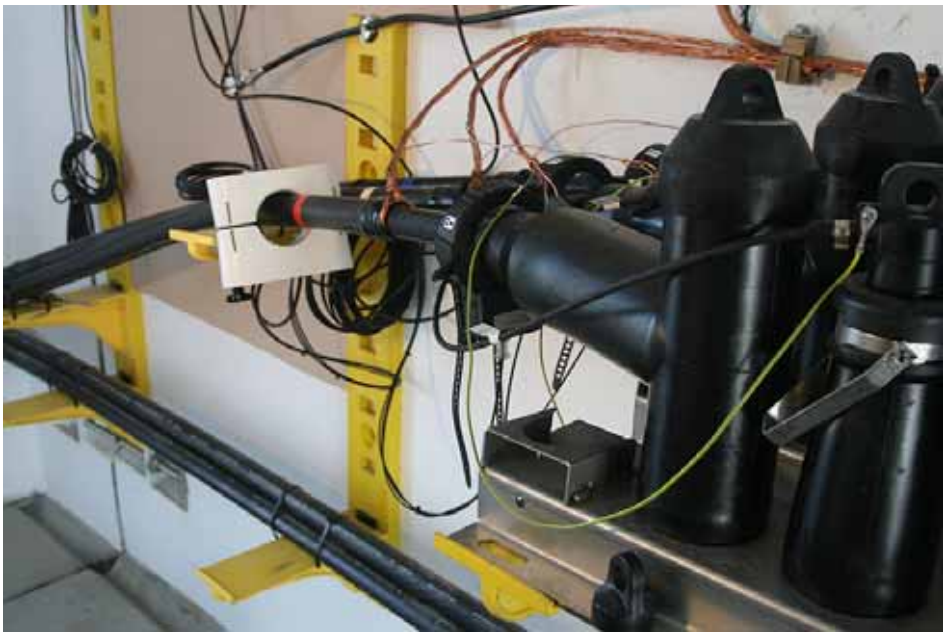
Figure TD 131–13: 4-way Test Point Cable Harness

Figure TD 131–14: 4-way Test Point Cable Harness Layout



h. The 4 Way Test Point Cable Harness has 5 connectors. One of the connector connects to the Test Point Adapter (black end), the other four connectors connects to the Smart LT LM LFD in the same phase (blue end).

Figure TD 131–15: SLT Test Point Adapter Installation Example



i. The Reporter SLT kit comes with Fiber-Optic cables for connection from the Reporter SLT unit to the Smart Load Tracker LM LFD. The Fiber-Optic cable comes with two different ends, a clear plastic end and a black plastic end. The clear plastic end is connected to the Smart Load Tracker LM LFD and the black plastic end is connected to the Reporter SLT.

Figure TD 131–16: Fiber Optic Cables

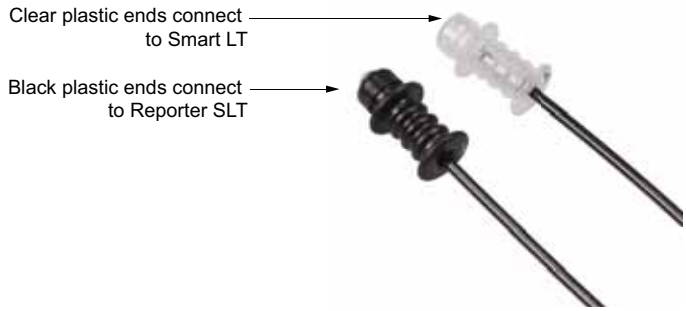
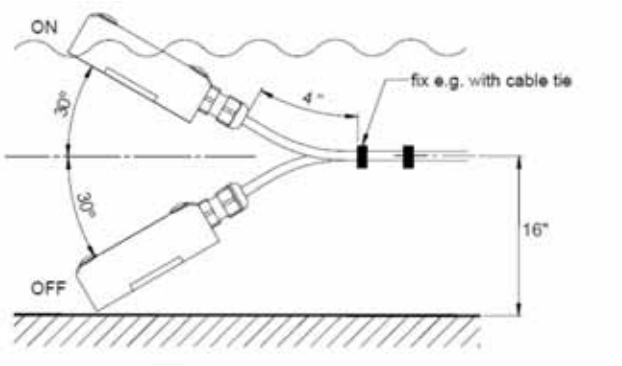


Figure TD 131–17: Flood Switch



STEP 6. Install the flood switch 16 inches from the ground.

NOTE

The flood switch must be installed as shown in Figure TD 131–17. No obstacles must block the flood switch from moving up or down.

STEP 7. On the Reporter SLT, verify blue "WAN" light is ON.
Next, contact Distribution Automation Engineering at 714-285-4325, and inform the operator that the Underground RFI has been installed and is powered up.

STEP 8. After installation, the UG-RFI will require the submission of an installation record. The installation record shall be submitted via the Asset Complete Data Capture (ACDC) mobile application by scanning the QR code on the Reporter SLT. If the ACDC mobile application is not available, the RFI Installation Form (See Figure TD 131-24) shall be filled out completely and emailed to emailDAP@sce.com.

1.4 Application and Installation: Padmount Switch Installation

Figure TD 131–18: Power Harvesting Unit

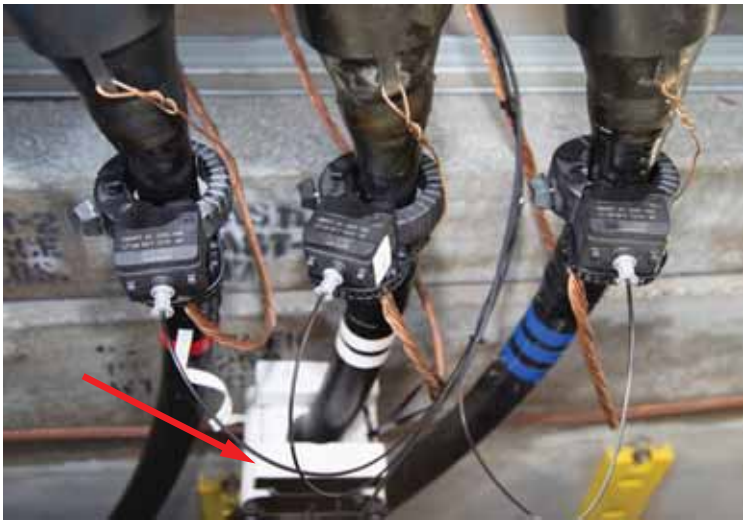
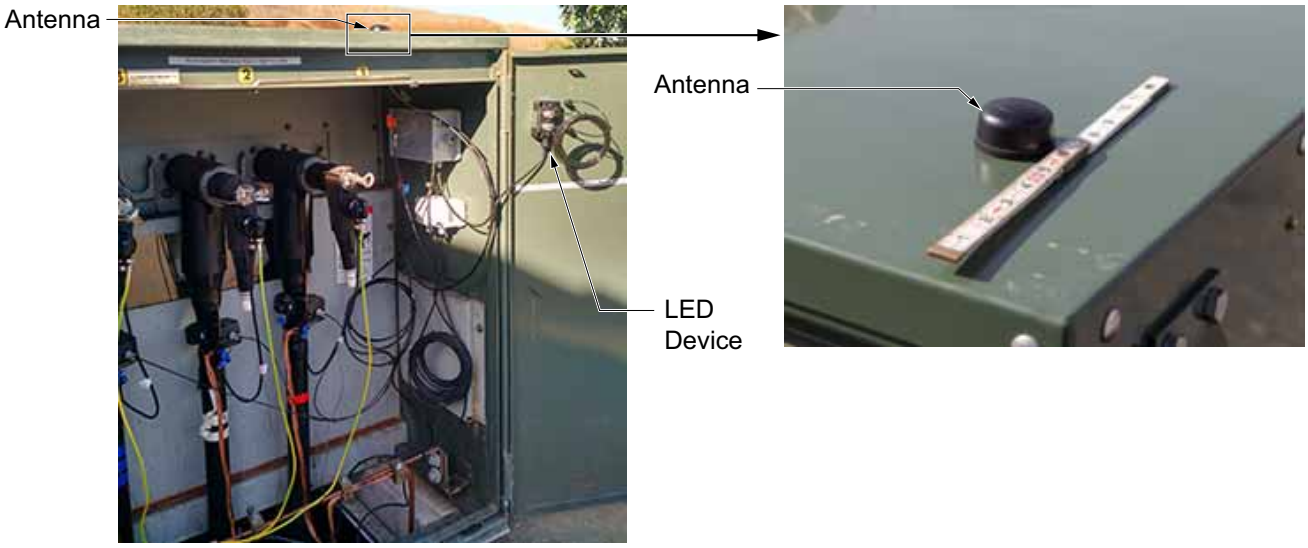


Figure TD 131–19: Reporter SLT Magnetic Mount (Cable Compartment Side Wall)

Figure TD 131–20: Padmount Switch Antenna Location



Note(s):

1. Antenna shall be located at least 6 inches from the front of enclosure and 6 inches from the side of the enclosure.

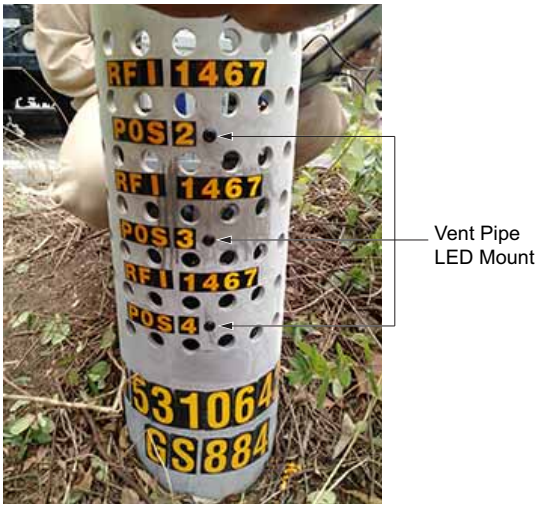
Figure TD 131–21: Padmount Switch LED Location on PME Door

1.5 Application and installation for UG switches (Vent Pipe)

A. Non-Louver Vent Pipe

Figure TD 131–22: Vent Pipe Mounting Bracket

Figure TD 131–23: Vent Pipte LED Mount



B. Louver Vent Pipe

Louver standpipe installation utilizing ground plate bracket (SAP # 10209783)

Figure TD 131–24: Louver Vent Pipe Mounting Plate

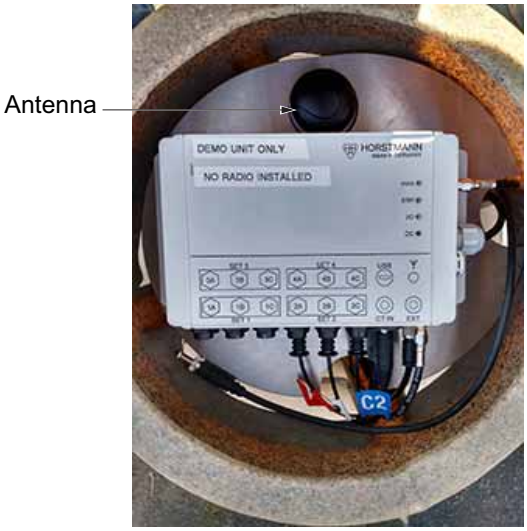


Figure TD 131–25: Louver Vent LED Mount

Figure TD 131–26: RFI Installation Form

☎Distribution Automation Hotline: (714) 285-4325 ✉E-mail to: emailDAP@sce.com

Updated 5/21/20

Remote Fault Indicator (RFI) Overhead and Underground Installation Form

⇨When installing any type of RFI, please use the Asset Complete Data Capture (ACDC) mobile application to send in this information.
⇨Only when the ACDC app is not available, fill out this form and e-mail it to: emailDAP@sce.com .
⇨When the RFI install is complete, call the Distribution Automation Hotline to preform a radio check. (Mon-Fri, 7am - 4pm)

Name: Date: Cell Phone #:

General Information (All Installs):

Work Order #: ☐ New Install ☐ Replacement

District #: RFI / Device #: Structure #:

Circuit: Substation:

Latitude: ° ' " N (Degrees (33-39) Minutes (0-59) Seconds (0-59))

Longitude: ° ' " W (Degrees (114-121) Minutes (0-59) Seconds (0-59))

Overhead RFI Installs Only: Installed Direction (MM3 & PDP): ☐ N ☐ S ☐ E ☐ W

Sentient MM3 Only:

☐ A Phase	☐ B Phase	☐ C Phase
Serial Number: R E	Serial Number: R E	Serial Number: R E
Radio #: 91. . .	Radio #: 91. . .	Radio #: 91. . .
Line Current: Amps	Line Current: Amps	Line Current: Amps

PDP Navigator 2.0 Only: Serial Number: Radio #: 91. . .

Underground RFI Installs Only: UG RFI Power Source: ☐ 120 VAC Power Supply ☐ Power Harvester Unit (PHU)

Serial Number:

Radio #: 91. . .

Power Harvester Unit Position: (If Applicable) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

PHU Current: Amps

Comments: (When replacing MM3 RFI's please include removed RFI's Radio #'s in the comment section below)

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Standard **Title**

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TP 100 Cable Terminals — Aluminum Compression

Scope TP 100.1 Cable Terminals — Aluminum Compression

Table TP 100–1: Cable Terminals — Aluminum Compression

Aluminum Cable	Cable to Flat (Swaged Tubing Type)					Bent Shank	Straight Shank Long	Straight and Stacking Lugs (Swaged Tubing Type)			Installation Data						
											Circular Crimps per End						
											MD-6		UT-15		Y-39, Y-60		
	Stud Size	Tongue Holes	"C" Dim.	"E" Dim.	SAP	SAP	SAP	"C"	"A" Trimmed Straight Lug SAP	"B" Trimmed Stacking Lug SAP	Die	No.	Die	No.	Die	No.
#4	1/2	1	.81	—	10112328	10112343	—	—	—	—	W-162 1/	3	—	—	—	—
#2	1/2	1	.88	—	10112329	10112344	—	—	—	—	W-163 1/	3	—	—	—	—
1/0	1/2	1	.81	—	10112330	10112345	—	—	—	—	BG	3	—	—	—	—
2/0	1/2	2	.94	1.75	10112331	10112346	—	—	—	—	W-245	3	—	—	—	—
4/0	1/2	2	1.18	1.75	10112332	10112347	—	1.18	10112304	10112307	W-K840	3	15CA71R 2/	1	15CA71R 2/	1
350 kcmil	1/2	2	1.50	1.75	10112333	10112348	10112230	1.50	10112305	10112308	—	—	15C96R	2	15CA96R 2/	1
500 kcmil	1/2	2	1.81	1.75	10112334	10112349	—	—	—	—	—	—	15C106R	2	—	—
700/750 kcmil	1/2	2	2.19	1.75	10112335	10112350	10112229	1.75	10112306	10112309	—	—	15C140R	3	—	—
1,000 kcmil	1/2	2	2.56	1.75	10112336	—	10112228	—	—	—	—	—	15C161R 3/ 15C150R	3	—	2
1,500 kcmil	1/2	2	3.12	1.75	10112339	—	—	—	—	—	—	—	—	—	4/	2

1/ See Note 4.
2/ See Note 3.
3/ See Note 5.
4/ See Note 6.

Note(s):

1. Barrel partly filled with inhibitor and sealed. After installation, carefully remove excess inhibitor.
2. Aluminum terminals installed in locations where moisture could be present should have a heat/cold shrink sleeve or jacketing tape applied over the cable insulation and connector to prevent moisture from entering the strands of the conductor.
3. Will fit UT_15 with adapter die M/C 851-5102.
4. Some terminals for #4 and #2 are manufactured from the same size materials as 1/0 terminals. These terminals are to be compressed with the "BIG" die.
5. The preferred die.
6. Use Y-60 tool and L46ART die.

B1 — Metallic Pin Terminal

4/0 Al connector with 2/0 compressed stranded Cu pigtail (M/C 610-94108) utilized to terminate 4/0 Al underground service to a 100A residential meter panel. See Table TP-1 for installation data on 4/0 Al cable.

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TP 101 Cable Terminals — Copper Compression

Scope TP 101.1 Cable Terminals — Copper Compression

Table TP 101–1: Cable Terminals — Copper Compression

Conductor		Cable to Flat				Bent Shank	Straight Shank (Short)	Straight Shank (Long)	Installation Data									
									Circular Crimps						Indents			
									MD-6		UT-15		Y-39		Y488 Hypress Die Set and Number of Indents			
Copper Cable	Stud Size	Material Code	C	E	Material Code	Material Code	Material Code	Die	No.	Die	No.	Die	No.	Nest	Indenter	No.
#4 str	1/4	605-47304	1/2	5/8	605-92201	605-89207	605-90601	W-161	3							
#2 str	5/16	605-47403	5/8	3/4	605-92300	605-89405	605-90809	W-162	3							
1/0 str	5/16	605-47700	3/4	7/8				W-163	3							
2/0 str	1/2	605-47809	27/32	1-3/4	605-92508	605-89603	605-91005	W-241	3							
4/0 str	1/2	605-48005	1-1/32	1-3/4	605-92706	605-89801	605-91203	BG	3	15CA54R[1/]	1	15CA54R	1			
250 kcmil	1/2	605-48104	1-1/8	1-3/4	605-92904	605-90007	605-91401			15CA60R	1	15CA60R	1			
350 kcmil	1/2	605-48302	1-5/16	1-3/4	605-93100	605-90205				15CA71R	1	15CA71R	1			
500 kcmil	1/2	605-48500	1-17/32	1-3/4	605-93209	605-90403	605-91609			15CA87R	2	15CA87R	2			
750 kcmil	1/2	605-49003	1-29/32	1-3/4						15C106R	3					
1,000 kcmil	1/2	605-49201	2-3/16	1-3/4										C44D	Y48PR-1	2

[1/] Will fit UT-15 with adapter die M/C 851-25102.

Note(s):

1. In order to prevent moisture from entering the strands of conductors, a heat/cold shrink sleeve or jacketing tape should be installed over the cable insulation and connector. Tin-plated terminals may be installed in locations where insulation is not necessary (such as on poles or in pad-mounted transformers) without insulating the connector.

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TP 105 Transformer Terminals — Multiple Tie

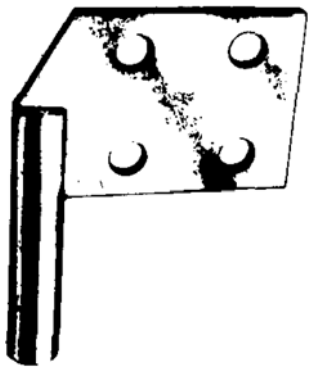
Scope TP 105.1 Multiple Tie Transformer Connector

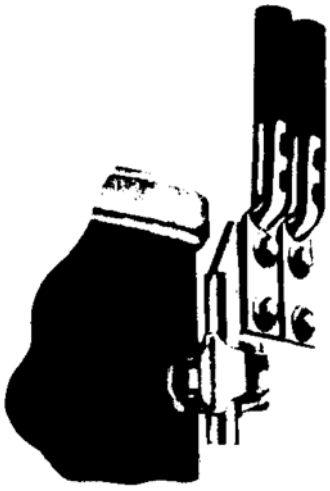
1.0 Application

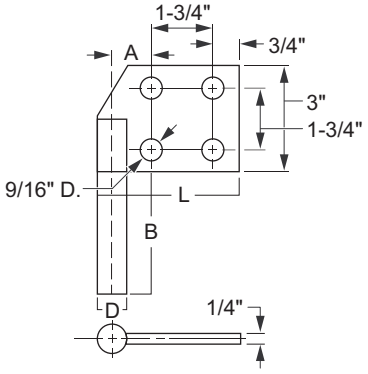
For use on modified or overhead type transformers **ONLY**. Not to be used on pad-mounted transformers.

This multiple tie connector provides a convenient means of connecting a number of cables to a single transformer terminal. Made entirely of copper and tin plate to minimize corrosion.

Figure TP 105–1: Multiple Tie Transformer Connectors

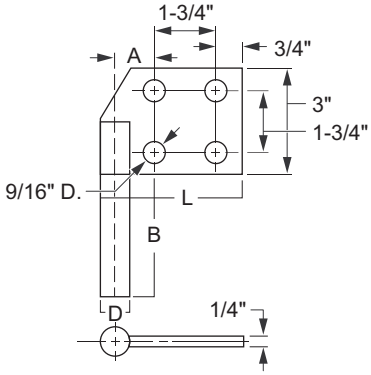






Four Hole NEMA Standard Drilling

Material Code Description: Transformer connector, flagpole w/4 hole NEMA spade (M/C 605-94009)



Four Hole Special Drilling

Material Code Description: Transformer connector, flagpole w/4 hole drilling to accommodate 750 kcmil Aluminum lugs.

Table TP 105–1: Multiple Tie Transformer Connector

Material Code	Dimensions (in)			
	A	B	D	L
605-94009	1-9/16	2-3/46	3/4	4-7/16
605-94108	1-3/4	3-1/2	7/7	6-1/16

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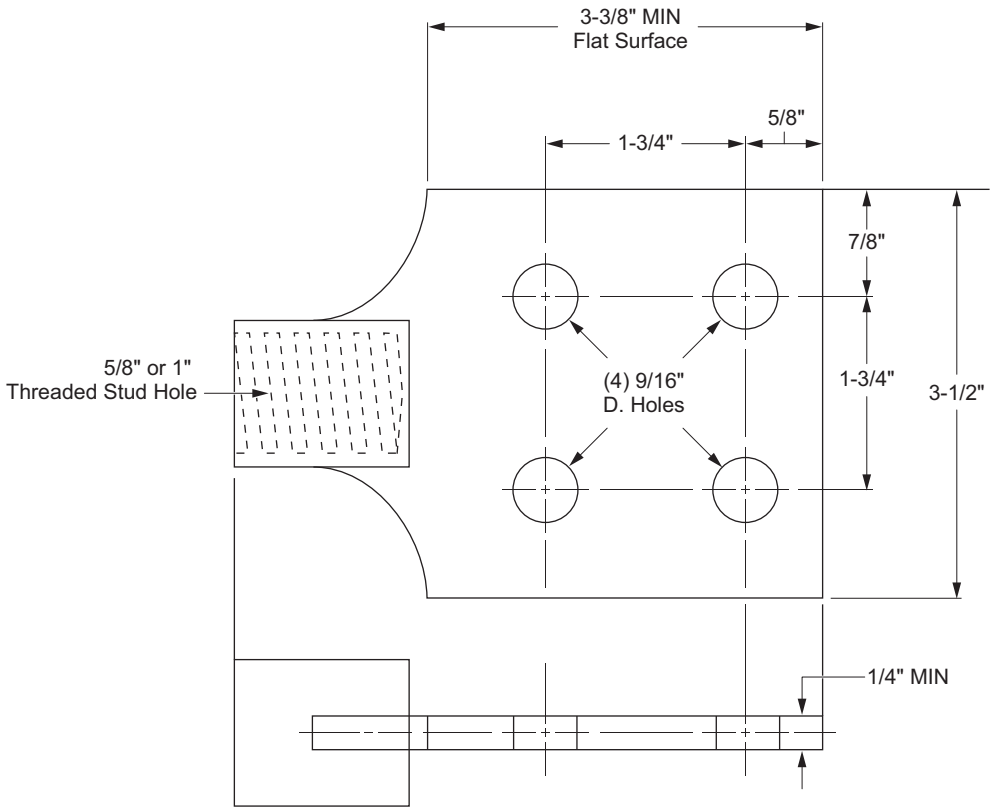
TP 110 Threaded Spade Terminals for 1Ø Pad-Mounted Transformers

Scope Scope TP 110.1Threaded Spade Terminals for 1Ø Pad-Mounted Transformers

Figure TP 110–1: Threaded Spade Terminals for 1Ø Pad-Mounted Transformers



For use as an alternate method on 1Ø transformers provided with threaded stud low-voltage bushings. Preferred method is using threaded set-screw connector. See JJ 125.

Note(s):

1. The threaded spade terminal should be utilized when:
   a. Low Voltage cables are larger than 350 kcmil.
   b. There are more than six conductors (exception #8 streetlight cables).
   c. Replacing existing transformers already equipped with spade terminals.
2. Cables should be attached to threaded spades with compression-type Al or Cu lug terminals. (See TP 100 for Al terminals and TP 101 for Cu terminals.)
3. See TP 115 for installation of spade terminals to the threaded studs of 1Ø pad-mounted transformers.
4. Spade terminal is made entirely of copper and is tin-plated.

Table TP 110–1: Threaded Spade Terminals

Material Code	Threaded Stud Size (in)
605-00956	5/8
605-00949	1

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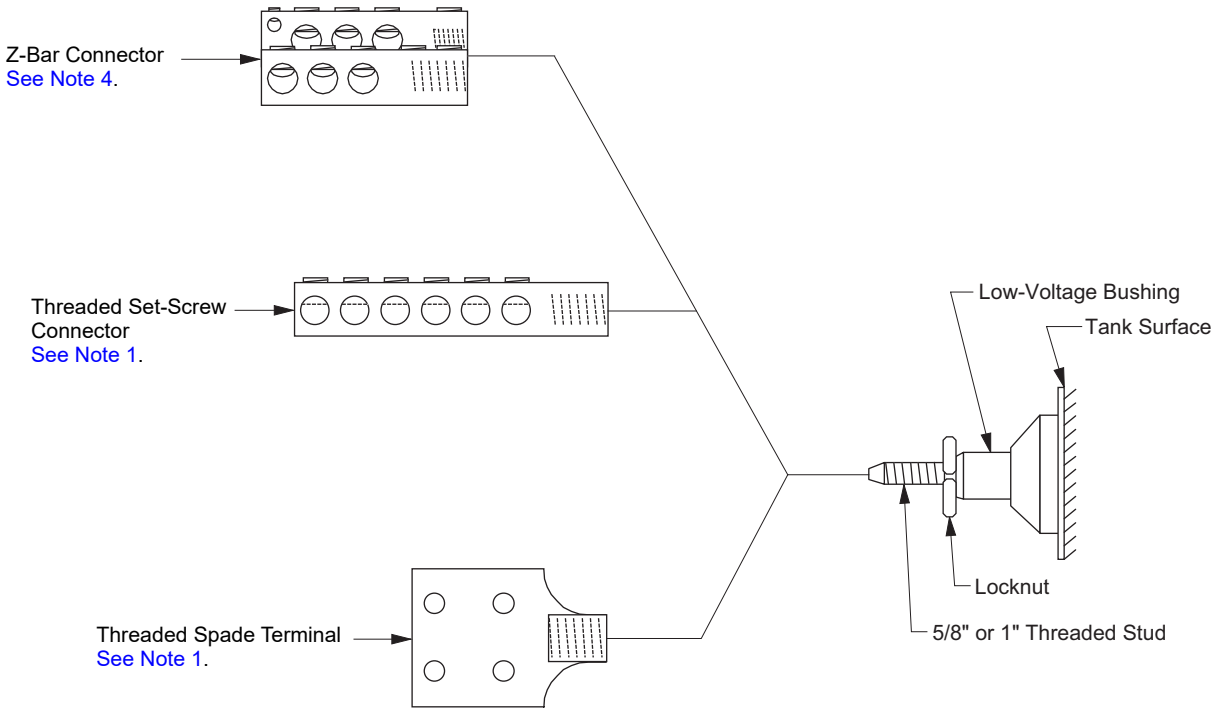
TP 115 Installation of Terminals for Single-Phase Pad-Mounted Transformers

Scope TP 115.1 Typical Installation of Terminals for Single-Phase Pad-Mounted Transformers

Figure TP 115–1: Terminals



Note(s):

1. See JJ 125 for threaded set-screw connectors, and TP 110 for threaded spade terminals.
2. 25 kVA, 50 kVA, and 75 kVA transformers are furnished with 5/8-inch threaded studs. 100 kVA transformers have 1-inch studs. Locking nuts are provided on each low-voltage bushing.
3. To attach a connector or terminal, screw the furnished locking nut to the back of the threaded stud. Rotate the connector/terminal clockwise onto the threaded stud until contact is made to the locking nut. The connector/terminal may have to be unscrewed slightly to obtain proper alignment. Tighten the locking nut to the threaded end of the connector/terminal.
4. Z-bar connectors, see JJ 125, are designed as slip-on, set screw connectors. To install this type of connector, remove the furnished locking nut (if present) from the threaded stud. Loosen the connector set screw(s) and slide the connector on to the threaded stud. Slightly tighten contact stud set screw(s) to hold connector in place. Install secondary cables into connector and tighten cable set screws. After all secondary conductors have been installed, retighten set screws twice and tighten connector set screw(s) to 25 foot pounds. Insulated cover for the z-bar connector is to be installed on all hot phases. See JJ 125 for the insulated cover material codes.

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TP 116 Homac "Z" Bar Transformer Secondary Connectors

Scope TP 116.1 Homac "Z" Bar Transformer Secondary Connectors

These connectors (see Table TP 116–1 [Sheet 1]) are provided with up to 12 outlets, and can accommodate multiple sizes of aluminum conductors. They are recommended for use on secondary spade terminals of three-phase pad-mounted transformers.

Figure TP 116–1: Homac "Z" Bar Transformer Secondary Connectors

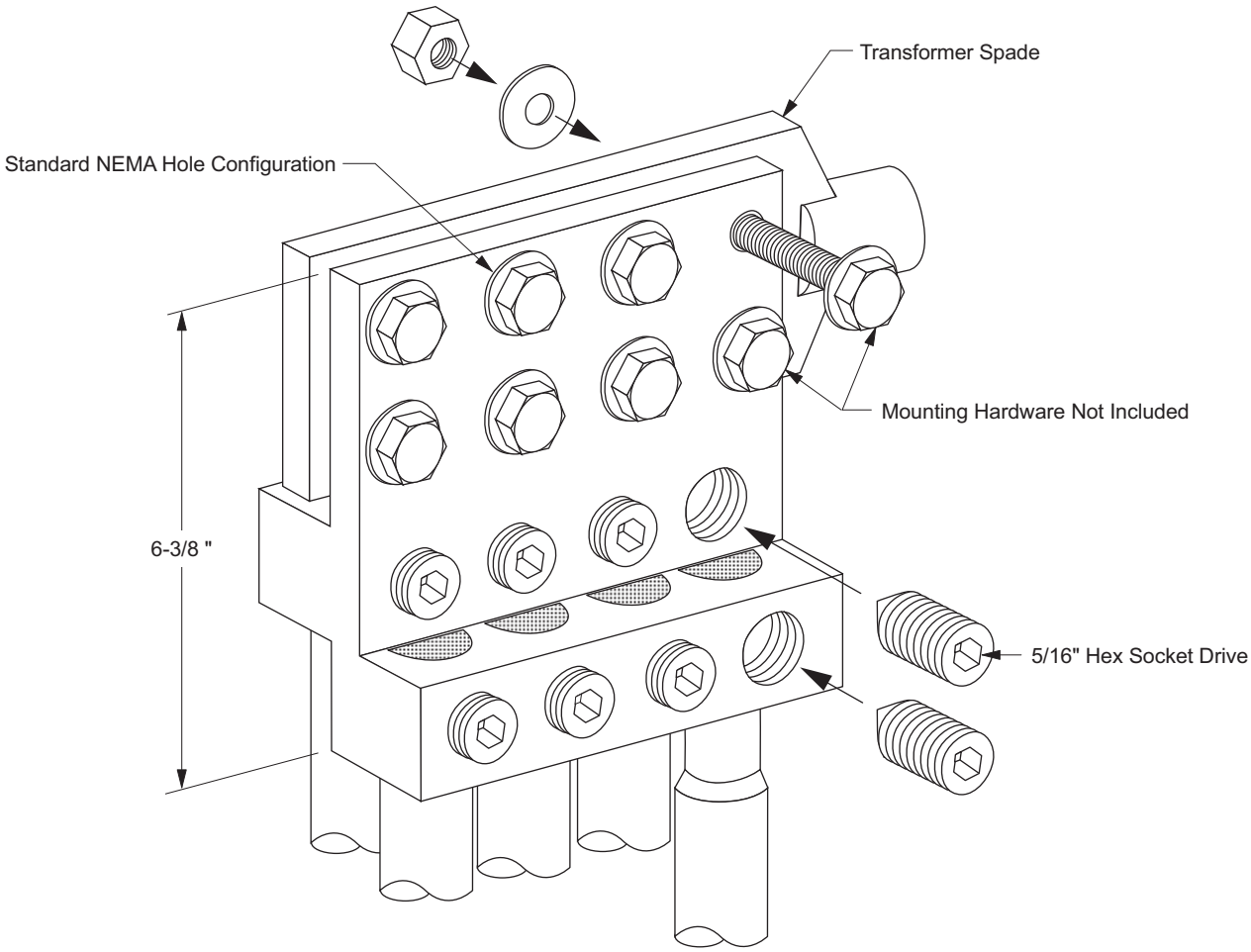


Table TP 116–1: 1/0 to 750 kcmil Aluminum Conductor

Material Code	Conductor Range	Length (in)	Connector	
			Pad Holes	Cable Outlets
609-00412	1/0 - 750 kcmil	6-3/4	8	8
609-00420	1/0 - 750 kcmil	8-1/2	10	10
609-00438	1/0 - 750 kcmil	10-1/4	12	12

For the termination of **neutrals**, where conductors larger than 350 kcmil are not required, the use of the Homac ZBT 350 kcmil series, shown below, is recommended. The cost of these connectors is approximately 40 percent less than the ZBT 750 series.

Table TP 116–2: 12 AWG to 350 kcmil Aluminum Conductor

Material Code	Conductor Range	Length (in)	Connector	
			Pad Holes	Cable Outlets
609-00446	12 - 350 kcmil	4-5/8	6	8
609-00453	12 - 350 kcmil	5-3/32	6	10
609-00461	12 - 350 kcmil	6-1/2	8	12

1.0 Installation

Following are the installation instructions for the subject connectors.

1.1 Attach the connector to the transformer secondary spade terminal.

1.2 Strip the insulation of the conductor a length slightly longer than the depth of the cable outlet.

1.3 Open the set screws completely.

1.4 Insert the conductor into the cable outlet. Tighten the set screws securely to attain the proper torque values. **Retighten all set screws twice.**

Recommended torque values for Homac's Bar Connectors are as follows:

Table TP 116–3: Homac Bar Connector Recommended Torque

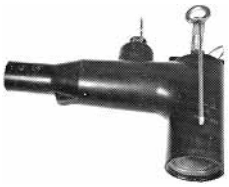
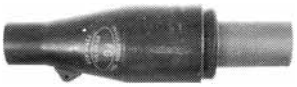
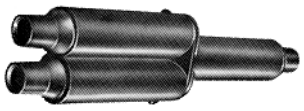
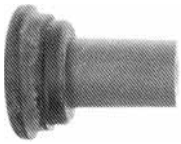
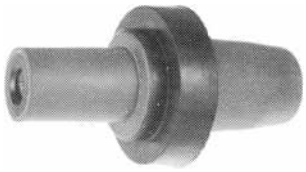
Wire Size	in-lb	ft-lb
#2 - 350 MCM	240	20
400–600 MCM	360	30
750–1,000 MCM	500	42

TP 120 Premolded Fittings

Scope TP 120.1 Code Numbers for 200 A Premolded Rubber Components and Accessories

The 200 A premolded rubber components and accessories shown in Table TP 120–1 (Sheet 1) are for use with 1/C concentric neutral cables with polyethylene insulation.

Table TP 120–1: 200 A Premolded Rubber Components and Accessories for 1/C Concentric Neutral Cables with Polyethylene Insulation

	Conductor and Insulation	SAP Number	Manufacturer	Standard Number
Elbow (bail included) 	#2-220 mil	10118047	Elastimold Blackburn RTE Burndy	TP 134
	#2-295 mil[1/]	10118048		
	1/0-220 mil	10118050		
 Straight Plug	#2-220 mil	10118019	Elastimold	TP 130
	#2-295 mil[1/]	10118020		
	1/0-220 mil	10118018		
Straight Receptacle	#2-220 mil	10118044	Elastimold	TP 132
	#2-295 mil[1/]	10118045		
	1/0-220 mil	10118043		
Permanent Splice	#2-220 mil	10118099	Elastimold General Electric 3M RTE	JJ 624
	#2-295 mil[1/]	10118100		
	1/0-220 mil	10118104		
Permanent “Y” Splice 	#2-220 mil	10118101	Elastimold	JJ 650
	#2-295 mil[1/]	10118102		
	1/0-220 mil	10118103		
Stress Cone	#2-220 mil	10117660	Elastimold General Electric	TP 200
Dead-End Plug 	12 kV and 16 kV	10118021	Elastimold	TP 122
Dead-End Receptacle	12 kV and 16 kV	10118046	Elastimold	TP 122
“T” Connector	12 kV and 16 kV	10117664	Elastimold	TP 124
 Bushing Plug	12 kV and 16 kV	10118014	Elastimold	TP 126
Elbow Insulating Plug	12 kV and 16 kV	10118024	Elastimold	TP 136

= For Reference Only

The Elastimold plug fittings shown in Table TP 120–2 (Sheet 2) are for grounding or insulating 200 A elbow receptacles.

Table TP 120–2: 200 A Premolded Rubber Components and Accessories for Elbow Receptacles

		Voltage	SAP Number	Manufacturer	Standard No.
Grounding Plug		12 kV and 16 kV	10118022	Elastimold	GR Section
Standoff Plug		12 kV and 16 kV	10118023	Elastimold	TP 130

Elastimold Bails

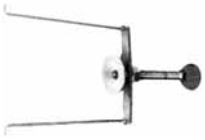
	Bail, for Straight Receptacle (SAP 10117623)
	Bail, for Dead End Receptacle (SAP 10117624)
	Bail, for Elastimold “T” Connector (SAP 10117621)
	Bail, for Elastimold for Two Elbows on a “T” Connector (SAP 10117622)

Table TP 120–2: 200 A Premolded Rubber Components and Accessories for Elbow Receptacles (Continued)

Elastimold Replacement Parts

Terminal contact for straight receptacle.
No. 2 Aluminum — SAP 10118133
No. 1/0 Aluminum — SAP 10118132

Terminal contact for straight plug.
No. 2 Aluminum — SAP 10118134
No. 1/0 Aluminum — SAP 10118135
Terminal contact (compression) for elastimold.
No. 2 Aluminum — SAP 10118136 — 25 kV dead-break and 15 & 25 kV load-break elbows for XLP cable

No. 1/0 Aluminum — SAP 10118137	— 25 kV dead-break and	15 & 25 kV load-break elbows for XLP cable
No. 1/0 Compact Copper — SAP 10117982	— 25 kV dead-break and	15 & 25 kV load-break elbows for EPR cable

No. 2 Aluminum — SAP 10117991 — 15 & 25 kV load-break repair (ELR) elbows for XLP cable
No. 1/0 Aluminum — SAP 10117992 — 15 & 25 kV load-break repair (ELR) elbows for XLP cable
No. 2 Aluminum — SAP 10117993 — 15 & 25 kV load-break replacement (RLR) elbows for XLP cable
No. 1/0 Aluminum — SAP 10117994 — 15 & 25 kV load-break replacement (RLR) elbows for XLP cable
Pin terminal for elastimold 25 kV dead-break elbows.
No. 2 Aluminum — SAP 10118138
No. 1/0 Aluminum — SAP 10118138

= For Reference Only

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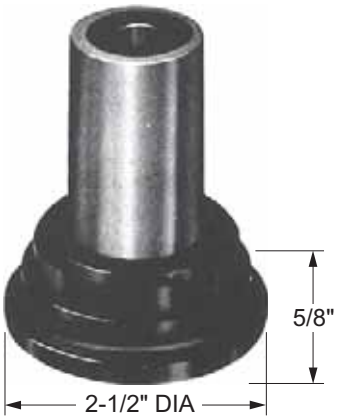
TP 122 Dead-End Plug and Receptacle

Scope TP 122.1 Application and Installation of Plug and Receptacle Dead-Ends

1.0 Application

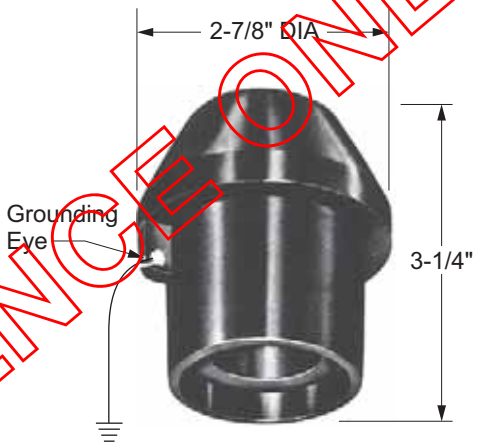
For insulating any open plug or receptacle.

Figure TP 122–1: Dead-End Plug 150-DP



M/C 656-15601

Figure TP 122–2: Dead-End Receptacle 150-DR



M/C 656-32804

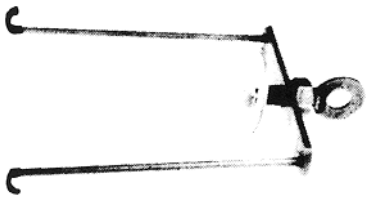
FOR REFERENCE ONLY

2.0 Instructions

2.1 Dead-end plugs and receptacles should be installed as follows:

A. Remove the protective caps and lubricate the plug end of appropriate fitting with the silicone grease supplied or silicone grease M/C 904-00615. Insert nylon rod into receptacle fittings to exhaust air during assembly. Insert plug into silicone receptacle as far as possible. Remove nylon rod. Apply three turns of #33 tape over point where mated receptacles butt together. Connect a wire from the dead end receptacle grounding eye to ground. It is recommended a primary concentric neutral wire be utilized for grounding.

Figure TP 122–3: Dead-End Receptacle Bail



M/C 655-07600

B. The dead end receptacle should be installed using the nylon rod to release trapped air. The bail should not be used to force the dead end receptacle onto the bushing.

Position the bail over the dead end receptacle and tighten until the plate on the end of the eyebolt makes complete contact with the top of the dead end receptacle; then tighten the eyebolt one and one-half turns. Hold the eyebolt in this position and tighten the locknut. Do not over-tighten the bail.

FOR REFERENCE ONLY

TP 124 "T" Connector

Scope TP 124.1 Application and Installation of Elastimold "T" Connector 150-T (M/C 655-31006)

1.0 Application

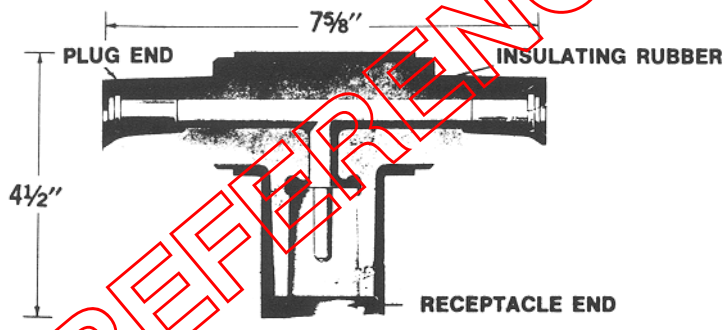
The "T" connector is a junction point with a receptacle and two plug ends. It is used, with appropriate fittings, for connecting 1/C polyethylene insulated cables where a "T" splice is desired for branch circuits or apparatus connections.

2.0 Instructions

All connections made to the "T" must be externally vented using the nylon rod supplied. Refer to installation instructions for the connectors being assembled to the 150-T.

Always prepare mating parts first. **DO NOT** remove protective caps until you are ready to make final connections.

Figure TP 124–1: Elastimold "T" Connector 150-T (M/C 655-31006)



3.0 Installation of "T" Connector Bail (M/C 655-07006)

Position the bail over the center of the "T" connector and tighten the eyebolt until the cap on the end of the eyebolt makes complete contact with the rubber projection on the "T" connector; then tighten the eyebolt 1-1/2 to 2 turns. Hold the eyebolt in this position and tighten the locknut. **DO NOT OVER-TIGHTEN THE BAIL**. See Figure TP 124–2.1 (Sheet 1) and Figure TP 124–2.2 (Sheet 1).

Figure TP 124–2: Installation of "T" Connector Bail (M/C 655-07006)

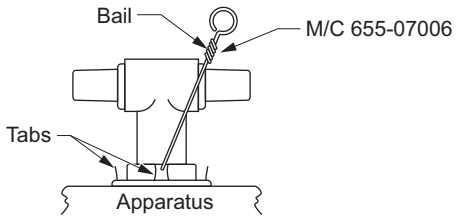


Figure TP 124–2.1

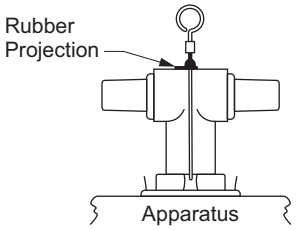


Figure TP 124–2.2

FOR REFERENCE ONLY

4.0 Installation of Bail Connectors (M/C 655-07105)

Position the bails which are supplied with the elbows over the elbows and then connect them by using the bail connectors. See Figure TP 124–3.1 (Sheet 2). Tighten the eyebolts until they make contact with the bail seat; then tighten each eyebolt 1-1/2 to 2 turns. **DO NOT OVERTIGHTEN THE BAILS.**

Figure TP 124–3: Installation of Bail Connectors (M/C 655-07105)

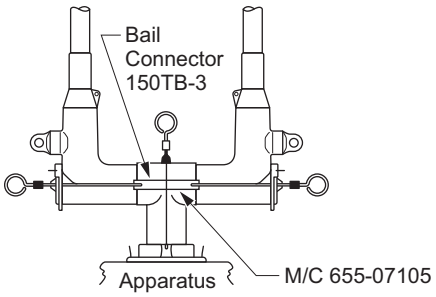


Figure TP 124–3.1

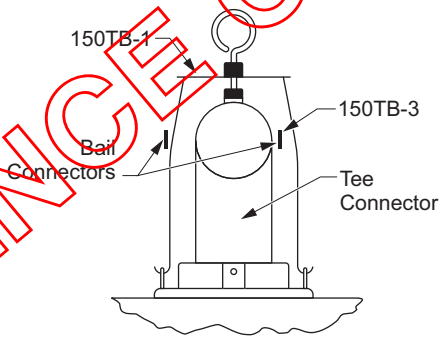


Figure TP 124–3.2

Note(s):

1. If a 150TB-1 is used to secure the "T" connector, then when assembling the 150TB-3 it will be necessary to place one bail connector under the 150TB-1 bail and one bail connector over the 150TB-1 bail. See Figure TP 124–3.2 (Sheet 2).

FOR REFERENCE ONLY

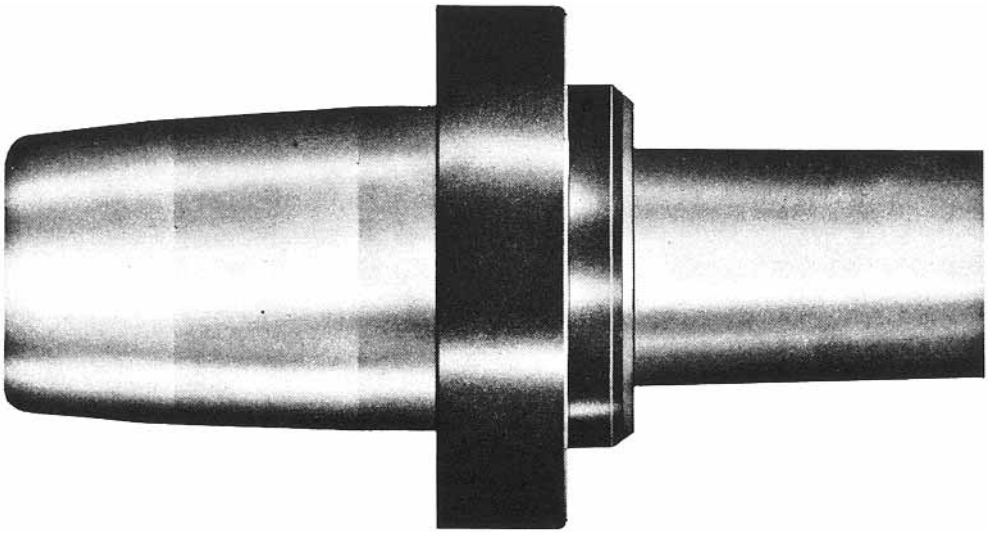
TP 126 Bushing Plug

Scope TP 126.1 Application and Installation of Elastimold Dead-Break Bushing Plug 1501-A1 (M/C 656-14505)

1.0 Application

The bushing plug is to be used on all equipment that uses the universal well (flower pot) as a high voltage bushing.

Figure TP 126–1: Elastimold Dead-Break Bushing Plug 1501-A1 (M/C 656-14505)



2.0 Instructions

2.1 Before actual bushing assembly make sure the “Flower pot” bushing well is clear of all contaminants.

2.2 Lubricate base of bushing with lubricant supplied or silicone grease M/C 904-00615. **DO NOT SUBSTITUTE** any other grease. Place the lubricated portion of the bushing in the “flower pot,” see Figure TP 126–1.1 (Sheet 1).

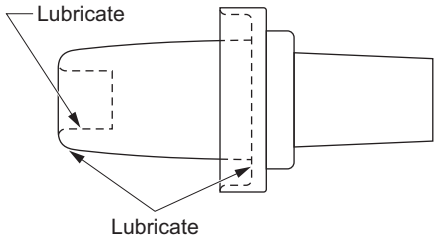


Figure TP 126–1.1

2.3 Rotate the bushing in a clockwise direction until the bushing contact bottoms on the “flower pot” stud. The conductive lip on the bushing should touch or be approximately 1/16 inch from the “flower pot,” see Figure TP 126–1.1 (Sheet 1).

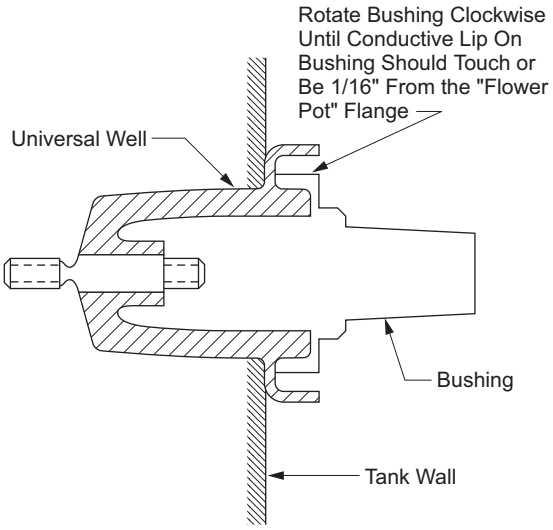


Figure TP 126–1.2

2.4 Wipe bushing surface clean before assembly with dead-break elbow. If the elbow connector is not to be immediately assembled, replace the protective shipping cap.

CAUTION

CAUTION: CAP OFFERS PROTECTION FROM DIRT ONLY — IT IS NOT AN INSULATING DEVICE.

If an insulating device is required, obtain an Elastimold dead end receptacle, Style 150-DR and hold-down bail or elbow with insulating plug and bail.

TP 128 Insulating Standoff Plug

Scope TP 128.1 Operating Instructions for Elastimold Insulating Standoff Plug (M/C 656-15809)

Figure TP 128–1: Elastimold Insulating Standoff Plug (M/C 656-15809)

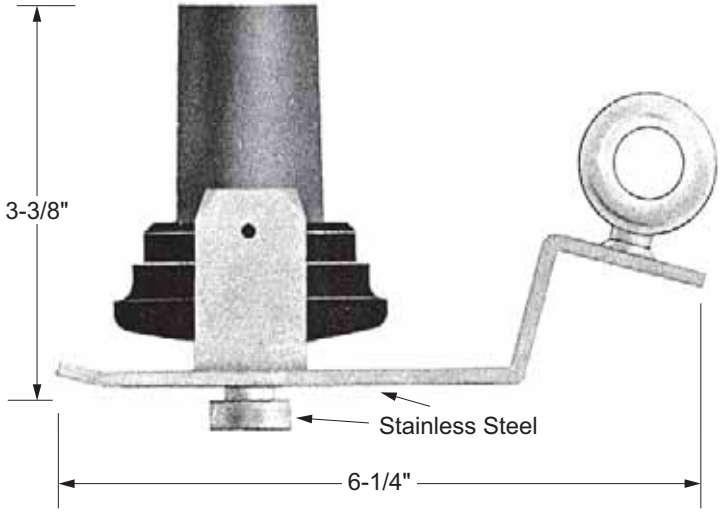


Figure TP 128–1.1

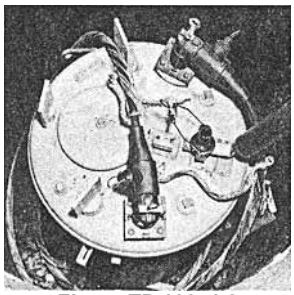


Figure TP 128–1.2

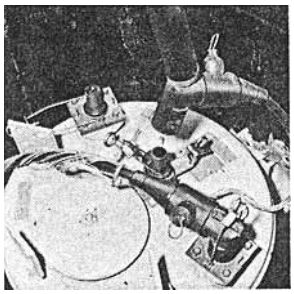


Figure TP 128–1.3

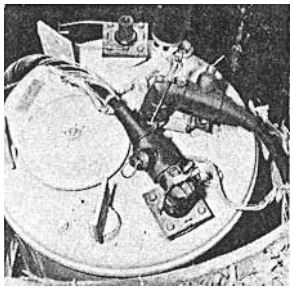


Figure TP 128–1.4

1.0 Instructions

1.1 Remove protective cap from elbow insulating plug. Inspect insulating surface for any abrasions or cuts (the surface must be smooth). Clean thoroughly and lubricate insulating surface with the silicone grease supplied or silicone grease M/C 904-00615. See Figure TP 128–1.1 (Sheet 1).

1.2 Place insulating plug on parking stand. See Figure TP 128–1.2 (Sheet 1).

1.3 Prove elbow de-energized with approved testing device.

1.4 Remove elbow from bushing with live-line tool and press on to insulating plug. Make sure is completely seated on insulating plug. See Figure TP 128–1.3 (Sheet 1).

1.5 Secure elbow to insulating plug with hold-down bail by turning bail eye clockwise with live-line tool. See Figure TP 128–1.4 (Sheet 1).

Note(s):
1. When insulating plug is not in use, keep covered with protective cap at all times.

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TP 130 Straight Plug Installation

Scope TP 130.1 Application and Installation of Elastimold Straight Plug 151-SP

1.0 Application

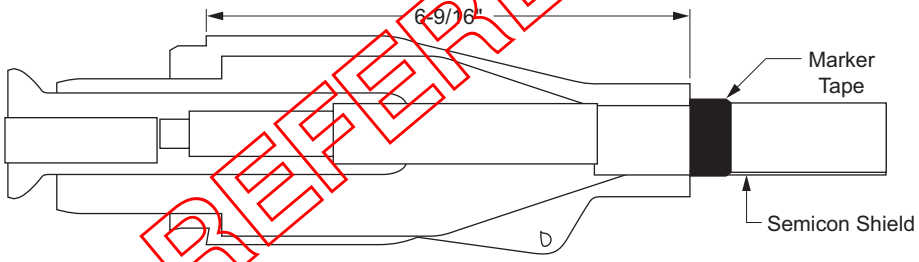
For connecting 1/C polyethylene-insulated cables to straight receptacles and T-connectors, and for insulated dead-ends (when used with matching dead-end receptacles.)

Table TP 130–1: Elastimold Straight Plug 151-SP

SAP Number	Straight Plug Description	Catalog Number
10118019	Plug, Straight, Elastimold, #2 Al, 220 mil, Polyethylene Cable	151-SP-FC-1AX
10118020	Plug, Straight, Elastimold, #2 Al, 295 or 320 mil, Polyethylene Cable	151-SP-GB-1AX
10118018	Plug, Straight, Elastimold, 1/0 Al, 220 mil, Polyethylene Cable	151-SP-GAB-10AX

= For Reference Only

Figure TP 130–1: Elastimold Straight Plug 151-SP



2.0 Instructions

For jacketed Concentric Neutral (JCN) cable follow steps 2.1 to 2.11; if nonjacketed CN cable skip steps 2.2 and 2.3.

2.1 Cut cable to desired length.

2.2 Remove 16 inches of the cable's concentric neutral jacket, measuring from the cut end of the cable. See Figure TP 130–1.1 (Sheet 1).

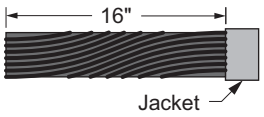


Figure TP 130–1.1

2.3 Seal the concentric neutral jacket from moisture intrusion following the jacket-sealing procedure described inIC 230.

FOR REFERENCE ONLY

2.4 Bind concentric neutral wires 7-1/2 inches back from end of cable. See Figure TP 130–1.2 (Sheet 2).

NOTE

When cutting cable, allow sufficient concentric neutral wires for connecting to ground point as required by the installation. If connecting to a mating receptacle, the cable end will be 3-1/8 inches apart when the connection is complete.

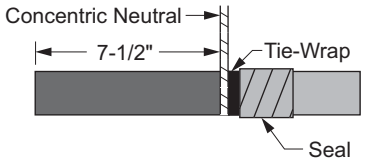


Figure TP 130–1.2

2.5 Remove 1 inch for #2 and 1-7/8 inches for 1/0 of cable insulation. CUT SQUARELY. DO NOT PENCIL. See Figure TP 130–1.3 (Sheet 2).

Figure TP 130–1.3

2.6 Wire brush bare aluminum conductor.

A. Crimp socket terminal on the bare conductor holding crimp barrel against the cable insulation. See Figure TP 130–1.4 (Sheet 2).

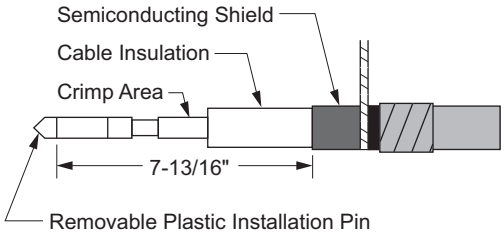


Figure TP 130–1.4

B. Use MD-6 compression tool (“X” Groove for #2 conductor and “BG” Groove for 1/0 conductor). Install 3 crimps and rotate the crimps 120 degrees. Wipe off excess inhibitor.

2.7 Remove conductive shield 7-13/16 inches from end of socket terminal (not the plastic pin) with a smooth squared cut. DO NOT CUT OR NICK THE INSULATION. See Figure TP 130–1.4 (Sheet 2). Remove all traces of semiconducting residue from insulation. At a point 8-13/16 inches back from the end of the socket contact (not the plastic pin), apply marker tape as an indicator for correct location of plug on cable. See Figure TP 130–1.5 (Sheet 3).

FOR REFERENCE ONLY

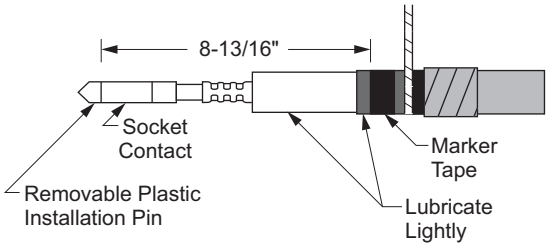


Figure TP 130–1.5

2.8 Lubricate cable and inside of cable entrance with silicone grease supplied or silicone grease SAP 10154115. **Do not substitute any other grease.** Keep cable insulation and plug clean. See Figure TP 130–1.5 (Sheet 3) and Figure TP 130–1.6 (Sheet 3).

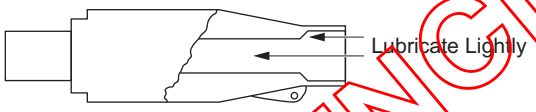


Figure TP 130–1.6

2.9 To exhaust air during assembly:

A. Insert nylon rod 5 inches to 5-1/2 inches into cable entrance.

B. Push cable into housing until the front edge of the socket contact comes flush with the front edge of the plug and the housing is flush with marker tape installed in Step 2.7. Remove plastic pin from socket. See Figure TP 130–1.7 (Sheet 3).

C. Pull out nylon rod. Assembly is now complete. See Figure TP 130–1.7 (Sheet 3).

NOTE If plug is not to be immediately connected, install an Elastimold Dead End Receptacle Style 150-DR, SAP 10118046.

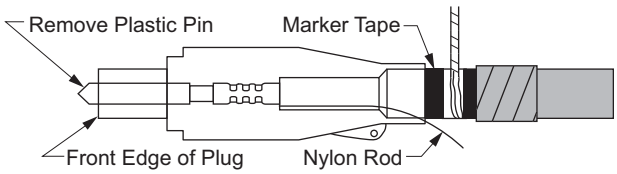


Figure TP 130–1.7

FOR REFERENCE ONLY

2.10 To connect to a mating receptacle (Figure TP 130–1.8 (Sheet 4)):

A. Lubricate nose of the straight plug with silicone grease supplied or silicone grease SAP 10154115. **Do not substitute any other grease.**

B. Place nylon rod in receptacle.

C. Insert plug assembly as far as possible in receptacle.

D. Pull out nylon rod.

E. Check to make certain marker tape is still flush with housing.

F. Remove marker tape.

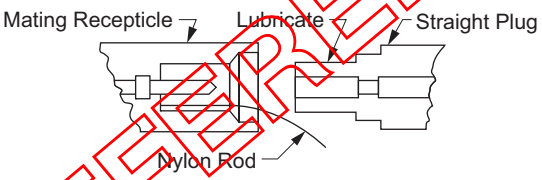


Figure TP 130–1.8

2.11 When using the plug for straight splices or T-connections, apply three one-half layers of Scotch #33 tape, approximately six inches in length over the point where components butt together. Connect one strand of concentric wire to grounding eye, shape concentric wires across splice or T-connector, and connect together. Connect concentric wires to ground.

FOR REFERENCE ONLY

TP 132 Straight Receptacle Installation

Scope TP 132.1 Application and Installation of Elastimold Straight Receptacle 151-SR

1.0 Application

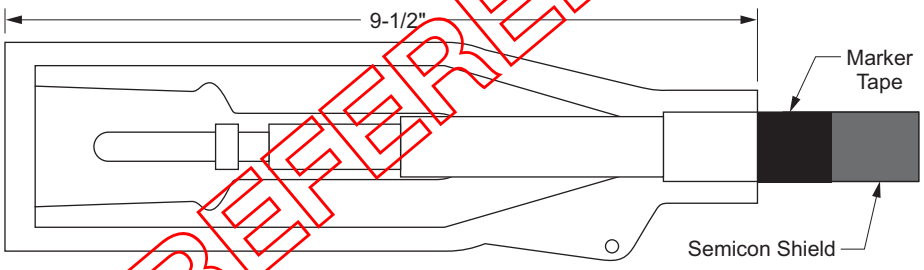
For connecting 1/C polyethylene-insulated cables to straight plug and/or T-connectors, transformers and/or apparatus bushings, and for insulated dead-ends (when used with matching dead-end plug).

Table TP 132–1: Elastimold Straight Receptacle 151-SR

SAP Number	Straight Plug Description	Catalog Number
10118044	Receptacle, Straight, Elastimold, #2 Al, 220 mil, Polyethylene Cable	151-SR-FG-1AX
10118045	Receptacle, Straight, Elastimold, #2 Al, 295 or 320 mil, Polyethylene Cable	151-SR-GB-1AX
10118043	Receptacle, Straight, Elastimold, 1/0 Al, 220 mil, Polyethylene Cable	151-SR-GAB-10AX

= For Reference Only

Figure TP 132–1: Elastimold Straight Receptacle 151-SR



2.0 Instructions

For jacketed Concentric Neutral (JCN) cable follow steps 2.1 to 2.11; if nonjacketed CN cable skip steps 2.2 and 2.3.

2.1 Cut cable to desired length. When cutting cable, allow sufficient concentric neutral wires for connecting to ground point as required by the installation.

2.2 Remove 16 inches of the cable's concentric neutral jacket, measuring from the cut end of the cable. See Figure TP 132–1.1 (Sheet 1).

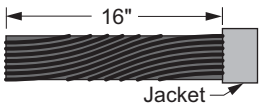


Figure TP 132–1.1

FOR REFERENCE ONLY

2.3 Seal the concentric neutral jacket from moisture intrusion following the jacket-sealing procedure described in IC 230.

2.4 Bind concentric neutral wires 8 inches back from end of cable (Figure TP 132–1.2 [Sheet 2]). If connecting to a mating plug, the cable end will be 3-1/8 inches apart when the connection is complete.

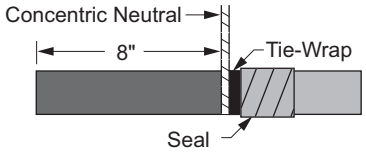


Figure TP 132–1.2

2.5 Remove 1 inch for #2 AWG (or 1-7/8 inches for 1/0 AWG) of cable insulation from conductor. CUT SQUARELY. DO NOT PENCIL. See Figure TP 132–1.3 (Sheet 2).

Figure TP 132–1.3

2.6 Wire brush bare aluminum conductor. Crimp pin terminal on the bare conductor holding crimp barrel against the cable insulation. See Figure TP 132–1.4 (Sheet 2). Use MD-6 compression tool (“X” Groove for #2 conductor and “BG” Groove for 1/0 conductor). Install 3 crimps and rotate the crimps 120 degrees. Wipe off excess inhibitor.

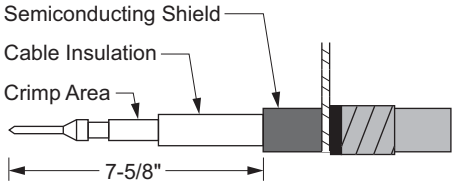


Figure TP 132–1.4

FOR REFERENCE ONLY

2.7 Remove conductive shield 7-5/8 inches from end of pin terminal with a smooth squared cut. DO NOT CUT OR NICK THE INSULATION. See Figure TP 132–1.4 (Sheet 2). Remove all traces of semiconducting residue from insulation. At a point 8-5/8 inches back from the end of the pin contact, apply a marker tape as an indicator for correct location of receptacle on cable. See Figure TP 132–1.5 (Sheet 3).

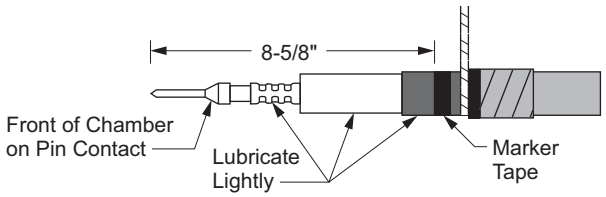


Figure TP 132–1.5

2.8 Lubricate cable and inside of cable entrance with silicone grease supplied or silicone grease SAP 10154115. **Do not substitute any other grease.** Keep cable insulation and receptacle clean. See Figure TP 132–1.5 (Sheet 3) and Figure TP 132–1.6 (Sheet 3).

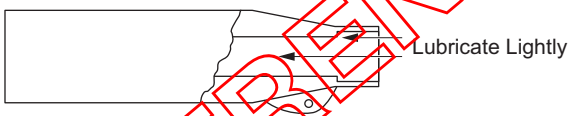


Figure TP 132–1.6

2.9 To exhaust air during assembly:

A. Insert nylon rod 5 inches to 5-1/2 inches into cable entrance.

B. Push cable into housing until the base of the pin chamfer (Figure TP 132–1.7 [Sheet 3]) comes flush with the inside face of the receptacle and the housing is flush with marker tape installed in Step 2.4.

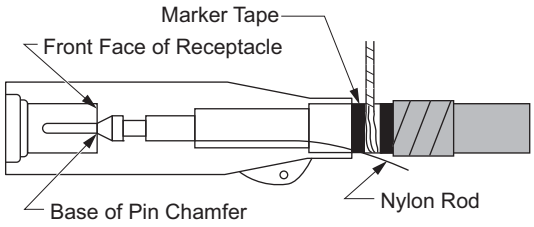


Figure TP 132–1.7

C. Pull out nylon rod. Assembly is now complete. See Figure TP 132–1.6 (Sheet 3).

NOTE

If receptacle is not to be immediately connected, install an Elastimold Dead-End Plug style 150-DP, SAP 10118021

FOR REFERENCE ONLY

2.10 To connect to a mating plug or bushing (Figure TP 132–1.8 [Sheet 4]):

A. Lubricate nose of plug or bushing with silicone grease supplied or silicone grease SAP 10154115 Place nylon rod in receptacle.

B. Insert plug assembly as far as possible in receptacle, or install receptacle fully onto bushing.

C. Pull out nylon rod.

D. Check to make certain marker tape is still flush with housing.

E. Remove marker tape.

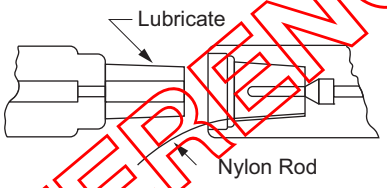


Figure TP 132–1.8

2.11 When using the plug for straight splices or T-connections, apply three one-half layers of Scotch #33 tape, approximately six inches in length over the point where components butt together. Connect one strand of concentric wire to grounding eye, shape concentric wires across splice or T-connector, and connect together. Connect concentric wires to ground.

FOR REFERENCE ONLY

TP 134 15/25 kV Dead-Break Elbow Installation

Scope TP 134.1 Application and Installation of 15/25 kV Class Dead-Break Elbow

1.0 Application

Refer to Distribution Design Standards (DDS) Manual for approved applications.

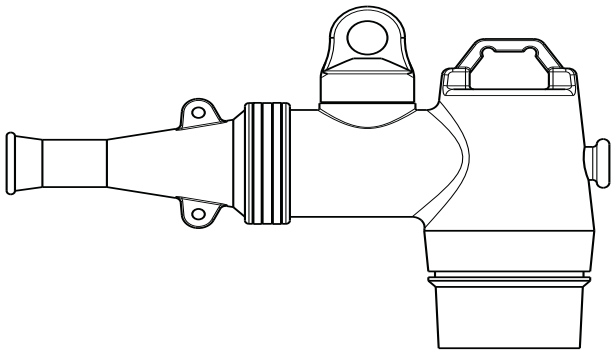
Table TP 134–1: 15/25 kV Class Dead-Break Elbow

SAP Number	Description
10118047	#2 Al, 220 mil CLP Cable
10118050	1/0 Al, 220 mil CLP Cable
10118049	#2 Al, 295 mil CLP Cable

Note(s):
1. 1. Replacement cap for capacitive test point SAP 10203052.

= For Reference Only

Figure TP 134–1: 15/25 kV Class Dead-Break Elbow



2.0 Instructions

For Jacketed Concentric Neutral (JCN) cable follow Steps 2.1 to 2.13; if nonjacketed CN cable, skip Steps 2.2 to 2.4.

2.1 Train the cable so that it is located in the final assembled position to provide adequate clearance for disconnecting elbow connectors and placing on operating accessories such as insulating bushing or feed-through devices. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising of the cable seat.

2.2 Mark the jacket approximately where the desired end cut will be.

2.3 Remove 27 inches of the cable's concentric neutral jacket, measuring from the cut end mark. See Figure TP 134–1.1 (Sheet 2).

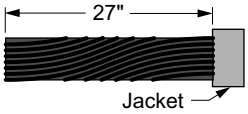


Figure TP 134–1.1

2.4 Seal the concentric neutral jacket from moisture intrusion following the jacket sealing procedure described inIC 230.

2.5 Spiral back the concentric neutral wires for a distance of 24 inches and bind down the wires. Cut off the excess cable (not the neutral) leaving an 8-1/2-inch length. See Figure TP 134–1.2 (Sheet 2).

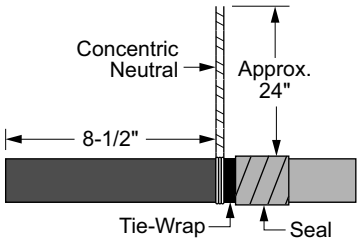


Figure TP 134–1.2

2.6 Remove cable insulation from cable end. CUT SQUARELY. DO NOT TAPER. See Figure TP 134–1.3 (Sheet 2). Remove any ridge from the leading edge of the insulation.

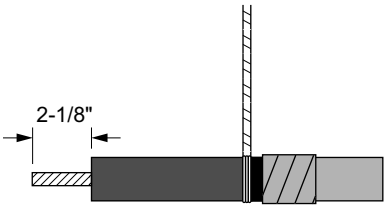


Figure TP 134–1.3

2.7 Wire brush bare aluminum conductor and immediately insert into crimp terminal. Before crimping, position crimp terminal on conductor so that one of the flat contact areas faces the bushing. Crimp the terminal holding the crimp barrel against the cable insulation. See Figure TP 134–1.4 (Sheet 3). Select the proper die and number of crimps in accordance with the die chart shown in DUG JJ 700, Table JJ 700–6 (Sheet 6). Wipe off excess inhibitor.

Note: If oxide inhibitor is not visually detected when the compression connector (called crimp terminals, crimp connectors, or spade terminals) is pushed onto the bare conductor, SCE approved oxide inhibitor should be applied to the bare conductor in the field, prior to crimping..

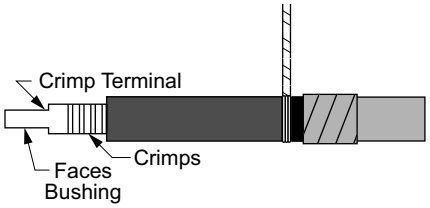


Figure TP 134–1.4

2.8 Remove semiconducting insulation shield 6-7/8 inches from end of crimp terminal with a smooth squared cut. Do not cut or nick the insulation. See Figure TP 134–1.5 (Sheet 3). All traces of semiconducting particles must be removed from the cable insulation. Wipe with a clean rag if necessary to be sure all semiconducting residue is removed.

At a point 7-7/8 inches (7-5/8 inches for Cooper RTE elbows) back from the end of the crimp terminal, put a turn of marker tape as an indicator for ease of seating cable into elbow. See Figure TP 134–1.5 (Sheet 3).

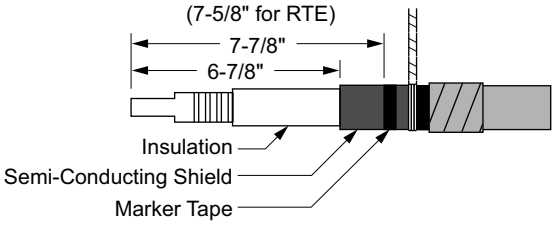


Figure TP 134–1.5

2.9 Lubricate cable surface with the silicone grease supplied or silicone grease SAP 10154115. See Figure TP 134–1.1 (Sheet 2). **Do not substitute any other grease.** Keep elbow and cable insulation clean.

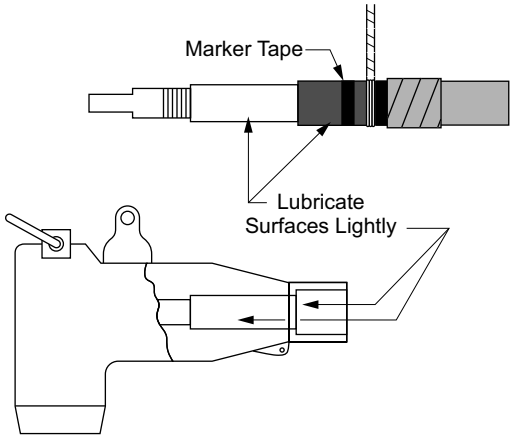
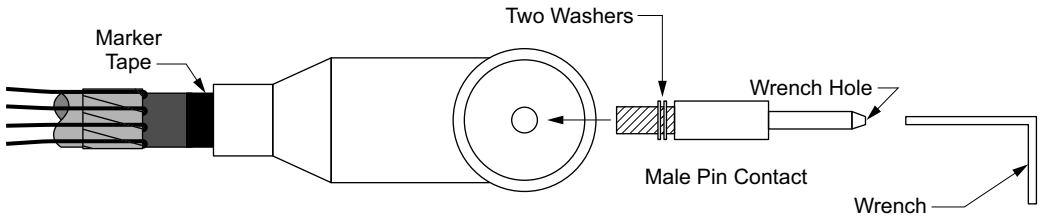


Figure TP 134–1.6

2.10 Slide cable into body of elbow with a back-and-forth twisting motion until the cable cannot advance any further. The marker tape should be flush with the end of the cable entrance of the elbow. Rotate elbow until flat area of crimp terminal is in the proper position to insert the male pin. Insert the threaded end of the male pin contact into the hold in large end of elbow. Engage threads using the wrench provided; tighten until wrench begins to bend. See Figure TP 134–1.1 (Sheet 2). If the elbow is not to be used immediately, install an Elastimold Dead-End Plug style 150-DP, SAP 10118021. Remove the marker tape.



Bottom View of Elbow

Figure TP 134–1.7

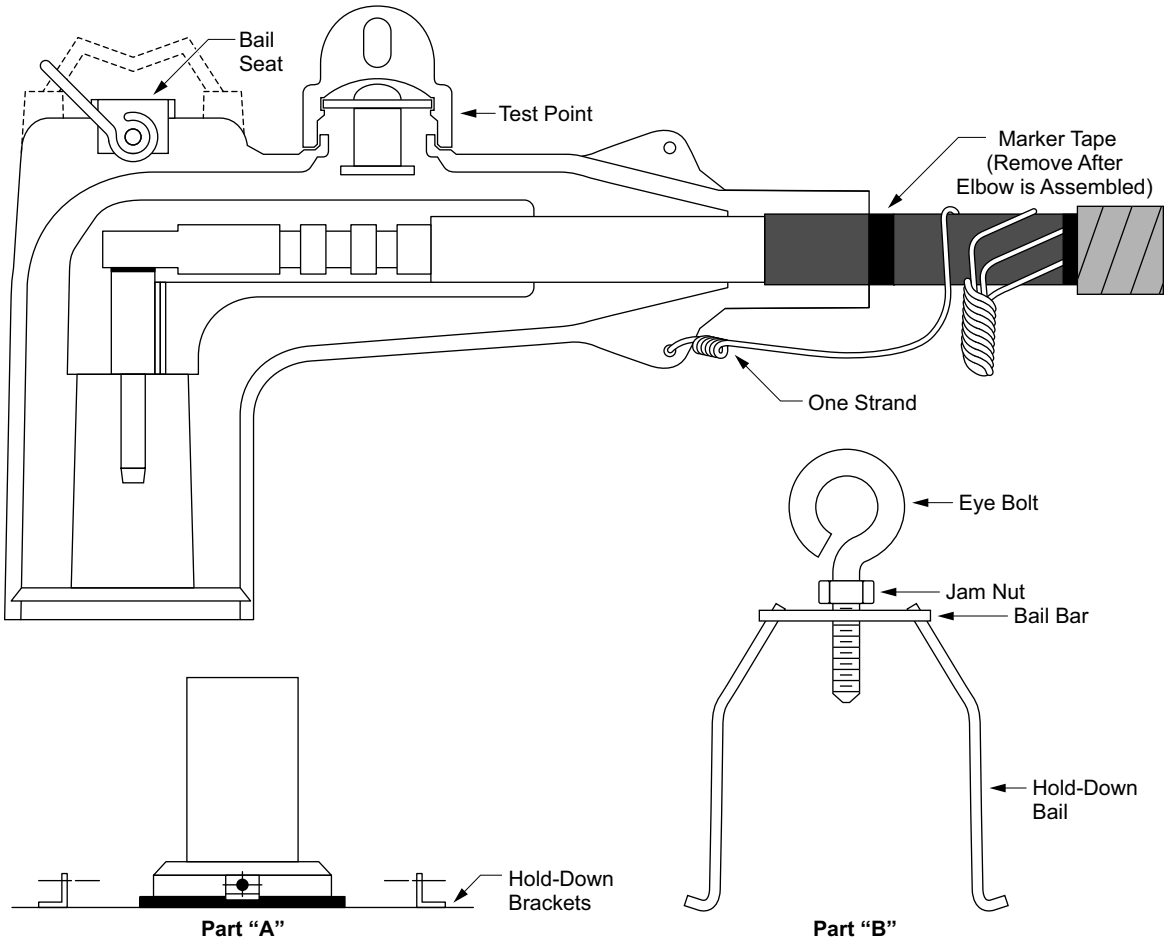


Figure TP 134–1.8

2.11 Place hold-down bail (Part B) in hold-down brackets by compressing bail prior to insertion in brackets. Swing bail ahead of elbow connector.

2.12 Lubricate both bushing and elbow receptacle with silicone grease supplied or silicone grease SAP 10154115; then place the elbow firmly down on the bushing. **Do not use the bail to force elbow onto bushing.**

2.13 With the elbow fully seated on the bushing, pull hold-down bail up over top of elbow so that eye bolt on the bail is directly over bail seat.

2.14 Turn the eye bolt clockwise until initial contact is made with the bail seat; then tighten the eye bolt two full (360 degrees) turns maximum, 1-1/2 turns minimum. With the eye bolt in the final position, adjust jam nut by bringing it down to top plate of bail. The nut acts as a stop to prevent the eye bolt from being tightened more in any future operation. The only time the nut needs to be readjusted is if the elbow, the bushing, or both are changed. In this case, repeat the above instructions to ensure correct bail pressure.

2.15 Connect one strand of concentric wires to grounding eye (Figure TP 134–1.8 [Sheet 4]) and connect remaining concentric wires to ground as required.

2.16 Remove voltage test cap and lightly lubricate inner surface of cap with silicone grease supplied. Replace cap and press firmly onto test point assembly. Do not lubricate plastic test point. When removing voltage test cap, peel off at an angle rather than directly in line with the test point assembly.

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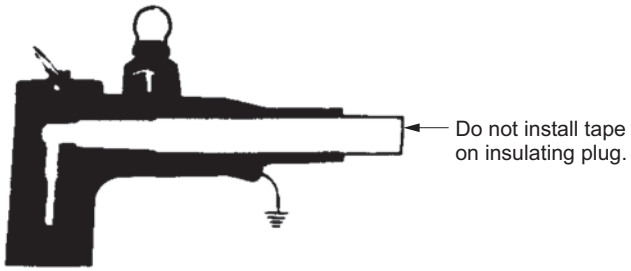
TP 136 Dead-Break Elbow Insulating Plug — Installation

Scope TP 136.1 Application and Installation of Dead-Break Elbow Insulating Plug (M/C 656-15833, SAP 10118024)

1.0 Application

The insulating plug is used to insulate and seal the cable end of a dead-break elbow receptacle. The elbow may then be used as a dead end receptacle with test point.

Figure TP 136–1: Dead-Break Elbow Insulating Plug — Installation



2.0 Instructions

2.1 Remove protective caps from elbow. Lightly lubricate surface of plastic insulating plug with silicone grease supplied or silicone grease M/C 904-00615. **Do not substitute.** Keep plug surface clean at all times.

2.2 Slide plug into elbow until it cannot advance any further. Flat contact area must face bushing.

2.3 Insert threaded end of male pin contact and tighten. **Caution: Snug tighten only, otherwise the thread of the plastic plug will strip.**

2.4 Place bail in hold-down brackets by compressing bail prior to insertion.

2.5 Lubricate both bushing and elbow receptacle with the silicone grease supplied or silicone grease M/C 904-00615.

2.6 Insert nylon rod into elbow/bushing interface to exhaust air when installing elbow on bushing. **Do not use bail to force elbow onto bushing.** When elbow is fully seated on bushing, remove nylon rod.

2.7 Pull hold-down bail up over crown on top of elbow so that the eyebolt is directly over bail seat. Turn eyebolt clockwise until initial contact is made with bail seat; then tighten the eyebolt two full (360 degree) turns maximum, 1-1/2 turns minimum. With the eyebolt in final position, adjust the jam nut by bringing it down to the top plate of the bail. The nut acts as a stop to prevent the eyebolt from being tightened more in any future operation. The only time the nut needs to be adjusted is if the elbow, the bushing, or both are changed. In this case, repeat the above instructions to insure correct bail pressure.

2.8 **Connect a wire from the grounding eye to ground**.

2.9 If elbow is removed and reinstalled, a nylon rod should be used to exhaust trapped air.

Note(s):

1. The plastic insulating plug can be used only with #2 220 mil (M/C 656-33000, SAP 10118047) and 1/0 220 mil (M/C 656-33307, SAP 10118050) dead-break elbow receptacle.

TP 140 12/16 kV Dead-Break Elbow Installation with 1/C PILC Cable

Scope TP 140.1 Application and Installation of 25 kV Class Dead-Break Elbow with Raychem Lead-to-Poly Heat Shrink Kit

1.0 Application

This standard details assembling a 25 kV class dead-break elbow (12 kV or 16 kV application) with #2 1/C PILC cable using a Raychem lead-to-poly heat shrink adapter.

For detailed elbow preparation, refer to TP 134.

Table TP 140–1: 25 kV Class Dead-Break Elbow and PILC Adapter Kit

SAP Number	Description
10117603	Complete Kit
10117981	Elastimold 25 kV Dead-Break Elbow. Replacement part only. This part is included in the complete kit.
10117600	Raychem 200 A adapter kit for #2 PILC. Replacement part only. This part is included in the complete kit.
10118136	Elastimold #2 connector. Replacement part only. This part is included in the complete kit.

Note(s):
1. Replacement cap for capacitive test point SAP 10203052.

2.0 Instructions

2.1 Cable Training

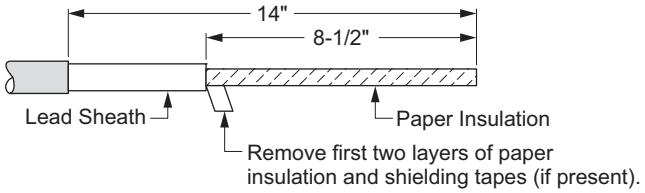
A. Train the cable so that it is located in the final assembled position to provide adequate clearance for disconnecting elbow connectors and placing on operating accessories such as insulating bushing or feed-through devices. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising of the cable seat.

2.2 Prepare Cable

A. After removing the jacket (if cable has jacket), but prior to removing the lead sheath, solvent clean and abrade the lead sheath for 6 inches from the cable jacket cutback. Prepare the cable to dimensions shown in Figure TP 140–1 (Sheet 2).

B. Remove two paper tapes together with any insulation shielding tape and tear off against the lead sheath cutback.

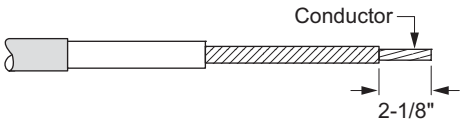
Figure TP 140–1: Cable Preparation Dimensions



2.3 Remove Insulation

Cut back the insulation as shown in Figure TP 140–2 (Sheet 2).

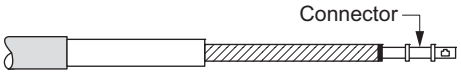
Figure TP 140–2: Insulation Removal



2.4 Install Connector and Mark Sheath

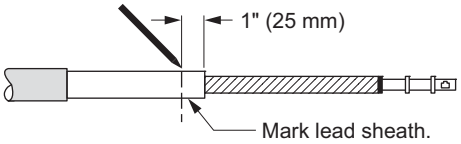
A. Install connector using appropriate compression tools and dies. See Figure TP 140–3 (Sheet 2).

Figure TP 140–3: Connector Installation



B. Mark the lead sheath as shown in Figure TP 140–4 (Sheet 2).

Figure TP 140–4: Marking of Lead Sheath

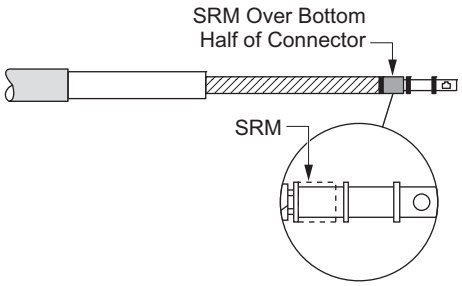


2.5 Install Stress Relief Material (SRM)

A. Solvent clean lead and lug.

B. Remove the backings from the small piece of angle-out SRM. Wrap the SRM around the solvent-cleaned bottom half of the connector as shown in Figure TP 140–5 (Sheet 3).

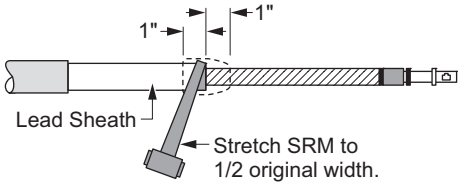
Figure TP 140–5: Application of SRM



C. Remove backing from one side of the long strip of SRM. Roll the SRM and remaining backing strip into a convenient size.

Remove the remaining backing strip and tightly wrap SRM around the lead cutback. Continue wrapping to the mark on the lead sheath, and then back onto the insulation for 1 inch as shown in Figure TP 140–6 (Sheet 3).

Figure TP 140–6: Wrapping of SRM

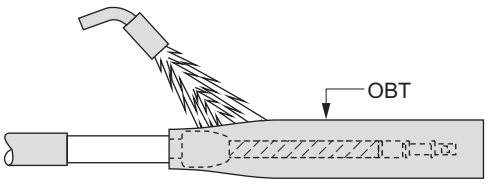


Note(s):
1. Apply a maximum thickness of 1/8 inch of SRM over the lead sheath to prevent excessive diameter buildup.
2. Do not apply silicone grease to SRM because it will prevent the necessary oil seal. Damage to the cable components will result if a leak develops between the SRM and the OBT.

2.6 Position and Shrink In-Place Clear Oil Barrier Tube (OBT)

A. Position the OBT over the lead cutback as shown. Shrink in place starting at the lead cutback. Work around the tube with a smooth brushing motion. See Figure TP 140–7 (Sheet 3).

Figure TP 140–7: Application of OBT



B. To achieve a smooth, wrinkle-free installation, use a reduced flame to install the thin-walled OBT. If the OBT “folds back” on itself, immediately eliminate the fold by pulling the OBT end.

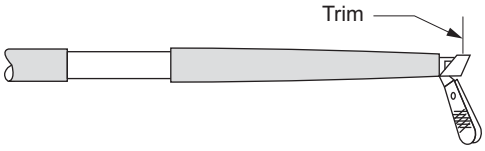
2.7 Inspection and Trimming of Excess OBT

The OBT should have a smooth, wrinkle-free surface after shrinking. Reheat to smooth any wrinkled areas. See Figure TP 140–8 (Sheet 4).

Figure TP 140–8: OBT Inspection

Allow tube to cool enough to touch before proceeding. If necessary, trim excess tubing from the lug area as shown in Figure TP 140–9 (Sheet 4).

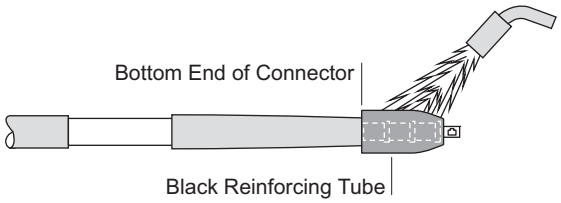
Figure TP 140–9: Trimming of Excess OBT



2.8 Install Black Reinforcing Tube

Position the black reinforcing tube to line up with the bottom end of the connector; heat shrink down. Black reinforcing tube should not interfere with the contact portion of the connector. See Figure TP 140–10 (Sheet 4).

Figure TP 140–10: Installation of Black Reinforcing Tube

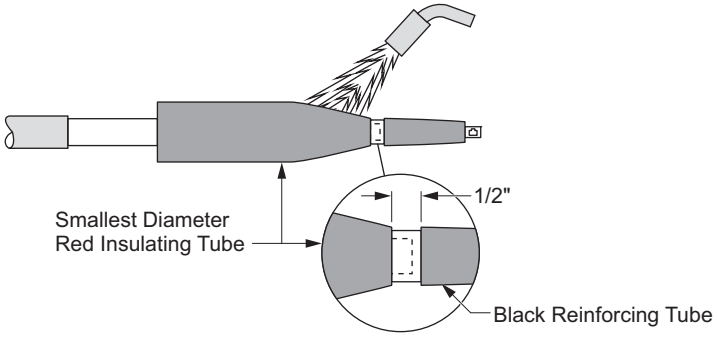


2.9 Position smallest diameter red tube; heat shrink in place.

A. Position the shorter red tube 1/2 inch from black reinforcing tube as shown in Figure TP 140–11 (Sheet 5).

B. Begin shrinking at the connector end and work the torch with a smooth brushing motion around the tube toward the other end.

Figure TP 140–11: Installation of Smaller Diameter Red Insulating Tube

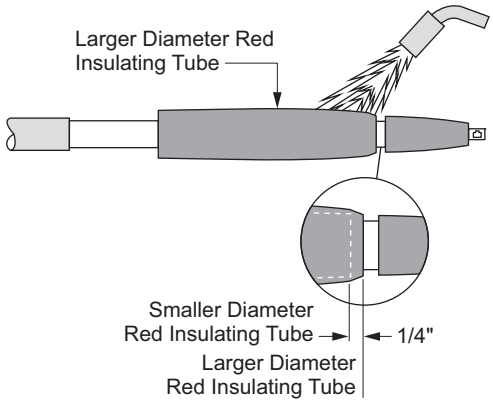


2.10 Position larger diameter red tube; heat shrink in place

A. Position the larger diameter tube to overlap the end of the shorter tube by 1/4 inch so that when it is shrunk, it “lips down” between the end of the first tube and the end of the lug barrel. This provides a beveled profile for ease of installation of the 200 A elbow. See Figure TP 140–12 (Sheet 5).

B. Begin shrinking at the connector end and work the torch with a smoother brushing motion around the tube toward the other end.

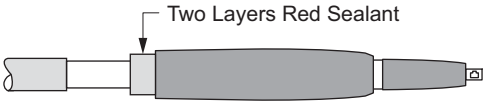
Figure TP 140–12: Installation of Larger Diameter Red Insulating Tube



2.11 Apply red sealant.

Apply two wraps of red sealant butted up to the previously applied red tube as shown in Figure TP 140–13 (Sheet 6). Do not half-lap or spiral the red sealant. Apply one wrap over the other.

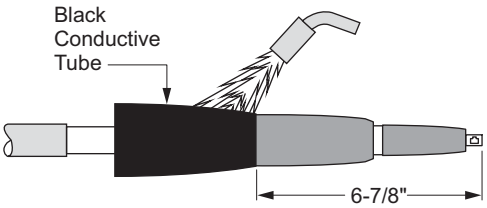
Figure TP 140–13: Application of Red Sealant



2.12 Position black conductive tube; heat shrink in place.

A. Position the black conductive tube approximately 7 inches from the end of the connector as shown in Figure TP 140–14 (Sheet 6).

Figure TP 140–14: Installation of Black Conductive Tube



B. Begin shrinking at the connector end and work the torch with a smooth brushing motion around the tube toward the other end.

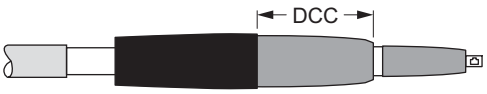
C. Allow all tubes to cool to the touch before proceeding to the next step.

2.13 Apply discharge control compound (DCC).

A. Cut open the end of the DCC ampule and apply a thin film of compound on the previously installed tubes and inside the elbow. See Figure TP 140–15 (Sheet 6).

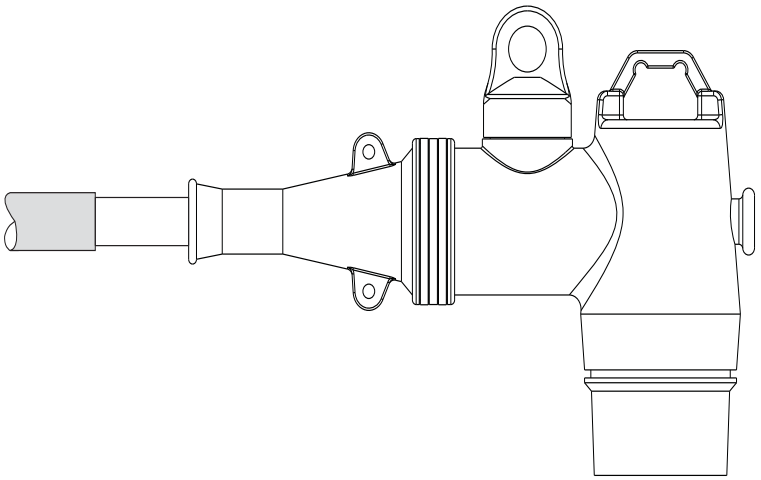
B. Push the elbow on and position as shown in Figure TP 140–16 (Sheet 7). Attach ground wire using standard procedures.

Figure TP 140–15: Application of DCC



CAUTION Failure could occur if the components are not properly bonded and grounded.

Figure TP 140–16: Final Installed Elbow



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TP 150 12 kV Load-Break Elbow Installation

Scope TP 150.1 Application and Installation of 15 kV Class Load-Break Elbow

1.0 Application of Load-Break Elbow

Consult Distribution Design Standards (DDS) for approved applications. Not for use on systems above 12 kV.

Table TP 150–1: 15 kV Class Load-Break Elbow

SAP Number	Description
10117361	Load-break elbow for #2 Aluminum, 220 mil CLP Cable
10117360	Load-break elbow for 1/0 Aluminum, 220 mil CLP Cable
10117363	Replacement 200 A contact probe for #2 or 1/0 load-break elbows

Note(s):
1. 1. Replacement cap for capacitive test point SAP 10203052.

= For Reference Only

2.0 Instructions to Install Load-Break Elbow

For Jacketed Concentric Neutral (JCN) cable, follow Steps 2.1 to 2.14; if nonjacketed CN cable, skip Steps 2.2 to 2.4.

2.1 Train the cable so that it is located in the final assembled position to provide adequate clearance for disconnecting elbow connectors and placing on operating accessories such as insulating bushings and feedthrough devices. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising of the cable seat.

2.2 Mark the jacket approximately where the desired end cut will be. Allow enough slack in concentric neutral wires to connect ground after installation and for elbow operation.

2.3 Remove 27 inches of the cable's concentric neutral jacket, measuring from the cut end mark. See Figure TP 150–1.1 (Sheet 1).

Figure TP 150–1: Installation of 15 kV Class Load-Break Elbow

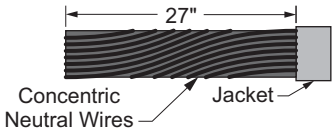


Figure TP 150–1.1

2.4 Seal the concentric neutral jacket from moisture intrusion following the jacket sealing procedure described in IC 230.

2.5 Measure 15 inches from the center of the load-break bushing insert. For unjacketed cable, bind concentric neutral wires with tape. Unwrap wires to this point. Cut the cable 3/4 inch short from the center line of bushing. See Figure TP 150–1.2 (Sheet 2) and Figure TP 150–1.3 (Sheet 2).

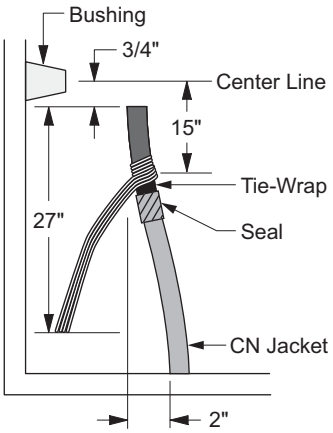
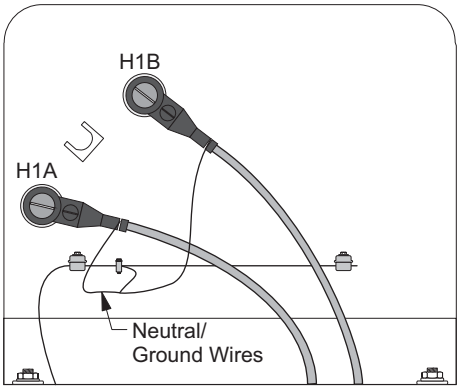


Figure TP 150–1.2



Typical 1Ø Mini Pad-mount Transformer
Front View

Figure TP 150–1.3

Note(s):
1. Leave enough concentric neutral wires to allow load-break elbow to be easily installed on and removed from bushing.
2. For feed-through circuits, concentric neutral wires from each elbow should be crimped together and then tied to ground to prevent neutral from being opened during transformer replacement.

2.6 Remove semiconducting insulation shield and cable insulation (Dimension “A”) from the cable end. **Cut squarely. Do not taper.** See Figure TP 150–1.4 (Sheet 2). Remove any ridge from the leading edge of the insulation.

Dimension “A” (in)	
Elastimold	2-1/8
Cooper/RTE	2-1/8

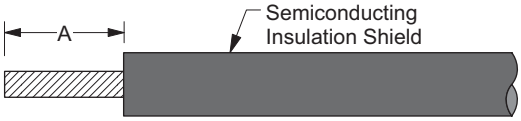


Figure TP 150–1.4

2.7 Wire brush bare aluminum conductors and immediately insert in conductor contact containing inhibitor. Before crimping, position conductor contact on prepared conductor so the flat contact area faces the bushing insert. Also, cable should be trained into final position so that cable movement will not affect the connection. Crimp the contact barrel as close to the cable insulation as possible. See Figure TP 150–1.5 (Sheet 3). Select the proper die and number of crimps in accordance with the die chart shown in DUG JJ 700, Table JJ 700–7 (Sheet 7). Wipe off excess inhibitor.

Note: If oxide inhibitor is not visually detected when the compression connector (called crimp terminals, crimp connectors, or spade terminals) is pushed onto the bare conductor, SCE approved oxide inhibitor should be applied to the bare conductor in the field, prior to crimping.

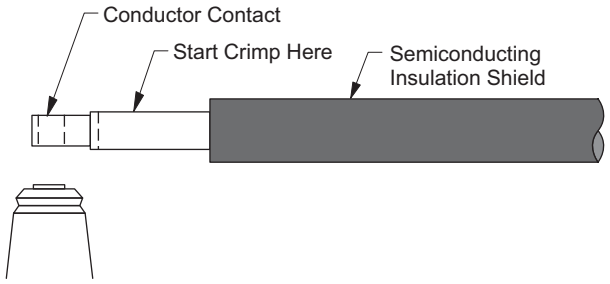


Figure TP 150–1.5

2.8 Remove the semiconducting insulation shield to a point 6 7/8 inches back from the end of the contact with a straight smooth “squared” cut. Do not cut or nick the insulation. Mark the semicon shield with a wrap of tape 1 inch back from the cut end. Bevel insulation end 1/8 inch max. Thoroughly clean the insulation to remove all traces of conductive residue. This may be done by wiping the insulation with a rag dampened with an approved solvent. Always wipe towards the semiconducting insulation shield. See Figure TP 150–1.6 (Sheet 3).

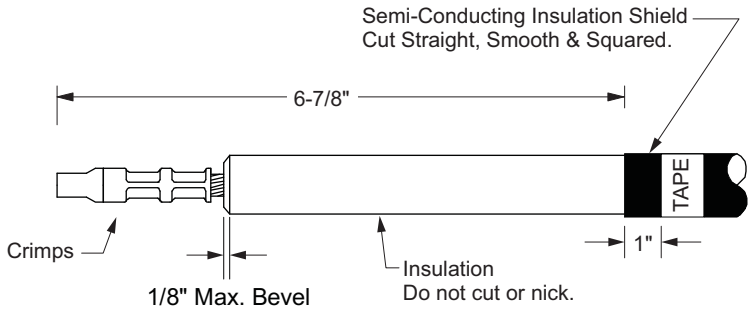


Figure TP 150–1.6

NOTE

Distribution Standards take precedence over manufacturer’s installation instructions for cutback dimensions.

2.9 Lubricate the cable insulation and inside of the elbow connector housing. See Figure TP 150–1.7 (Sheet 4), with the silicone grease supplied or silicone grease SAP 10154115. **Do not substitute any other grease.**

2.10 Slide the elbow connector housing. See Figure TP 150–1.7 (Sheet 4), onto the cable with a back and forth twisting motion until it cannot advance any farther. The cable entrance end of the elbow should be approximately flush with the marker tape when connector is positioned correctly. Rotate the connector until it is aligned with the apparatus bushing. Remove the marker tape.

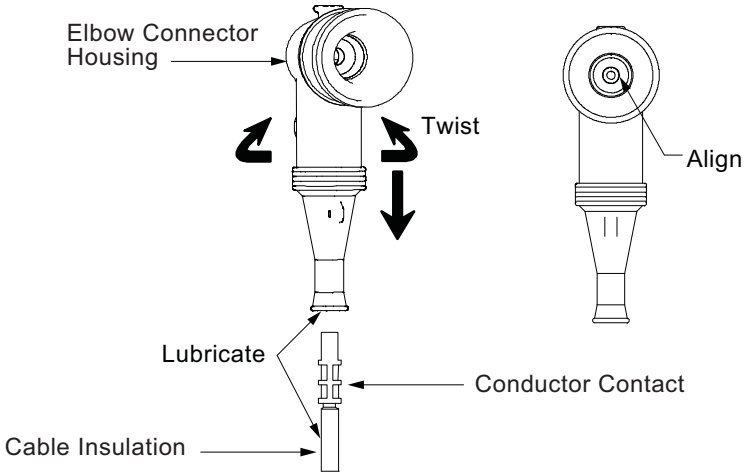


Figure TP 150–1.7

2.11 Screw the probe (Figure TP 150–1.8 [Sheet 4]) into the conductor contact, making sure that the threads are properly aligned. Eight to nine half-turns of the probe can be made before it becomes snug in the conductor contact.

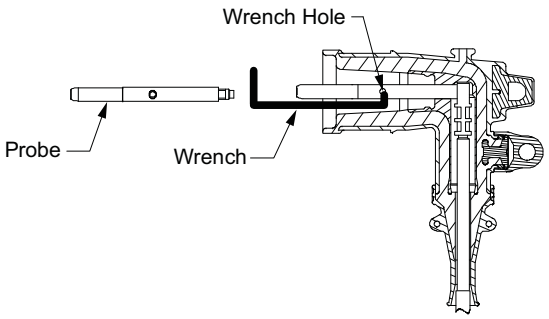


Figure TP 150–1.8

CAUTION

If great resistance is encountered in the first half-turn to one and one-half turns, do not force. Remove probe and check threads for possible stripping. If threads are good, reinsert and engage threads, making sure that they are properly aligned. If threads are stripped, the conductor contact and probe must be replaced.

2.12 Take the probe wrench, insert the short end of the wrench into the hole in the probe (Figure TP 150–1.8 [Sheet 4]). Tighten until the wrench bends about 180 degrees (approximately 110 inch-pounds). Or a Load-Break Elbow Probe Tool - Hot Stick Operable (SAP 10147302) may be used to tighten the probe. Both tools have a preset torque handle that provides the proper torque.

2.13 Connect one concentric wire to grounding eye (Figure TP 150–1.9 [Sheet 5]) and connect remaining concentric wires to ground as required.

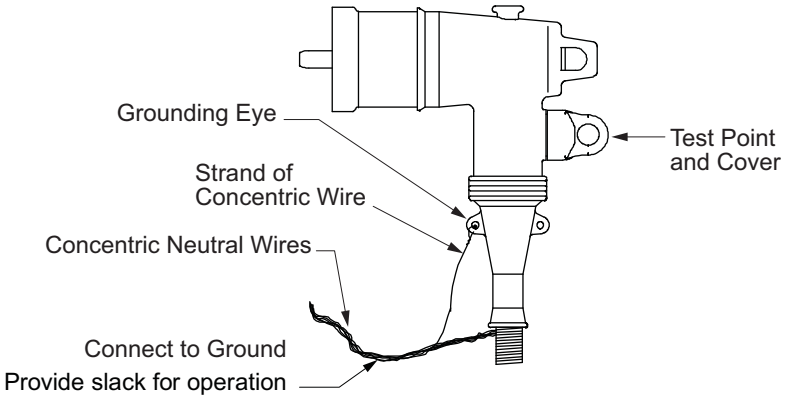


Figure TP 150–1.9

CAUTION Failure could occur if the components are not properly bonded and grounded.

2.14 Remove test point cover and lubricate the inner surface of the cover with silicone grease supplied or silicone grease SAP 10154115. See Figure TP 150–1.9 (Sheet 5). Do not lubricate plastic test point. Replace cover onto test point assembly. When removing test point cover, pull off at an angle rather than directly in line with the test point assembly.

2.15 **CONFIRM THE APPARATUS AND ELBOW ARE DE-ENERGIZED**. Lightly lubricate the receptacle portion of the elbow connector with silicone grease supplied or with silicone grease SAP 10154115. Also, lightly lubricate the mating bushing only with apparatus de-energized. Place elbow on the bushing insert using the pulling or operating eye portion of the elbow. See Figure TP 150–1.10 (Sheet 6).

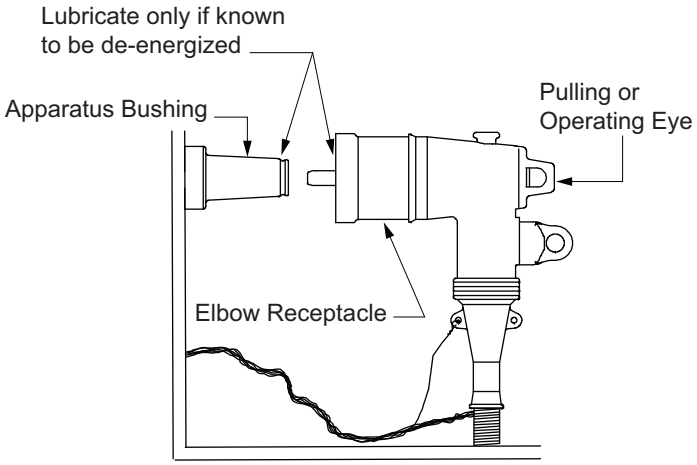


Figure TP 150–1.10

2.16 Place elbow on the bushing insert with a hot stick tool only. See Figure TP 150–1.11 (Sheet 6). Pulling or pushing on the housing and crimp terminal area of the elbow will cause misalignment of the probe in the elbow. **DO NOT OPERATE BY HAND.**

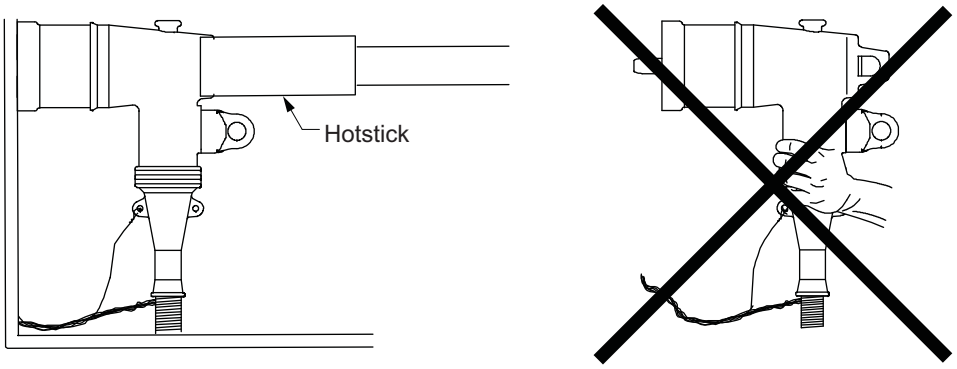


Figure TP 150–1.11

Note(s):
1. Bails are not used with load-break elbows.
2. Using too much grease can cause the elbow to pop back off.

TP 151 12 kV Load-Break Bushing Insert — Installation

Scope TP 151.1 Application and Installation of 15 kV Class Load-Break Bushing Insert

1.0 Application

Consult Distribution Design Standards for approved applications.

Load-break bushing insert provides the apparatus interface for load-break elbow connectors. Install or remove only when the apparatus is deenergized. Do not use on systems above 12 kV.

Table TP 151–1: 12 kV Class Load-Break Bushing Insert

SAP Number	kV Class	Bushing Insert Color
10117356	15	Red

NOTE

The latest version of the 15 kV Class bushing inserts are supplied in a solid red color. Older versions of this bushing insert may have a red, yellow, or gray color-band on the bushing insert surface that mates to the load break elbow. Some older units may not have color-bands. Be sure to use the correct voltage load break bushing insert.

2.0 Instructions

2.1 Inspect the apparatus bushing well, see Figure TP 151–1.1 (Sheet 1), to ensure it is dry and free from all contaminants. Remove the protective shipping cap from the bushing insert.

CAUTION Shipping cap is not an insulating device.

Lubricate the bushing well interface area of the bushing insert with the silicone grease supplied or silicone grease SAP 10154115. **Do not substitute any other grease.**

NOTE Damage may occur to bushing insert if a grease other than those specified is used.

2.2 Place the lubricated portion of the bushing insert in the apparatus bushing well. See Figure TP 151–1.2 (Sheet 1). Hand tighten the bushing insert in a clockwise direction until it bottoms or use Load-break Bushing Tool-Hand Operable

Figure TP 151–1: Installation of 15 kV Class Load-Break Bushing Insert

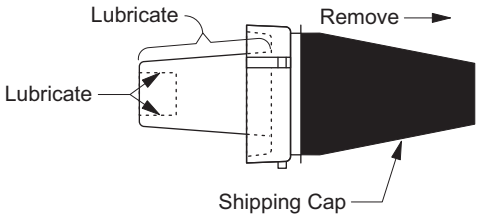


Figure TP 151–1.1

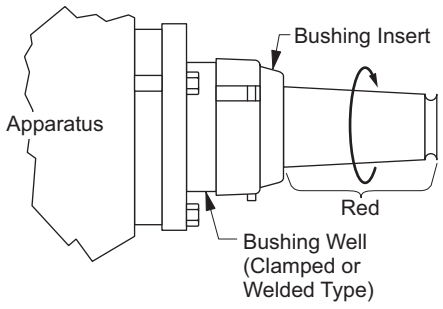


Figure TP 151–1.2

(SAP 10147548) or Load-break Bushing Tool - Hot Stick Operable (SAP 10147305) to achieve proper torque (100 to 120 inch-pounds).

2.3 Installation of Bushing Insert Copper Bond Wire

CAUTION Failure could occur if the components are not properly bonded and grounded.

A. Switch Applications

Connect one end of a length of copper wire, #14 AWG (SAP 10109303), to the equipment ground for BURD switches (See Figure 151-1.3), or to the equipment ground tab either just above or below the bushing well for PME switches (See Figures 151-1.4 and 151-1.5). Push the free end of the copper wire through one of the grounding tabs on the bushing insert. Make a small loop and twist tight, taking care not to damage the grounding tab.

Figure TP 151–1.3: Bond Wire on BURD Switch

Figure TP 151–1.4: Bond Wire on PME Switch

Figure TP 151–1.5: Bond Wire on PME Switch

B. Transformer Applications

Connect one end of copper wire, #14 AWG (SAP 10109303), to the bushing well frame (See Figure 151-1.6), or to the equipment ground (See Figure 151-1.7). Push the free end of the copper wire through one of the grounding tabs on the bushing insert. Make a small loop and twist tight, taking care not to damage the grounding tab.

Figure TP 151–1.6: Bond Wire on Transformer Bushing Well Frame

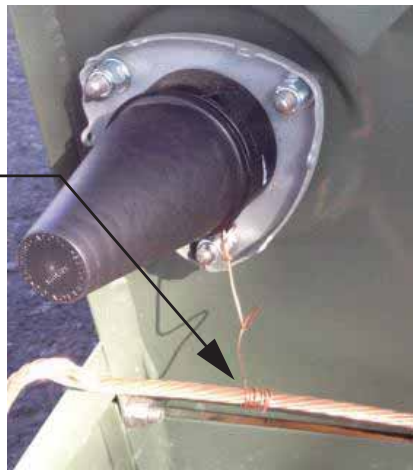
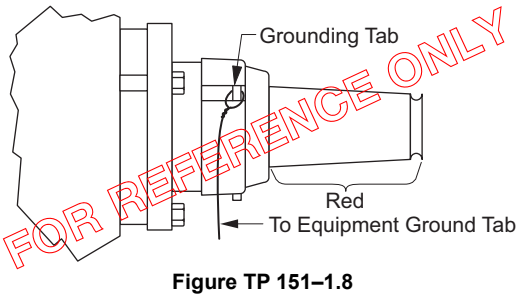


Figure TP 151–1.7: Bond Wire on Transformer Equipment Ground (Shown with Shipping Cap; Remove before Energizing)

2.4 Thoroughly wipe the bushing interface clean of any contaminants and lightly lubricate with the silicone grease supplied or silicone grease SAP 10154115 (see Figure TP 151–1.2 [Sheet 1]). **Do not substitute any other grease.**



FOR REFERENCE ONLY

Figure TP 151–1.8

NOTE

Using too much grease can cause the mating component to pop back off.

The insert is ready to accept a mating product such as an elbow connector, an insulated cap, or a grounding elbow. See operations manual for instructions to operate any of the above mating components.

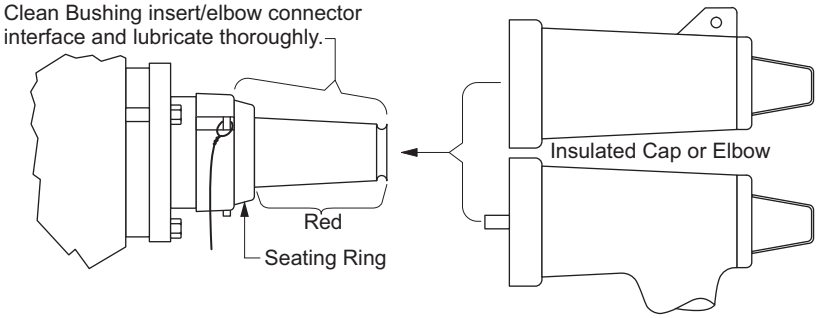


Figure TP 151–1.9

15 kV Red Interface Shield

Figure TP 151–1.10

TP 152 12 kV Load-Break Repair and Replacement Elbows Installation

Scope TP 152.1 Application and Installation of 15 kV Class Load-Break Repair and Replacement Elbows

1.0 Application of Load-Break Repair (ELR) and Replacement (RLR) Elbows

Not for use on systems above 12 kV. Standard elbows should be used whenever possible. Repair (ELR) and Replacement (RLR) elbows shall only be used if standard elbows cannot be used. The ELR and RLR elbows are not to be used for general elbow replacement.

The ELR elbow provides an additional elbow length of approximately 3 inches, and the RLR elbow provides an additional elbow length of approximately 10 inches. ELR and RLR elbows may be used as follows:

- ELR Elbows: Use for replacing damaged or blown standard load-break elbows.
- Replacement (RLR) Elbows: Use when a longer length elbow is required, such as when live-front equipment is replaced with dead-front equipment (for example, PME switches or minipad transformers).

Table TP 152–1: 15 kV Class Load-Break Repair and Replacement Elbows

SAP Number	Description
10117585	Repair load-break elbow (ELR type), #2 CLP cable
10117586	Repair load-break elbow (ELR type), 1/0 CLP cable
10117587	Replacement load-break elbow (RLR type), #2 CLP cable
10117588	Replacement load-break elbow (RLR type), #1/0 CLP cable

Note(s):
1. Replacement cap for capacitive test point SAP 10203052.

2.0 Instructions on Installing 15 kV Class Load-Break ELR Elbows

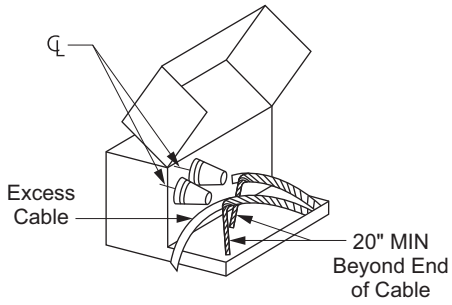
For elbow housing replacement without changing the compression lug, skip to Paragraph 2.2.

2.1 For new installation and total replacement of elbow housing and compression lug, complete the following:

A. Cable Training

1. Train the cable so that it is located in the final assembled position to provide adequate clearance for disconnecting elbow connectors and placing on operating accessories such as insulating bushing or feed-through devices. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising of the cable seat. See Figure TP 152–1 (Sheet 2).

Figure TP 152–1: Cable Training Example



2. For new installations, cut excess cable squarely at center line of bushing.

3. For replacements:

    1. Using pin wrench, remove probe from elbow and discard probe. See Figure TP 152–2 (Sheet 2).

    2. With a twisting motion, pull the elbow off the cable.

    3. Cut off old compression lug as shown below in Figure TP 152–3 (Sheet 2).

Figure TP 152–2: Removal of Probe from Elbow

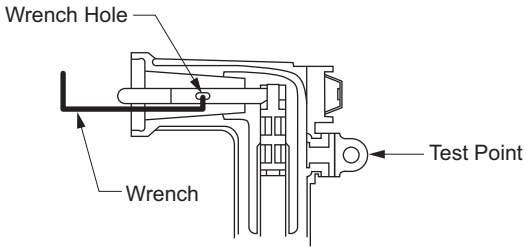
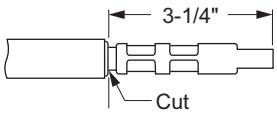


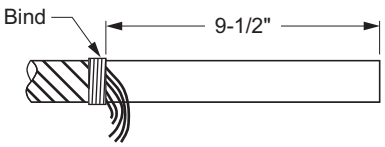
Figure TP 152–3: Cutting Off Old Compression Lug



B. Cable Preparation

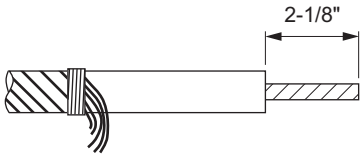
1. Unwrap and bind concentric neutral wires 9-1/2 inches back from end of cable as shown below in Figure TP 152–4 (Sheet 2).

Figure TP 152–4: Cutback of Concentric Neutral Wires



2. Remove shield and insulation from the cable end. Cut squarely, taking care not to nick the conductor. See Figure TP 152–5 (Sheet 3) below.

Figure TP 152–5: Removal of Shield and Insulation from Cable End

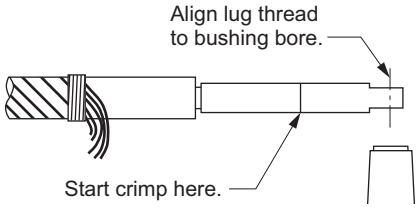


3. Wire brush bare aluminum conductors and immediately install compression lug. Rotate to spread inhibitor.

   Position compression lug so the CONTACT THREADED HOLE ALIGNS WITH THE BUSHING BORE. See Figure TP 152–6 (Sheet 3) below. Refer to crimp chart packaged with compression lug for recommended crimp tool information.

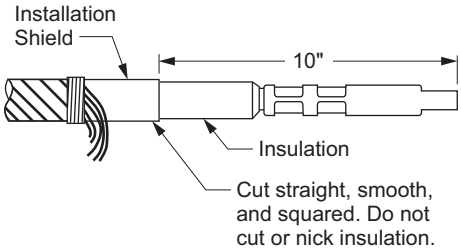
   Start crimp at the crimp-line mark. Rotate 180 degrees each successive crimp. Carefully wire excessive inhibitor from the outside of the lug and cable.

Figure TP 152–6: Start of Crimp and Alignment with Bushing Bore



4. Remove insulation shield as shown in Figure TP 152–7 (Sheet 3).

Figure TP 152–7: Insulation Shield to Lug Dimension



5. Thoroughly clean insulation to remove all traces of conductive residue.

C. Proceed to Paragraph 2.3.

2.2 For elbow housing replacement without changing the compression lug, complete the following:

A. Remove Elbow

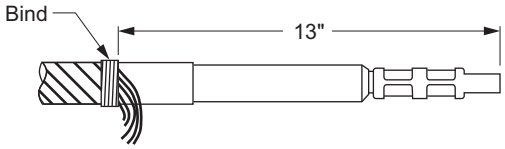
1. Using pin wrench, remove probe from elbow and discard probe. See Figure TP 152–2 (Sheet 2).

2. With a twisting motion, pull the elbow off the cable.

B. Cable Preparation

1. Unwrap and bind concentric neutral wires 13 inches back from end of connector as seen in Figure TP 152–8 (Sheet 4).

Figure TP 152–8: Unwrapping and Binding Concentric Neutrals Back 13 Inches



2. Remove insulation shield as shown in Figure TP 152–8 (Sheet 4).

3. Bevel the insulation end 1/8 inch maximum as shown in Figure TP 152–7 (Sheet 3).

4. Thoroughly clean insulation to remove all traces of conductive residue.

C. Proceed to Paragraph 2.3.

2.3 Elbow Assembly

A. Lubricate the cable insulation and inside the elbow housing with the lubricant supplied. DO NOT SUBSTITUTE. See Figure TP 152–9 (Sheet 5). Other lubricants may be harmful to this product or its mating product(s). Keep insulation clean of dirt and grime.

B. Slide the elbow connector onto the cable with a back-and-forth twisting motion. Wipe off all excess grease. See Figure TP 152–9 (Sheet 5).

C. Align elbow with the compression lug's threaded hole. See Figure TP 152–9 (Sheet 5).

D. Thread probe into lug by hand, taking care not to cross-thread. Tighten with wrench until wrench bends. See Figure TP 152–10 (Sheet 5).

Figure TP 152–9: Lubrication and Alignment for Elbow Assembly

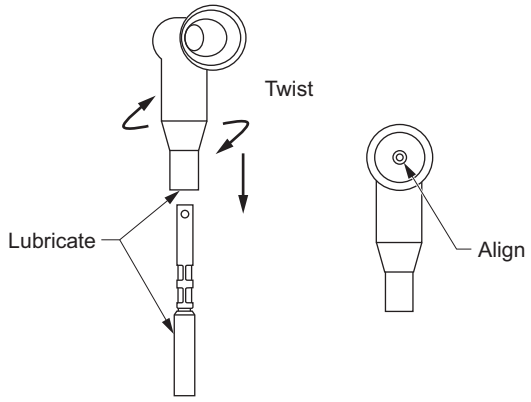
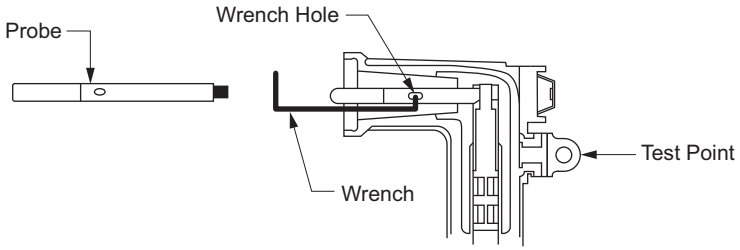


Figure TP 152–10: Threading of Probe into Lug for ELR Elbow Assembly

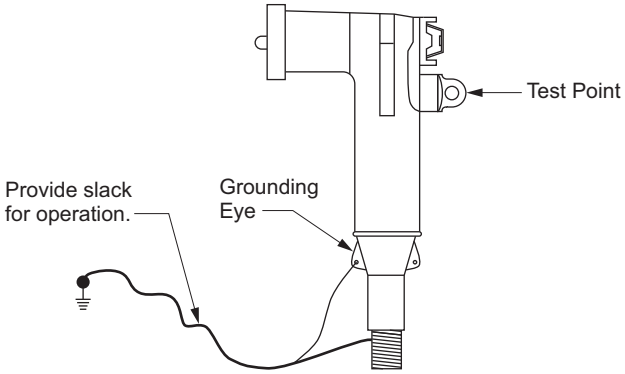


2.4 Concentric Neutral Connection

A. Insert one end of a No. 14 AWG (2.5mm) copper wire, or equivalent, through the grounding eye on the elbow. See Figure TP 152–11 (Sheet 6). Twist the wire tight, taking care not to damage the eye.

B. Twist neutral wires with wire from the grounding eye and connect to ground using appropriate connector. Provide adequate slack in wires for elbow operation.

Figure TP 152–11: Inserting Wire through Grounding Eye

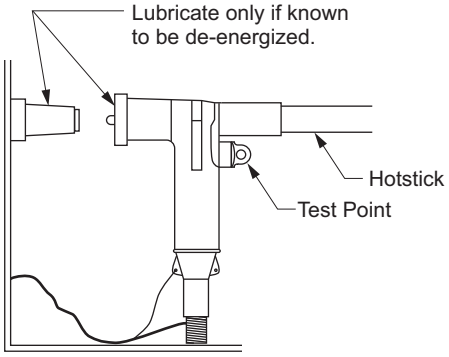


CAUTION Failure could occur if the components are not properly bonded and grounded.

2.5 Connect Elbow and Bushing Plug

A. Lubricate the receptacle portion of the elbow connector and the mating bushing with the lubricant supplied. LUBRICATE ONLY IF THE EQUIPMENT AND ELBOW ARE KNOWN TO BE DE-ENERGIZED. See Figure TP 152–12 (Sheet 6).

Figure TP 152–12: Connecting 15 kV ELR Elbow to Bushing Plug



B. Operate per operations guidelines. DO NOT OPERATE BY HAND.

3.0 Instructions on Installing 15 kV Load-Break RLR Elbows

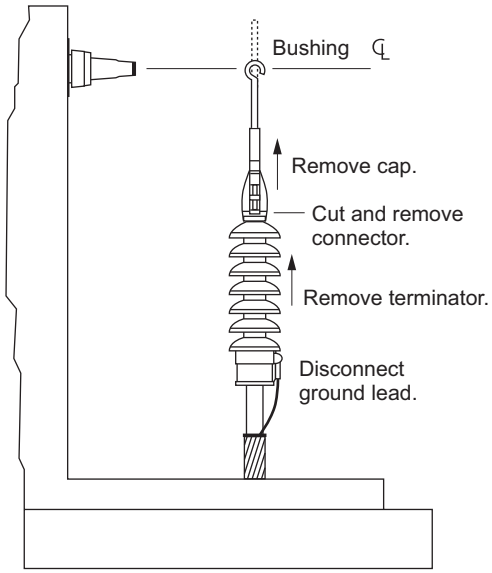
3.1 New Installation of Replacement Elbow Housing and Compression Lug

WARNING All apparatus must be de-energized during installation or removal of part(s).

A. Live-Front Removal

1. Remove the rubber cap (if Elastimold) from the terminator. See Figure TP 152–13 (Sheet 7).
2. Cut off connector at the top of the terminator.
3. Disconnect ground lead from the base of the terminator.
4. Remove the terminator housing from the cable.

Figure TP 152–13: Live-Front Removal



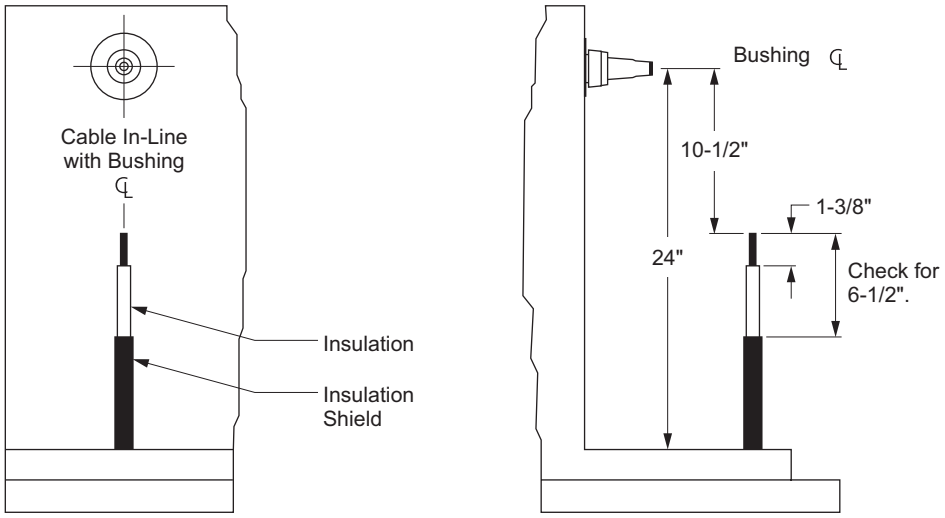
B. Cable Preparation

1. Train the cables to be straight and in-line with bushing centerline. See Figure TP 152–14 (Sheet 8).
2. The end of the cable MUST measure 10-1/2 inches from the bushing centerline. Cut the cable to 10 1/2 inches. See Figure TP 152–14 (Sheet 8).

   Check the distance from the end of the cut cable to the insulation shield. If the insulation shield measures less than 6 /2 inches, proceed to Step 3.

3. Remove cable insulation 1 3/8 inches from the end of the cable. Cut squarely. DO NOT NICK THE CONDUCTOR.

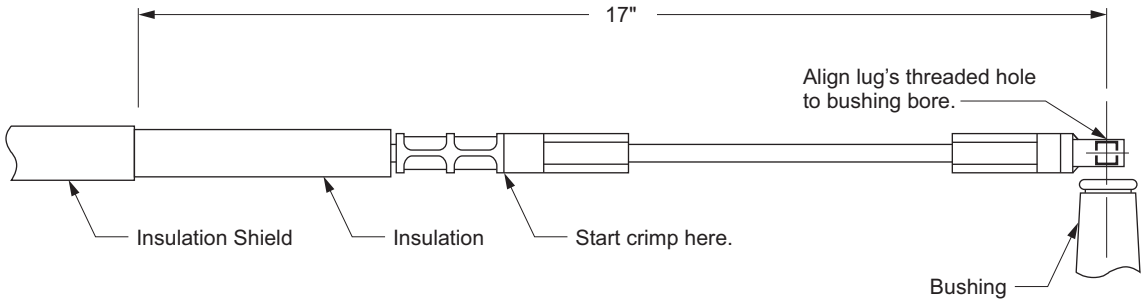
Figure TP 152–14: Cable Preparation



C. Wire brush bare aluminum conductor and immediately install compression lug. Rotate to spread inhibitor. Position the compression lug so the contact threaded hole aligns with the bushing bore. (Refer to crimp chart packaged with compression lug for recommended crimp information.)

Start crimp at the crimp line mark. Rotate 180 degrees each successive crimp. Carefully wipe excessive inhibitor from the outside of the lug and cable. See Figure TP 152–15 (Sheet 8).

Figure TP 152–15: Crimping of Conductor



D. Elbow Assembly

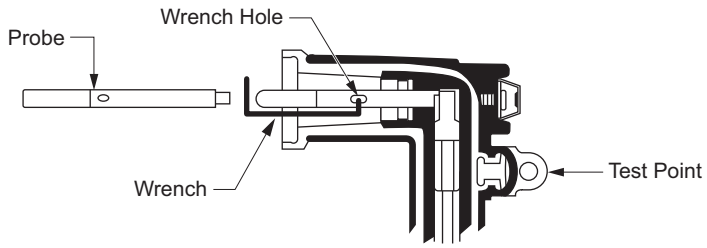
1. Lubricate the cable insulation and inside the elbow housing with the lubricant supplied. DO NOT SUBSTITUTE. Other lubricants may be harmful to this product or its mating product(s). Keep insulation clean of dirt and grime. Do not use excess grease and do not introduce any grease into the gap between the lug and the insulation.

2. Slide the elbow connector onto the cable with a back-and-forth twisting motion. Wipe off all excess grease. See Figure TP 152–9 (Sheet 5).

3. Align elbow with compression lug's threaded hole. See Figure TP 152–9 (Sheet 5).

4. Thread probe into lug by hand, taking care not to cross-thread. Tighten with wrench until wrench bends. See Figure TP 152–16 (Sheet 9).

Figure TP 152–16: Threading of Probe into Lug for ELR Elbow Assembly



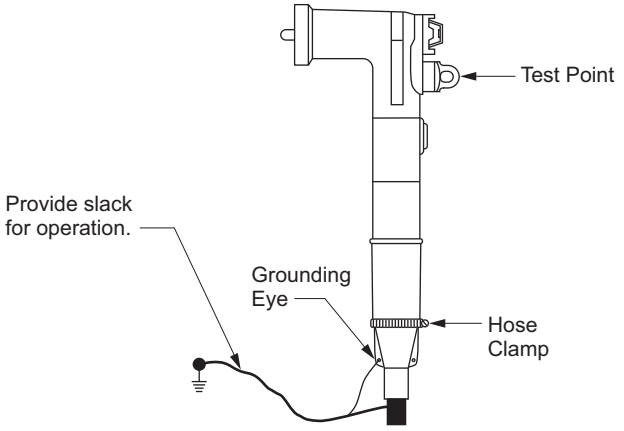
E. Concentric Neutral Connection

1. Insert one end of a No. 14 AWG (2.5mm) copper wire or equivalent through the grounding eye on the elbow. Twist tight, taking care not to damage the eye. See Figure TP 152–17 (Sheet 10).

2. Twist neutral wires, and connect to ground using appropriate connector. Provide adequate slack in wires for elbow operation. See Figure TP 152–17 (Sheet 10).

3. Add hose clamp as shown. Tighten snugly. Do not overtighten. See Figure TP 152–17 (Sheet 10).

Figure TP 152–17: Concentric Neutral Connection



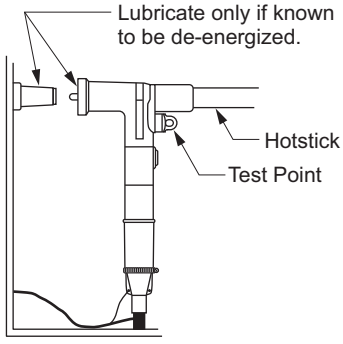
CAUTION Failure could occur if the components are not properly bonded and grounded.

F. Connect Elbow and Bushing Plug

1. Lubricate the receptacle portion of the elbow connector and the mating bushing with the lubricant supplied. LUBRICATE ONLY IF THE EQUIPMENT AND ELBOW ARE KNOWN TO BE DE-ENERGIZED. See Figure TP 152–18 (Sheet 10).

2. Operate per operations guidelines. DO NOT OPERATE BY HAND. See Figure TP 152–18 (Sheet 10).

Figure TP 152–18: Connecting 15 kV RLR Elbow to Bushing Plug



TP 155 Load-Break Elbow Insulating Plug — Installation

Scope TP 155.1 Application and Installation of Load-Break Elbow Insulating Plug

1.0 Application

The insulating plug (SAP 10118024), applicable for use on 15 and 25 kV Load-Break Elbows for #2 and 1/0 cable sizes, is used to insulate and seal the cable end of a load-break elbow receptacle. The elbow may then be used as a dead end receptacle with test point.

NOTE

200A Load Break Insulating Plugs shall not be installed in locations that require grounding accessories above 9,000 A.

Figure TP 155–1: Load-Break Elbow Insulating Plug — Installation

2.0 Instructions

1. Remove protective caps from elbow. Lightly lubricate surface of plastic insulating plug with silicone grease supplied or silicone grease (SAP 10154115). Do not substitute. Keep plug surface clean at all times.
2. Slide plug into elbow until it cannot advance any further. Flat contact area must face bushing.

CAUTION Hand tighten only, do not use wrench. Snug tighten only, otherwise the thread of the plastic plug will strip.

3. Insert threaded end of male pin contact and tighten. Caution: Hand tighten only, do not use wrench. Snug tighten only, otherwise the thread of the plastic plug will strip.
4. Lubricate both bushing and elbow receptacle with the silicone grease supplied or silicone grease (SAP 10154115).

TP 160 16 kV Load-Break Bushing Insert — Installation

Scope TP 160.1 Application and Installation of 25 kV Class Load-Break Bushing Insert

1.0 Application

Consult Distribution Design Standards for approved applications.

Load-break bushing insert provides the apparatus interface for load-break elbow connectors. Install or remove only when the apparatus is deenergized. Do not use on systems above 16 kV.

Table TP 160–1: 25 kV Class Load-Break Bushing Insert

SAP	kV Class	Bushing Insert Color
10117355	25	Blue

NOTE

The latest version of the 25 kV Class bushing inserts are supplied in a solid blue color. Older versions of this bushing insert may have a red, yellow, or gray color-band on the bushing insert surface that mates to the load break elbow. Some older units may not have color-bands. Be sure to use the correct voltage load break bushing insert.

2.0 Instructions

2.1 Inspect the apparatus bushing well, see Figure TP 160–1.1 (Sheet 1), to ensure it is dry and free from all contaminants. Remove the protective shipping cap from the bushing insert.

CAUTION

Shipping cap is not an insulating device.

Lubricate the bushing well interface area of the bushing insert with the silicone grease supplied or silicone grease SAP 10154115. **Do not substitute any other grease.**

CAUTION

Damage may occur to bushing insert if a grease other than those specified is used.

Figure TP 160–1: Installation of 25 kV Class Load-Break Bushing Insert

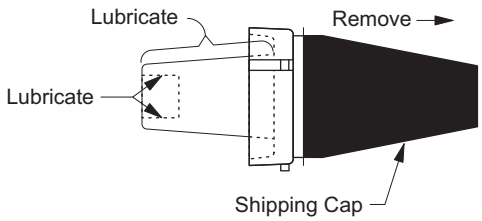


Figure TP 160–1.1

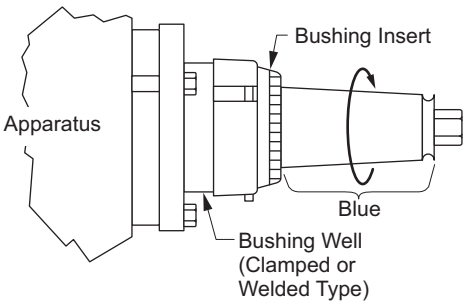


Figure TP 160–1.2

2.2 Place the lubricated portion of the bushing insert in the apparatus bushing well. See Figure TP 160–1.2 (Sheet 1). Hand tighten the bushing insert in a clockwise direction until it bottoms or use Load-break

Bushing Tool - Hand Operable (SAP 10147548) or Load-break Bushing Tool - Hot Stick Operable (SAP 10147305) to achieve proper torque (100 to 120 inch-pounds).

2.3 Installation of Bushing Insert Copper Bond Wire

CAUTION Failure could occur if the components are not properly bonded and grounded.

A. Switch Application

Connect one end of copper wire, #14 AWG (SAP 10109303), to the equipment ground for BURD switches (See Figure 160-1.3), or to the equipment ground tab either just above or below the bushing well for PME switches (See Figures 160-1.4 and 160-1.5). Push the free end of the copper wire through one of the grounding tabs on the bushing insert. Make a small loop and twist right, taking care not to damage the grounding tab.

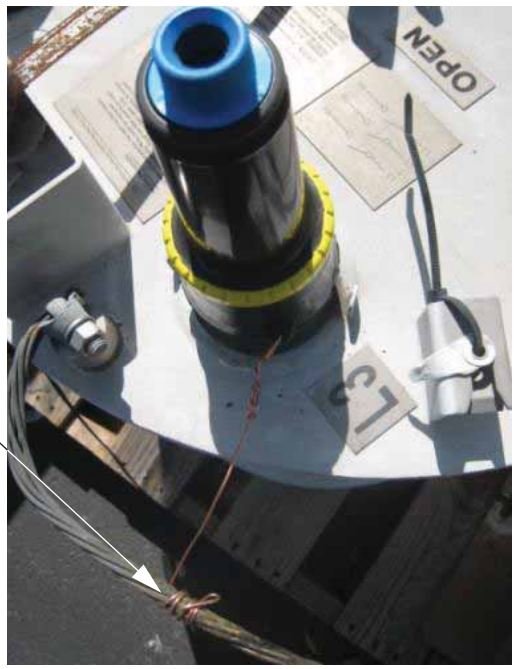


Figure TP 160–1.3: Bond Wire on BURD Switch

Load Break Bushing Insert Bond Wire Attachment (SAP 10109303)

Figure TP 160–1.4: Bond Wire on PME Switch

Figure TP 160–1.5: Bond Wire on PME Switch

B. Transformer Applications

Connect one end of copper wire, #14 AWG, to the bushing well frame (see Firgure 160-1.6), or to the equipment ground (See Figure 160-1.7). Push the free end of the copper wire through one of the grounding tabs on the bushing insert. make a small loop and twist tight, taking care not to damage the grounding tab.

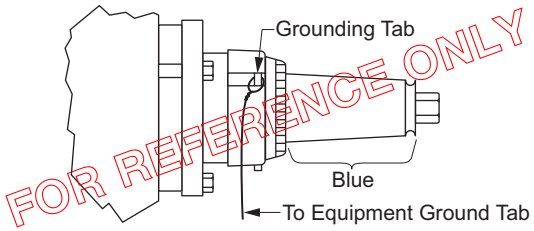
Bushing Well Frame

Load Break Bushing Insert Bond Wire Attachment (SAP 10109303)

Figure TP 160–1.6: Bond Wire on Transformer Bushing Well Frame (Shown with Shipping Cap; Remove before Energizing)

Figure TP 160–1.7: Bond Wire on Transformer Equipment Ground (Shown with Shipping Cap; Remove before Energizing)

2.4 Thoroughly wipe the bushing interface clean of any contaminants and lightly lubricate with the silicone grease supplied or silicone grease SAP 10154115. See Figure TP 160–1.1 (Sheet 1). **Do not substitute any other grease.**



FOR REFERENCE ONLY

Figure TP 160–1.8

NOTE

Using too much grease can cause the mating component to pop back off.

The insert is ready to accept a mating product such as an elbow connector, an insulated cap, or a grounding elbow. See operations manual for instructions to operate any of the above mating components.

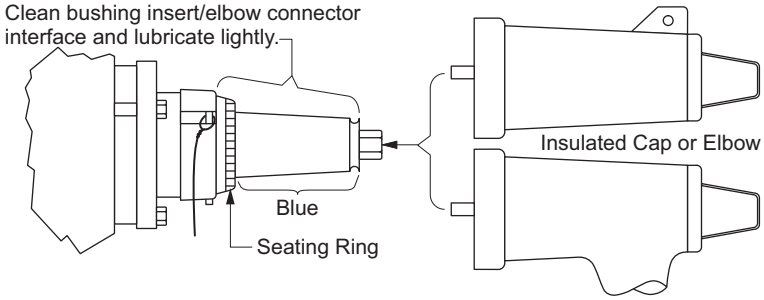


Figure TP 160–1.9

25 kV Blue Interface Shield

Figure TP 160–1.10

TP 161 16 kV Load-Break Elbow Installation

Scope TP 161.1 Application and Installation of 25 kV Class Load-Break Elbow

1.0 Application of Load-Break Elbow

Consult Distribution Design Standards (DDS) for approved applications. Use on 9.4 kV and 16 kV.

Table TP 161–1: 25 kV Class Load-Break Elbow

SAP Number	Description
10117359	Load-break elbow for #2 CLP Cable
10117358	Load-break elbow for 1/0 CLP Cable
10117362	Replacement 200A contact probe for #2 or 1/0 load-break elbow

Note(s):
1. Replacement cap for capacitive test point SAP 10203052.

= For Reference Only

2.0 Instructions to Install Load-Break Elbow

For Jacketed Concentric Neutral (JCN) cable, follow Steps 2.1 to 2.13; if nonjacketed CN cable skip Steps 2.2 to 2.4.

2.1 Train the cable so that it is located in the final assembled position. This will provide adequate clearance for disconnecting elbow connectors and placement on operating accessories such as insulating bushings or feed-through devices. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising of the cable seat.

2.2 Mark the jacket approximately where the desired end cut will be. Be sure to allow enough extra concentric neutral wires to connect ground after installation, with slack for operation.

2.3 Remove 27 inches of the cable's concentric neutral jacket, measuring from the cut end mark. See Figure TP 161–1.1 (Sheet 1).

Figure TP 161–1: Installation of 25 kV Class Load-Break Elbow

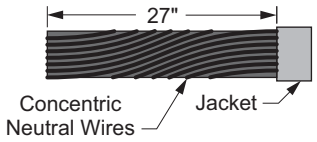


Figure TP 161–1.1

2.4 Seal the concentric neutral jacket from moisture intrusion following the jacket sealing procedure described in IC 230.

2.5 Measure 15 inches from the center of the load-break bushing insert. For unjacketed cable, bind concentric neutral wires with tape. Unwrap wires to this point. Cut the cable 3/4 inch short from the centerline of bushing. See Figure TP 161–1.2 (Sheet 2) and Figure TP 161–1.3 (Sheet 2).

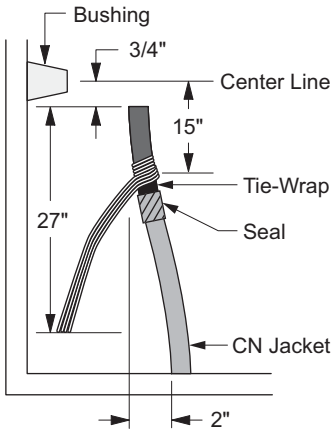
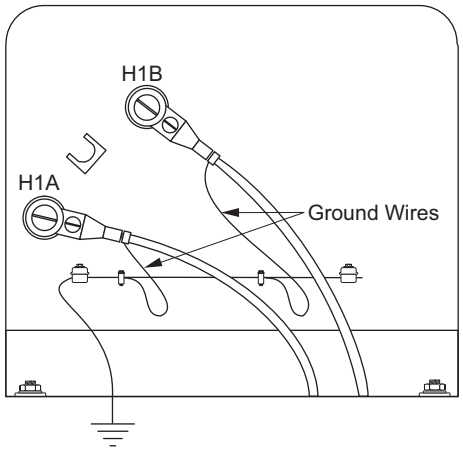


Figure TP 161–1.2



Typical 1Ø Mini Pad-mount Transformer
Frontview

Figure TP 161–1.3

Note(s):
1. Leave enough concentric neutral wires to allow load-break elbow to be easily installed on and removed from bushing.
2. For feed-through circuits, concentric neutral wires from each elbow should be crimped together, then tied to ground, to prevent neutral being opened during transformer replacement.

2.6 Remove semiconducting insulation shield and cable insulation (Dimension “A”) from the cable end. **Cut squarely. Do not taper.** See Figure TP 161–1.4 (Sheet 3). Remove any ridge from the leading edge of the insulation.

Dimension “A” (in)	
Elastimold	2-1/8
Cooper/RTE	2-1/8

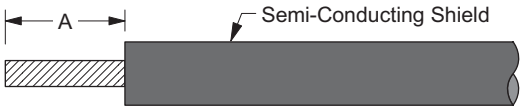


Figure TP 161–1.4

2.7 Wire brush bare aluminum conductors and immediately insert in conductor contact containing inhibitor. Before crimping, position conductor contact on prepared conductor so the flat contact area faces the bushing insert. Also, cable should be trained into final position so that cable movement will not affect the connection. Crimp the contact barrel as close to the cable insulation as possible. See Figure TP 161–1.5 (Sheet 3). Select the proper die and number of crimps in accordance with the die chart shown in DUG JJ 700, Table JJ 700–6 (Sheet 6). Wipe off excess inhibitor.

Note: If oxide inhibitor is not visually detected when the compression connector (called crimp terminals, crimp connectors, or spade terminals) is pushed onto the bare conductor, SCE approved oxide inhibitor should be applied to the bare conductor in the field, prior to crimping.

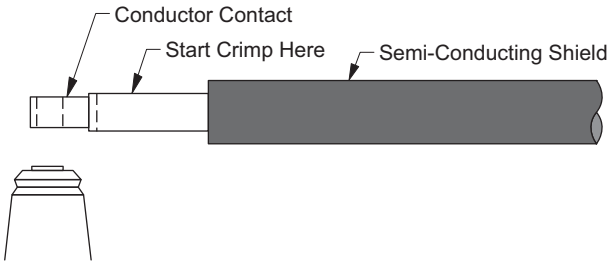


Figure TP 161–1.5

2.8 Remove the semiconducting insulation shield to a point 6-7/8 inches back from the end of the contact with a straight smooth “squared” cut. Do not cut or nick the insulation. Mark the semicon shield with a wrap of tape 1 inch back from the cut end of the jacket. Bevel insulation end 1/8 inch max. Thoroughly clean the insulation to remove all traces of conductive residue. This may be done by wiping the insulation with a rag dampened with an approved solvent. Always wipe towards the semiconducting insulation shield. See Figure TP 161–1.6 (Sheet 3).

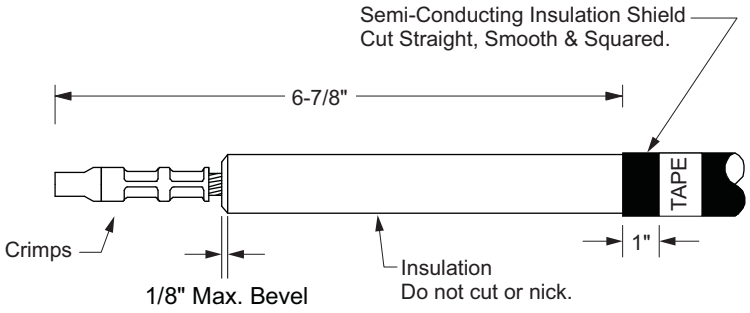


Figure TP 161–1.6

2.9 Lubricate the cable insulation and inside of the elbow connector housing, see Figure TP 161–1.7 (Sheet 4), with the silicone grease supplied or silicone grease SAP 10154115. **Do not substitute any other grease.**

2.10 Slide the elbow onto the cable with a back and forth twisting motion until it cannot advance any further. Rotate the elbow until it is aligned with the conductor contact. See Figure TP 161–1.7 (Sheet 4). The cable entrance should be approximately flush with the marker tape when connector is positioned correctly. Rotate the connector until it is aligned with the apparatus bushing. Remove the marker tape.

NOTE

Damage may occur to cable insulation and elbow housing if grease other than those specified is used. Keep elbow and cable insulation clean.

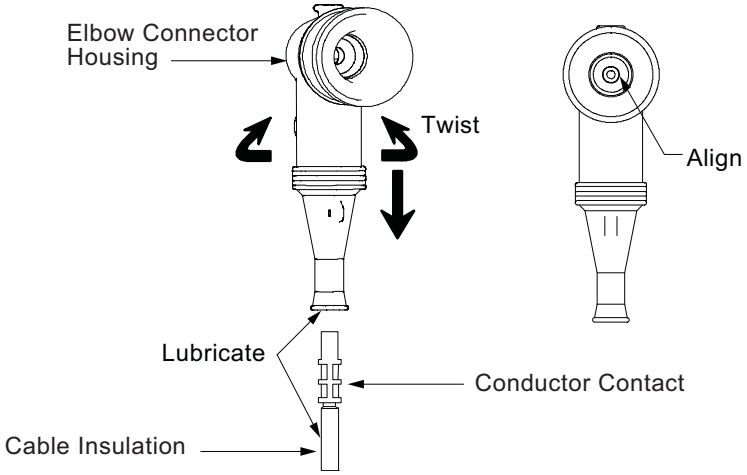


Figure TP 161–1.7

2.11 Insert the threaded end of the male contact (probe) into the receptacle end of the elbow and engage the probe threads with the conductor contact threads, making sure that the threads are properly aligned. Eight to nine half-turns of the probe can be made before it becomes snug in the conductor contact. See Figure TP 161–1.8 (Sheet 5).

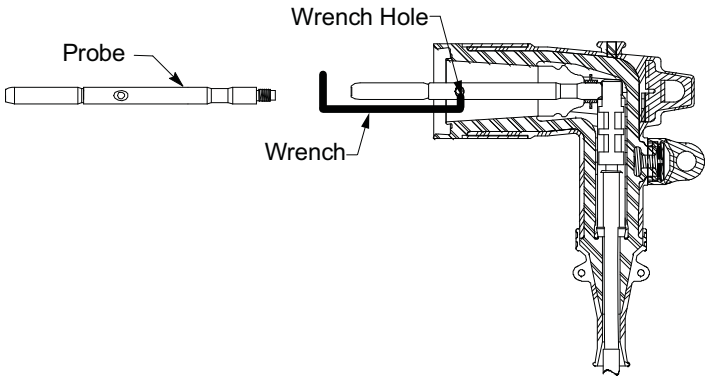


Figure TP 161–1.8

CAUTION If great resistance is encountered in the first half-turn to one and one-half turns, do not force. Remove probe and check threads for possible stripping. If threads are good, reinsert and engage threads, making sure that they are properly aligned. If threads are stripped, the conductor contact and probe must be replaced.

2.12 Take the probe wrench, insert the short end of the wrench into the hole in the probe. See Figure TP 161–1.8 (Sheet 5). Tighten until the wrench bends about 180 degrees (approximately 110 inch-pounds). Or, a Load-Break Elbow Probe Tool - Hot Stick Operable (SAP 10147302) may be used to tighten the probe. Both tools have a preset torque handle that provides the proper torque.

CAUTION Make sure that the new 25 kV-class probe is the correct length. 25 kV-class probes are about 2.5 inches longer than 5-inch 15 kV-class probes.

2.13 Connect one strand of concentric wires to grounding eye (Figure TP 161–1.9 [Sheet 6]) and connect remaining concentric wires to ground as required.

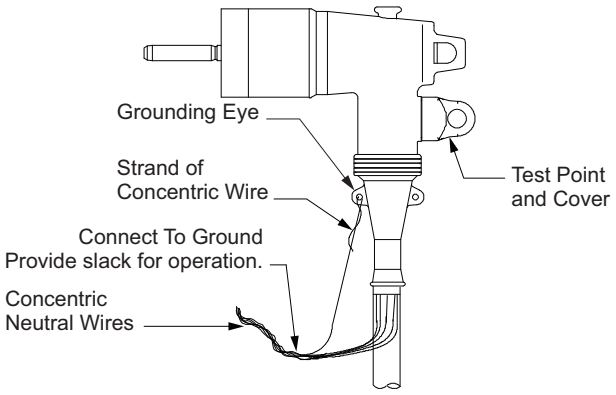


Figure TP 161–1.9

CAUTION Failure could occur if the components are not properly bonded and grounded.

2.14 Remove test point cover and lubricate the inner surface of the cover and test point with silicone grease supplied or silicone grease SAP 10154115. See Figure TP 161–1.9 (Sheet 6). Do not lubricate plastic test point. Replace cover onto test point assembly. When removing test point cover, pull off at an angle rather than directly in line with the test point assembly.

2.15 **CONFIRM THE APPARATUS AND ELBOW ARE DE-ENERGIZED.** Lightly lubricate the receptacle portion of the elbow connector with silicone grease supplied or silicone grease SAP 10154115. Also, lightly lubricate the mating bushing only with apparatus deenergized. Place elbow on the bushing insert using the pulling or operating eye portion of the elbow. See Figure TP 161–1.10 (Sheet 6).

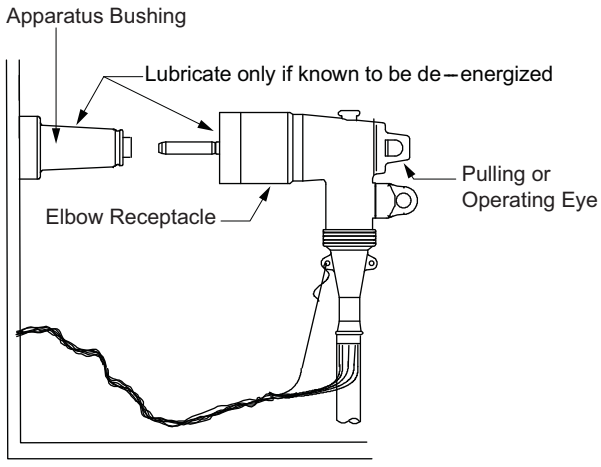


Figure TP 161–1.10

2.16 Place elbow on the bushing insert with a hot stick tool only. See Figure TP 161–1.11 (Sheet 7). Pulling or pushing on the housing and crimp terminal area of the elbow will cause misalignment of the probe in the elbow. **DO NOT OPERATE BY HAND.**

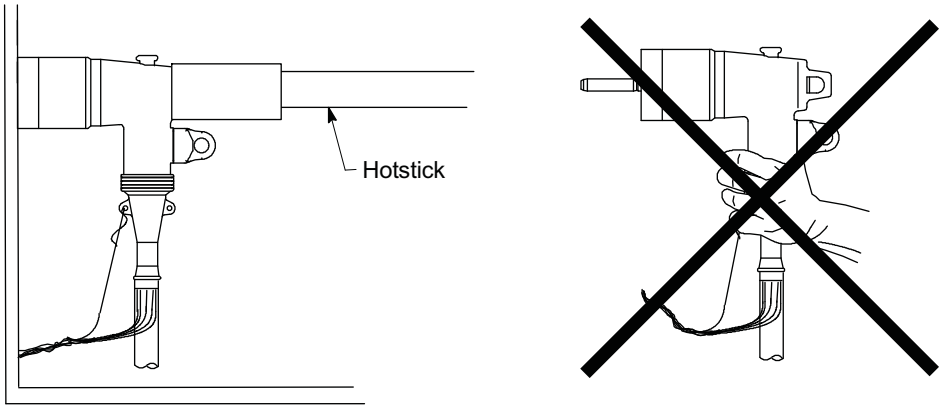


Figure TP 161–1.11

Note(s):
1. Bails are not used with load-break elbows.
2. Using too much grease can cause the elbow to pop back off.

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TP 162 16 kV Load-Break Repair and Replacement Elbows Installation

Scope TP 162.1 Application and Installation of 25 kV Class Load-Break Repair and Replacement Elbows

1.0 Application of Load-Break Repair (ELR) and Replacement (RLR) Elbows

This standard is for use on 16 kV systems. Standard elbows shall be used whenever possible. ELR and RLR elbows shall only be used if standard elbows cannot be used. ELR and RLR elbows are not to be used for general elbow replacement.

The ELR type elbows provide an additional elbow length of approximately 3 inches, and the RLR type elbows provide an additional elbow length of approximately 10 inches. ELR and RLR elbows may be used as follows:

- ELR Elbows: Use for replacing damaged or blown standard load-break elbows.
- RLR Elbows: Use when a longer length elbow is required such as when live-front equipment is replaced with dead-front equipment (for example, PME switches or minipad transformers).

Table TP 162–1: 25 kV Class Load-Break Repair and Replacement Elbows

SAP Number	Description
10117584	Repair load-break elbow (ELR type), #2 CLP cable
10117583	Repair load-break elbow (ELR type), 1/0 CLP cable
10117582	Replacement load-break elbow (RLR type), #2 CLP cable
10117581	Replacement load-break elbow (RLR type), #1/0 CLP cable

Note(s):
1. Replacement cap for capacitive test point SAP 10203052.

= For Reference Only

2.0 Instructions on Installing 25 kV Class Load-Break ELR Elbows

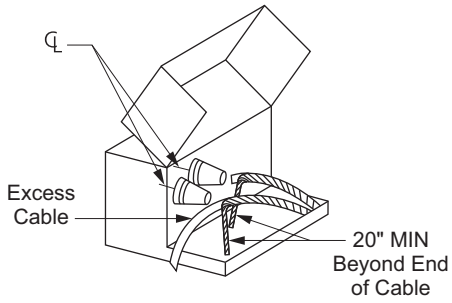
For elbow housing replacement without changing the compression lug, skip to Paragraph 2.2.

2.1 For new installation and total replacement of elbow housing and compression lug, complete the following:

A. Cable Training

1. Train the cable so that it is located in the final assembled position. This will provide adequate clearance for disconnecting elbow connectors and placement on operating accessories such as insulating bushings or feed-through devices. Cable should extend straight out of the elbow at least 6 inches before starting a bend to prevent distortion of the elbow and compromising of the cable seat. See Figure TP 162–1 (Sheet 2).

Figure TP 162–1: Cable Training Example



2. For new installations, cut excess cable squarely at center line of bushing.

3. For replacements:

    1. Using pin wrench, remove probe from elbow and discard probe. See Figure TP 162–2 [Sheet 2].

    2. With a twisting motion, pull the elbow off the cable.

    3. Cut off old compression lug as shown below in Figure TP 162–3 (Sheet 2).

Figure TP 162–2: Removal of Probe from Elbow

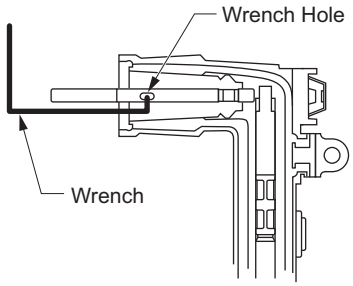
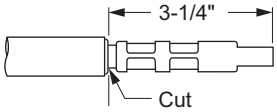


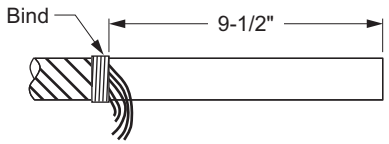
Figure TP 162–3: Cutting Off Old Compression Lug



B. Cable Preparation

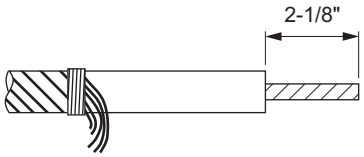
1. Unwrap and bind concentric neutral wires 9-1/2 inches back from end of cable as shown below in Figure TP 162–4 (Sheet 3).

Figure TP 162–4: Cutting Back of Concentric Neutral Wires



2. Remove shield and insulation from the cable end. Cut squarely, taking care not to nick the conductor. See Figure TP 162–5 (Sheet 3) below.

Figure TP 162–5: Removal of Shield and Insulation from Cable End

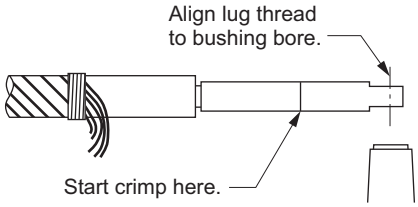


3. Wire brush bare aluminum conductors and immediately install compression lug. Rotate to spread inhibitor.

   Position compression lug so the CONTACT THREADED HOLE ALIGNS WITH THE BUSHING BORE. See Figure TP 162–6 (Sheet 3) below. Refer to crimp chart packaged with compression lug for recommended crimp tool information.

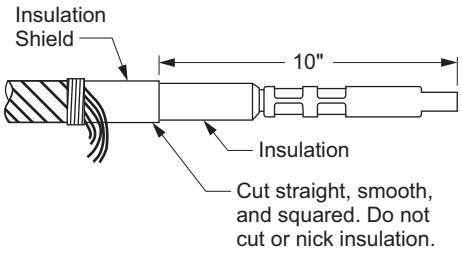
   Start crimp at the crimp line mark. Rotate 180 degrees each successive crimp. Carefully wire excessive inhibitor from the outside of the lug and cable.

Figure TP 162–6: Start of Crimp and Alignment with Bushing Bore



4. Remove insulation shield as shown in Figure TP 162–7 (Sheet 3).

Figure TP 162–7: Insulation Shield to Lug Dimension



5. Thoroughly clean insulation to remove all traces of conductive residue.

C. Proceed to Paragraph 2.3.

2.2 For elbow housing replacement without changing the compression lug, complete the following:

A. Remove elbow.

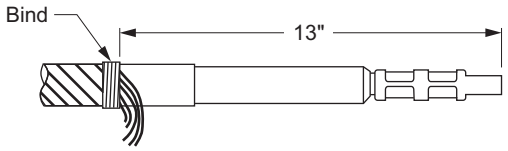
1. Using pin wrench, remove probe from elbow and discard probe. See Figure TP 162–2 (Sheet 2).

2. With a twisting motion, pull the elbow off the cable.

B. Prepare Cables.

1. Unwrap and bind concentric neutral wires 13 inches back from end of connector as seen in Figure TP 162–8 (Sheet 4).

Figure TP 162–8: Unwrapping and Binding Concentric Neutrals Back 13 Inches



2. Remove insulation shield as shown in Figure TP 162–8 (Sheet 4).

3. Bevel the insulation end 1/8 inch maximum as shown in Figure TP 162–7 (Sheet 3).

4. Thoroughly clean insulation to remove all traces of conductive residue.

C. Proceed to Paragraph 2.3.

2.3 Elbow Assembly

A. Lubricate the cable insulation and inside the elbow housing with the lubricant supplied. DO NOT SUBSTITUTE. See Figure TP 162–9 (Sheet 5). Other lubricants may be harmful to this product or its mating product(s). Keep insulation clean of dirt and grime.

B. Slide the elbow connector onto the cable with a back-and-forth twisting motion. Wipe off all excess grease. See Figure TP 162–9 (Sheet 5).

C. Align elbow with the compression lug's threaded hole. See Figure TP 162–9 (Sheet 5).

D. Thread probe into lug by hand, taking care not to cross-thread. Tighten with wrench until wrench bends. See Figure TP 162–10 (Sheet 5).

Figure TP 162–9: Lubrication and Alignment for Elbow Assembly

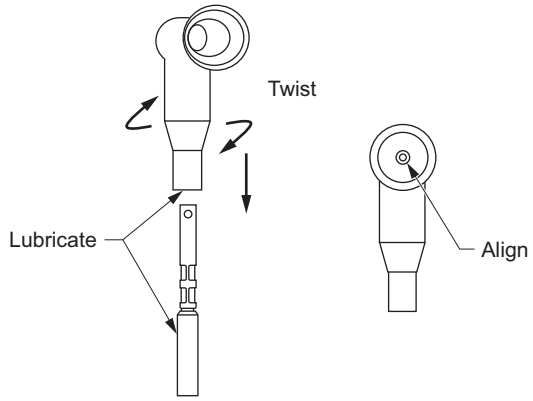
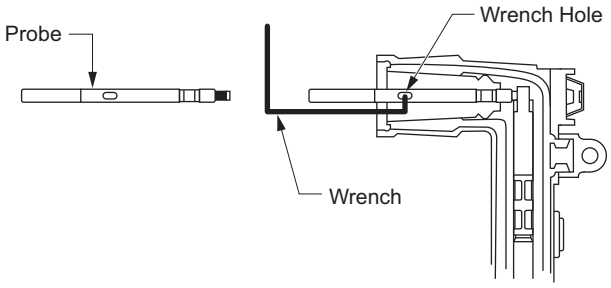


Figure TP 162–10: Threading of Probe into Lug for ELR Elbow Assembly

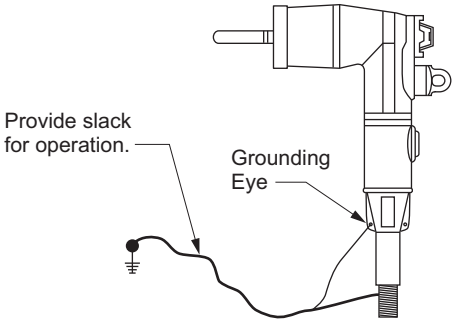


2.4 Concentric Neutral Connection

A. Insert one end of a No. 14 AWG (2.5 mm) copper wire, or equivalent, through the grounding eye on the elbow. See Figure TP 162–11 (Sheet 6). Twist the wire tight, taking care not to damage the eye.

B. Twist neutral wires with wire from the grounding eye and connect to ground using appropriate connector. Provide adequate slack in wires for elbow operation.

Figure TP 162–11: Inserting Wire through Grounding Eye

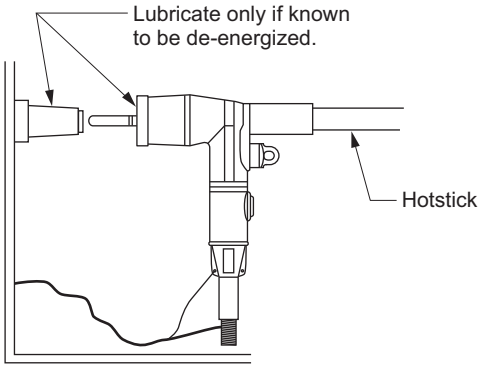


CAUTION Failure could occur if the components are not properly bonded and grounded.

2.5 Connect Elbow and Bushing Plug

A. Lubricate the receptacle portion of the elbow connector and the mating bushing with the lubricant supplied. LUBRICATE ONLY IF THE EQUIPMENT AND ELBOW ARE KNOWN TO BE DE-ENERGIZED. See Figure TP 162–12 (Sheet 6).

Figure TP 162–12: Connecting 25 kV ELR Elbow to Bushing Plug



B. Operate per operations guidelines. DO NOT OPERATE BY HAND.

3.0 Instructions on Installing 25 kV Load-Break RLR Elbows

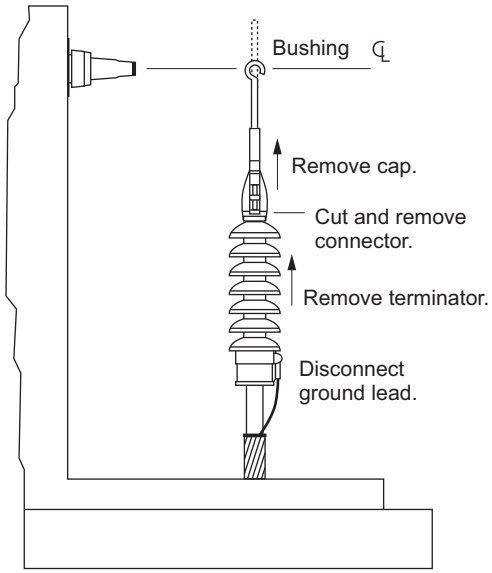
3.1 New Installation of Replacement Elbow Housing and Compression Lug

WARNING All apparatus must be de-energized during installation or removal of part(s).

A. Live-Front Removal

1. Remove the rubber cap (if Elastimold) from the terminator. See Figure TP 162–13 (Sheet 7).
2. Cut off connector at the top of the terminator.
3. Disconnect ground lead from the base of the terminator.
4. Remove the terminator housing from the cable.

Figure TP 162–13: Live-Front Removal



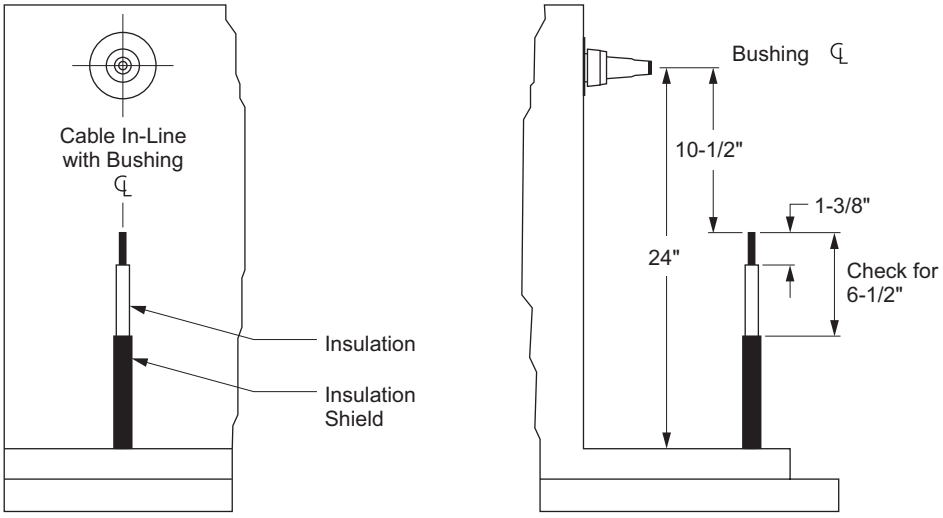
B. Cable Preparation

1. Train the cables to be straight and in-line with bushing centerline. See Figure TP 162–14 (Sheet 8).
2. The end of the cable MUST measure 10-1/2 inches from the bushing centerline. Cut the cable to 10-1/2 inches. See Figure TP 162–14 (Sheet 8).

3. Check the distance from the end of the cut cable to the insulation shield. If the insulation shield measures less than 6-1/2 inches, proceed to Step 3.

4. Remove cable insulation 1-3/8 inches from the end of the cable; cut squarely. DO NOT NICK THE CONDUCTOR.

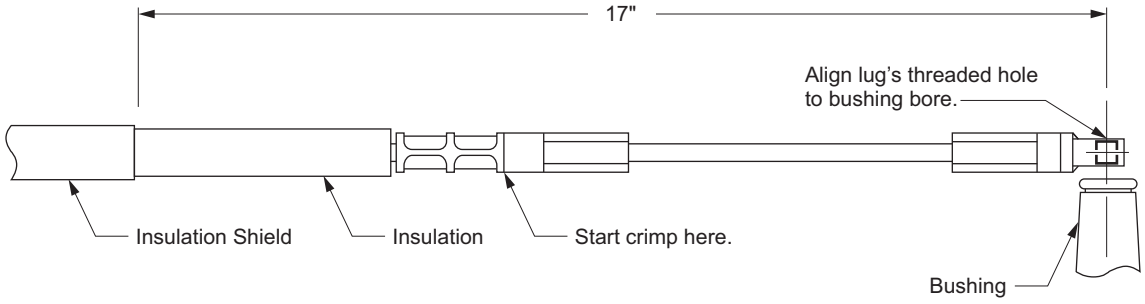
Figure TP 162–14: Cable Preparation



C. Wire brush bare aluminum conductor and immediately install compression lug. Rotate to spread inhibitor. Position the compression lug so the contact threaded hole aligns with the bushing bore. (Refer to crimp chart packaged with compression lug for recommended crimp information). See Figure TP 162–15 (Sheet 8).

Start crimp at the crimp line mark. Rotate 180 degrees each successive crimp. Carefully wipe excessive inhibitor from the outside of the lug and cable. See Figure TP 162–15 (Sheet 8).

Figure TP 162–15: Crimping of Conductor



D. Elbow Assembly

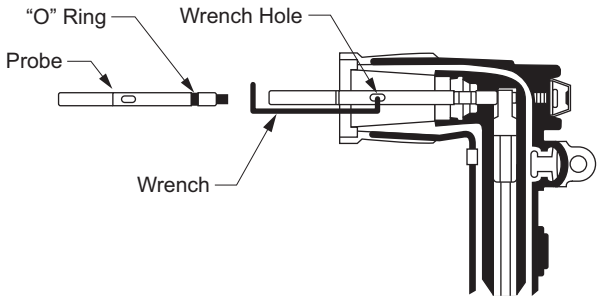
1. Lubricate the cable insulation and inside the elbow housing with the lubricant supplied. DO NOT SUBSTITUTE. Other lubricants may be harmful to this product or its mating product(s). Keep insulation clean of dirt and grime. Do not use excess grease and do not introduce any grease into the gap between the lug and the insulation.

2. Slide the elbow connector onto the cable with a back and forth twisting motion. Wipe off all excess grease. See Figure TP 162–9 (Sheet 5).

3. Align elbow with the compression lug's threaded hole. See Figure TP 162–9 (Sheet 5).

4. Thread probe into lug by hand, taking care not to cross-thread. Tighten with wrench until wrench bends. See Figure TP 162–16 (Sheet 9).

Figure TP 162–16: Threading of Probe into Lug for ELR Elbow Assembly



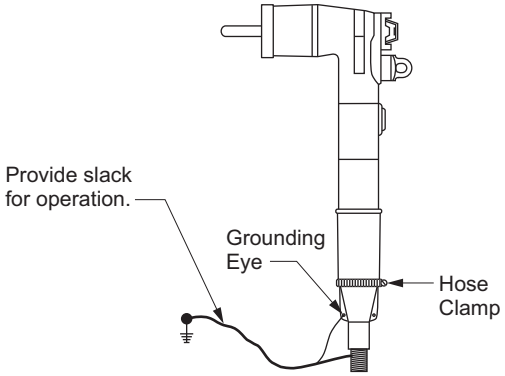
E. Concentric Neutral Connection

1. Insert one end of a No. 14 AWG (2.5 mm) copper wire or equivalent through the grounding eye on the elbow. Twist tight, taking care not to damage the eye. See Figure TP 162–17 (Sheet 10).

2. Twist neutral wires and connect to ground using appropriate connector. Provide adequate slack in wires for elbow operation. See Figure TP 162–17 (Sheet 10).

3. Add hose clamp as shown. Tighten snugly. Do not overtighten. See Figure TP 162–17 (Sheet 10).

Figure TP 162–17: Concentric Neutral Connection



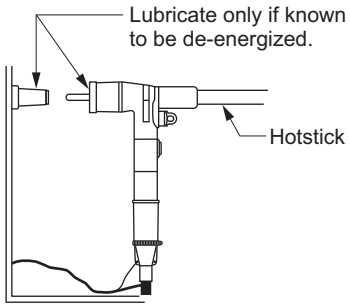
CAUTION Failure could occur if the components are not properly bonded and grounded.

F. Connecting Elbow and Bushing Plug

1. Lubricate the receptacle portion of the elbow connector and the mating bushing with the lubricant supplied. LUBRICATE ONLY IF THE EQUIPMENT AND ELBOW ARE KNOWN TO BE DE-ENERGIZED. See Figure TP 162–18 (Sheet 11).

2. Operate per operations guidelines. DO NOT OPERATE BY HAND. See Figure TP 162–18 (Sheet 11).

Figure TP 162–18: Connect 25 kV RLR Elbow to Bushing Plug



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TP 200 Indoor Terminal — Stress Cone — 12/16 kV Poly

Scope TP 200.1 Indoor Taped Termination with Stress Cone for #2 — 220 mil — CLP Insulated Cable

1.0 Installation

1.1 Train cable into position and cut to desired length. Tie concentric wires back 18 inches with a cable tie.

1.2 Remove 1-1/2 inches of semiconducting jacket, cable insulation and semiconducting strand shielding. Remove 14 inches of semiconducting jacket as shown in Figure TP 200–1 (Sheet 2).

1.3 Pencil cable insulation approximately 2 inches with a pencilling tool. Remove all traces of semiconducting material from the surface of the exposed cable insulation.

1.4 Place a tape marker 1 inch back from the end of the semiconducting jacket. Lubricate exposed cable insulation and inside of stress cone with the silicone grease supplied in the kit. Slide the stress cone on to the cable until the black end of the cone coincides with the tape marker. Wipe excess grease from the cable.

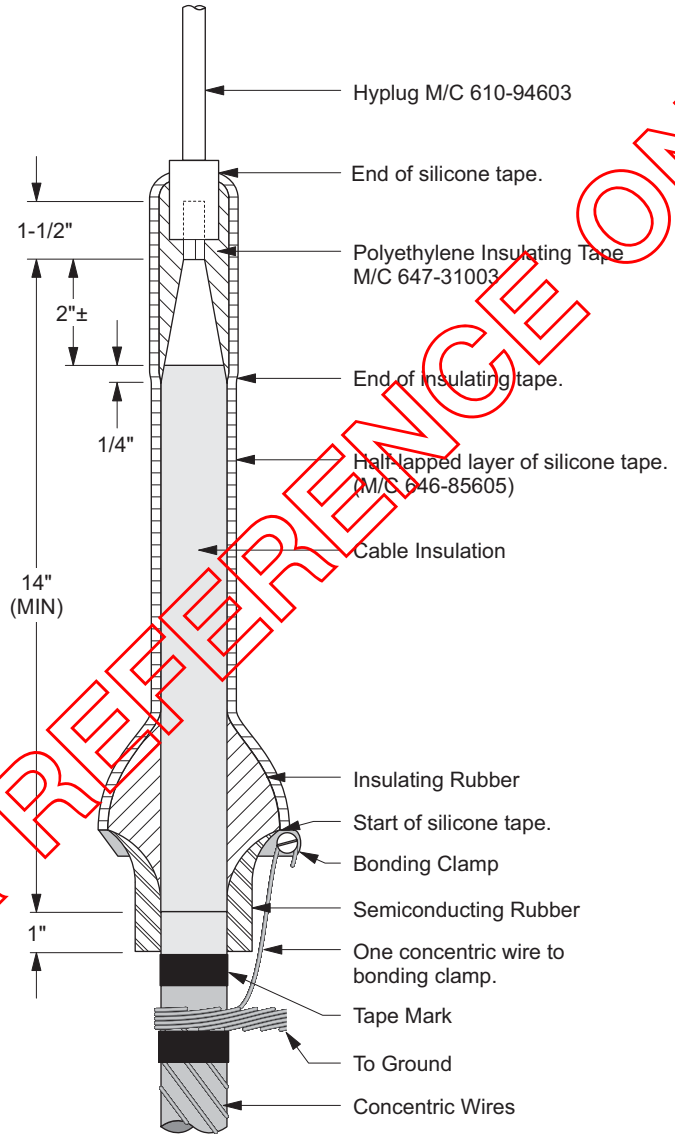
1.5 Clean exposed conductor with a wire brush. Crimp the hyplug on to the conductor using the W163 insert die in the Burndy MD6 compression tool. Apply 3 crimps.

1.6 Build up area around base of hyplug to cable diameter, using insulating tape. Apply one half-lapped layer of silicone tape starting at the high point of the stress cone and ending on the hyplug above the insulating tape.

1.7 Connect one strand of concentric wire to the bonding clamp as shown in Figure TP 200–1 (Sheet 2). Tie remaining concentric wires to ground. Remove the tape marker.

FOR REFERENCE ONLY

Figure TP 200–1: Indoor Taped Termination



FOR REFERENCE ONLY

TP 204 Outdoor Termination of Elastimold Molded Rubber — 12/16-kV

Scope TP 204.1 Installation of Elastimold Molded Rubber Outdoor Termination for Use on 1/C 12/16-kV CLP Insulated Aluminum Cables #2 M/C 650-00143, 1/0 M/C 650-00135

1.0 Instructions

1.1 Train, measure, and cut cable to the desired length. Prepare cable to dimensions shown in Figure TP 204–1.1 (Sheet 1).

1.2 Place a marker tape one inch below the end of the semiconducting jacket. See Figure TP 204–1.1 (Sheet 1). Wrap a layer of vinyl tape around the end of the conductor strands to prevent damage to the inside of the termination. See Figure TP 204–1.2 (Sheet 1).

1.3 Lubricate cable insulation and inside base of termination with the silicone grease provided, or silicone grease M/C 904-00615. **Do not substitute any other grease.**

1.4 Slide the termination housing down on the cable using a spiral motion until the base of the terminator is aligned with the marker tape. See Figure TP 204–1.2 (Sheet 1). The top of the terminator must be flush with the cable insulation.

1.5 Remove the wrap of tape from the conductor. Wire brush the bare aluminum conductor. Place a flat washer over the bare conductor. Crimp the terminal holding the crimp barrel tightly against the washer. Use the MD-6 compression tool and the BG groove. Install three crimps and rotate them 120 degrees. Wipe off excess inhibitor. See Figure TP 204–1.3 (Sheet 1).

1.6 If, after crimping, the terminal is not tight against the plain washer, slide the slotted washers between the plain washer and the compression terminal until the gap is filled. See Figure TP 204–1.4 (Sheet 1).

Figure TP 204–1: Installation of Elastimold Molded Rubber Outdoor Termination

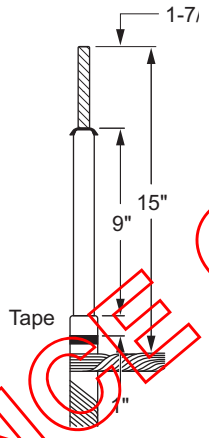


Figure TP 204–1.1

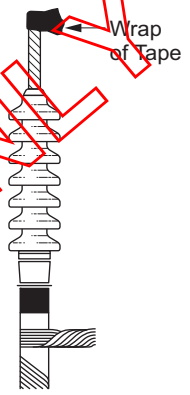


Figure TP 204–1.2

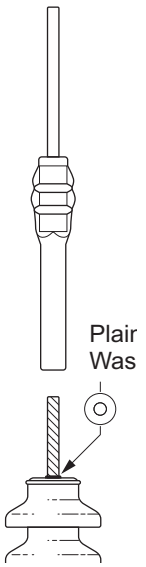


Figure TP 204–1.3

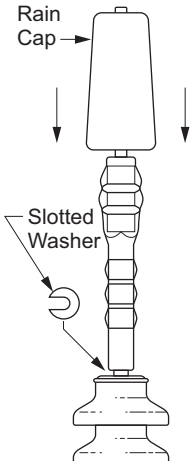


Figure TP 204–1.4

FOR REFERENCE ONLY

1.7 Lubricate inside of rain cap and outside of terminal with the silicone grease provided. Slide the ram cap down until it is fully seated and locked on the termination housing. See Figure TP 204–1.4 (Sheet 1). Ensure that the groove in the bottom of the cap snaps into place over the matching ring on top of the terminator housing. Remove the marker tape.

1.8 NOTE: Pin terminal and cable-support bracket are supplied with termination kit. For pole mounting, use crossarm bracket M/C 076-00016

1.9 Bolt the termination support bracket to the crossarm bracket. See Figure TP 204–1.5 (Sheet 2).

1.10 Open mounting strap, slip over cable, and slide over lower step of termination onto the black base of the terminator. See Figure TP 204–1.6 (Sheet 2). Squeeze the mounting strap tabs together, then slide the termination and strap into the locking slot of the terminator support bracket until it locks into the final position. See Figure TP 204–1.7 (Sheet 2).

1.11 Connect concentric wires to ground on crossarm bracket. Attach overhead tap to termination using appropriate connector.

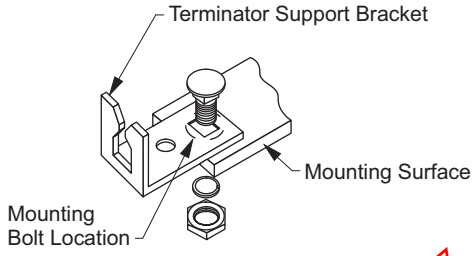


Figure TP 204–1.5

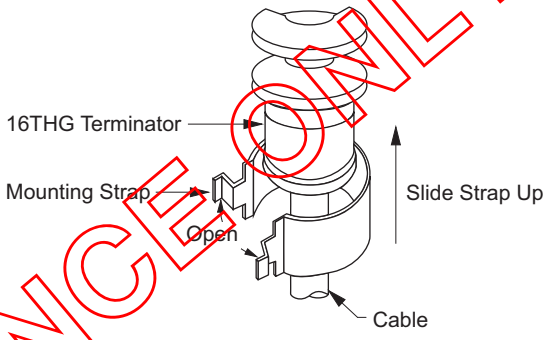


Figure TP 204–1.6

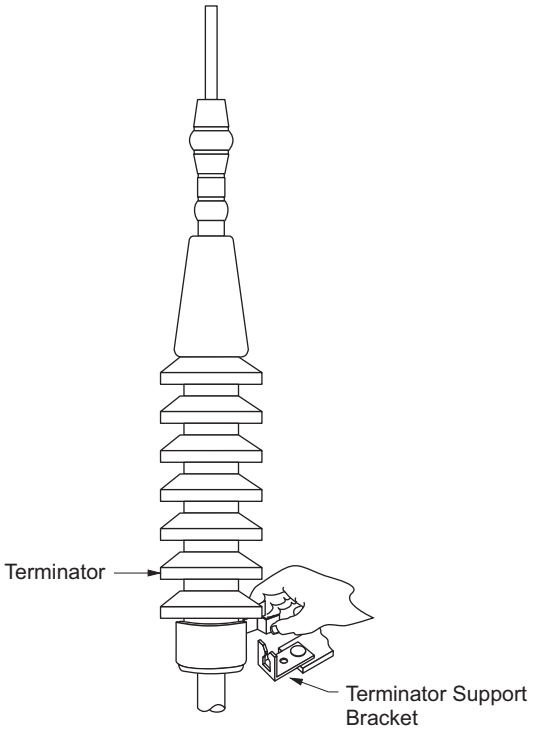


Figure TP 204–1.7

FOR REFERENCE ONLY

TP 205 Raychem Indoor/Outdoor Heat Shrink Terminal — 5 kV, 12 kV, 16 kV, and 34.5 kV — Poly

Scope TP 205.1 Installation of Indoor/Outdoor Heat Shrink Terminations for Use on 1/C 5 kV, 12 kV, 16 kV, and 34.5 kV CLP Insulated Aluminum Cables (#4/0 – 1,500 kcmil)

Table TP 205–1: Raychem Indor/Outdoor Heat Shrink Termination Data

SAP Number	Cable Size	System Voltage	Dimension "A"
10117090	4/0	35 kV	32"
10117089	750		
10117089	1,500		
L = Length of compression portion of connector + 1/4 inch			

Bracket Cable Support	10067309
Bracket–X Arm	076-00016
Tywrap	10120916

Table TP 205–2: Pin Terminal (Long)

Hyplug–10"	
SAP Number	**Cable Size**
10112226	4/0
10112229	750
10112227	1,500

Table TP 205–3: Cable to Flat, Al Compression Lug

2-Hole NEMA	
SAP Number	**Cable Size**
10112332	4/0
10112335	700/750
10112239	1,500

Table TP 205–4: Circumferential-Type Compression Dies

Circumferential-Type Compression			
Conductor Aluminum Cable		Y-60 Die Set	UT-15 Die Set
4/0 AWG	Die No. SAP 10148902		15CA71R[1/]
750 kcmil	Die No. SAP 10148896		15C140R
1,500 kcmil	Die No. SAP 10148788	L46ART	

[1/] Will fit in UT-15 with Adapter Die – SAP 10148852

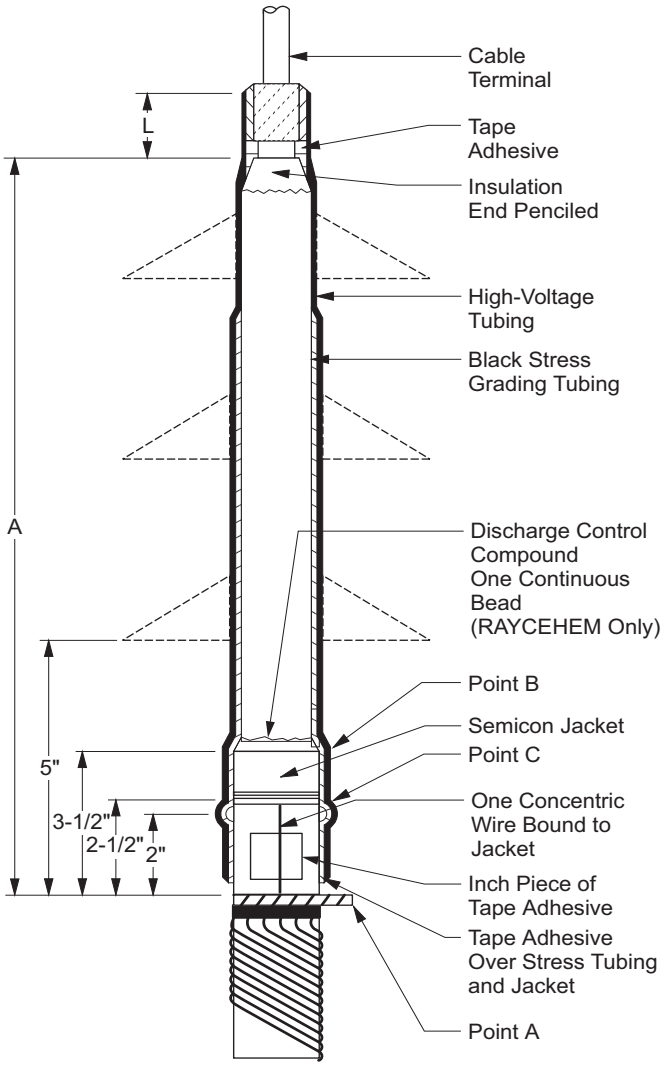
= For Reference Only

Table TP 205–5: Raychem Outdoor Heatshrink Termination Data

SAP Number	Cable Size	System Voltage	Dimension "A"
10117095	350	5 kV	8"
10117096	750		
10117093	350	12/16-kV	15"
10117092	750		
10117091	1,000		
L = Length of compression portion of connector + 1/4 inch			

= For Reference Only

Figure TP 205–1: Installation of Raychem Molded Rubber Outdoor Termination



1.0 Instructions

1.1 Train, measure, and cut cable to desired length. Wind one concentric wire around remainder of wires at point “A.” See Figure TP 205–1 (Sheet 2). Bend the remainder of the wires downward over the cable.

1.2 Remove cable insulation to dimension “L.” Remove semiconducting jacket to point “B” as shown in Figure TP 205–1 (Sheet 2).

1.3 Take one concentric wire upward and bind it around the semiconducting jacket, at point “C,” as shown in Figure TP 205–1 (Sheet 2). Using the proper tool and die, install the terminal. Pencil insulation to outside diameter of cable terminal barrel.

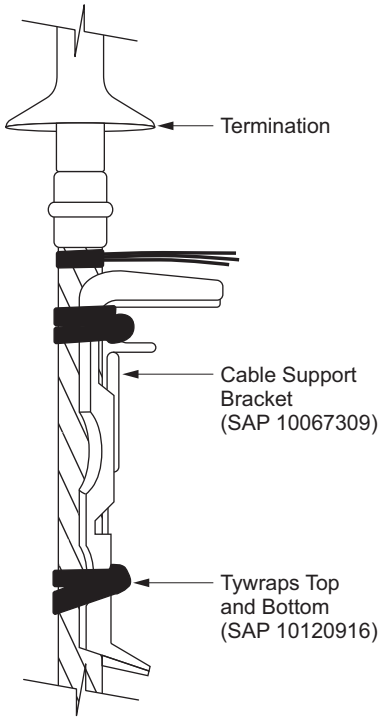


Figure TP 205–1.1

NOTE

For cable terminal connectors (hyplugs) and proper tool/die reference, see TP 205 (Sheet 1)

1.4 Cut tapered tip off Discharge Control Compound (DCC) tube. Squeeze bead of compound on insulation at the semiconductive jacket cutback. Make the bead continuous around the cable and at least as thick as the semiconductive jacket at point “B.”

1.5 Position black stress grading tubing at the 2-inch dimension. See Figure TP 205–1 (Sheet 2). Do not disturb bead of DCC compound when positioning tubing. Start shrinking at the concentric wire end of the tubing with a PROPANE torch and work toward cable terminal.

1.6 Clean semiconducting jacket and place a 1-inch length of tape adhesive, folded once, under concentric wire just below the grading tubing as shown in Figure TP 205–1 (Sheet 2).

1.7 Tape over bottom end of stress tubing and semiconducting jacket with tape adhesive to provide a 2-inch seal as shown in Figure TP 205–1 (Sheet 2).

1.8 Wrap tape adhesive over cable terminal barrel and 1/2 inch of cable insulation. Apply two layers of tape unless additional tape is required to build up irregularities in terminal barrel, as shown in Figure TP 205–1 (Sheet 2).

1.9 Position H.V. tubing over adhesive on cable and semiconducting jacket as shown. Start shrinking H.V. tubing at the concentric wire end and work toward the cable terminal using propane torch, See Note 1.

1.10 Position first skirt at bottom, as shown, and shrink into place. Position and shrink remaining skirts at approximately equal distances. See Figure TP 205–1 (Sheet 2).

1.11 Connect termination to equipment terminals. Twist concentric wires together, and connect to ground.

Note(s):
1. PROPANE torch required for shrinking.
2. For pole mounting of terminations, use cable support bracket (SAP 10067309), and cross-arm bracket (SAP 10067306).

TP 206 Cold Shrink Termination for 12 kV, 16 kV, and 34.5 kV CLP Cable — 3M

Scope TP 206.1 Installation of Indoor/Outdoor 3M Cold Shrink Terminations on 1/C 12, 16, and 34.5 kV CLP Insulated Aluminum Jacketed and Nonjacketed Cables (#2 AWG through 1,500 kcmil)

1.0 Instructions

Table TP 206–1: Cable Preparation Dimensions

SAP	Termination Part Number[1/] (No. of Skirts)	Cable Data			Dimension (in)		
		System Voltage (kV)	Conductor Size (AWG/kcmil)	Insulation Thickness (mil)	A	B	C
10117085[2/]	5651 (6)	12/16	#2	220	10-1/2	Lug Depth + 1/4 Inch	8
10117085[2/]	5651 (6)	12/16	1/0	220	10-1/2	Lug Depth + 1/4 Inch	8
10117098	5651-2-MB3[3/] (6)	12/16	#2	220	10-1/2	Lug Depth + 1/4 Inch	8
10117097	5651-1/0-MB3[3/] (6)	12/16	1/0	220	10-1/2	Lug Depth + 1/4 Inch	8
10117099	5652-MB4 (6)	12/16	350	220	10-1/2	Lug Depth + 1/4 Inch	8
10117100	5653-MB5 (6)	12/16	750	220	11	Lug Depth + 1/2 Inch	8-1/2
10117101	5654-MB5 (6)	12/16	1,000	220	11	Lug Depth + 1/2 Inch	8-1/2
10117107	5647-MB5 (8)	34.5	4/0	420	16	Lug Depth + 1/4 Inch	13-1/2
10117108	5649-MB6 (8)	34.5	750	420	16-1/2	Lug Depth + 1/2 Inch	14-1/2
10117108	5649-MB6 (8)	34.5	1,500	345	16-1/2	Lug Depth + 3/4 Inch	14-1/2

[1/] Termination kits include cable support bracket, except for the 5641 kit
[2/] Indoor only
[3/] Includes pin terminal connector

= For Reference Only

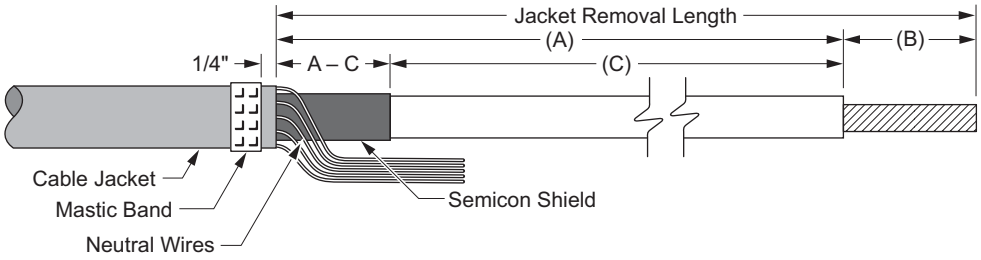
1.1 Verify that the termination is for the cable size to be terminated. See Table TP 206–1.

1.2 Train cable into position and cut to length required for installation. Leave sufficient concentric neutral wire length for grounding.

NOTE For Nonjacketed Cable, Go to Step 2.0.

1.3 Prepare cable using the appropriate dimensions shown in Table TP 206–1 and Figure TP 206–1. Allow for depth of terminal and elongation during crimping.

Figure TP 206–1: Cable Preparation for Jacketed Cable



1.4 Select 1 of 2 mastic strips from the kit and remove white release liners. Using light tension, wrap a band of mastic around the cable jacket 1/4 inch from the cut edge of the jacket. See Figure TP 206–1. Cut off excess mastic.

1.5 Bend concentric neutral wires back over and into the applied sealing mastic ensuring that the wires lay flat and do not cross. Secure the concentric neutral wires to the jacket 2-1/2 inches below the cut edge of the jacket using vinyl tape or a tie-wrap. See Figure TP 206–2.

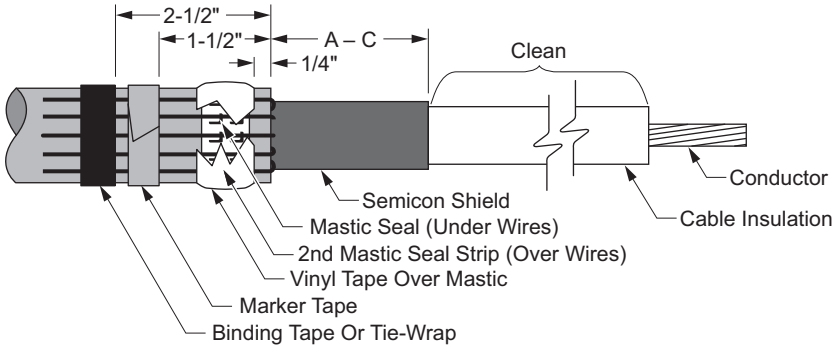
1.6 Apply second mastic band over the concentric neutral wires and previously applied mastic strip. See Figure TP 206–2. Cut off excess mastic.

1.7 Compress the mastic into the concentric neutral wires by over wrapping the mastic layers with two highly stretched layers of Scotch 33 vinyl tape or equivalent. See Figure TP 206–2. The vinyl tape also protects the mastic from being disturbed as the termination core ripcord is pulled past it.

IMPORTANT: Do not extend vinyl tape wrapping more than 1/8 inch beyond mastic strip.

1.8 Place a marker tape 1-1/2 inches back from the cut edge of the jacket. See Figure TP 206–2.

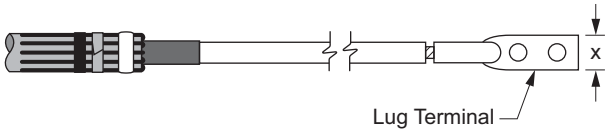
Figure TP 206–2: Concentric Neutral Preparation for Jacketed Cable



1.9 Clean the cable insulation by wiping the insulation with an approved solvent. **Do not allow solvent to touch semicon shield.** To remove any residual semicon bits from the cable insulation, use an aluminum oxide abrasive (grit 120 or finer). **Do not use abrasive on semicon shield.** Figure TP 206–2.

1.10 The terminations are designed to fit over most copper and aluminum lugs. There may be some lug terminals (see Dimension "x" in Figure TP 206–3) that do not fit through the termination tube. In these cases, clean the insulation (per Step 1.9) and slide the termination tube onto the cable before installing the lug terminal. **Do not remove core at this time.**

Figure TP 206–3: Terminal Installation



1.11 Position the terminal and crimp according to TP 100. Remove excess oxide inhibitor and sharp crimp flashings following crimping. **Do not crimp the bottom 1/2 inch of the terminal.**

Table TP 206–2: Circumferential-Type Compression Dies

Conductor Aluminum Cable	Y-60 Die Set	UT-15 Die Set	Y-39 Die Set
350 kcmil	—	15C96R	15CA96R[1/]
750 kcmil	—	15C140R	—
1,000 kcmil	—	15C161R[2/] 15C150R	—
1,500 kcmil	L46ART	—	—

[1/] Will fit in UT-15 with Adapter Die — SAP 10148852
[2/] Preferred Die

Table TP 206–3: Pin Terminal (Long)

SAP	Cable Size
10112226	4/0
10112230	350
10112229	750
10112228	1,000
10112227	1,500

= For Reference Only

NOTE #2 and 1/0 termination kits include pin terminal. Use MD6 tool and BG groove.

Crossarm Bracket	SAP 10067306

Table TP 206–4: Lug Terminal (Cable to Flat)

SAP	Cable Size
10112333	350
10112334	500
10112335	700/750
10112336	1,000
10112239	1,500

= For Reference Only

1.12 A moisture seal must be made between the termination body and terminal using the gray Scotch No. 70 Silicone Rubber Electrical Tape strip (contained in kit). After removing the two clear release liners, wrap a band of silicone tape around the base of the terminal. See Figure TP 206–4.

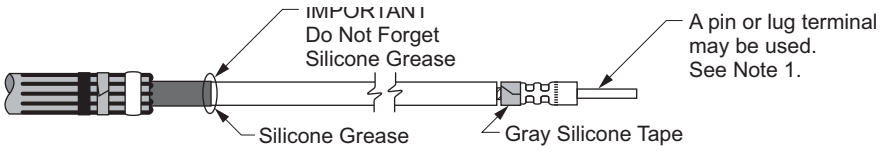
IMPORTANT:

A. If the terminal barrel diameter is equal to or greater than the cable insulation, the silicone tape band must not exceed two layers.

B. If the terminal barrel diameter is smaller than the cable insulation, use one full silicone tape strip to form the silicone tape band.

1.13 Cover edge of the semicon shield with a liberal coating of silicone grease provided, or SAP 10154115. See Figure TP 206–4. **The silicone grease fills the step at the semicon cutoff; it does not serve as a lubricant.**

Figure TP 206–4: Final Jacketed Cable Preparation

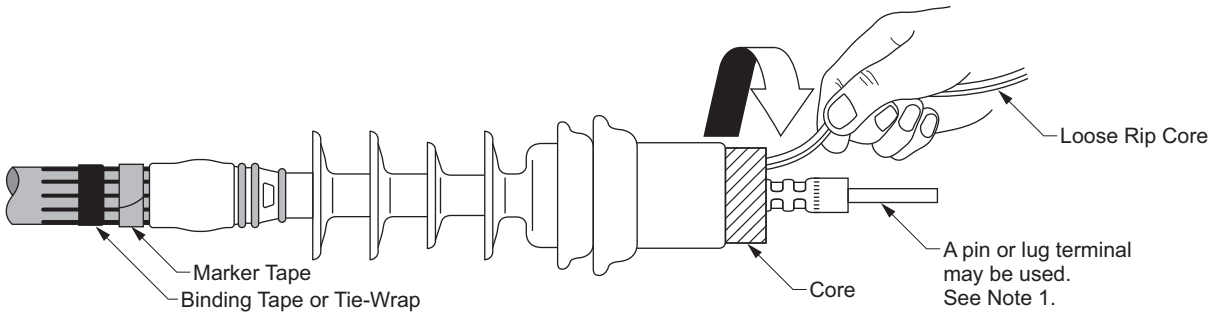


Note(s):
1. For simplification, a pin terminal is shown, however either lug or a pin terminal may be used.

CAUTION

Slide the termination onto the cable and in line with the marker tape. Start removing the core. Pull while unwinding, counter-clockwise, starting with the loose rip cord. See Figure TP 206–6. Ensure that the termination body (not the core) is butted up to the edge of the marker tape. See Figure TP 206–6.

Figure TP 206–5: Installing Termination

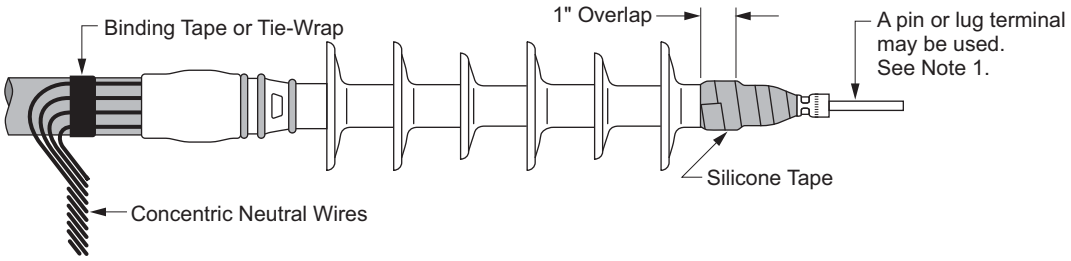


NOTE

With termination installed, complete the terminal area moisture seal using the remaining gray Scotch No. 70 Silicone Rubber Electrical Tape. Start at the non-crimped portion of the terminal, and extend the tape, wrapping to overlap the termination body by approximately 1 inch. See Figure TP 206–6.

1.14 Twist the concentric neutral wires together (Figure TP 206–6) and connect to the system ground.

Figure TP 206–6: Installed Termination



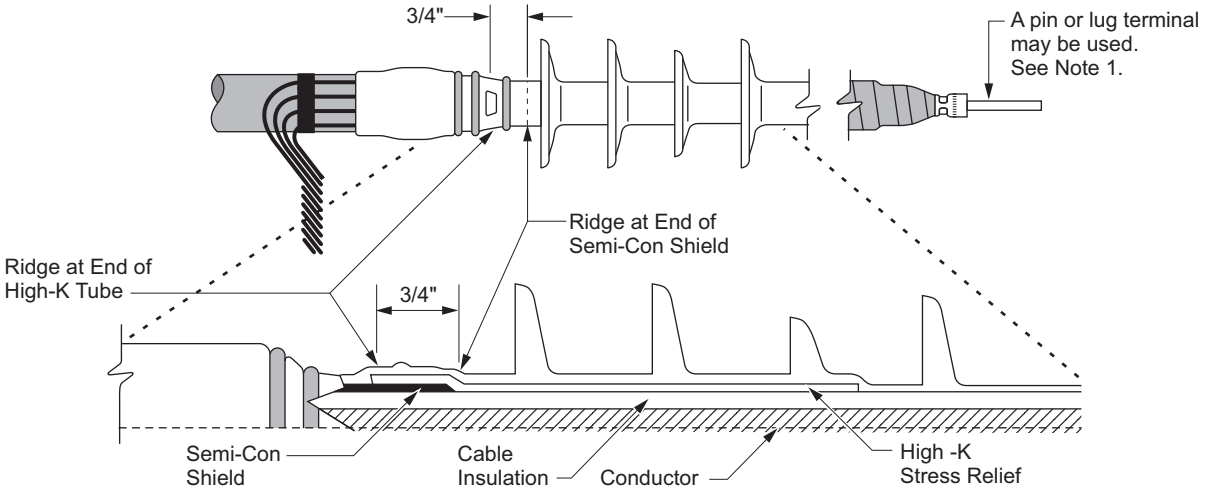
Note(s):
1. For simplification, a pin terminal is shown, however either lug or a pin terminal may be used.

1.15 Remove the marker tape. See Figure TP 206–5.

CAUTION

When all steps have been completed and termination has been installed, verify that the termination is properly positioned on the cable. See Figure TP 206–7. The 3M logo must be above the semicon shield and should be approximately 3/4 inches from the cut semicon edge. See Figure TP 206–7.

Figure TP 206–7: Properly Positioned Termination

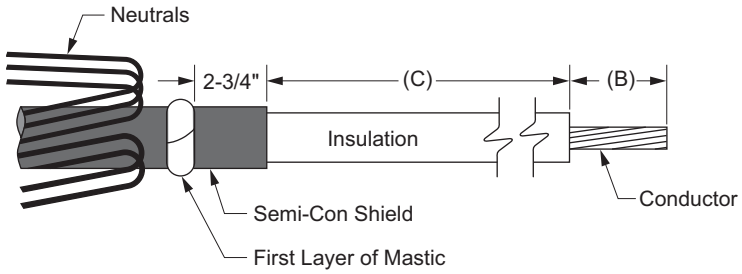


Note(s):
1. For simplification, a pin terminal is shown, however either lug or a pin terminal may be used.

2.0 Concentric Neutral Preparation for Nonjacketed Cable

2.1 Prepare cable using the appropriate dimensions shown in Table TP 206–1 and Figure TP 206–8 Allow for depth of terminal and elongation during crimping.

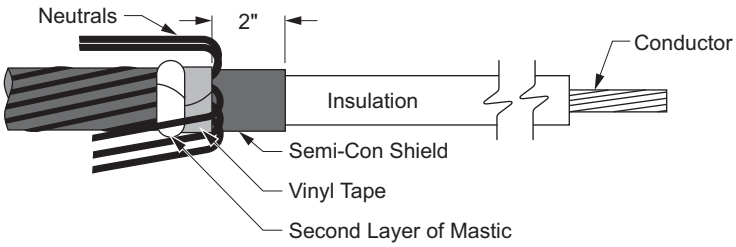
Figure TP 206–8: Concentric Neutral Preparation for Nonjacketed Cable



2.2 Select 1 of 2 mastic strips from the kit and remove the white release liners. Lift up the concentric neutral wires and using light tension, wrap a band of mastic around the semicon beginning 2-3/4 inches from the cut edge of the insulation semicon shield. Cut off excess mastic. See Figure TP 206–8.

2.3 Lay concentric neutral wires into the applied sealing mastic ensuring that the wires lay flat and do not cross. Wrap three to four layers of Scotch 33 vinyl tape or equivalent, beginning 2 inches from the cut edge of the insulation semicon, to simulate the cable jacket as shown in Figure TP 206–9.

Figure TP 206–9: Simulating Cable Jacket



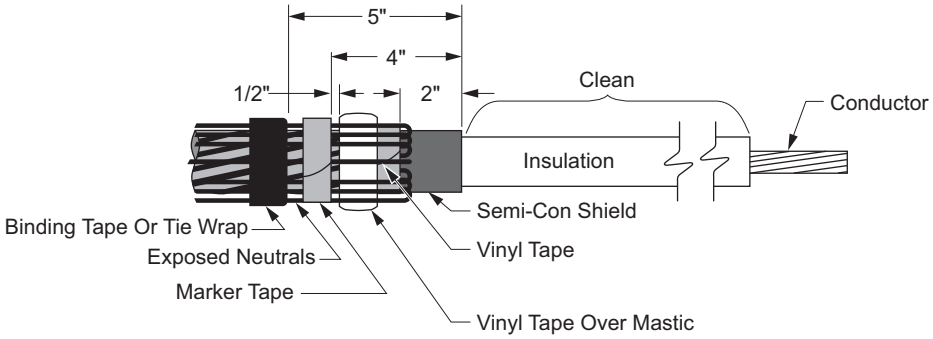
2.4 Apply a second layer of mastic directly over concentric neutral wires and the previously applied layer of mastic as shown in Figure TP 206–9.

2.5 Compress the mastic into the concentric neutral wires by over wrapping the mastic layers with two highly stretched layers of Scotch 33 vinyl tape or equivalent. See Figure TP 206–10. The vinyl tape also protects the mastic from being disturbed as the termination core ripcord is pulled past it.

IMPORTANT: Do not extend vinyl tape wrapping more than 1/8 inch beyond mastic strip.

2.6 Bend concentric neutral wires back over the mastic layers and vinyl tape. Secure the concentric neutral wires to the nonjacketed cable beginning 5 inches below the cut edge of the insulation semicon using vinyl tape or a tie-wrap. See Figure TP 206–10.

Figure TP 206–10: Concentric Neutral Preparation for Nonjacketed Cable

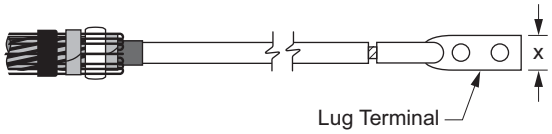


2.7 Place a marker tape 4 inches back from cut edge of the insulation semicon as shown in Figure TP 206–10. Leave 1/2 inch of neutrals exposed between the marker tape and vinyl tape covering mastic.

2.8 Clean the cable insulation by wiping the insulation with an approved solvent. **Do not allow solvent to touch semicon shield.** To remove any residual semicon bits from the cable insulation, use an aluminum oxide abrasive (grit 120 or finer). **Do not use abrasive on semicon shield.** See Figure TP 206–10

2.9 The terminations are designed to fit over most copper and aluminum lugs. There may be some lug terminals (see Dimension "x" in Figure TP 206–11 that do not fit through the termination tube. In these cases, clean the insulation (per Step 2.8) and slide the termination tube onto the cable before installing the lug terminal. **Do not remove core at this time.**

Figure TP 206–11: Terminal Installation



2.10 Position the terminal and crimp according to TP 100. Remove excess oxide inhibitor and sharp crimp flashings following crimping. **Do not crimp the bottom 1/2 inch of the terminal.**

Table TP 206–5: Circumferential-Type Compression Dies

Conductor Aluminum Cable	Y-60 Die Set	UT-15 Die Set	Y-39 Die Set
350 kcmil	—	15C96R	15CA96R[1/]
750 kcmil	—	15C140R	—
1,000 kcmil	—	15C161R[2/] 15C150R	—
1,500 kcmil	L46ART	—	—

[1/] Will fit in UT-15 with Adapter Die — SAP 10148852
[2/] Preferred Die

Table TP 206–6: Pin Terminal (Long)

SAP	Cable Size
10112226	4/0
10112230	350
10112229	750
10112228	1,000
10112227	1,500

NOTE

#2 and 1/0 termination kits include pin terminal. Use MD6 tool and BG groove.

Crossarm Bracket	SAP 10067306

Table TP 206–7: Lug Terminal (Cable to Flat)

SAP	Cable Size
10112333	350
10112334	500
10112335	700/750
10112336	1,000
10112239	1,500

= For Reference Only

2.11 A moisture seal must be made between the termination body and terminal using the gray Scotch No. 70 Silicone Rubber Electrical Tape strip (contained in kit). After removing the two clear release liners, wrap a band of silicone tape around the base of the terminal. See Figure TP 206–12.

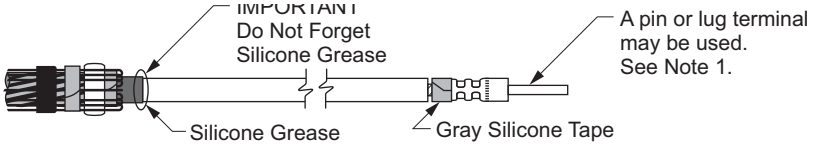
IMPORTANT:

A. If the terminal barrel diameter is equal to or greater than the cable insulation, the silicone tape band must not exceed two layers.

B. If the terminal barrel diameter is smaller than the cable insulation, use one full silicone tape strip to form the silicone tape band.

2.12 Cover edge of the semicon shield with a liberal coating of silicone grease provided, or SAP 10154115. See Figure TP 206–12. **The silicone grease fills the step at the semicon cutoff; it does not serve as a lubricant.**

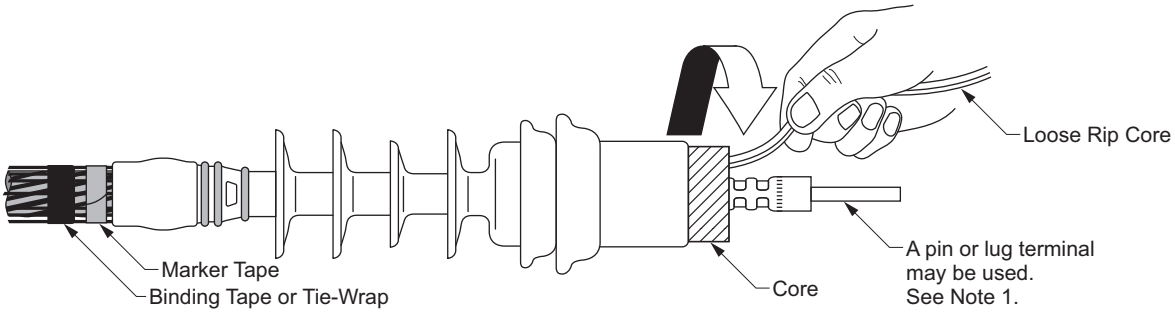
Figure TP 206–12: Final Nonjacketed Cable Preparation



CAUTION

Slide the termination onto the cable and in line with the marker tape. Start removing the core. Pull while unwinding, counter-clockwise, starting with the loose rip cord. See Figure TP 206–13. Ensure that the termination body (not the core) is butted up to the edge of the marker tape. See Figure TP 206–13.

Figure TP 206–13: Installing Termination

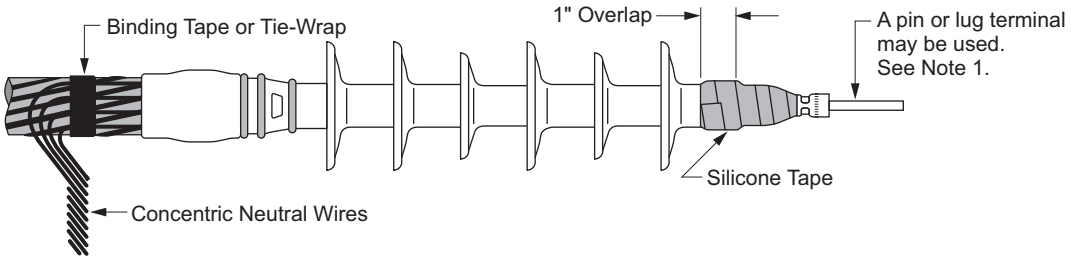


NOTE

With termination installed, complete the terminal area moisture seal using the remaining gray Scotch No. 70 Silicone Rubber Electrical Tape. Start at the non-crimped portion of the terminal, and extend the tape, wrapping to overlap the termination body by approximately 1 inch. See Figure TP 206–14.

2.13 Twist the concentric neutral wires together (Figure TP 206–14) and connect to the system ground.

Figure TP 206–14: Installed Termination



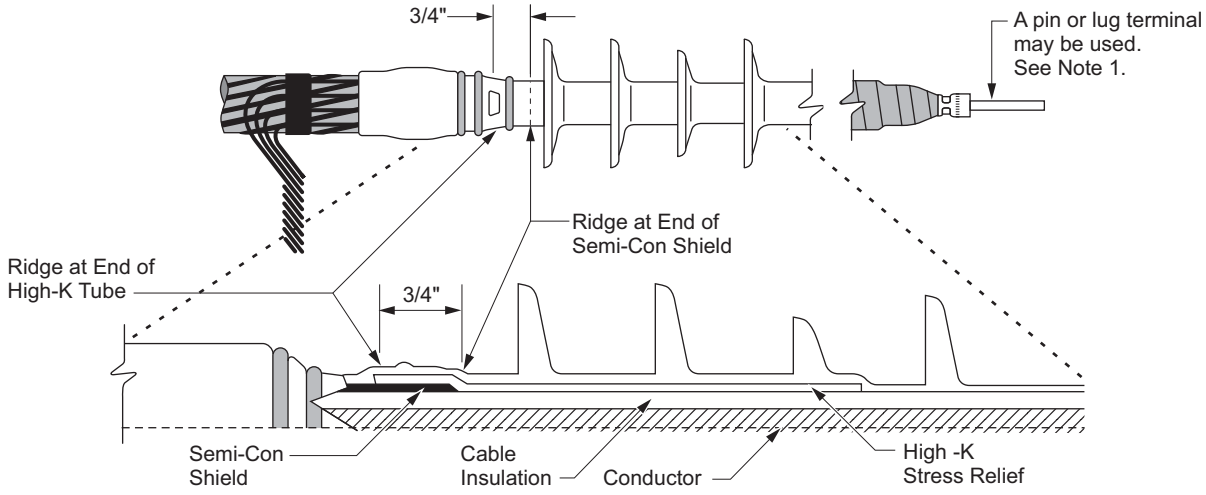
Note(s):
1. For simplification, a pin terminal is shown, however either lug or a pin terminal may be used.

2.14 Remove the marker tape. See Figure TP 206–13.

CAUTION

When all steps have been completed and termination has been installed, verify that the termination is properly positioned on the cable. See Figure TP 206–15. The 3M logo must be above the semicon shield and should be approximately 3/4 inches from the cut semicon edge. See Figure TP 206–15.

Figure TP 206–15: Properly Positioned Termination



Note(s):
1. For simplification, a pin terminal is shown, however either lug or a pin terminal may be used.

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TP 207 Indoor Termination — Cold Shrink — 3M Molded Rubber — 12/16-kV

Scope TP 207.1 Installation of Indoor 3M Cold Shrink Termination for Use on 1/C — #2 and 1/0, 12/16-kV CLP (M/C 650-00010)

1.0 Instructions

1.1 Train, measure, and cut cable to the desired length. Bind concentric wires as shown. **Mark cable and install tape marker**. See Figure TP 207–1.1 (Sheet 2).

1.2 Remove semiconducting insulation shield and insulation for lug/connector installation. See Figure TP 207–1.1 (Sheet 2).

1.3 Remove the semiconducting insulation shield for terminator installation. See Figure TP 207–1.1 (Sheet 2).

1.4 Using the proper tool and die, install the lug/connector (lug/connector not included in kit).

1.5 Cover the edge of the semiconducting insulation shield with a liberal coating of silicone grease provided, or silicone grease M/C 904-00615. **Do not substitute any other grease.** Spread silicone grease onto the exposed insulation.

1.6 Slide the termination body onto the cable and remove the core by unwinding counterclockwise. Ensure that the termination body is aligned with the marker tape. See Figure TP 207–1.2 (Sheet 2).

1.7 Fasten one concentric wire with stainless steel bonding strap to base of termination between the molded rings. See Figure TP 207–1.3 (Sheet 2).

1.8 Connect the termination to the equipment terminal. Twist the concentric wires together and connect them to ground and neutral where applicable.

FOR REFERENCE ONLY

Figure TP 207–1: Installation of Indoor 3M Cold Shrink Termination

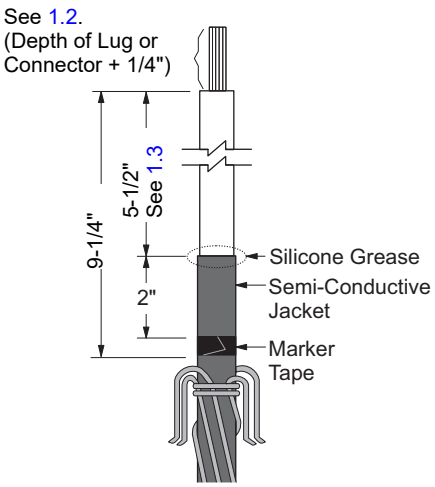


Figure TP 207–1.1

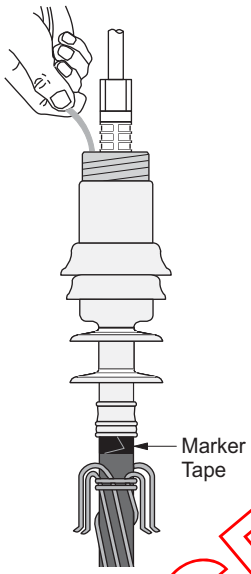


Figure TP 207–1.2

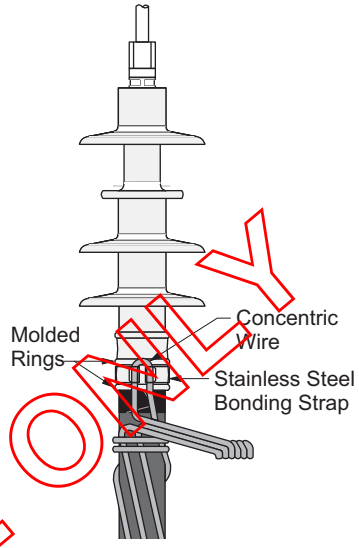


Figure TP 207–1.3

FOR REFERENCE ONLY

TP 208 Cold Shrink Terminations for 12 kV and 16 kV CLP Cable and for 4 kV and 12/16 kV EPR Cable — Raychem

Scope TP 208.1 Installation of Raychem Cold Shrink Terminations for Use on 1/C 12/16 kV Jacketed and Nonjacketed Cables

Table TP 208–1: Raychem Cold Shrink Terminations Data

SAP Number	Termination Part Number[1/] (No. of Skirts)	Cable Data			Dimensions (in)		
		System Voltage (kV)	Conductor Size (AWG/kcmil)	Insulation Thickness (mil)	A	B	C
10117085[2/]	TFT-251E (5)	12/16	#2	220	11	Lug Depth + 1/4"	9
10117085[2/]	TFT-251E (5)	12/16	1/0	220	11	Lug Depth + 1/4"	9
10117098	TFT-251E[3/] (5)	12/16	#2	220	11	Lug Depth + 1/4"	9
10117097	TFT-251E (5)	12/16	1/0	220	11	Lug Depth + 1/4"	9
10117099	TFT-252E (5)	12/16	350	220	11	Lug Depth + 1/4"	9

[1/] Termination kits include cable support bracket, except TFT-151E kit.
[2/] Indoor only
[3/] Includes “Hyplug” compression connector

= For Reference Only

1.0 Instructions

1.1 Ensure termination kit is the appropriate one for the cable to be terminated.

NOTE For nonjacketed cable, go to Step 2.0 (Sheet 5).

1.2 Cut back jacket to dimension shown in Table TP 208–1 (Sheet 1). Solvent clean and abrade cable jacket for 3 inches. Using light tension, wrap two layers of gray sealant onto jacket as shown in Figure TP 208–1.1 (Sheet 1).

Figure TP 208–1: Raychem Cold Shrink Terminations for Use on 1/C 12/16 kV CLP Jacketed Cables

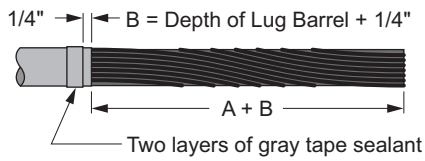


Figure TP 208–1.1: Cable Preparation for Jacketed Cable

1.3 Without crossing, fold back neutral wires over the cable jacket cutback and press into the sealant. Wrap one additional layer of gray sealant **over** the wires and first two layers of sealant. See Figure TP 208–1.2 (Sheet 2).

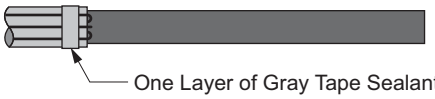


Figure TP 208–1.2: Concentric Neutral Wire Preparation for Jacketed Cable

NOTE

It may help to use a tie-wrap to secure the wires. If the cable is nonjacketed, see Step 2.0 (Sheet 5).

1.4 Remove semiconducting insulation shield to the dimension C (Figure TP 208–1.3 [Sheet 2]). Abrade and clean the surface of the primary insulation with an approved solution to remove conductive particles.

Remove the insulation to the dimension B shown in Figure TP 208–1.3 (Sheet 2).

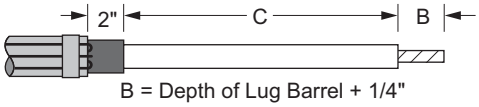


Figure TP 208–1.3: Final Cable Preparation

1.5 Install and crimp the lug using proper die and tool. Clean lug barrel of inhibitor and dirt.

Remove sharp edges of crimped lug barrel (Figure TP 208–1.4 [Sheet 2]).

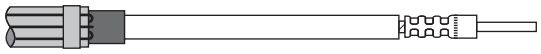


Figure TP 208–1.4: Terminal Installation

1.6 Build up the barrel diameter to that of cable insulation using gray tape sealant and overlap 1/2 inch onto insulation providing a smooth profile. See Figure TP 208–1.5 (Sheet 2).

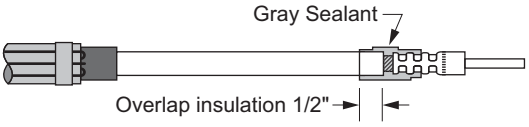


Figure TP 208–1.5: Terminal Area Preparation

1.7 Apply the stress relief patch (Figure TP 208–1.6 [Sheet 3]) by removing the backing paper from the patch. Using light tension, wrap the entire patch around the semicon shield oriented as shown. Avoid wrinkles and creases.

NOTE

The stress patch easily sticks to itself and loose particles.

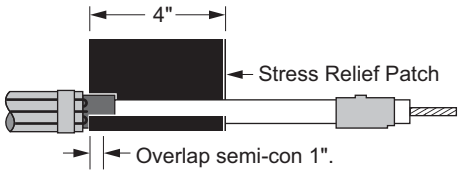


Figure TP 208–1.6: Applying Stress Relief Material

Remove backing paper from the patch. Using light tension, wrap the entire patch around the semicon shield oriented as shown. Avoid wrinkles and creases.

1.8 Loosen the termination as shown in Figure TP 208–1.7 (Sheet 3) and as described below. This operation is vital to the simple installation of the product.

NOTE

The skirts may be flipped backwards or forwards to ease the following operation and therefore may look different to that shown in the drawing. The orientation of the skirts is not important prior to fitting as they automatically align themselves after installation.

Hold the area of the flipped-back portion of the termination in one hand and the holdout in the other. Grip firmly and sharply twist the termination and holdout in opposite directions until the termination is felt to slide over the holdout. Repeat the operation with each skirt and the end of the termination in turn.

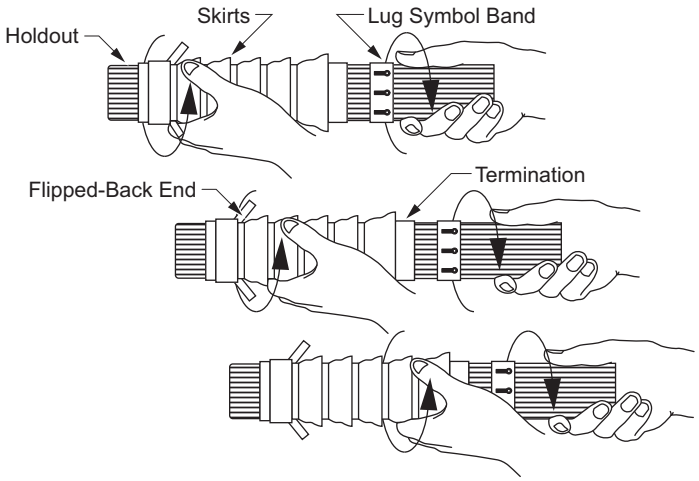


Figure TP 208–1.7: Loosening the Termination

1.9 Slide the holdout over the cable (Figure TP 208–1.8 [Sheet 4]) until it meets the leading edge of the gray sealant strip. Twist the termination and slowly push it to the end of the holdout.

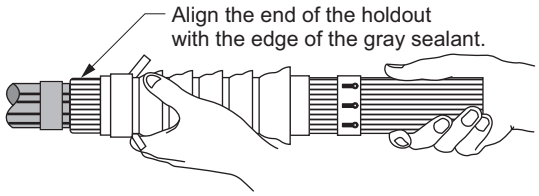


Figure TP 208–1.8: Aligning Termination

1.10 Using the pull-tabs (Figure TP 208–1.9 [Sheet 4]), roll the flip-back over onto the sealant. The flipped back portion should extend 1/4 inch beyond the bottom edge of the sealant.

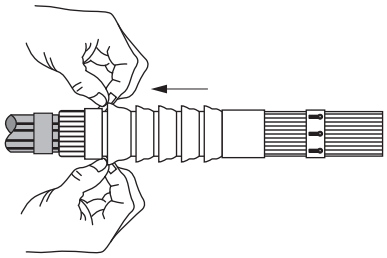


Figure TP 208–1.9: Completing Jacket Seal

1.11 Slide the termination core completely off the holdout using a twisting and pulling motion as shown in Figure TP 208–1.10 (Sheet 4).

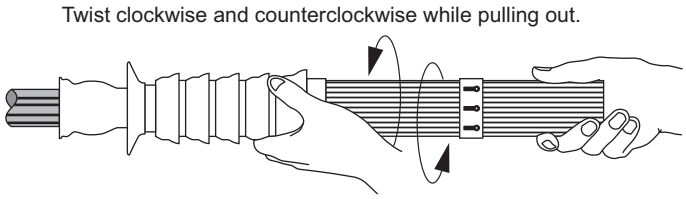


Figure TP 208–1.10: Termination Core Removal

If after installation, the termination is not correctly positioned, it is possible to gently slide it into place.

1.12 Wipe the surface of the termination to remove any dirt or grease (Figure TP 208–1.11 [Sheet 4]).

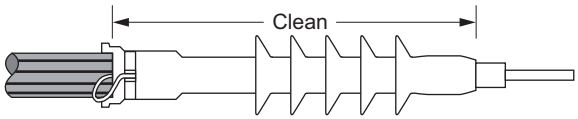


Figure TP 208–1.11: Final Product

2.0 Concentric Neutral Preparation for Nonjacketed Cable

2.1 Lift up neutrals and wrap mastic around the semicon beginning 2-3/4 inches from the end of the semicon shield step (Figure TP 208–2.1 [Sheet 5]).

Figure TP 208–2: Concentric Neutral Preparation for Nonjacketed Cable

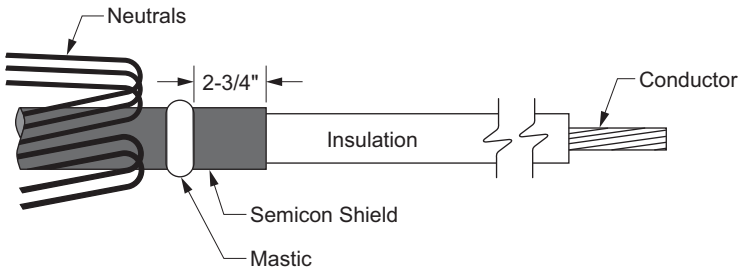


Figure TP 208–2.1: Sealing Termination on Nonjacketed Cable

2.2 Lay neutrals into mastic and wrap three to four layers of vinyl tape over neutrals beginning 2 inches from end of semicon (Step 2.1) to simulate cable jacket as shown in Figure TP 208–2.2 (Sheet 5).

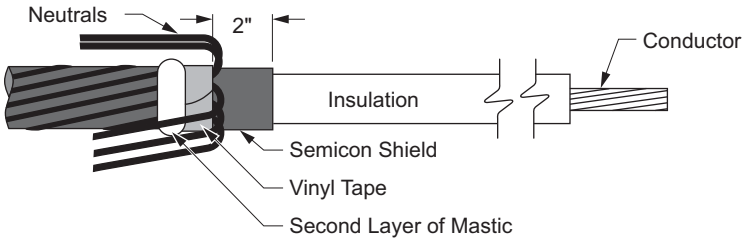


Figure TP 208–2.2: Final Nonjacketed Cable Preparation

2.3 Install a second layer of mastic directly over neutrals and first layer of mastic (Figure TP 208–2.2 [Sheet 5]).

Cover neutrals over mastic with vinyl tape and install marker tape 4 inches from semicon step as shown in Figure TP 208–2.3 (Sheet 5). Leave 1/2 inch of neutrals exposed between the marker tape and vinyl tape covering mastic.

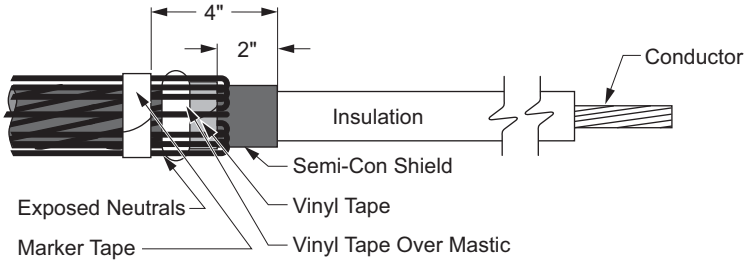


Figure TP 208–2.3: Covering Neutrals and Installing Marker Tape

2.4 Follow Steps 1.5 to 1.12 for jacketed cable-sealing instructions.

Scope TP 208.2 Installation of Raychem Cold Shrink Terminations for Use on 3/C 4 kV and 12/16 kV EPR Copper Cable w/ Tape Shield

1.0 Application

The Raychem outdoor-type, cold-shrink termination is used to terminate 3/C EPR copper cable with tape shield. This termination shall be used for both 4 kV and 12/16 kV applications. The specified material codes contain three terminator units with ground braids.

The heat-shrink breakout boot with six openings is required to convert one 3/C cable into three 1/C cables and three solid copper grounds before proceeding to the termination phase. See JJ 508 for installation instructions on the breakout boot. Remove release paper from breakout boot before installing.

Three compression-type terminal connectors are required to complete the assembly. For copper compression terminals, see TP 101.

Table TP 208–2: SAP Numbers and Catalog Numbers

SAP Number	3/C EPR Cable Conductor Size
10117117	1/0
10117118	4/0
10117119	350
10117120	500
10117441	3/C EPR Cable Breakout Boot

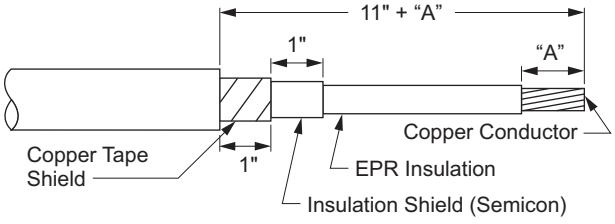
Note(s):
1. See TP 101 for copper compression terminals selection and installation data.
2. Terminations are supplied with mounting brackets.
3. 3/C EPR cable has tape shields on each conductor and three solid-copper grounds. The insulation is 115 mil or 220 mil depending on the voltage class. (See IC 125 for more EPR Cable information.)

2.0 Instructions

2.1 Strip away outer jacket of 3/C EPR cable as required in JJ 508.

2.2 Train cable into position and cut to length required for installation. Secure copper tape shield with a piece of copper tape foil provided.

Figure TP 208–3: Cable Preparation



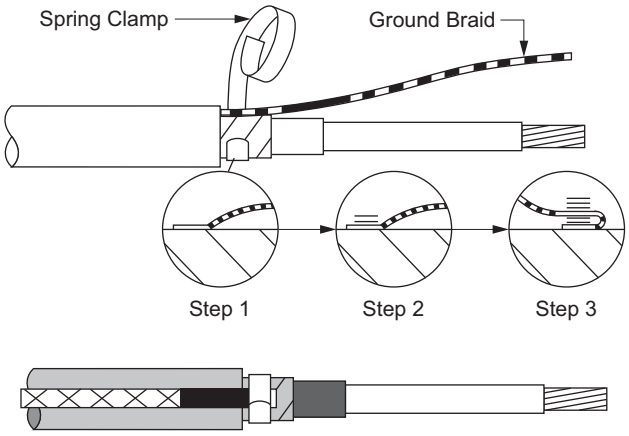
Note(s):
1. Dimension "A" – Allow for Lug Depth + 1/4". See TP 101 for copper compression terminal selection and installation data.

2.3 Flare the moisture-blocked end of the ground braid and place it onto the metallic tape butted up to the cable jacket. (See Figure TP 208–2.1 [Sheet 5].)

2.4 Attach the braid to the shield by placing two wraps of the spring clamp over the braid. (See Figure TP 208–2.2 [Sheet 5].)

2.5 Fold the braid back over the spring clamp wraps. Continue to wrap the remaining clamp over the braid. Tighten clamp by twisting it in the direction it is wrapped and secure with the copper foil tape provided. (See Figure TP 208–2.3 [Sheet 5].)

Figure TP 208–4: Install Ground Braid



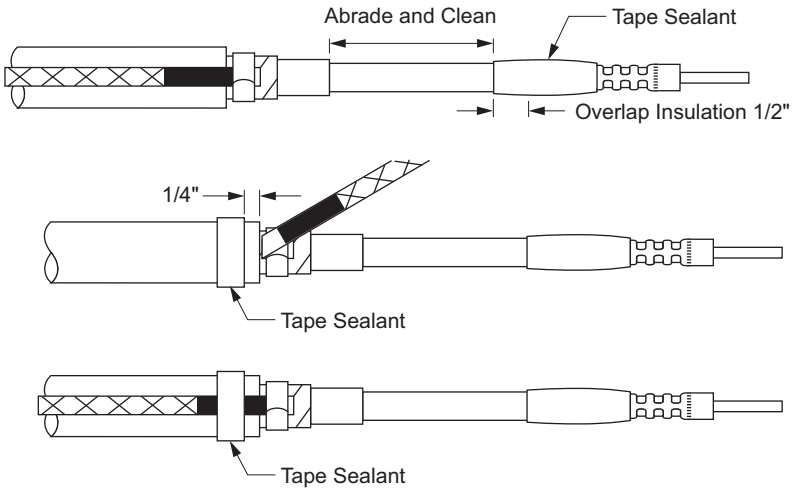
2.6 Crimp the copper connector using proper die and tool per TP 101. Clean lug barrel of excess inhibitor and remove any sharp edges.

2.7 Abrade and clean insulation surface using approved solvent to remove any conductive particles or contamination.

2.8 Build up lug barrel diameter to that of cable insulation using tape sealant, then overlap tape sealant 1/2" onto insulation to provide a smooth profile.

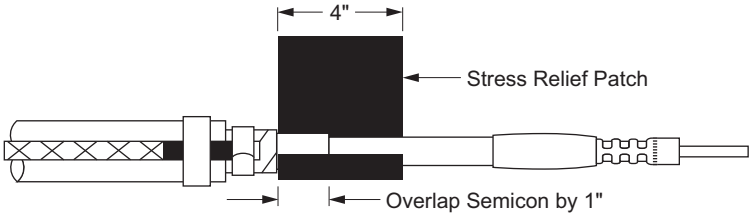
2.9 Solvent clean and abrade jacket. Using light tension, wrap one layer of sealant onto the cable jacket as shown in Figure TP 208–5 (Sheet 8). Press the solder-blocked potion of the braid into the sealant. Wrap an additional layer of sealant over the braid solder block.

Figure TP 208–5: Install Sealant



2.10 Remove backing paper from the entire patch around the semicon oriented as shown in Figure TP 208–6 (Sheet 8). Avoid wrinkles and creases.

Figure TP 208–6: Apply Stress Relief Material

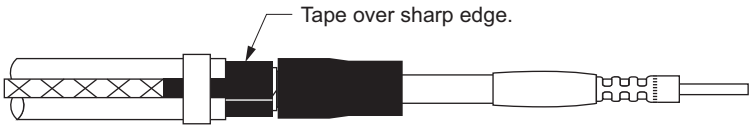


NOTE

The stress patch easily sticks to itself and loose particles.

2.11 Using cloth tape provided, tape over all sharp edges of the ground clamp assembly and jacket cutback.

Figure TP 208–7: Tape Over Sharp Edges



2.12 Loosen the termination as described below. This operation is vital to the simple installation of the product.

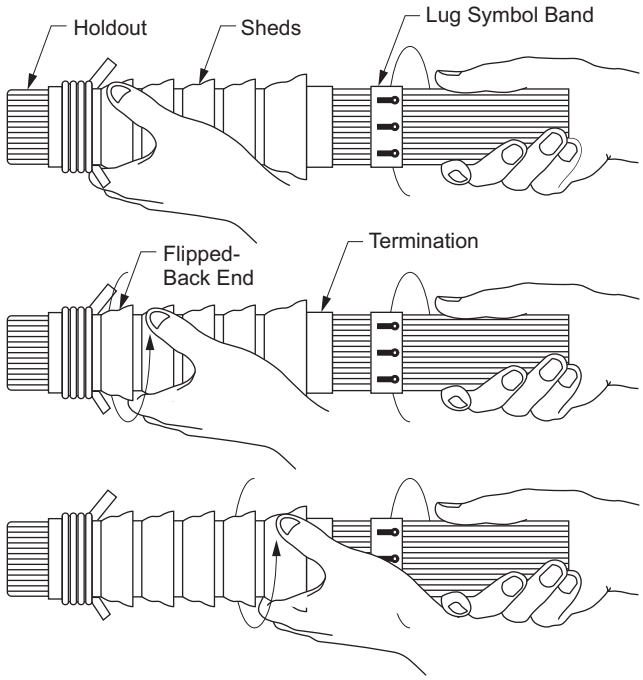
NOTE

The skirts may be flipped backwards or forwards to ease the following operation and therefore may look different from that shown in the drawings. The orientation of the skirts is not important prior to fitting, as they automatically align themselves after installation.

Hold the termination in one hand and the holdout in the other. Gripping firmly, twist the termination and holdout in opposite directions. Repeat twisting the termination and holdout, moving the hand in short increments along the termination until the entire termination is felt to move on the holdout.

Take care not to slide the termination off the end of the holdout.

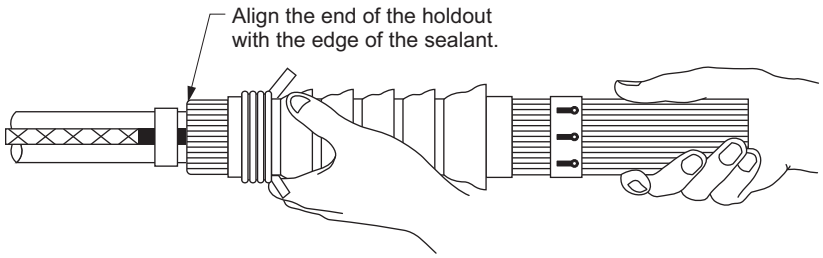
Figure TP 208–8: Loosening Termination



2.13 Position the holdout over the cable until it meets the jacket cutback. Twist the termination and slowly push it to the end of the holdout.

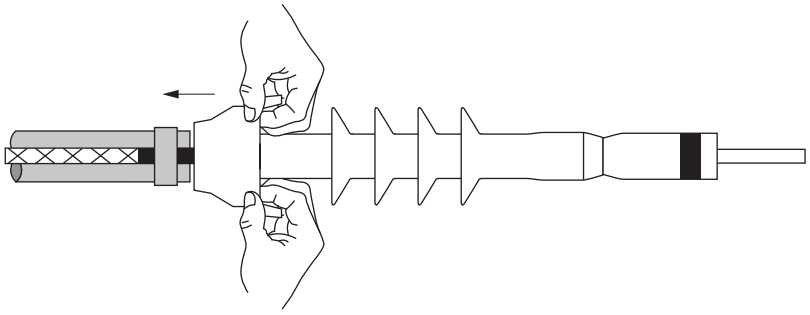
2.14 Slide the termination completely off the holdout using a twisting and pulling motion as shown in Figure TP 208–9 (Sheet 10).

Figure TP 208–9: Installing Termination



2.15 Using the pull tabs, pull the flip-back portion away from the main termination, at the same time working the first two fingers on each hand between the flip-back and main termination. Pull the stretched out flip-back over the cable jacket and sealant. If the installation of the termination is not correctly positioned, it is possible to gently slide it into place, so that the final assembly is positioned as shown in Figure TP 208–10 (Sheet 10).

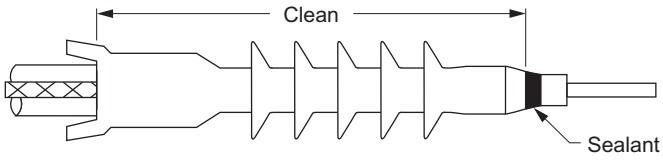
Figure TP 208–10: Complete Termination



2.16 Wipe the surface of the termination to remove any dirt or grease.

2.17 Connect ground braid to system ground.

Figure TP 208–11: Complete Termination



NOTE

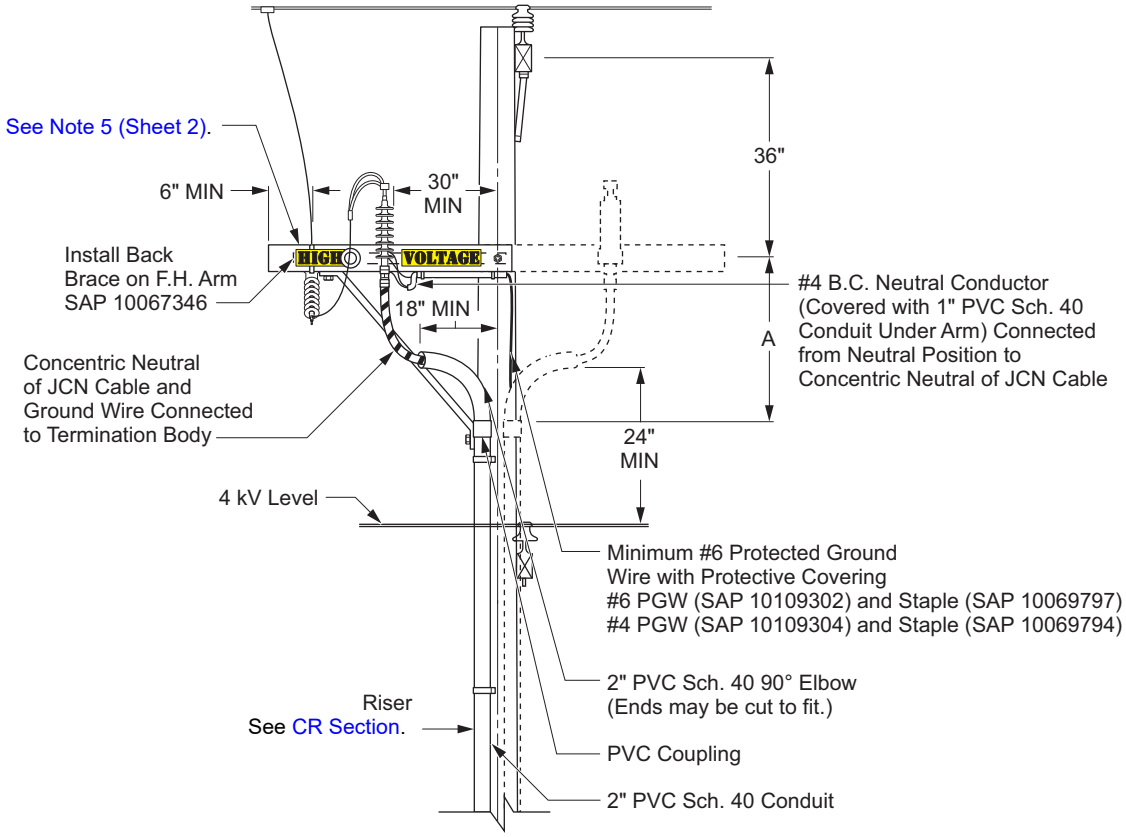
Be sure to position termination at lug end so that there is a bead of sealant exposed.

2.18 Install termination support bracket for outdoor applications.

TP 209 Typical Pole Termination Installation

Scope TP 209.1 Typical Pole Termination Installation — 6.9 kV or 9.4 kV Nonfused Transformers

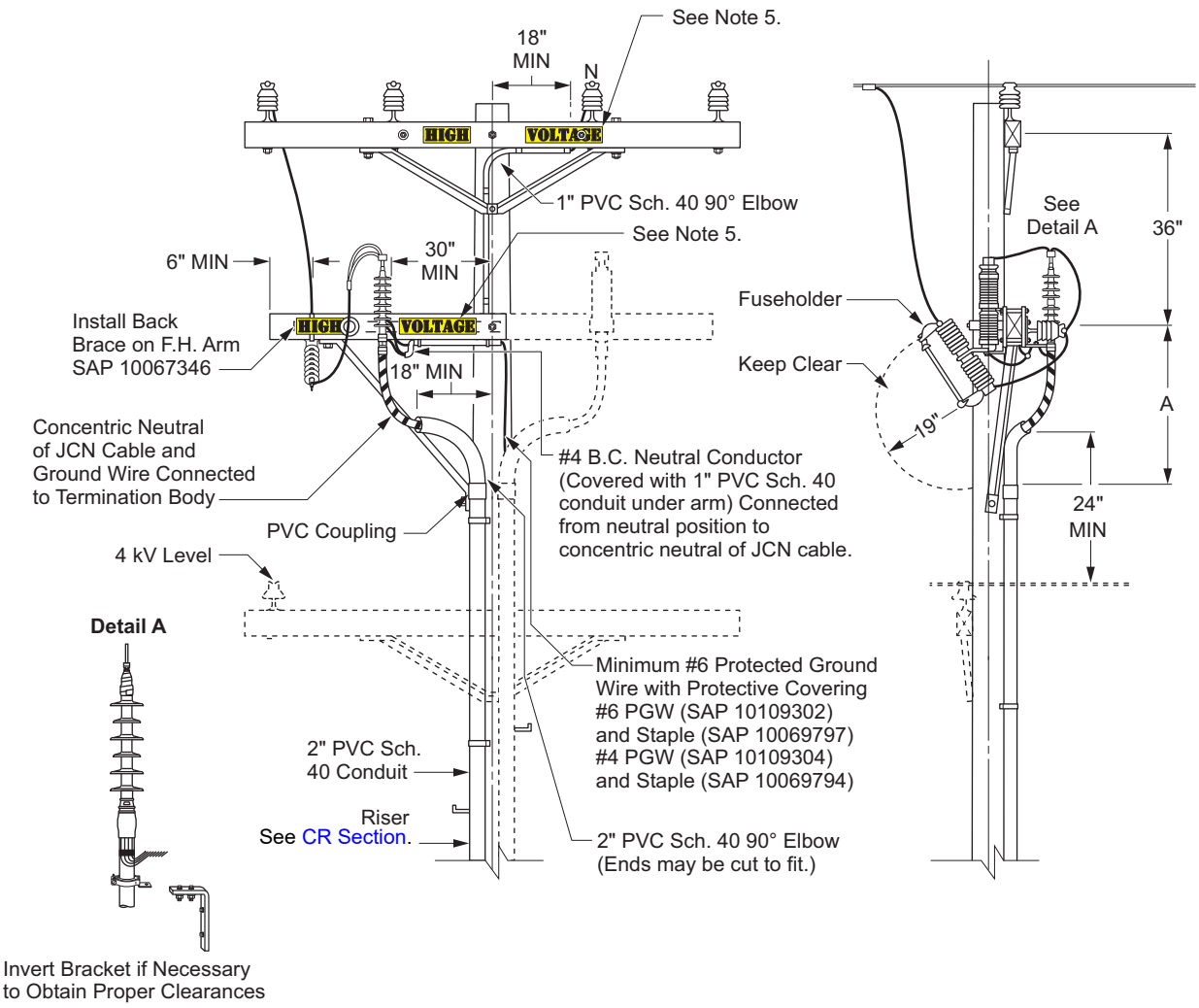
Figure TP 209–1: Pole Termination Installation — 6.9 kV or 9.4 kV Nonfused Transformers



Note(s): :

1. See DUG CR 150 for placement of riser conduit warning labels.

Figure TP 209–1.1 Preferred Construction



CONDUCTOR SIZE	DIMENSION "A" APPROX.
#2-1/0	3-1/2 ft

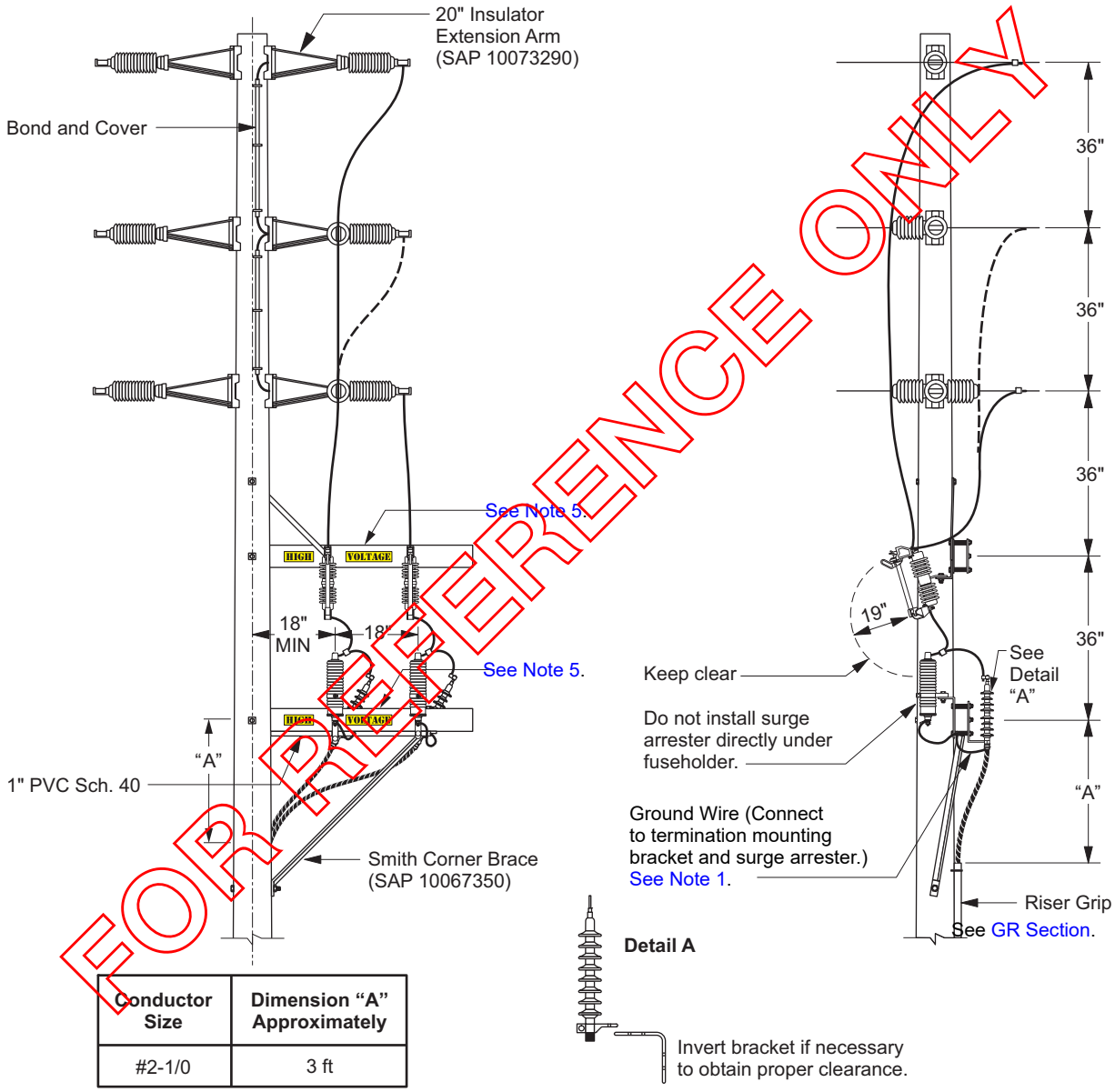
Figure TP 209–1.2: Alternate Construction

Note(s):

1. Where possible, the preferred construction for installing the pothead is in the buck arm position. This allows the tap to be placed on any phase should load balancing be required.
2. Connect surge arrester ground to termination mounting bracket and neutral grounds. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with 1-inch PVC Schedule 40 conduit under crossarm and wood molding on pole or PGW.
3. This installation assumes no switch at the first transformer.
4. No more than two single-phase risers shall be installed on the same riser pole. If two risers are required, use full length crossarm.
5. The High Voltage sign mounted on the crossarm is for existing construction only. For new construction, install the High Voltage sign per DOH PO 120.
6. A transformer can be installed on a pole with a primary riser **only** if the climbing space on the pole can be maintained.
7. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.
8. See DUG CR 150 for placement of riser conduit warning labels.

Scope TP 209.2 Typical Overhead Cable Termination on Armless Construction, 12/16 kV CLP, 1Ø, 3-Wire Fused

Figure TP 209–2: Overhead Cable Termination on Armless Construction, 12/16 kV CLP, 3-Wire Fused



Conductor Size	Dimension "A" Approximately
#2-1/0	3 ft

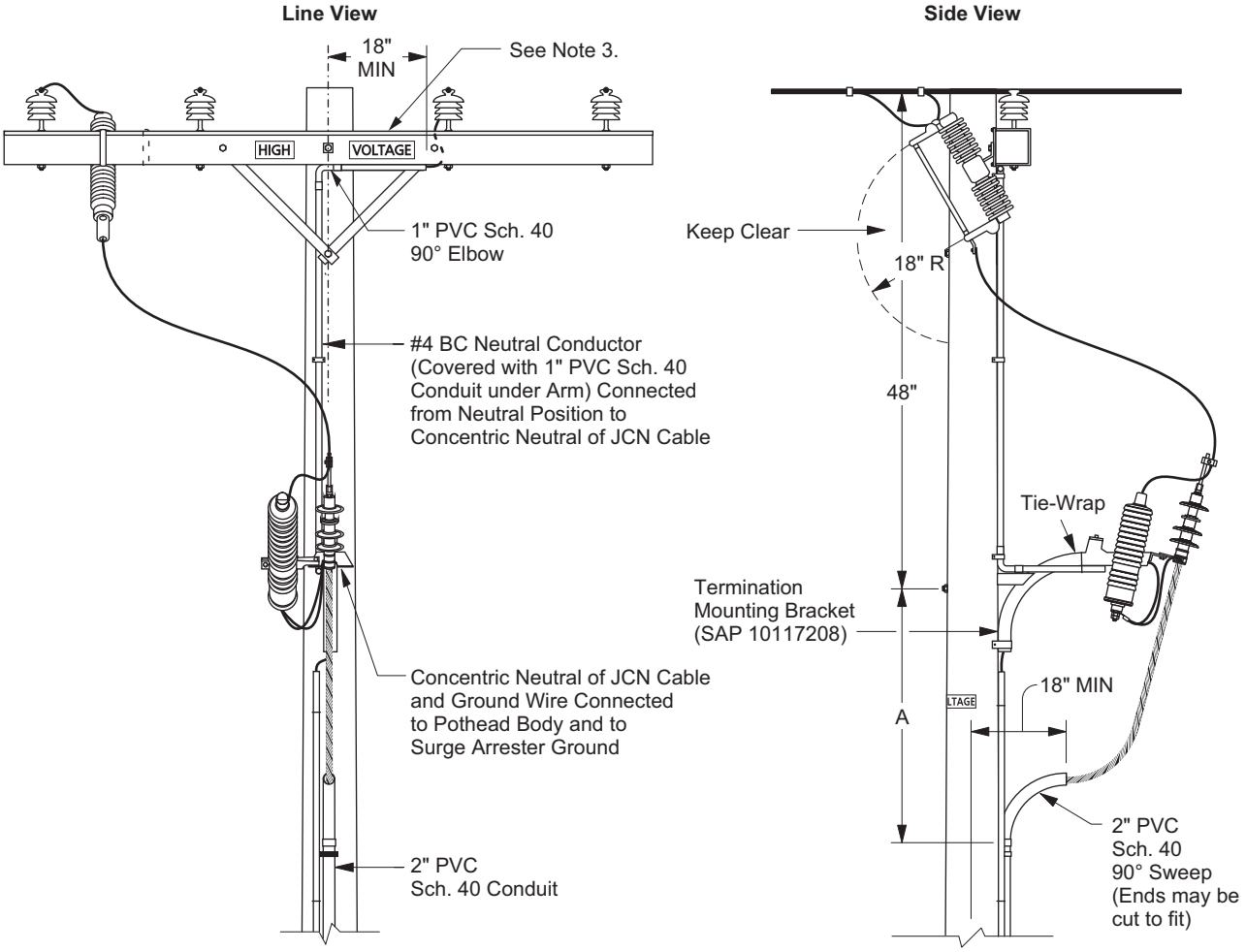
FOR REFERENCE ONLY

Note(s):

1. Connect surge arrester ground to termination mounting bracket and concentric neutral of cable. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with 1-inch PVC Schedule 40 conduit under crossarm and wood molding on pole or PGW.
2. Angle terminations to allow the cable to enter straight into the termination; angle not to exceed 45 degrees.
3. For risers, see CR Section.
4. Ferroresonance sign shall be installed when required. See PD Section.
5. The HIGH VOLTAGE sign mounted on the crossarm is for existing construction only. For new construction, install the HIGH VOLTAGE sign per DOH PO 120.
6. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.

Scope TP 209.3 1Ø 4-Wire Riser Fused Pole Termination with Pothead Bracket

Figure TP 209–3: 1Ø 4-Wire Riser Fused Pole Termination with Pothead Bracket



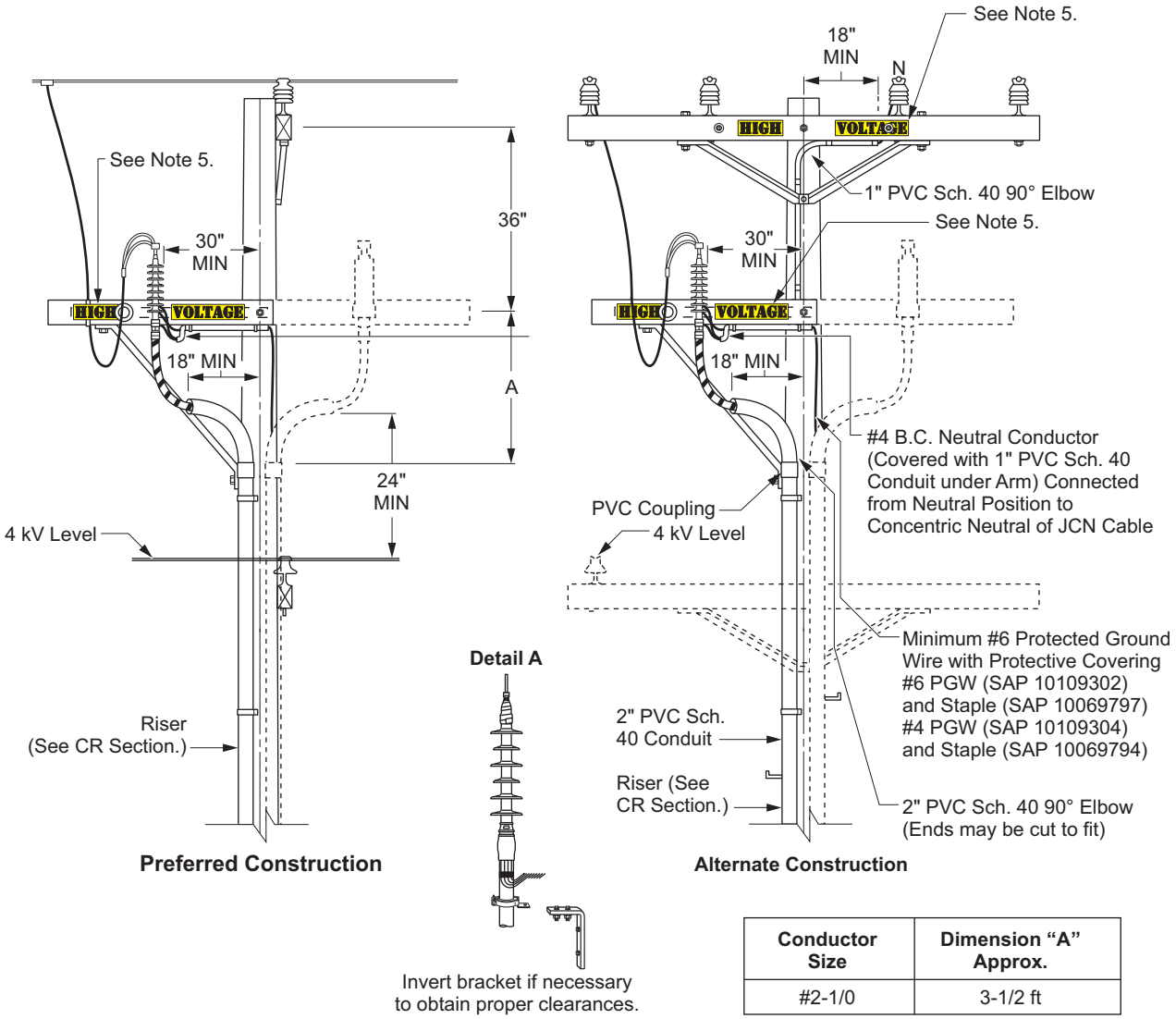
Conductor Size	Dimension "A" Approx.
#2 and 1/0	3'-6"

Note(s):

1. Connect surge arrester ground to termination, termination mounting bracket, and neutral ground. Surge arrester ground lead shall have a short drip loop, neutral wire is to be covered with 1-inch PVC Sch. 40 conduit under crossarm and on pole.
2. The ground wire is protected by wood molding or PGW on the pole and is in factory-installed 1-inch PVC as it passes through the mast arm. The concentric wires and the surge arrester grounds are to be connected to this ground wire.
3. The High Voltage sign mounted on the crossarm is for existing construction only. For new construction, install the High Voltage sign per DOH PO 120.
4. A transformer can be installed on a pole with a primary riser **only** if the climbing space on the pole can be maintained.
5. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.
6. See DUG CR 150 for placement of riser conduit warning labels.

Scope TP 209.4 Typical Pole Termination Installation — 12/16 kV CLP 1Ø, 4-Wire Fused Pad-Mounted

Figure TP 209–4: Typical Pole Termination Installation, — 12/16 kV CLP 1Ø, 4-Wire Fused Pad-Mounted



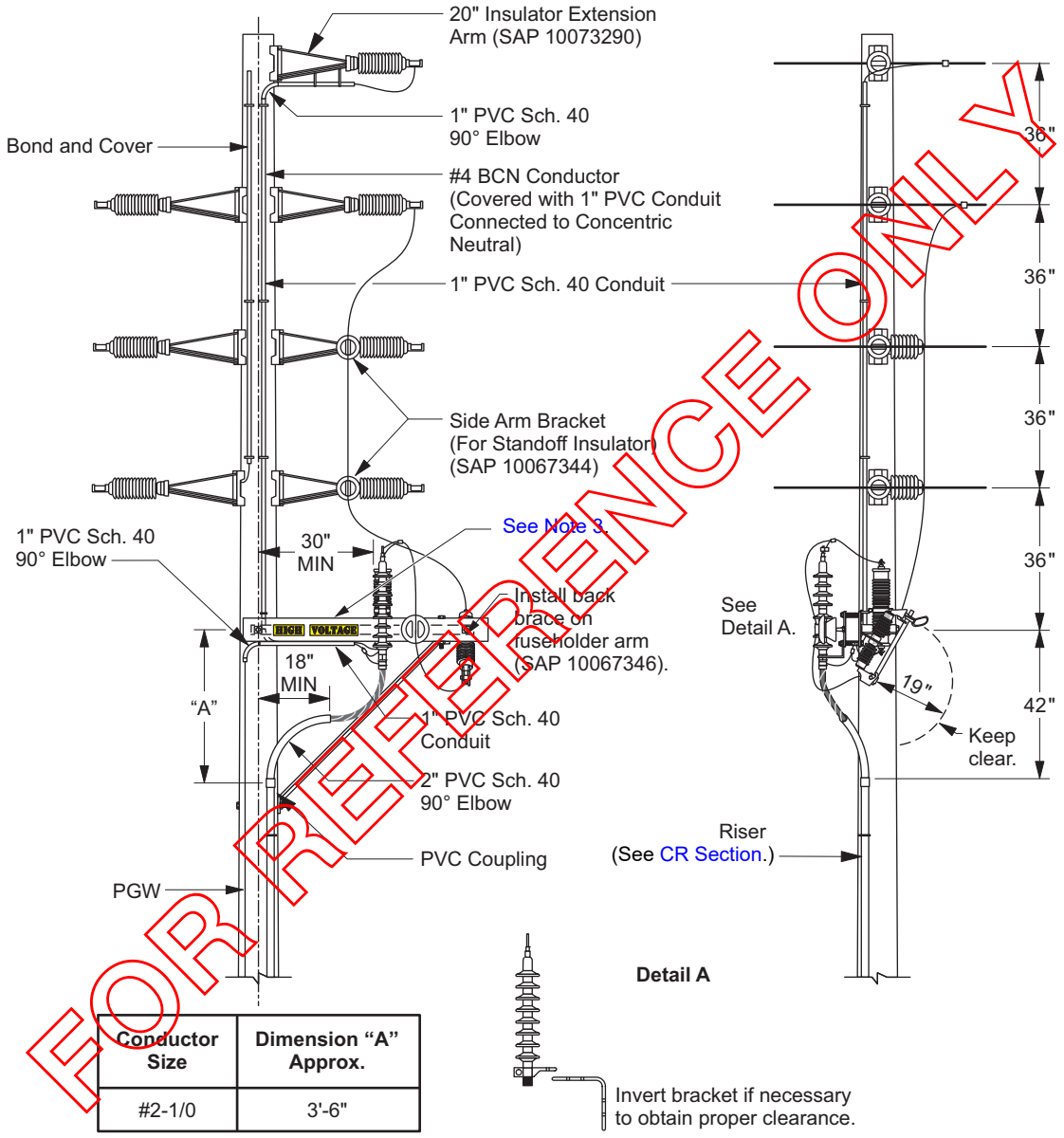
Conductor Size	Dimension "A" Approx.
#2-1/0	3-1/2 ft

Note(s):

1. Where possible, the preferred construction for installing the pothead is in the buck arm position. This allows the tap to be placed on any phase should load balancing be required.
2. Connect surge arrester ground to termination ground, termination mounting bracket, and neutral grounds. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with one-inch PVC Schedule 40 conduit under crossarm and wood molding on pole.
3. This installation assumes no switch at the first transformer.
4. No more than two single-phase risers shall be installed on the same riser pole. If two risers are required, use full length crossarm.
5. The "HIGH VOLTAGE" sign mounted on the crossarm is for existing construction only. For new construction, install the "HIGH VOLTAGE" sign per DOH PO 120.
6. A transformer can be installed on a pole with a primary riser **only** if the climbing space on the pole can be maintained.
7. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.
8. See DUG CR 150 for placement of riser conduit warning labels.

Scope TP 209.5 Typical Pole Termination Installation — 12/16 kV CLP Armless Construction, 1Ø, 4-Wire Fused Pad Mount

Figure TP 209–5: Pole Termination Installation — 12/16 kV CLP Armless Construction, 1Ø, 4-Wire Fused Pad Mount



Conductor Size	Dimension "A" Approx.
#2-1/0	3'-6"

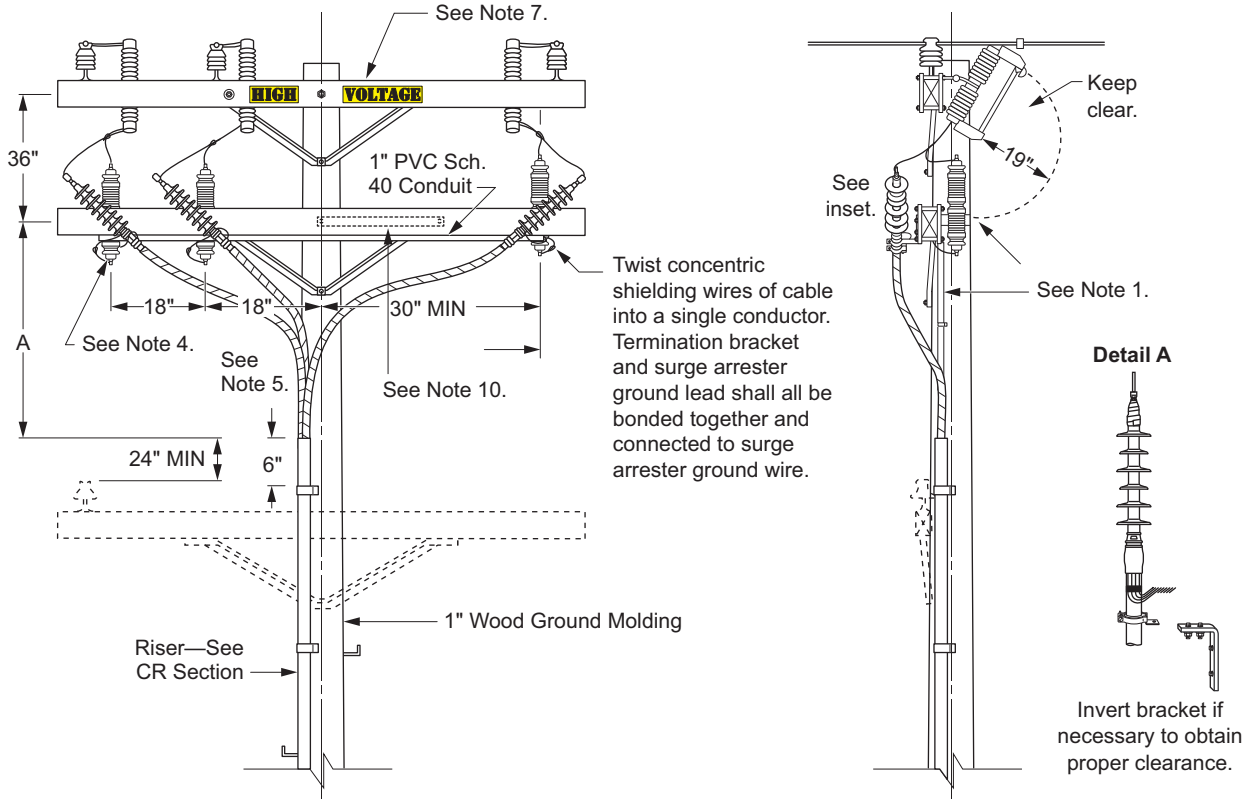
FOR REFERENCE ONLY

Note(s):

1. Connect surge arrester ground to termination ground and concentric neutral of cable. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with 1-inch PVC Schedule 40 conduit under crossarm and wood molding on pole.
2. This installation assumes a switch at the first pad mount.
3. The HIGH VOLTAGE sign mounted on the crossarm is for existing construction only. For new construction, install the HIGH VOLTAGE sign per DOH PO 120.
4. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.

Scope TP 209.6 Typical Pole Termination Installation — Service to Pad-Mounted Transformers (Maximum 1,500 kVA) 12/16 kV CLP, 3Ø, 3-Wire Fused

Figure TP 209–6: Typical Pole Termination Installation — Service to Pad-Mounted Transformers (Maximum 1,500 kVA) 12/16 kV CLP, 3Ø, 3-Wire Fused



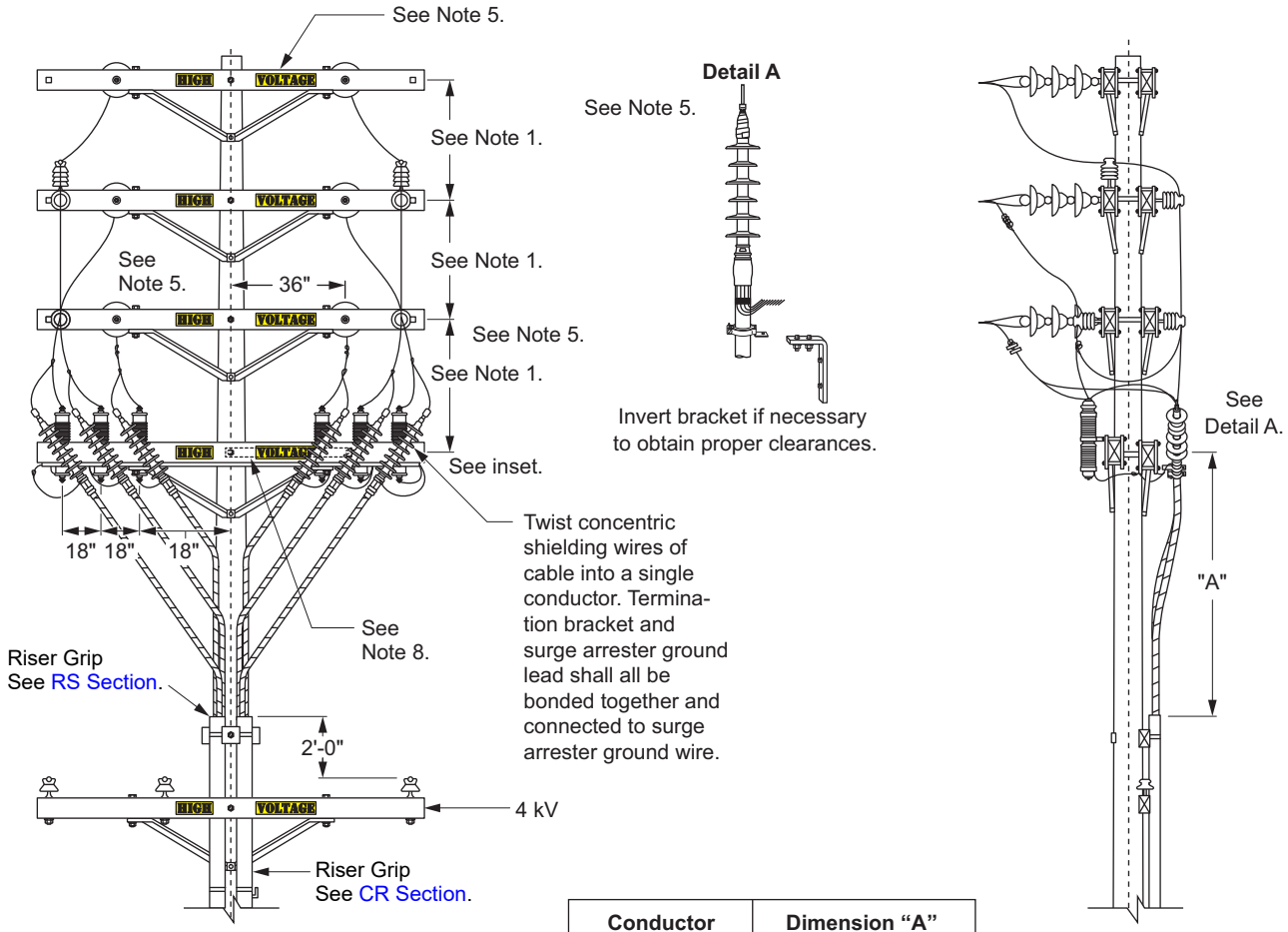
Conductor Size	Dimension "A" Approx.
#2-1/0	3 ft

Note(s):

1. Connect surge arrester ground to termination ground. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with 1-inch PVC Schedule 40 conduit under crossarm and wood molding on pole.
2. Angle terminations to allow cable to enter straight into termination; angle not to exceed 45 degrees.
3. Install ferroresonance sign when required. See PD Section.
4. Do not install surge arresters directly under fuseholder.
5. This dimension may be increased to comply with approach distances listed in the Accident Prevention Manual, Rule 147.
6. This standard can also be used for 1Ø fuse dips. Use any two phases. Maximum is 500 kVA.
7. The High Voltage sign mounted on the crossarm is for existing construction only. For new construction, install the High Voltage sign per DOH PO 120.
8. A transformer can be installed on a pole with a primary riser **only** if the climbing space on the pole can be maintained.
9. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.
10. Back Brace is required on Pothead arms with 750+ kcmil cable. See Back Brace standard DOH DC 615.
11. 12' crossarms are to be used with this configuration.
12. See DUG CR 150 for placement of riser conduit warning labels.

Scope TP 209.7 Typical Termination Pole Installation — 12/16-kV CLP 3Ø, 3-Wire Vertical Construction

Figure TP 209–7: Termination Pole Installation — 12/16-kV CLP 3Ø, 3-Wire Vertical Construction



Conductor Size	Dimension "A" Approx.
#2	3'-6"
1/0	3'-6"
350	3'
750	5'
1,000	5'

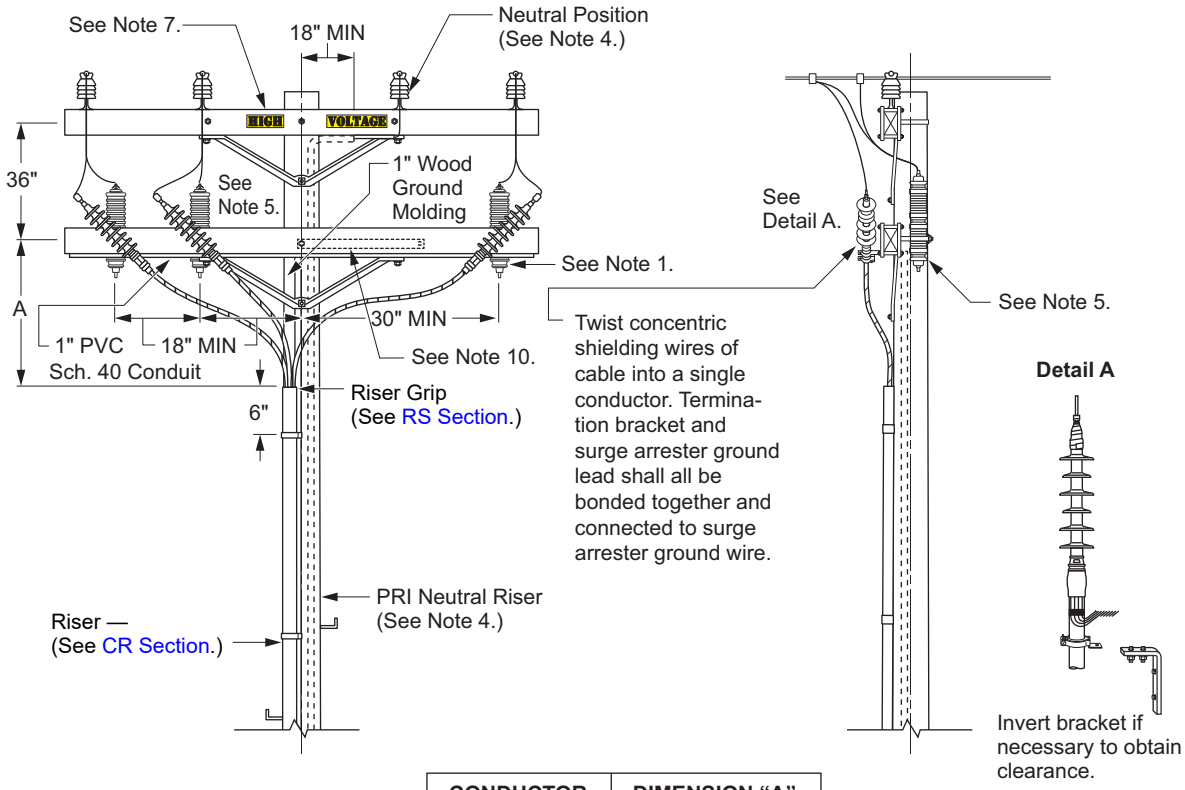
= For Reference Only

Note(s):

1. Refer to Distribution Overhead Construction Standards (DOH) manual, DC 540, for constuction requirements.
2. Connect surge arrester ground to termination ground. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with wood molding on pole and 1-inch PVC Sch. 40 conduit under crossarms.
3. Angle terminations to allow the cable to enter straight into the terminations; angle not to exceed 45 degrees.
4. Ferroresonance signs shall be installed when necessary. See PD Section.
5. The High Voltage sign mounted on the crossarm is for existing construction only. For new construction, install High Voltage sign per DOH PO 120.
6. A transformer can be installed on a pole with a primary riser **only** if the climbing space on the pole can be maintained.
7. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.
8. Back Brace is required on Pothead arms with 750+ kcmil cable. See Back Brace standard DOH DC 615.
9. See DUG CR 150 for placement of riser conduit warning labels.

Scope TP 209.8 Typical Pole Termination — 12/16 kV CLP Construction 3Ø, 3-Wire and 4-Wire

Figure TP 209–8: Pole Termination — 12/16 kV CLP Construction 3Ø, 3-Wire and 4-Wire



CONDUCTOR SIZE	DIMENSION "A" APPROX.
#2	3 ft
1/0	3 ft
350	3 ft
750	5 ft
1,000	5 ft

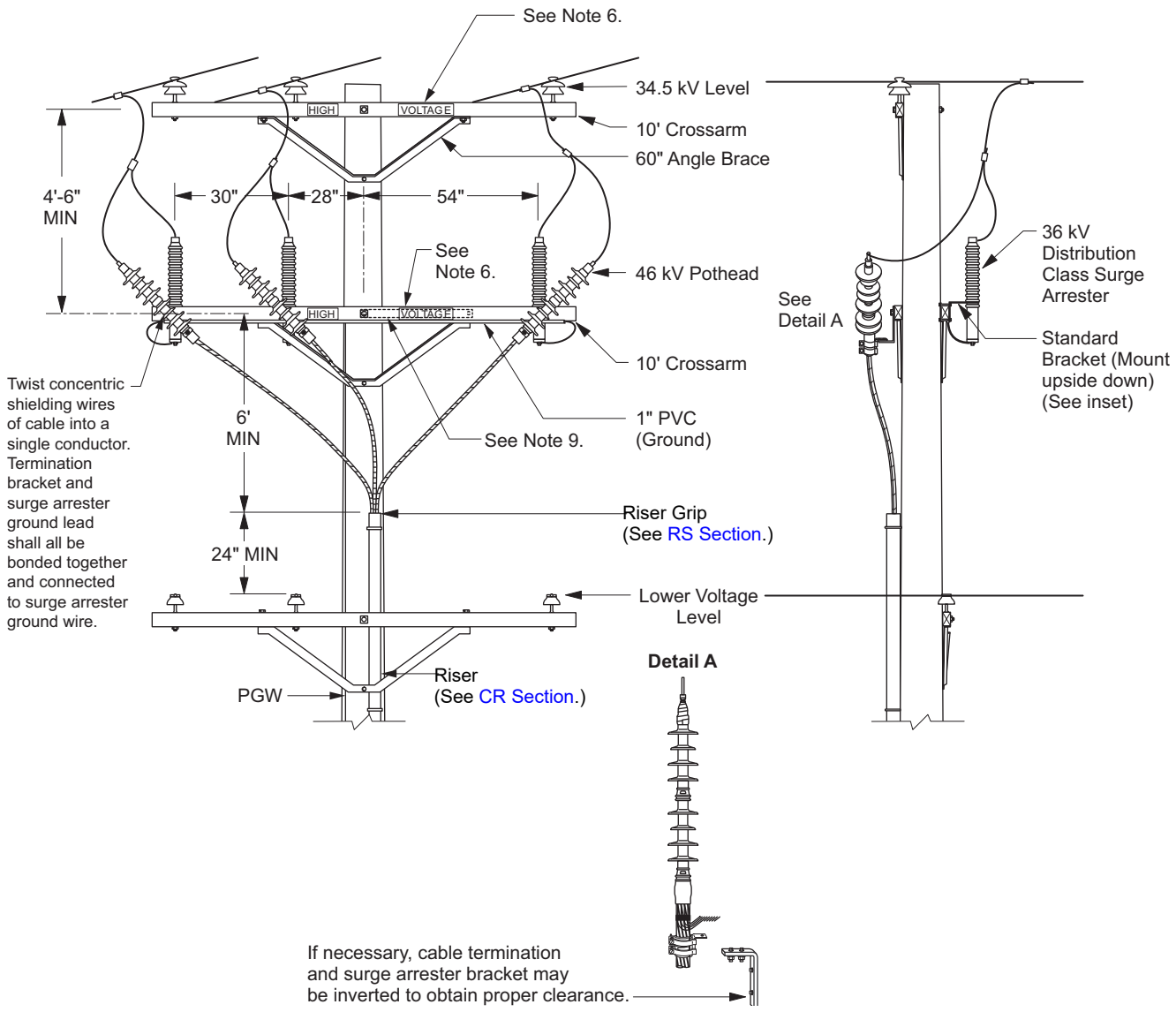
= For Reference Only

Note(s):

1. Connect surge arrester ground to termination ground. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with 1-inch PVC Schedule 40 conduit under crossarm and wood molding on pole. Do not break into or connect to the neutral riser for the purpose of grounding termination or surge arresters.
2. Angle terminations to allow cable to enter straight into termination. Angle not to exceed 45 degrees.
3. Ferroresonance signs shall be installed when necessary. See PD Section.
4. For neutral riser details, see CR 140.
5. A back-up brace is required when using 750 kcmil and 1,000 kcmil conductor sizes.
6. This dimension may be increased to comply with approach distances listed in Rule 147 of the Accident Prevention Manual.
7. The High Voltage sign mounted on the crossarm is for existing construction only. For new construction, install High Voltage sign per DOH PO 120.
8. A transformer can be installed on a pole with a primary riser **only** if the climbing space on the pole can be maintained.
9. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.
10. Back Brace is required on Pothead arms with 750+ kcmil cable. See Back Brace standard DOH DC 615.
11. See DUG CR 150 for placement of riser conduit warning labels.

Scope TP 209.9 Typical Overhead Cable Termination — 34.5 kV CLP, 3Ø, 3-Wire

Figure TP 209–9: Typical Overhead Cable Termination — 34.5 kV CLP, 3Ø, 3-Wire

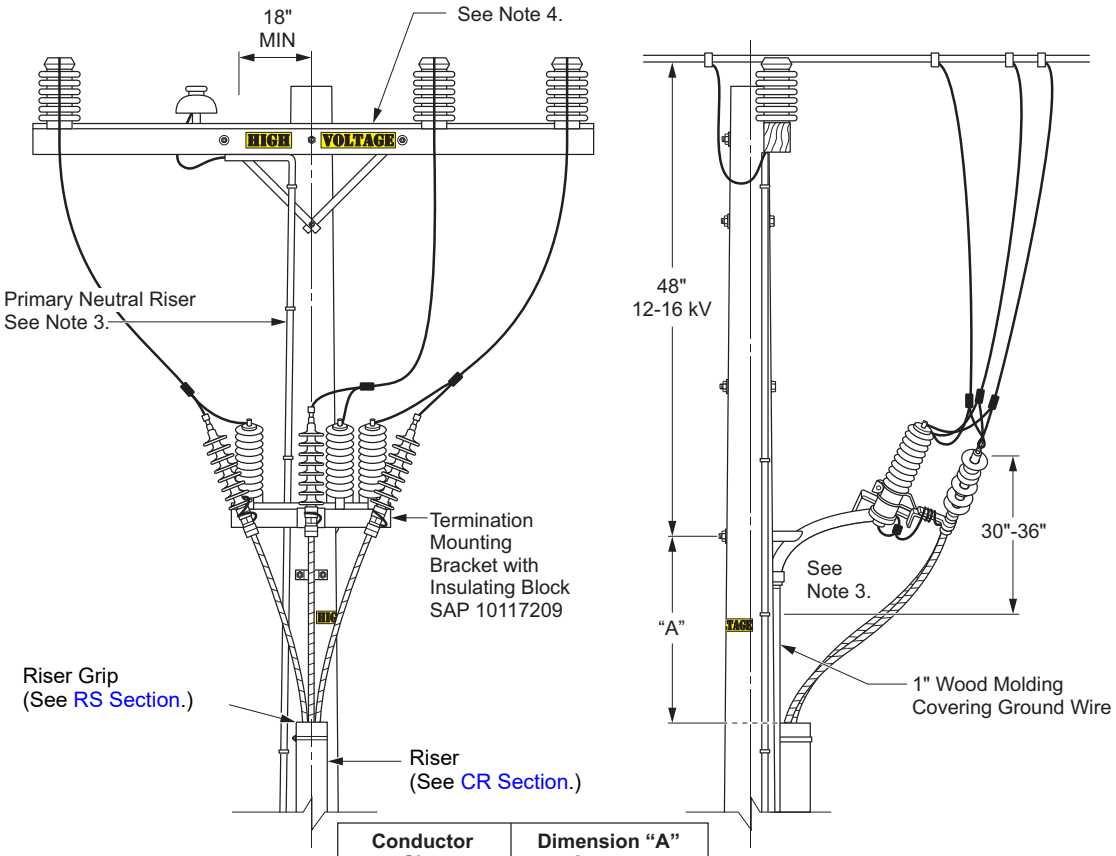


Note(s):

1. Angle termination to allow the cable to enter straight into the termination; angle not to exceed 45 degrees.
2. Connect surge arrester ground to termination ground. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with wood molding on pole and with 1-inch PVC Sch. 40 conduit under crossarm.
3. Ferroresonance signs shall be installed when necessary. See PD Section.
4. The use of bird guard material is recommended on cable termination and surge arrester leads.
5. Wherever possible the riser should be installed on the side of the pole opposite traffic flow.
6. The High Voltage sign mounted on the crossarm is for existing construction only. For new construction, install the High Voltage sign per DOH PO 120.
7. A transformer can be installed on a pole with a primary riser **only** if the climbing space on the pole can be maintained.
8. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.
9. Back Brace is required on Pothead arms with 750+ kcmil cable. See Back Brace standard DOH DC 615.
10. See DUG CR 150 for placement of riser conduit warning labels.

Scope TP 209.10 Typical Termination Winged Post Insulator Arm Construction, Single-Circuit 4-Wire Top of Pole or Below Transmission — 12/16 kV, CLP, 3Ø, 4-Wire

Figure TP 209–10: Typical Termination Winged Post Insulator Arm Construction, Single-Circuit 4-Wire Top of Pole or Below Transmission — 12/16 kV, CLP, 3Ø, 4-Wire



Conductor Size	Dimension "A" Approx.
#2	2'-6"
1/0	2'-6"
350	3'
750	4'-6"
1,000	5'

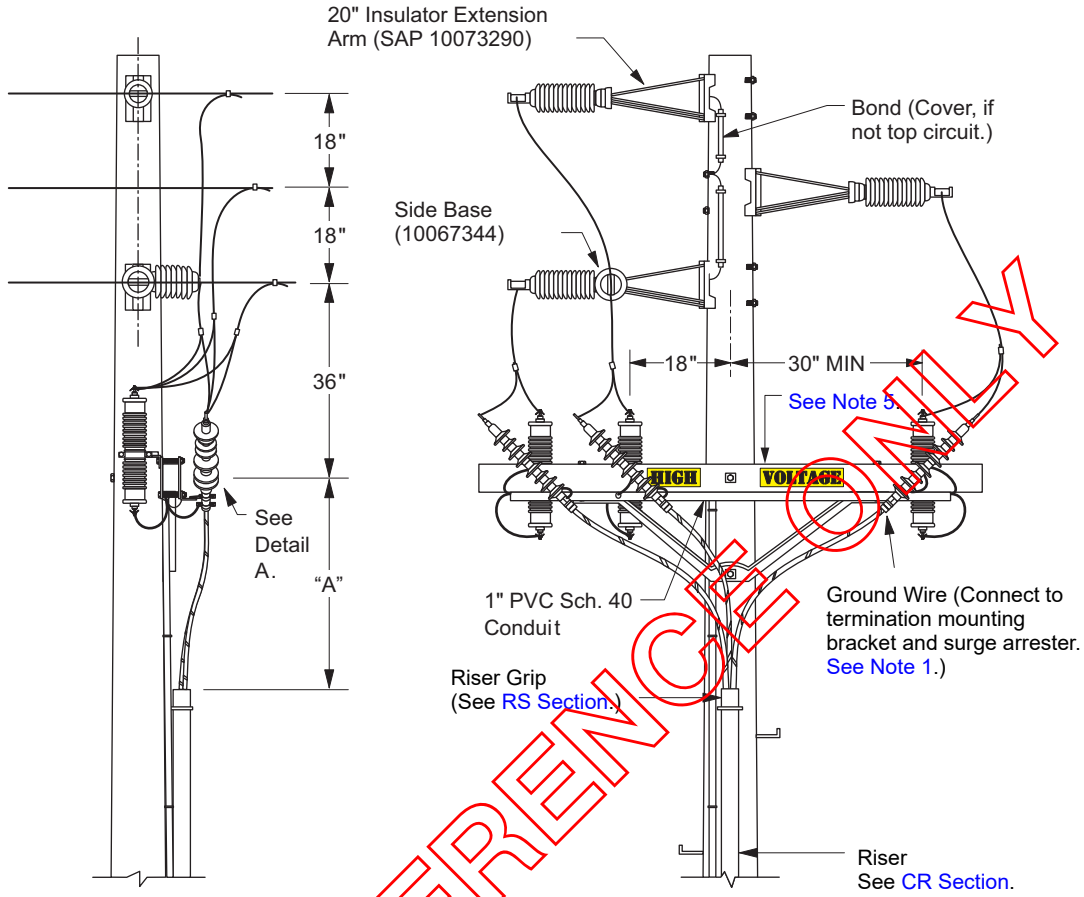
= For Reference Only

Note(s):

1. Connect surge arrester ground to termination ground and concentric neutral of cable. Surge arrester ground lead shall have a short drip loop.
2. The ground wire is protected by wood molding or PGW on the pole and is in factory-installed 1-inch PVC as it passes through the mast arm to the metal crossarm. The concentric wires and the surge arrester grounds are to be connected to this ground wire. The metal crossarm can be used for bonding purposes; however, it cannot be used as part of the grounding system.
3. For primary neutral riser, see CR 140.
4. The High Voltage sign mounted on the crossarm is for existing construction only. For new construction, install High Voltage sign per DOH PO 120.
5. A transformer can be installed on a pole with a primary riser **only** if the climbing space on the pole can be maintained.
6. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.
7. See DUG CR 150 for placement of riser conduit warning labels.

Scope TP 209.11 Typical Overhead Cable Termination Armless Construction — 12/16 kV CLP, 3Ø, 3-Wire

Figure TP 209–11: Overhead Cable Termination Armless Construction — 12/16 kV CLP, 3Ø, 3-Wire



Conductor Size	Dimension "A" Approximately
1/0	3 ft
350	3 ft
750	5 ft
1,000	5 ft

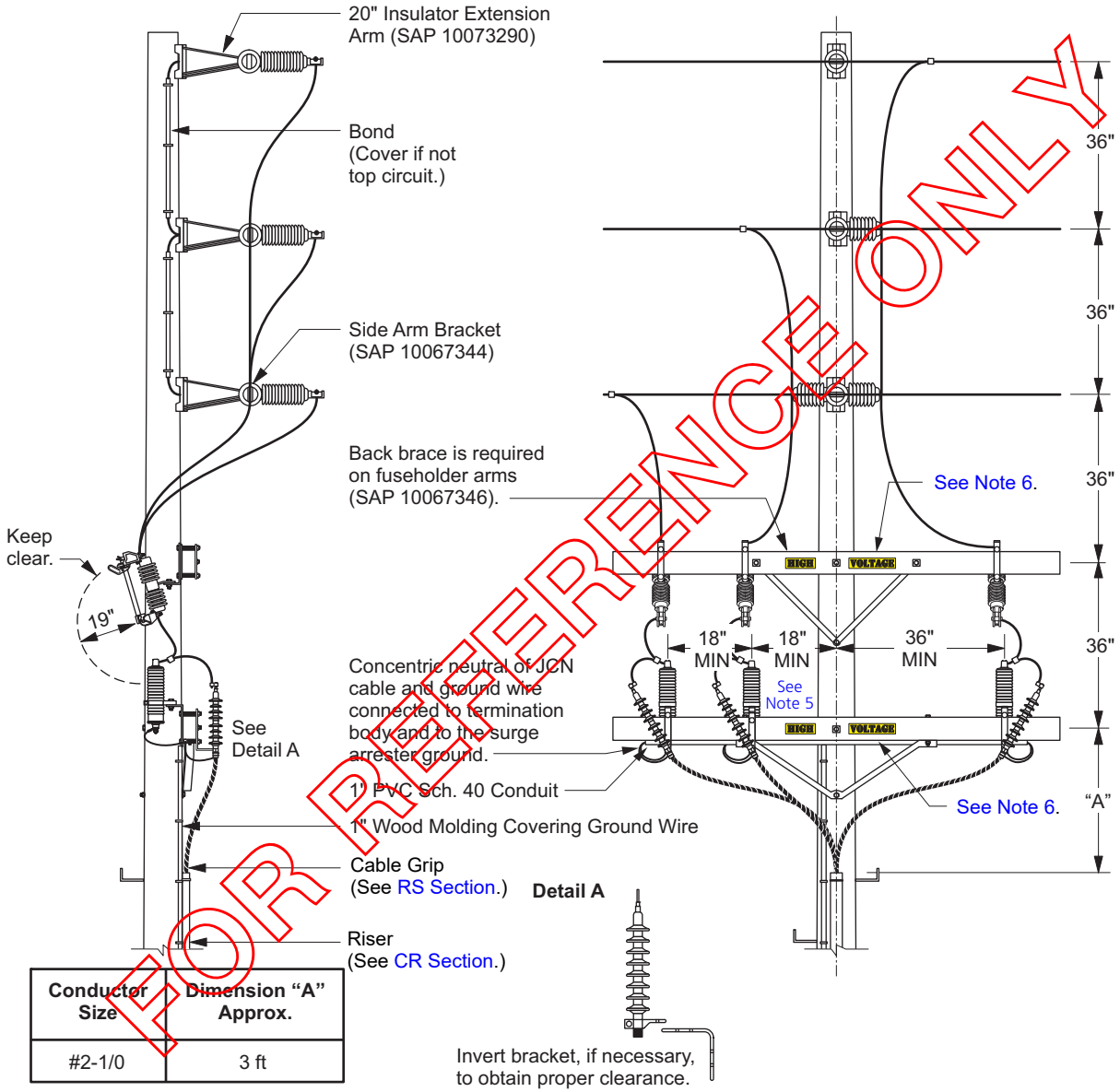
FOR REFERENCE ONLY

Note(s):

1. Connect surge arrester ground to termination ground and concentric neutral of cable. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with 1-inch PVC Schedule 40 conduit under crossarm and wood molding on pole.
2. Angle terminations to allow the cable to enter straight into the termination; angle not to exceed 45 degrees.
3. A back-up brace on the termination crossarm is required when using 750 kcmil and 1,000 kcmil conductor sizes.
4. Ferroresonance sign shall be installed when required. See PD Section.
5. The HIGH VOLTAGE sign mounted on the crossarm is for existing construction only. For new construction, install the HIGH VOLTAGE sign per DOH PO 120.
6. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.

Scope TP 209.12 Typical Termination Armless Construction — 12/16 kV CLP, 3Ø, 3-Wire Fused

Figure TP 209–12: Termination Armless Construction — 12/16 kV CLP, 3Ø, 3-Wire Fused



Conductor Size	Dimension "A" Approx.
#2-1/0	3 ft

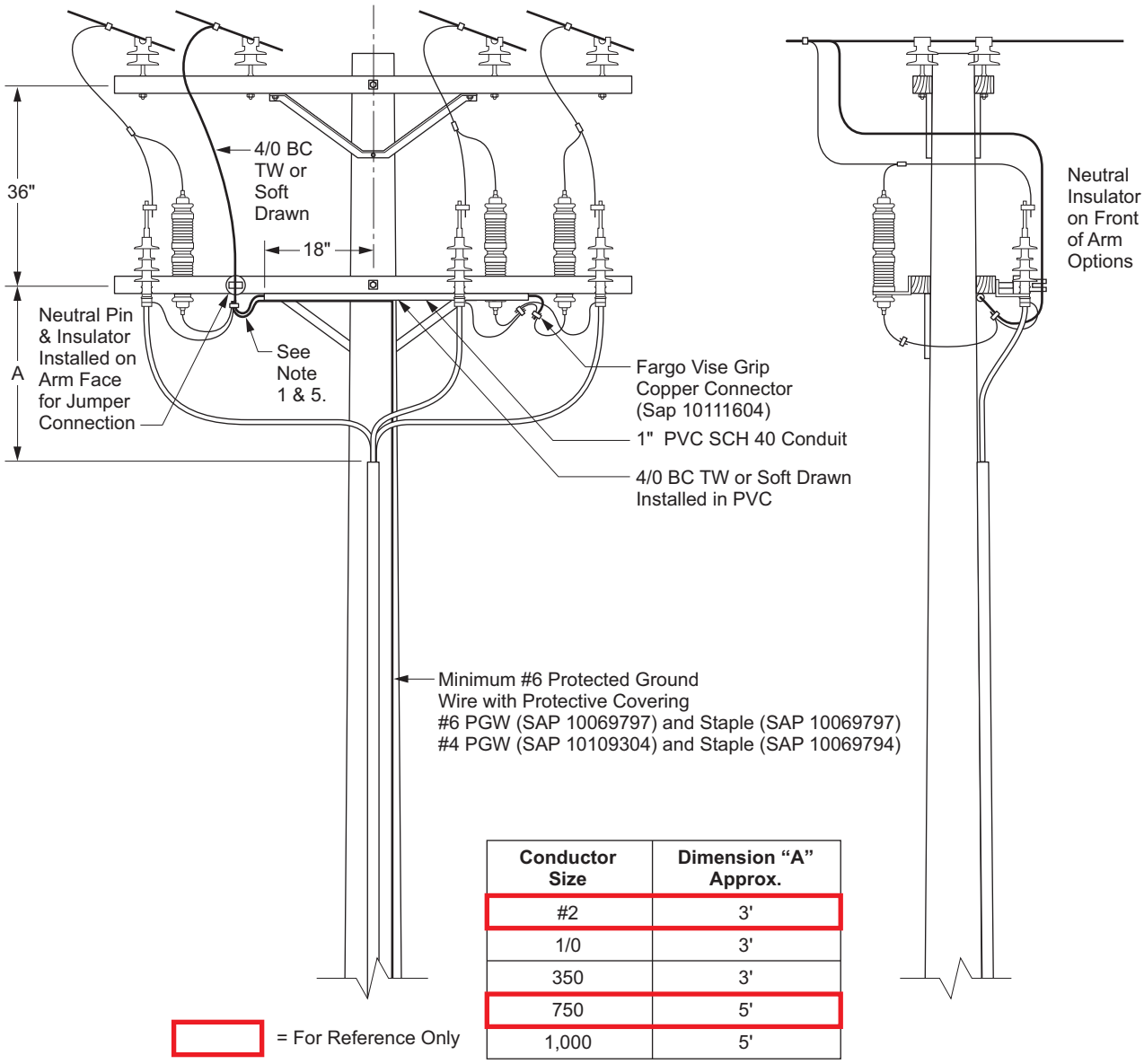
FOR REFERENCE ONLY

Note(s):

1. Connect surge arrester ground to termination ground and concentric neutral of cable. Surge arrester ground lead shall have a short drip loop. Ground wire is to be covered with 1-inch PVC Schedule 40 conduit under crossarm and wood molding on pole.
2. Angle termination to allow cable to enter straight into termination; angle not to exceed 45 degrees.
3. Install ferroresonance sign when required. See PD Section.
4. Do not install surge arresters directly under fuseholder.
5. This dimension may be increased to comply with approach distances listed in the Accident Prevention Manual, Rule 147.
6. The HIGH VOLTAGE sign mounted on the crossarm is for existing construction only. For new construction, install HIGH VOLTAGE sign per DOH PO 120.
7. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.

Scope TP 209.13 Typical Pole Termination Using Concentric As Neutral — 12/16 kV CLP Construction 3Ø, 4-Wire (Alternate 1)

Figure TP 209–13: Typical Pole Termination Using Concentric As Neutral — 12/16 kV CLP Construction 3Ø, 4-Wire (Alternate 1)



Conductor Size	Dimension "A" Approx.
#2	3'
1/0	3'
350	3'
750	5'
1,000	5'

= For Reference Only

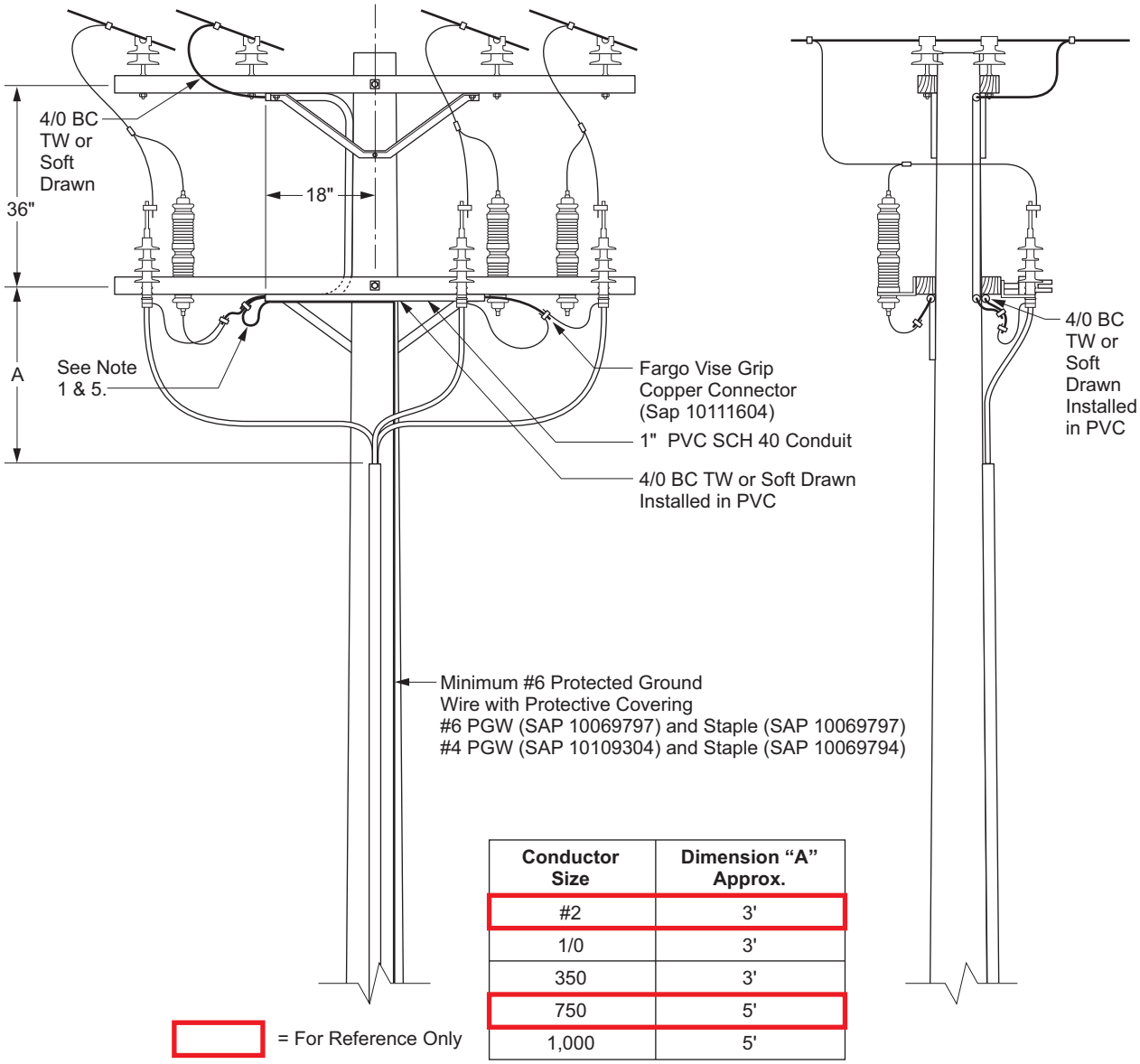
Note(s):

1. Cable concentric neutrals, surge arrester ground, and pole ground shall be terminated all together at the 4/0 BC installed under the pothead arm in PVC. All connections shall have a short drip loop.
2. Angle terminations to allow cable to enter straight into termination; angle not to exceed 45 degrees.
3. Install ferroresonance sign when required. See DUG PD 100.
4. Double Pothead Arm w/ single V-brace on back arm.
5. Per DOH GR 110, maintain clearance between neutral return conductor and pole line hardware.
6. Install sign (SAP 10180155) indicating the installation uses the cable concentric neutrals as the primary return conductor.

7. 2-1/2 inch Sch. 80 PVC is the minimum size that may be used below the 8 foot level. Conduit installed above the 8 foot level shall be Sch. 40 PVC.
8. Steps are required on all riser poles above the 8 foot level.
   EXCEPTION: Solely owned Edison poles with one low voltage riser (3 inches or less) need not be stepped.
9. PVC couplings are to be cemented to PVC conduit at top socket of coupling. Do not cement the lower socket of any coupling. This allows for expansion and contraction of the conduit.
10. Do not install surge arresters directly under fuseholder.
11. A transformer can be installed on a pole with a primary riser **only if the climbing space on the pole can be maintained.**
12. See DUG CR 150 for placement of riser conduit warning labels.

Scope TP 209.14 Typical Pole Termination Using Concentric As Neutral — 12/16 kV CLP Construction 3Ø, 4-Wire (Alternate 2)

Figure TP 209–14: Typical Pole Termination Using Concentric As Neutral — 12/16 kV CLP Construction 3Ø, 4-Wire (Alternate 2)



Conductor Size	Dimension "A" Approx.
#2	3'
1/0	3'
350	3'
750	5'
1,000	5'

= For Reference Only

Note(s):

1. Cable concentric neutrals, surge arrester ground, and pole ground shall be terminated all together at the 4/0 BC installed under the pothead arm in PVC. All connections shall have a short drip loop.
2. Angle terminations to allow cable to enter straight into termination; angle not to exceed 45 degrees.
3. Install ferroresonance sign when required. See DUG PD 100.
4. Double Pothead Arm w/ single V-brace on back arm.
5. Per DOH GR 110, maintain clearance between neutral return conductor and pole line hardware.
6. Install sign (SAP 10180155) indicating the installation uses the cable concentric neutrals as the primary return conductor.

7. 2-1/2 inch Sch. 80 PVC is the minimum size that may be used below the 8 foot level. Conduit installed above the 8 foot level shall be Sch. 40 PVC.
8. Steps are required on all riser poles above the 8 foot level.
   EXCEPTION: Solely owned Edison poles with one low voltage riser (3 inches or less) need not be stepped.
9. PVC couplings are to be cemented to PVC conduit at top socket of coupling. Do not cement the lower socket of any coupling. This allows for expansion and contraction of the conduit.
10. Do not install surge arresters directly under fuseholder.
11. A transformer can be installed on a pole with a primary riser **only if the climbing space on the pole can be maintained.**
12. See DUG CR 150 for placement of riser conduit warning labels.

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TP 210 Pothead G&W #2 — 1/0 — 12/16-kV — Poly

Scope TP 210.1 Installation of G&W Slip-On Dry Potheads for use on #2 and 1/0 Aluminum 1/C Synthetic Insulated 220 mil 12/16-kV Cables (#2 M/C 650-35503, 1/0 M/C 650-28300)

1.0 Train, Measure, and Cut Cable

Temporarily install the pothead to the mounting bracket in the desired position. Train the cable along the side of the pothead and cut the cable off at top cap, reference point "A" + 2 inches. Bind the concentric wires with a plastic strap to the dimension shown. Unwrap the wires and twist together.

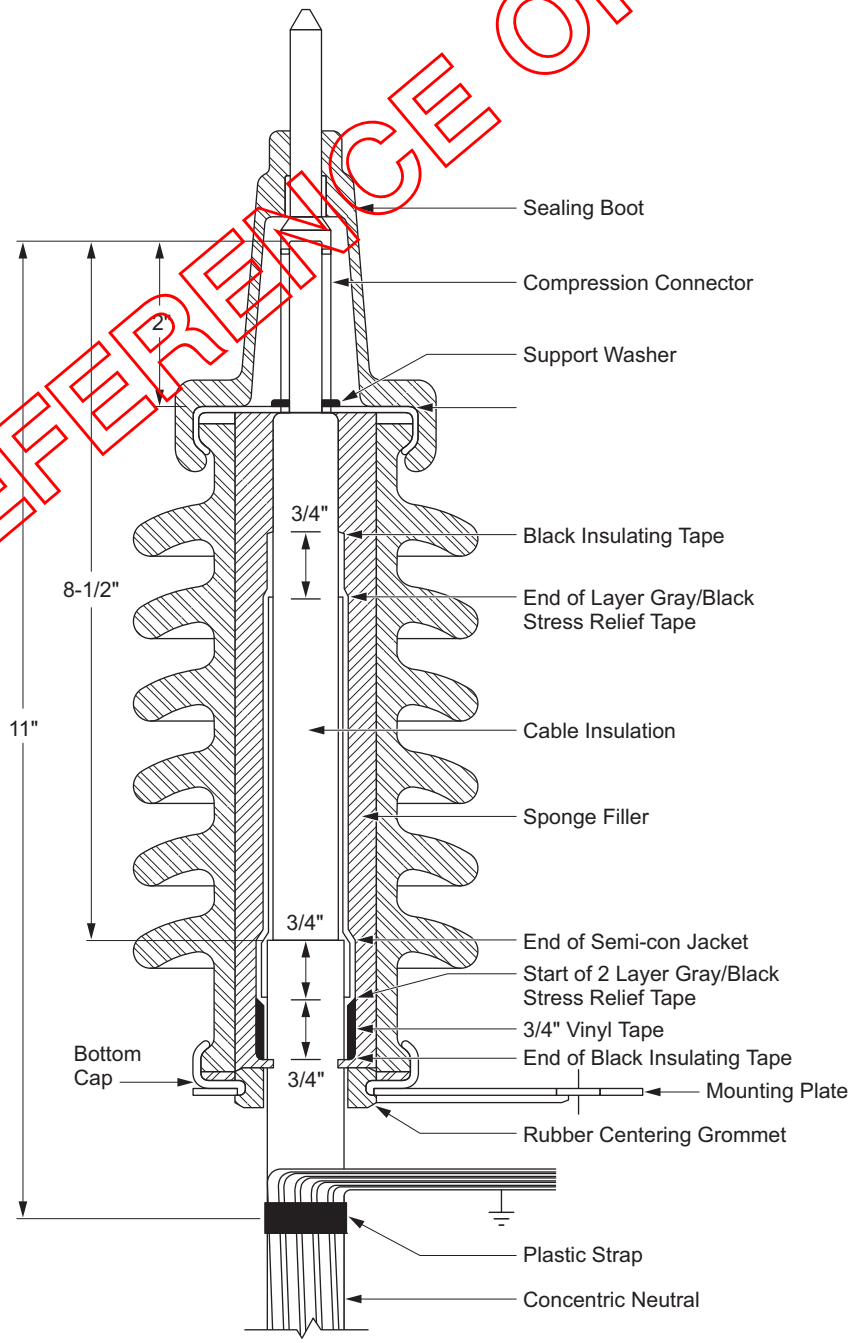
2.0 Prepare Cable

Remove the cable insulation and semiconducting jacket to the dimensions shown. Bevel the end of the insulation to remove any sharp edges. DO NOT PENCIL. Clean the exposed insulation of all semiconducting material.

3.0 Stress Tape Application

Place the rubber centering grommet over the semiconducting jacket. Apply one full even turn of the two layer gray/black stress relief tape, starting 3/4 inches onto the semiconducting jacket. Tape should be stretched 3/4 inches wide and wrapped half lapped with gray side toward cable. Continue taping upward onto the insulation until the gray portion of the roll ends. Extend the black insulating portion of the roll 3/4 inches past the end of the gray portion. Leaving an even front

Figure TP 210–1: G&W Slip-On Dry Potheads for Use on #2 and 1/0 Aluminum 1/C Synthetic Insulated 220 mil 12/16-kV Cables



FOR REFERENCE ONLY

edge, tape downward to a point 3/4 inches past the original starting point. Apply two layers of 3/4 inch vinyl tape (M/C 646-72009) over the bottom 3/4 inches of the previously applied 3/4 inch black insulating tape.

4.0 Complete Pothead Assembly

Wrap a layer of vinyl tape over end of conductor strands. Apply silicone grease supplied, or silicone grease (M/C 898-41407) over exposed insulation and tapes. Slide pothead onto cable, rotating it in the direction of the wrapped tape until end of insulating contacts top cap. Clean conductor with wire brush. Install support washer and connector onto conductor. Keeping insulation against the top cap, apply 4 crimps, rotated 90 degrees between each crimp, with the BG die in the Burndy MD-6 compression tool. Remove excess inhibitor compound. Install sealing boot over connector and top cap. DO NOT grease boot. Insert rubber centering grommet into bottom cap. Bolt pothead to mounting bracket.

5.0 Make Connections

Connect concentric wires to ground lug on mounting bracket. Attach overhead tap to pothead using parallel grove connector (M/C 611-09401).

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TP 212 Pothead Joslyn #2 — 1,000 — 5–16-kV — Poly

Scope TP 212.1 Installation of Joslyn Easy-On Outdoor Terminators for use on Aluminum 1/C Synthetic Insulated 5–16-kV Cables

1.0 Train, Measure, and Cut Cable

Attach mounting plate to lower cover and install terminator on the mounting bracket in the desired position. Train cable along the side of the terminator and cut off cable at distance “A” above top cover plate. Bind the concentric wires to the dimension “C” as shown. Unwrap the wires and twist together.

2.0 Prepare Cable

Remove the cable insulation and semiconducting jacket to the dimensions “A” and “B” as shown. Bevel the end of cable insulation 1/8 inch at a 45 degree angle. DO NOT USE PENCILLING TOOL. Clean exposed insulation of all semiconducting material.

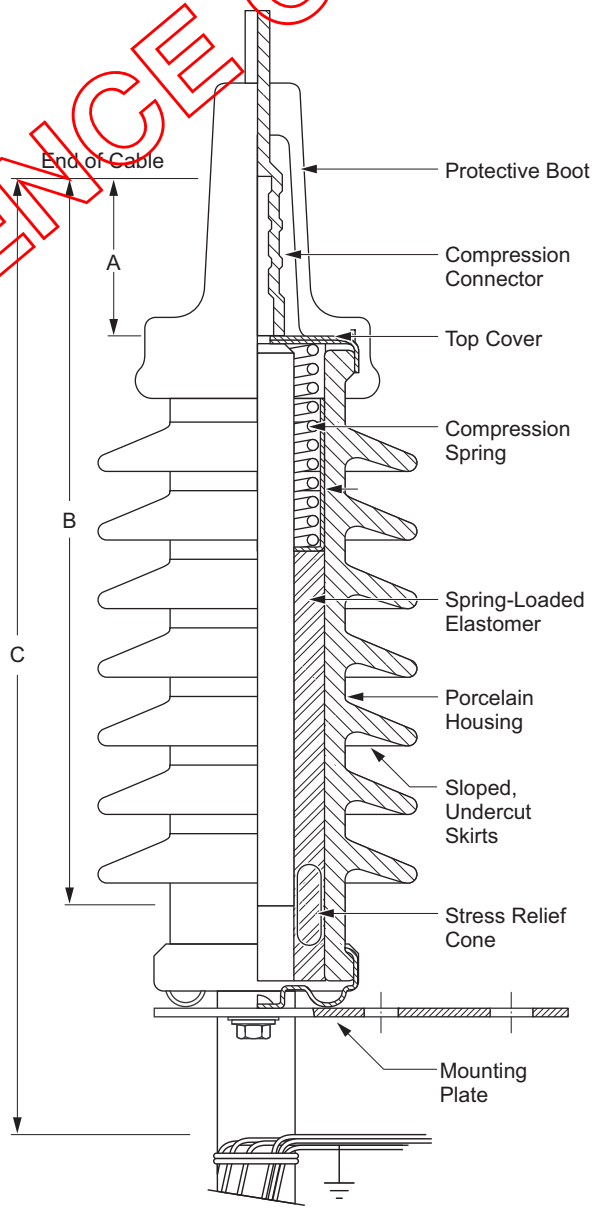
3.0 Complete Pothead Assembly

Using plastic glove, coat exposed insulation and 1-1/2 inches of semiconducting jacket with grease provided. Insert cable into terminator until end of insulation butts against bottom of top cover. Keeping cable supported, clean conductor with wire brush. Install connector on conductor and crimp using the tools, dies, and total crimps as shown below. Pull cable down until cable is tight against top cover and then remove the two compression spring release pins. Slip protective boot over connector stud and top cover.

4.0 Make Connections

Connect concentric wires to ground lug on mounting bracket. Connect overhead tap to terminator. Use parallel grove connector (M/C 611-09401) on #2 and 1/0 cables. On cable sizes 350–1,000-kcmil, use aerial lug provided.

Figure TP 212–1: Joslyn Easy-On Outdoor Terminators for Use on Aluminum 1/C Synthetic Insulated 5–16-kV Cables



FOR REFERENCE ONLY

Table TP 212–1: Pothead Joslyn #2 — 1,000 — 5–16-kV — Poly

Material Code	System Voltage (kV)	Conductor Size (kcmil)	Dimensions (in)			Tools, Dies, and Total Crimps	
			A	B	C	Die	Crimps
650-11405	5	1/0	2-1/8	9-1/4	12-1/2	BG	3
650-35503	12–16	#2	2-1/8	9-1/4	12-1/2	W-163	3
650-28300	12–16	1/0	2-1/8	9-1/4	12-1/2	BG	3
650-11504	5	350	5-3/8	12-3/4	17	15CA96R	2
650-12502	5	750	5-3/8	12-3/4	17	15C140R	3
650-28342	12–16	350	5-3/8	12-3/4	17	15CA96R	2
650-28409	12–16	750	5-3/8	15-3/4	20	15C140R	3
650-49009	12–16	1,000	5-3/8	15-3/4	20	15C161R	3

FOR REFERENCE ONLY

TP 215 Pothead Joslyn — 1/0–1,500 35 kV — Poly

Scope TP 215.1 Installation of Joslyn PSC Terminators on 34.5 kV Insulated Aluminum Cables Conductors — 1/0–1,500 kcmil

1.0 Cable Preparation

1.1 Mount the terminal in the desired position. Train the cable along the side of the terminal. Mark and cut the cable one inch below the reference surface as shown in the drawing. Tie the concentric wires with a cable tie at point “A” inches from the end of the cable. Unwrap the concentrics and bend them out of the way. Remove the terminal from the mounting bracket.

1.2 Remove cable insulation and semiconducting jacket “B” inches from the end of the cable. Remove semiconducting jacket for a distance “C.” The edge of the semiconducting jacket should be even, with no protrusions. Remove all traces of semiconducting material from the exposed insulation.

2.0 Pothead Assembly

2.1 Remove the cover casting from the housing casting and slip the cover casting over the cable. Use the plastic gloves provided to insure cleanliness in handling the prepared cable and elastomers. Cover the exposed cable insulation and 1 inch of the semiconducting jacket with the grease provided. Place the plastic guide bushing on the cable.

2.2 Thoroughly coat the entire surface of the black elastomer, including the inside of the cone, with the grease provided. Slip the black elastomer onto the cable until it overlaps the semiconducting jacket and reaches the internal stop. Slip the white elastomer over the cable until it fits into the cone of the black elastomer. Place the plastic bag over the elastomers for protection against contamination and puncture the bag to expose the conductor.

2.3 Wire brush the aluminum conductor strands and immediately install the compression connector using the tools and dies recommended in Table TP 215–2 (Sheet 2). Remove the plastic bag and clean away all traces of inhibitor. Coat the surface of the white elastomer with the grease provided.

2.4 Hold the elastomers in place on the cable and work the cover casting over the black elastomer and onto the white elastomer.

3.0 For 1/0 Potheads

3.1 Coat the first three inches inside the porcelain housing with the remaining grease. Insert the cable, with elastomers in place, into the porcelain housing. Engage the long compression screws from the cover casting into the housing casting and alternately tighten them until the castings seat together. Maintain force on the cable while tightening to overcome cable weight and to cause the compression connector to move all the way up into the terminator.

3.2 Place the connector nut on the threaded stud and tighten down against the top of the terminator. Mount the pothead on the bracket provided.

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4.0 For 750 kcmil and 1,500 kcmil Potheads

4.1 Mount the cover casting, with elastomers and cable in place, on the flange mounting bracket using the short mounting screws. Coat the first three inches inside the porcelain housing with the remaining grease. Slide the porcelain housing over the elastomers and engage the long compression screws from the cover casting into the housing casting. Alternately tighten them, maintaining force on the cable to overcome the cable weight, until the castings seat together.

4.2 Place the connector nut on the threaded stud and tighten down against the top of the terminator.

5.0 Connections

5.1 Connect the ground wire to the ground terminal on the pothead mounting bracket. Twist the concentric wires into a single conductor and attach to the ground wire. Make aerial connections using the aerial lug provided. DO NOT WIRE BRUSH OR SAND THE AERIAL LUG.

Table TP 215–1: Identification and Dimensions for Joslyn PSC Terminators

Material Code	Cable Description	Catalog Number	Dimensions (in)		
			A	B	C
650-71706	34.5 kV — 1/0 kcmil	SCE-16	24-3/4	2-3/8	19-1/4
650-71508	34.5 kV — 750 kcmil	SCE-13	31-11/16	3-1/8	25-7/16
650-71607	34.5 kV — 1,500 kcmil	SCE-15	33-1/2	3-15/16	27-5/16

Table TP 215–2: Tool and Die Guideline for Installing Joslyn Compression Connectors

Conductor Size	Tool, Dies, and Total Crimps Required					
	Burndy MD6		Somerset UT15		Alcoa 60 AFT.	
	Die	Crimps	Die	Crimps	Die	Crimps
1/0	BG	4	—	—	—	—
750 kcmil	—	—	15C140R	3	—	—
1,500 kcmil[1/]	—	—	—	—	L46ART	2

[1/] Contact Supervising Division Engineer for tools and dies.

Tools	
Item	Material Code
Burndy MD6	851-05708
Somerset UT15	851-01806

Dies	
Index Number	Material Code
BG	Fixed Die in MD6 Tool
15C140R	851-57105

Note(s):
1. Only circular crimp dies are approved for Joslyn connectors.

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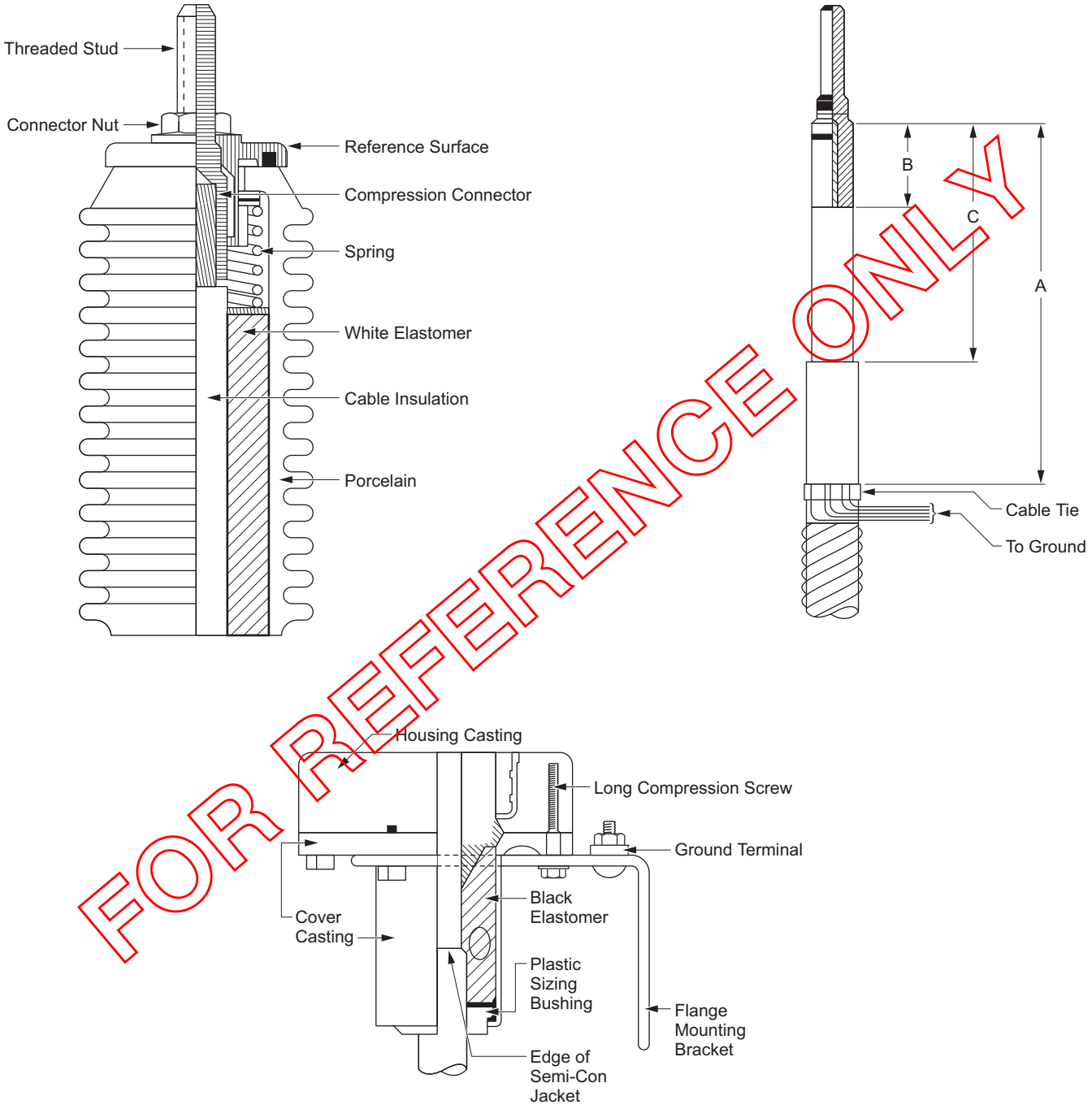
Figure TP 215–1: 1/0-750-1,500-kcmil Potheads



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TP 218 Pothead G&W — 4/0–1,000 — 5–35 kV — Poly

Scope TP 218.1 Installation of G&W Slip-On Terminators for Use on 5 kV, 12 kV, 16 kV, and 34.5 kV Aluminum 1/C Polyethylene Insulated Cable (Cable Range 1/0–1,000-kcmil)

1.0 General Information

This pothead is factory assembled. It contains a stress control device and is prefilled with compound. Each unit is sealed to prevent contamination. Make all required reference marks using tape. Do not loosen any bolts unless indicated in the instructions. Do not pull cable out of pothead after it is inserted.

2.0 Train, Measure, and Cut Cable

2.1 Mount the pothead in its final position, and form the cable outside the pothead as nearly as possible to its final position. Avoid all sharp bends by using a minimum bending radius of ten times the diameter of the cable. Keep the cable straight for a distance of a least six inches beyond the end of the duct or conduit and six inches below the pothead.

2.2 Tie the concentric ground wires around the cable at a point three inches below the end of the pothead. Unwind the concentric wires and bend them down out of the way. Allow enough concentric wire to connect to the pothead ground terminal.

2.3 Apply a tape marker around the cable with the top edge of the tape located level with the lower end of the pothead entrance. Measure up the cable distance “A” as shown on the drawing, and cut cable

3.0 Apply Terminal Connector

Remove the semiconducting jacket and cable insulation for distance “B” as shown on the drawing. Pencil the insulation to O.D. of connector. Remove all traces of semiconducting material from the exposed conductor strands. Use a wire brush to remove all traces of aluminum oxide from the bare conductor. Remove the seal over the connector and immediately fit the connector over the cable conductor. Press the connector on the conductor using compression tool and dies as shown on the drawing.

4.0 Prepare Cable for Termination

4.1 Remove the semiconducting jacket for distance “C” as shown on the drawing. Remove all traces of semiconducting material from the surface of exposed insulation. Do not cut or damage the insulation. The edge of the semiconducting jacket should be even, with no protrusions.

4.2 To avoid damaging the diaphragm when inserting the cable into the terminator, special care should be taken to prepare the connector. For this application, a pad of filler compound (G&W 256) and tape are supplied. The space between the cable insulation and the connector, and any indents or crimps should be filled with the compound. The area should then be covered with half-lapped layers of the tape, starting below the taper on connector, extending onto the cable insulation, and returning to the taper on the connector. Coat the connector, exposed cable insulation, and semiconducting jacket, down to the tape marker, with the silicone grease supplied.

5.0 For 4/0 kcmil Conductor Sizes

Remove the pipe plug. Screw the plastic bottle onto the pipe plug boss. Push the cable into the pothead. The end of the connector will puncture the plastic seal. Use a constant force and slowly push the cable into the pothead. The cable may be considered in place when the top edge of the previously applied tape

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marker in within 1/4 inch of the bottom of the pothead entrance. It may be necessary to loosen set screw in order to get connector properly seated. Hold the cable in position. Tighten the nut to lock and seal the set screw in place. Remove the marker tape. Remove the plastic bottle, replace and tighten pipe plug.

6.0 Complete Pothead Assembly For 350 kcmil, 750 kcmil, and 1,000 kcmil Conductor Sizes

6.1 Try sliding the centering guide over the connector and the cable. If the guide will not fit, it is not necessary to use it. If the guide does fit, insert it lip end first into the cable entrance hole. Make certain the lip is seated against the diaphragm seal.

6.2 Remove the sealing cap from the hood and insert a plastic bottle. Remove the pipe plug and insert the second bottle into the pipe plug boss. Slowly push the cable into the terminator using constant force. The cable is in place when the tape marker in within 1/4 inch of the terminator entrance.

6.3 Remove both the plastic bottles, replace the pipe plug. Clean the sealing bolt entrance with the wooden spatula, replace the sealing bolt and tighten. Remove the marker tape.

7.0 Make Connection

Twist the concentric wires into a bundle and connect to ground lug on bracket. Make the aerial connection using the clamp type aerial lug provided. Tighten “U” bolts to 20 foot-pounds. DO NOT WIRE BRUSH OR SAND THE EYE BOLT CONNECTOR.

Table TP 218–1: Identification and Dimensions for G&W Slip-On Terminators

Material Code	Cable Description	Catalog Number	Dimension (in)		
			A	B	C
650-11405	5 kV — 1/0 kcmil	PAT 1701	7-11/16	2-1/8	9-1/4
650-11504	5 kV — 350 kcmil	PAT 1772	9-13/16	2-1/8	12-9/16
650-12502	5 kV — 750 kcmil	PATR 1773	10-3/8	2-3/4	13-1/4
Reference[1/] Only	12-16 kV — #2	PAT 1801	11-7/16	2-1/8	13-0
Reference[1/] Only	12-16 kV — 1/0	PAT 1802	12-1/2	2-1/8	13-5/8
650-47508	12-16 kV — 4/0	PAT 1802	12-1/2	2-1/8	13-5/8
650-28342	12-16 kV — 350 kcmil	PAT 1872	12-7/8	2-1/8	15-5/8
650-28409	12-16 kV — 750 kcmil	PATR 1873	13-7/8	2-3/4	16-5/16
650-49009	12-16 kV — 1000 kcmil	PATR 1873	13-7/8	2-3/4	16-5/16
650-71508	34.5 kV — 750 kcmil	PATR 1073	24-3/8	2-3/4	27-1/4

[1/] G&W LCT Potheads for No. 2 and 1/0 Cable are to be installed per TP 210.

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Tools	Material Code
Burndy MD6	851-05708
Burndy Y34	851-02507
Burndy Y35 or Alcoa 12HA	851-04008
Somerset UT15	851-01806

Die	Material Code
15CA49R	851-57303
15CA74R	851-57402
15CA96R	851-57501
15C140R	851-57105
15C161R	851-57907
A31D	851-14809
C39AR	851-50001
C44AR	851-57006
C35D	851-24501
C45D	851-19204
C46D	851-19600

FOR REFERENCE ONLY

Table TP 218–2: Tool and Die Guideline for Installing G&W Compression Connectors

Conductor Size	Tools, Dies, and Total Crimps Required							
	Burndy MD6		Burndy Y35 or Alcoa 12HA		Somerset UT15		Burndy Y48	
	Die	Crimps	Die	Crimps	Die	Crimps	Die	Crimps
#2	BG	4	15CA49R	2	15CA49R[1/]	2	—	—
1/0	BG	4	15CA49R	2	15CA49R[1/]	2	—	—
4/0[2/]	—	—	15CA71R	2	15CA71R[1/]	2	—	—
350 kcmil	—	—	15CA96R	2	15CA96R[1/]	2	C35D	2
750 kcmil	—	—		2	15C140R	3	C45D	2
							C39AR	2
1,000 kcmil	—	—	—	—	15C161R	3	C46D	2
							C44AR	2

[1/] These dies will fit in UT15 w/Adapter Dies M/C 851-25102.
[2/] May also be installed with Burndy Y34 Tool and Y34PR-5, A31D Dies.

Note(s):
1. Previous models of this pothead require different cutting dimension. Check the dimensions on the instruction sheet in the package; if there is a difference, use the dimensions shown on the instruction sheet.

Figure TP 218–1: G&W Slip-On Terminators for use on 5 kV, 12 kV, 16 kV, and 34.5 kV Aluminum 1/C Polyethylene Insulated Cable (Cable Range 1/0–1,000-kcmil)

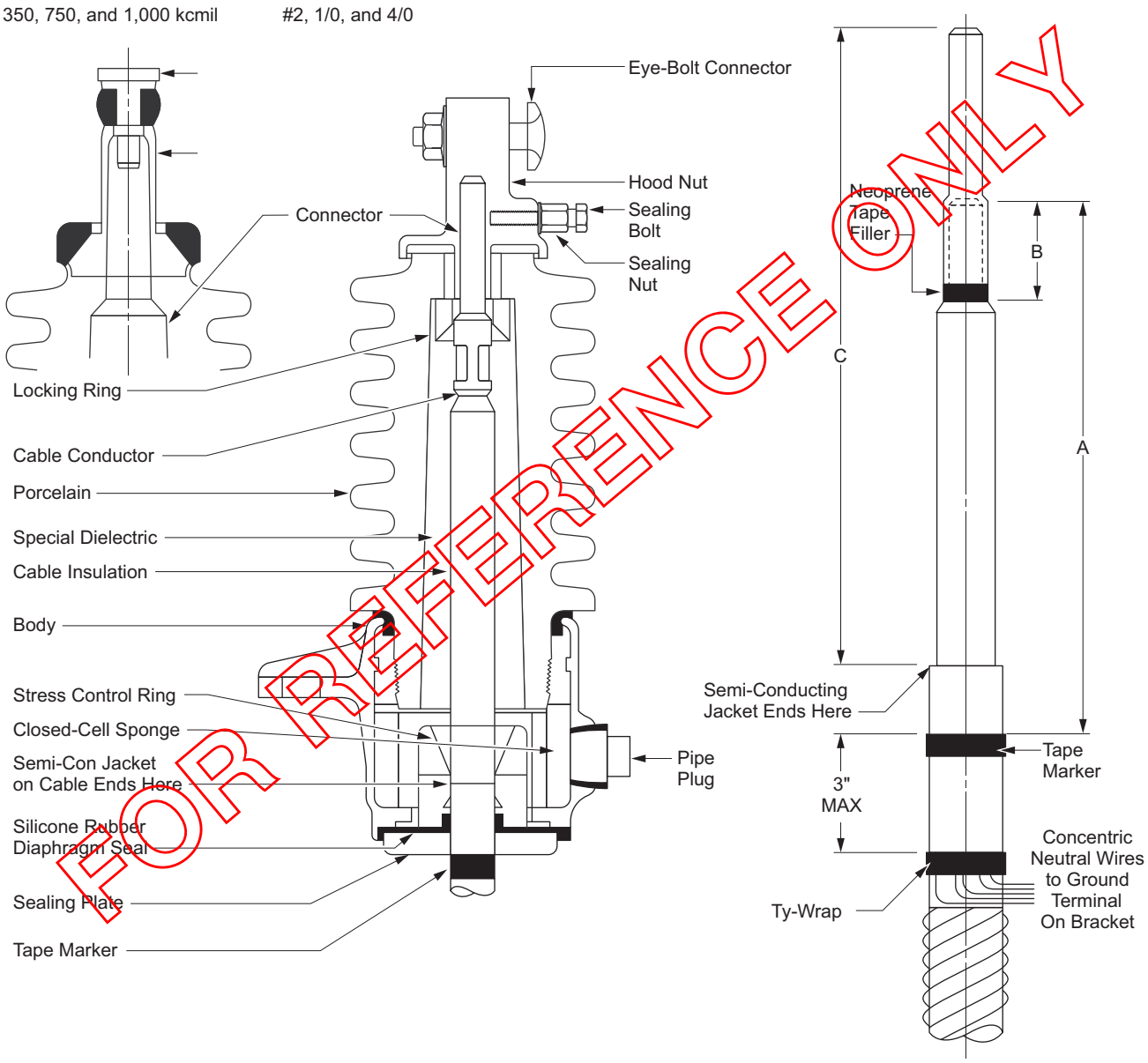

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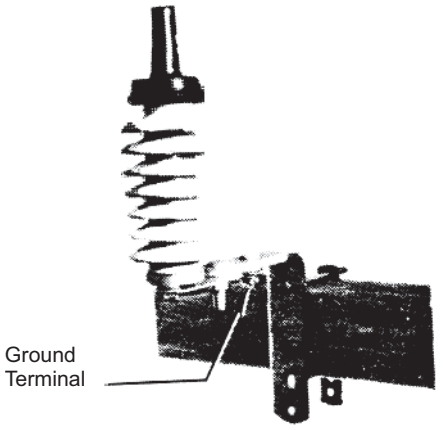
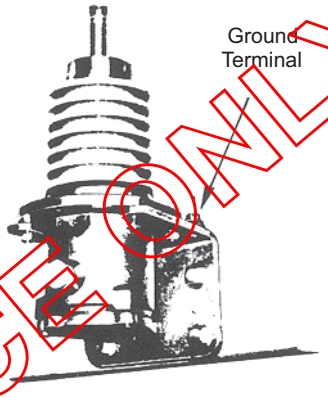
Figure TP 218–2: Pothead Mounting Brackets



Conductor Sizes
#2, 1/0, 4/0, and 350 kcmil



Conductor Sizes
750 and 1,000 kcmil

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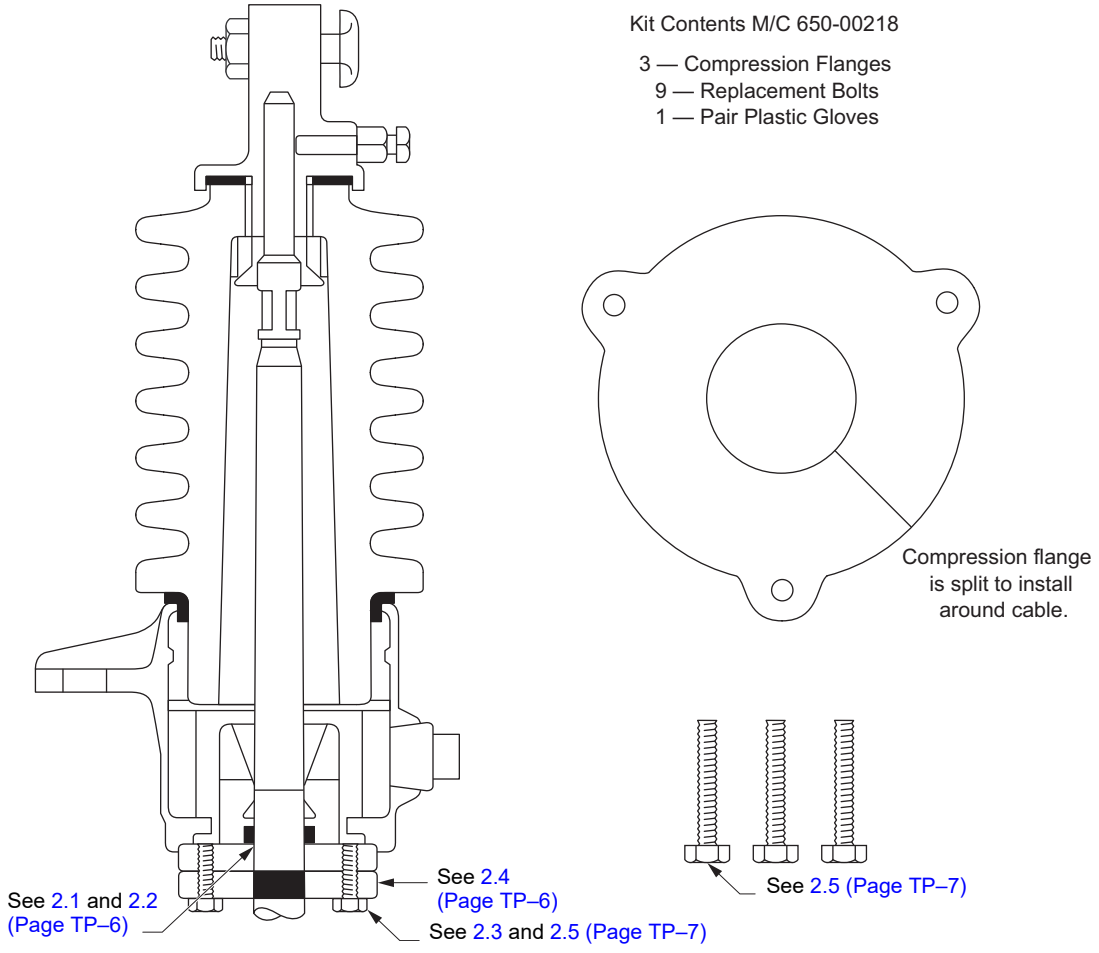
Scope TP 218.2 Pothead G&W — 750- and 1,000-kcmil 5–35 kV Poly Leak Repair Kit

Figure TP 218–3: G&W Pothead Leak Repair Kit (M/C 650-00218)



1.0 Application

Install on G&W potheads prior to leaks developing or when only a slight loss of dielectric fluid has occurred.

2.0 Installation

2.1 Use clean dry rag to wipe dust and debris from cable entrance to pothead.

2.2 Using a cartridge gun, apply SCE-approved silicone sealant (M/C 656-00116) in and around cable entrance.

2.3 Remove all three existing flange bolts.

2.4 Place compression flange around cable and fill with silicone sealant.

2.5 Install the three new bolts to hold compression flange in place. Wipe excess silicone sealant from around pothead and cable. The installation is complete. Order silicone and caulking gun separately.

2.6 The installation is complete.

Note(s):
1. Order silicone and caulking gun separately.

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TP 220 Pothead G&W — 1,500 kcmil 35 kV — Poly

Scope TP 220.1 Installation of G&W Terminator on 34.5 kV 1,500 kcmil Insulated Aluminum Cables (M/C 650-71607)

1.0 Installation

1.1 Train, Measure, and Cut Cable

A. Temporarily mount the pothead, less entrance, in its final position. Train the cable along side of the pothead. Mark the cable jacket even with the bottom edge of the pothead body.

B. Cut the cable at 24 inches above this mark. Bind the neutral shield wires below the final position of “RS” entrance.

C. Lower the “RS” entrance, entrance extensions (2) and gaskets over the cable. Be sure the entrance parts are in proper order for later assembly.

1.2 Apply Terminal Connector

A. Measure depth of the connector socket and add 1/2 inch to this dimension. Remove the cable semiconductor jacket, cable insulation and strand shielding for this distance from the end of the cable.

B. Clean conductor strands, fit the connector over the conductor. The connector locking fins must be parallel with the pothead mounting bracket. Press the connector onto the conductor with 2 crimps using Y60 Hydraulic Tool and Burndy L46 ART die set.

1.3 Preparation of Cable

A. Remove cable semiconductor jacket from top of cable to 6 inches below mark on jacket.

B. Pencil the end of the cable insulation a minimum of 1 inch. Fill in the pencil to the level of cable insulation with half-lapped layers of VDG tape (supplied with pothead) as shown on the drawing.

1.4 Apply Stress Relief Cone

Starting at the top of the stress cone which is 12 inches from the end of semiconductor jacket, apply one half-lapped layer of VDG tape down to within 1/2 inch of the end of the cable semiconductor jacket. Continue taping to form a stress cone of 1 inch larger than cable insulation diameter. Continue the last layer of the tape back to the starting point.

1.5 Apply Tinned Copper Shielding Braid

Apply tinned copper shielding braid (supplied with pothead) starting slightly below the peak of the stress cone and wrapping up to the peak. Make sure there are no strands of braid protruding from the edge at the peak of the stress cone shielding. Continue the shielding braid by wrapping half-lapped down the slope and over the cable semiconductor jacket for 1/2 inch overlap. Tack solder the tinned copper shielding braid to itself in three axial lines on the stress cone. Apply cover

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insulation of VDG tape, starting over the connector, wrapping half-lapping down the cable insulation, to a point 3 inches below the peak of the stress cone. Continue wrapping, half-lapped, back to the starting point.

A. Wrap the tinned copper shielding braid with 4 turns of ground wire at bottom of stress cone and solder tack ground wire turns to shielding braid. Arrange three ground straps around the cable and solder to the ground wire turns. Leave the end of the ground straps free for future attachment to pothead body.

1.6 Assembly of Terminator on Cable

A. Slip the pothead over the cable end and bolt to the mounting structure. Temporarily tighten the hoodnut to assure that the connector is seated against inside shoulders of porcelain insulator.

B. Raise the entrance extensions and gaskets and attach three ground straps to the entrance. Bolt entrance extensions to pothead body and each other. Raise the “RS” body and bolt to the entrance extensions. Assemble discs and gaskets into “RS” body and tighten “RS” compression nut.

C. Bind the neutral shield wires with tie-wrap approximately 3 inches below “RS” entrance. Connect neutral shield wires to the pothead mounting bracket.

1.7 Fill with Compound

A. Install a riser filling pipe in the pothead body. The top of the riser pipe should be higher than the highest point on the pothead to be filled. Remove the hoodnut from the pothead to provide a vent around the connector.

B. The pothead should be pre-warmed if the ambient temperature is below 70°F, to prevent premature cooling of the compound. The pothead can be preheated.

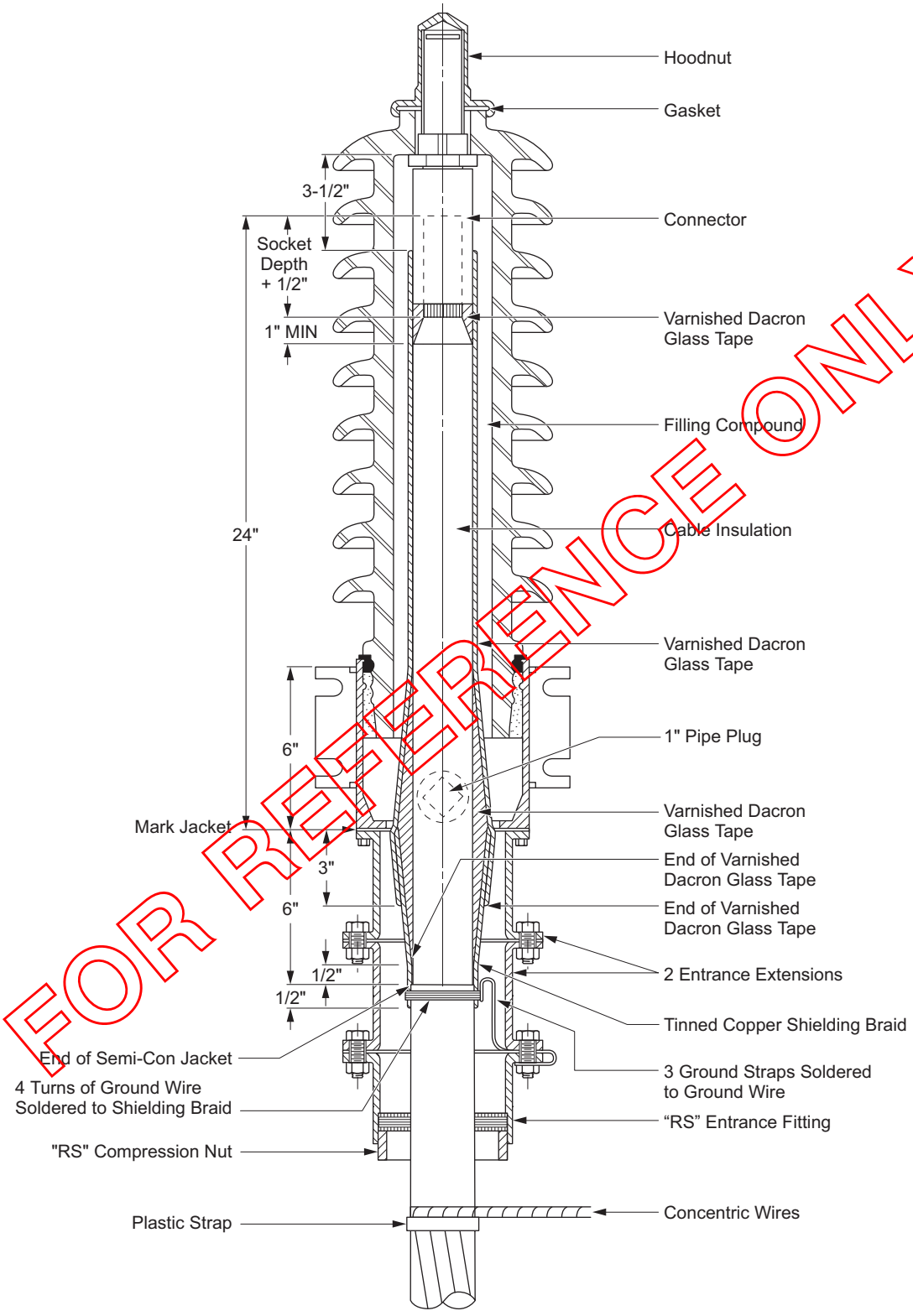
C. Heat the insulating compound (M/C 645-28102) and riser pipe to pouring temperature of 275°F – 325°F. Pour the compound until it emerges at the top of the porcelain. Clean all compound from porcelain sealing surface. Assemble hoodnut. Continue heating riser pipe for 15 minutes. Allow the pothead to cool. Remove the riser pipe and insert the pipe plug.

1.8 Complete Assembly

A. Tighten bolts and fitting, and assemble the aerial lug.

FOR REFERENCE ONLY

Figure TP 220–1: G&W Terminator on 34.5 kV 1,500 kcmil Insulated Aluminum Cables



FOR REFERENCE ONLY

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TP 240 SW Terminal — ESCO Stud Bushing — Poly

Scope TP 240.1 ESCO Stud Bushing Termination — "RA" Oil Disconnect for 1/C 12/16 kV 750 kcmil, Al, CLP Cable

1.0 General

The following instructions cover the termination of cross-linked polyethylene-insulated aluminum cable at a stud bushing with a stuffing box entrance. (See Figure TP 240–1 [Sheet 3] for this procedure.) **Do not remove bushing body until after the switch is permanently mounted. Do not remove stud bushing from switch.**

2.0 Train, Measure, and Cut Cable

Remove the "RS" stuffing box entrance, leaving the stud bushing body in place. Train the cable in front or to the side of the stud bushing body and mark the cable jacket nine and one-quarter inches down from the bottom of the switch. CUT THE CABLE AT THIS MARK. Bend the concentric neutral wires out of the way, approximately four feet.

Remove the body and place the "RS" entrance and body over the cable in proper sequence for reassembly.

3.0 Apply Terminal Connector

Measure the depth (L) of the connector socket, and add 3/4 inches to this dimension. Using the stripping tool, remove the cable jacket, insulation, and semiconducting strand shielding for this distance.

Measure and remove 8-1/4 inches of cable jacket as shown. Remove all traces of semiconducting material from the surface of the exposed cable insulation. If necessary, use nonmetallic abrasive cloth (M/C 057-06007) on hard to remove residue. Pencil the insulation with penciling tool.

Clean the bared conductor strands of all traces of aluminum oxide with a wire brush. Remove the seal over the connector socket and immediately fit the connector over the cable conductor. Orient the connector on the conductor for final connection without twisting the cable. Press the connector onto the conductor with 3 circular crimps. Use the UT15 compression tool with the 15C140R circular die set.

4.0 Apply Tapes and Stress Cone

Bolt connector to the stud bushing pad. Pack all crevices with Aquaseal or Electroseal to form a smooth taping surface. Clean the porcelain, connector, and cable insulation. Smooth the circular crimp area with semiconducting tape (M/C 656-69608), then apply one half-lapped layer of semiconducting tape (M/C 656-69608) from 1/4 inches up on penciled cable insulation, over cable stranding, over connector, and to the upper edge shown.

Apply half-lapped layers of insulating tape (M/C 647-31003) to form the termination as shown. Start at the connector conductor junction and "fill in" until the applied tape is the same diameter as the cable insulation. Then complete the overall taping to the 3 inch diameter dimension as shown. (Note: Leave a 1/4 inch gap between the applied insulating tape and the cable jacket at the bottom of the termination.)

Apply one half-lapped layer of silicone tape (M/C 646-85605) over all of the insulating tape to the edge of the cable jacketing. This is to keep the compound from making direct contact with the insulating tape.

FOR REFERENCE ONLY

Apply one half-lapped layer of shielding braid, starting 3-1/2 inches above the cable jacket and taping down the slope and overlap the cable jacket one inch. Wrap several turns of wire over the braid to bind it to the cable jacket. Solder-tack the shielding braid to the wire serving, then apply three lines of solder down successive turns of the stress cone 120 degrees apart.

5.0 Complete Pothead Assembly

Assemble the gasket and body to the side plate and cross-torque bolts to 10 foot-pounds.

Bolt the “RS” entrance to the gasket and the base of the body. Cross-torque bolts to 10 foot-pounds. Raise the “RS” entrance washers, gaskets, and nut and tighten nut to seal the cable entrance.

6.0 Fill with Compound

Install a riser filling pipe in the lower pipe plug boss. Extend pipe 12 inches above the highest point to be compounded. Remove the vent screw from the side plate.

Heat the compound to the temperature indicated on the container and observe the precautions thereon. Use a thermometer to prevent overheating.

The pothead body must be warm to prevent the compound from freezing. The riser pipe must be kept hot during the entire pouring operation until the compound in the body has completely cooled.

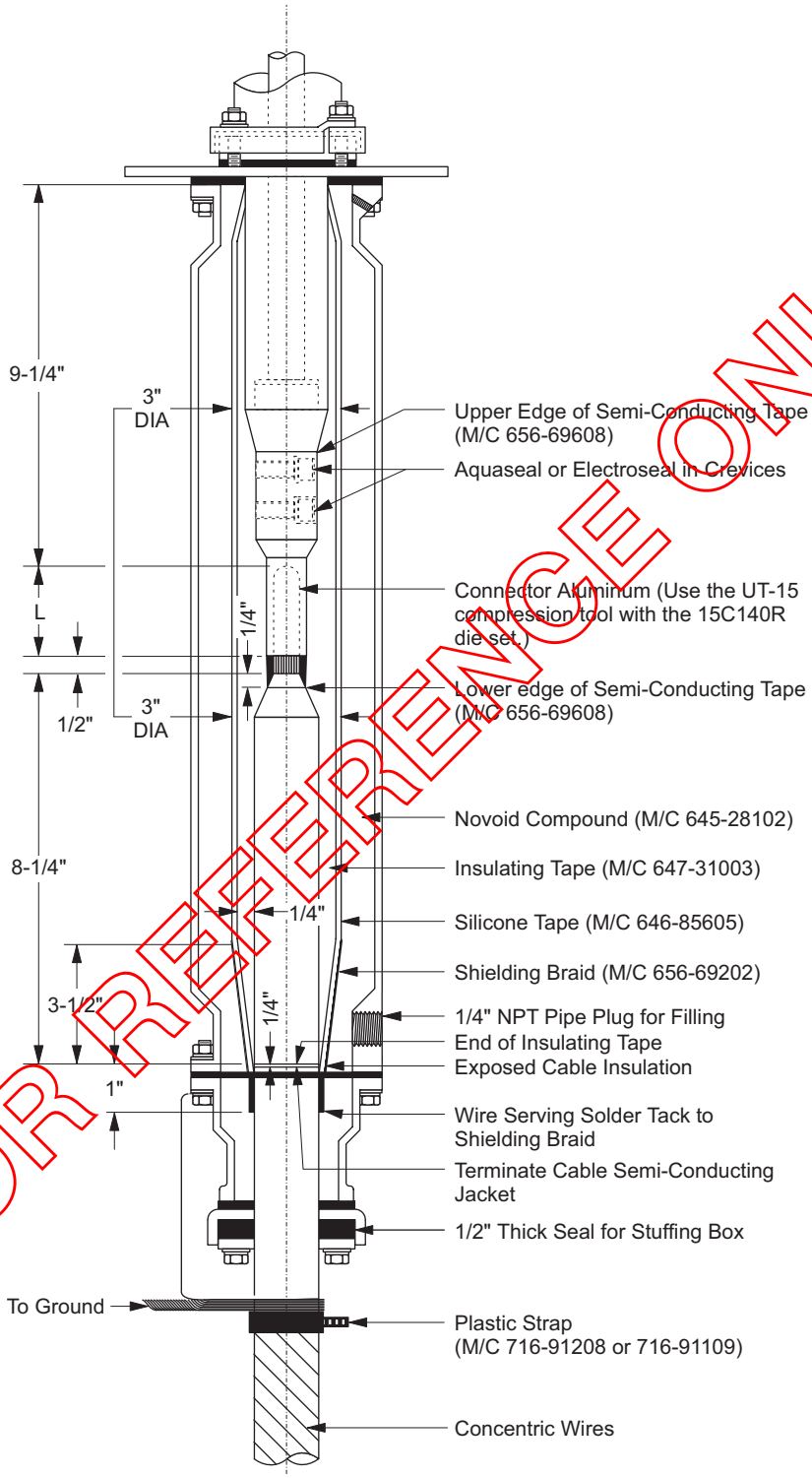
Pour the compound through the riser pipe until the compound reaches the vent level. Clean all compound from the sealing surface and seal the vent. To prevent void formation, continue to add compound until cool. Remove the riser pipe, clean the gasket surface, and replace pipe plug.

Restore neutral wires to their original position, binding them to the cable just below the entrance nut. Loosen one entrance bolt and attach two of the concentric wires. Retighten entrance bolt as before.

Twist the remaining concentric wires together and attach to vault or system ground.

FOR REFERENCE ONLY

Figure TP 240–1: ESCO Stud Bushing Termination — "RA" Oil Disconnect for 1/C 12/16 kV, 750 kcmil, Al, CLP Cable



FOR REFERENCE ONLY

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TP 242 SW Terminal — G&W Stud Bushing — Poly

Scope TP 242.1 G&W Stud Bushing Termination — "RA" Oil Disconnect for 1/C 5 , 12 , and 16 kV, 750 kcmil, Aluminum, CLP Cable

1.0 General

The following instructions cover the termination of crosslinked polyethylene insulated aluminum cable at a stud bushing with a stuffing box entrance. (See Figure TP 242–1 [Sheet 3] for this procedure.) Do not remove bushing body until after the switch is permanently mounted. Do not remove stud bushing from switch.

2.0 Train, Measure, and Cut Cable

Remove the "RS" stuffing box entrance. Train the cable in front or to the side of the stud bushing body and mark the cable jacket even with the bottom edge of the body at point (M).

With the connector assembled on the stud bushing, measure the distance (X) and mark cable this distance from mark (M). Cut the cable at mark (X) and bend the concentric neutral wires out of the way, approximately four feet.

Remove the body and place the "RS" entrance and body over the cable in the proper sequence for reassembly. Concentric wires must be removed a sufficient distance to allow for these parts, plus sufficient cable to terminate.

3.0 Apply Terminal Connector

Measure the depth (L) of the connector socket, and add one-half inch to this dimension. Remove the cable jacket, insulation, and semiconducting strand shielding for this distance from the end of the cable, using the stripping tool.

Measure and remove the cable jacket to mark (J) shown in the drawing. Remove all traces of semiconducting material from the surface of the exposed cable insulation. If necessary, use nonmetallic abrasive cloth on hard-to-remove residue. Pencil the insulation with penciling tool.

Clean the bared conductor strands of all traces of aluminum oxide with a wire brush. Remove the seal over the connector socket and immediately fit the connector over the cable conductor. Orient the connector on the conductor for final connection without twisting the cable. Press the connector onto the conductor with three circular crimps. Use the UT15 compression tool with the 15C140R die set.

4.0 Apply Tapes and Stress Cone

Bolt connector to the stud bushing pad. Pack all crevices and fill indents in connector with Aquaseal or Electroseal to form a smooth taping surface.

Clean the porcelain insulator, connector, and cable insulation. Apply one half-lapped layer of semiconducting tape (M/C 656-69608) over the entire connector surface starting at the cable stranding and wrapping to the edge of the porcelain at the top of the connector.

Apply half-lapped layers of polyethylene insulating tape (M/C 647-31003) to form the termination as specified. Start at the connector-conductor junction and "fill in" until the applied tape is same diameter as the cable insulation. Then complete the overall taping to the dimensions shown on the drawing. (Note: Leave one-fourth inch of cable insulation exposed.)

FOR REFERENCE ONLY

Apply one half-lapped layer of silicone tape (M/C 646-85605) over all of the insulating tape. This is to keep the compound from making direct contact with the insulating tape.

Apply one half-lapped layer of shielding braid, starting “B” inches above the cable jacket and taping down the slope and overlap the cable jacket one inch. Wrap several turns of wire over the braid to bind it to the cable jacket. Solder-tack the shielding braid to the wire serving, then apply three lines of solder down successive turns of the stress cone.

5.0 Complete Pothead Assembly

Assemble the gasket and body to the side plate and cross-torque bolts to values in the table.

Bolt the “RS” entrance to the gasket and the base of the body. Cross-torque bolts to value in the table. Raise the “RS” entrance washers, gaskets, and nut and tighten nut to seal the cable entrance.

6.0 Fill with Compound

Install a riser filling pipe in the lower pipe plug boss. Extend pipe twelve inches above the highest point to be compounded. Remove the vent screw from the side plate.

Heat the compound to the temperature indicated on the container and observe the precautions thereon. Use a thermometer to prevent overheating.

The body must be warm to prevent the compound from freezing. The riser pipe must be kept hot during the entire pouring operation until the compound in the body has completely cooled.

Pour the compound through the riser pipe until the compound reaches the vent level. Clean all compound from the sealing surface and seal the vent. To prevent void formation, continue to add compound until cool. Remove the riser pipe, clean the gasket surface, and replace pipe plug. Torque plug to value in table.

Restore neutral wires to their original position, binding them to the cable just below the entrance nut. Loosen one entrance bolt and attach two of the concentric wires. Retighten entrance bolt as before.

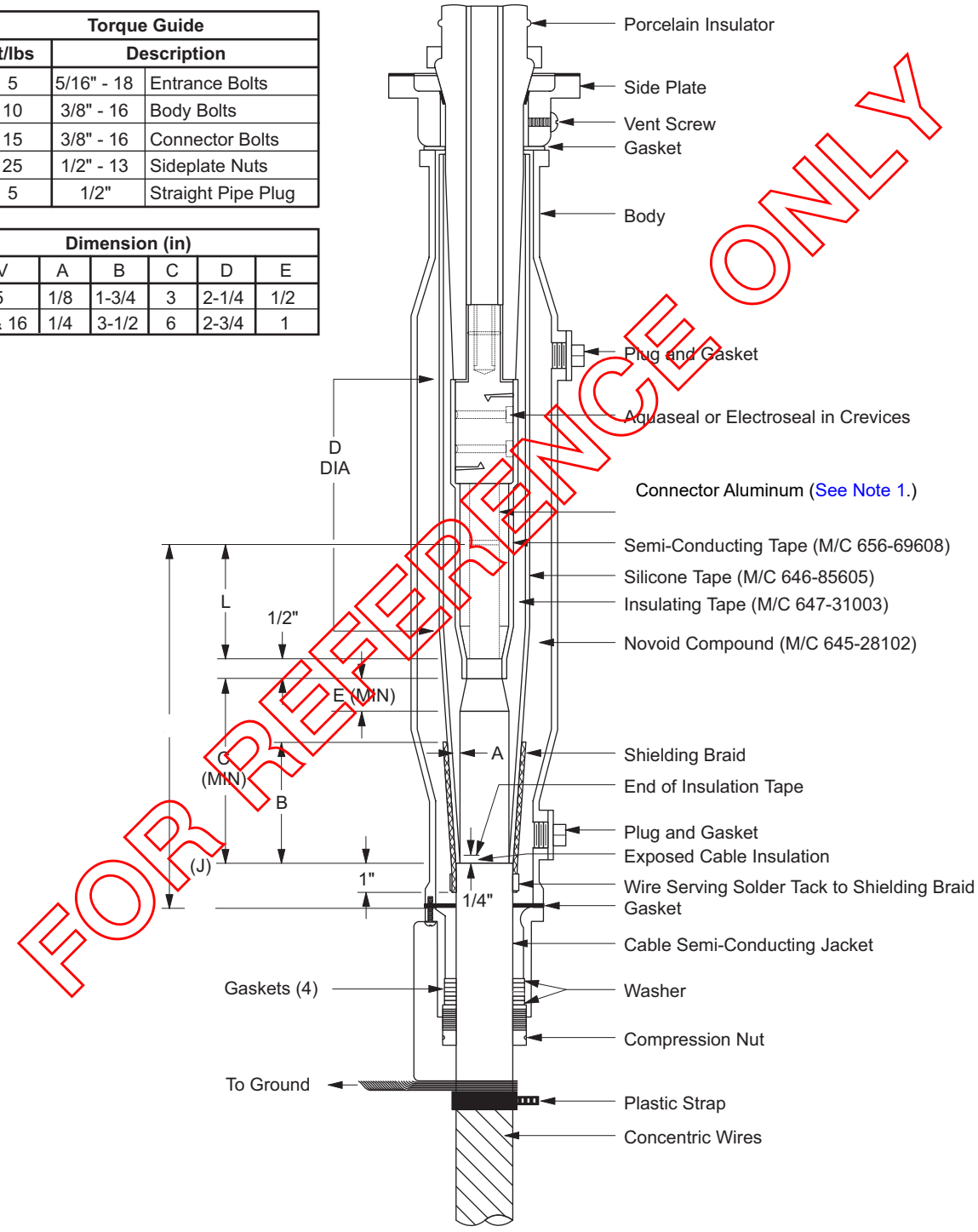
Twist the remaining concentric wires together and attach to vault or system ground.

FOR REFERENCE ONLY

Figure TP 242–1: G&W Stud Bushing Termination — "RA" Oil Disconnect for 1/C 5 , 12 , and 16 kV 750 kcmil, Aluminum, CLP Cable

Torque Guide		
ft/lbs	Description	
5	5/16" - 18	Entrance Bolts
10	3/8" - 16	Body Bolts
15	3/8" - 16	Connector Bolts
25	1/2" - 13	Sideplate Nuts
5	1/2"	Straight Pipe Plug

Dimension (in)					
kV	A	B	C	D	E
5	1/8	1-3/4	3	2-1/4	1/2
12 & 16	1/4	3-1/2	6	2-3/4	1



FOR REFERENCE ONLY

Note(s):
1. Use the UT-15 compression tool with the 15C140R Die Set - 3 crimps required.

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TP 250 SW Terminal — Pothead Type — Poly Cable

Scope TP 250.1 Pothead Termination, Type "RA" Oil Disconnect for 1/C 5 , 12 , and 16 kV, 350 kcmil, MAX Al, CLP Cable

1.0 Procedure

1.1 See Figure TP 250–1 (Sheet 3) for this procedure. Temporarily mount the cablehead with side plate gasket (but without the "RS" stuffing box entrances) in its final position. Train the cable in front or to the side of the pothead. Mark the jacket even with the bottom edge of the side plate point (M). Use tape for reference marks. Remove the pothead.

1.2 Assemble the connector in the porcelain insulator. Measure distance "X" from the bottom of the connector socket to the bottom edge of the side plate.

1.3 Mark the cable the distance "X" from the mark (M) previously made. Cut the cable at this mark. Bend the concentric neutral wires back out of the way.

1.4 Lower the "RS" stuffing box entrance over the cable. Slide entrance gaskets over the cable. Be sure "RS" entrance parts are in the proper order for later assembly. (One of the washers has a ground lead attached and should be discarded.)

1.5 Measure the depth of the connector socket, and add 1/2 inch to this dimension. Using stripping tool, remove the cable jacket, insulation, and strand shielding for this distance from the end of the cable. Do not pencil insulation.

1.6 Using a wire brush, clean the bared conductor strands to remove all traces of aluminum oxide. Remove the seal over the connector socket, and immediately fit the connector over the cable conductor. The connector locking fins must be parallel to the slots in the insulator neck. Crimp the connector onto the conductor.

1.7 Measure and remove the cable jacket to mark (J) shown on the drawing. (The jacket should be ring cut at this mark.) This distance is 5 inches beyond point (M). Care must be taken to avoid damaging the cable insulation.

1.8 Remove all traces of semiconducting material from the exposed insulation. (The cable insulation should be kept clean and dry.) If necessary, use nonmetallic abrasive cloth on hard-to-remove semiconducting residue.

1.9 Starting B + 1-1/2 inches above the cable jacket termination, apply one half-lapped layer of insulating tape to within 1/4 inch of cable jacket. Half-lap tape back and forth until double cone of dimension is obtained, as shown in drawing. Apply one half-lapped layer of silicone tape over the insulating tape.

1.10 Starting at the peak of the stress cone, apply one half-lapped layer of tinned one-inch shielding braid down the slope of the stress cone and over the cable semiconducting jacket. Make sure no strands of braid are protruding from the edge at the peak of the stress cone. Wrap several turns of wire over the shielding braid to bind it to the semiconducting jacket.

FOR REFERENCE ONLY

1.11 Solder-tack the shielding braid to the wire serving and apply 3 lines of solder down the successive turns of braid on the stress cone.

1.12 Lower the insulator assembly over the cable end. Temporarily tighten the hoodnut to assure that the connector locking fins are properly seated in the porcelain neck.

1.13 Raise the entrance body and gasket. Bolt entrance to side plate. Do not use adhesive on gasket. (Gasket and gasket surfaces must be free of oil or dirt.) Cross torque bolts to values shown in the table on the drawing. Assemble discs and gaskets into RS body and tighten nut to seal on the jacket.

2.0 Proceed with Compounding of Potheads as Follows

2.1 Install a riser filling pipe (same size as pipe plug or larger) in the body. The top of the riser pipe should be higher than the highest point on the pothead to be filled. Remove the vent screw or hoodnut from the pothead to provide a vent around the connector.

2.2 The pothead should be prewarmed with hot air if the ambient temperature is below 70 °F to prevent premature cooling of the compound. Do not allow an open flame to be applied directly on porcelain insulator.

2.3 Heat the compound to recommended pouring temperature shown on compound label. Heat the riser pipe to compound pouring temperature. Pour the compound until it emerges at the top of the porcelain. Fill cablehead with hot compound. Do not "top off". Clean all compound from insulator sealing surface. Assemble and seal the hoodnut. Continue heating riser pipe for 15 minutes. Allow the cablehead to cool. Remove the riser pipe. Insert the pipe plug boss to complete the sealing of the cablehead.

2.4 Clean the outside of the pothead. Tighten bolts and fittings.

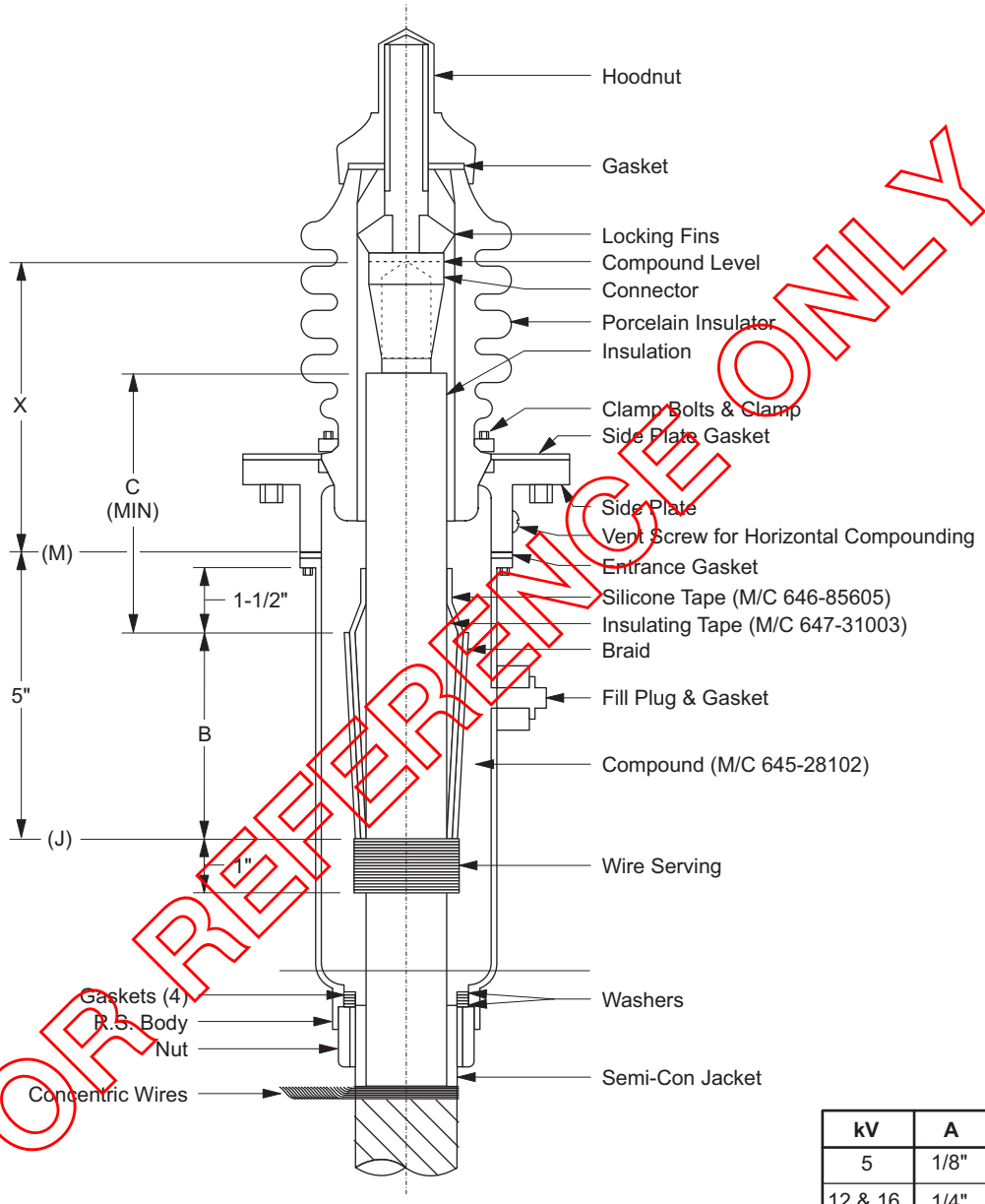
2.5 Slip side plate gasket over pothead, and attach this unit to the equipment. Do not use adhesive on gasket. Gasket and gasket surfaces must be free of oil or dirt.

2.6 Assemble the contact lugs to hoodnuts of the cablehead.

2.7 Restore the concentric neutral wires to their original position, binding them to the cable below the "RS" body nut. Twist wires together underneath entrance, and attach to ground. Before concentric wires are twisted together, two of them should be taken up and connected to one of the entrance bolts.

FOR REFERENCE ONLY

Figure TP 250–1: Pothead Termination Type "RA" Oil Disconnect for 1/C 5 kV, 12 kV, and 16 kV, 350 kcmil, MAX Al, CLP Cable



FOR REFERENCE ONLY

kV	A	B	C
5	1/8"	1-3/4"	3"
12 & 16	1/4"	3-1/2"	5"

Conductor Size	Installation Data						
	Indents			Circular Crimps			
	Y34 & Y48			MD-6		UT-15	
	Nest	Indenter	No. of Indents	Die	No. of Crimps	Die	No. of Crimps
1/0				BG	3	*15CA49R	1
4/0	A31D	Y34PR-5	1			*15CA71R	1
350	C35D	Y48PR-1	1			*15CA96R	2

TORQUE GUIDE	
ft/lbs	Description
10	3/8" - 16 Entrance Bolts
8	5/16" - 18 Porcelain Clamp Bolts
25	1/2" - 13 Side Plate Nuts
5	1/2" Str. Pipe Plug
12	Rat 25 Size Connector Hoodnut Assembly

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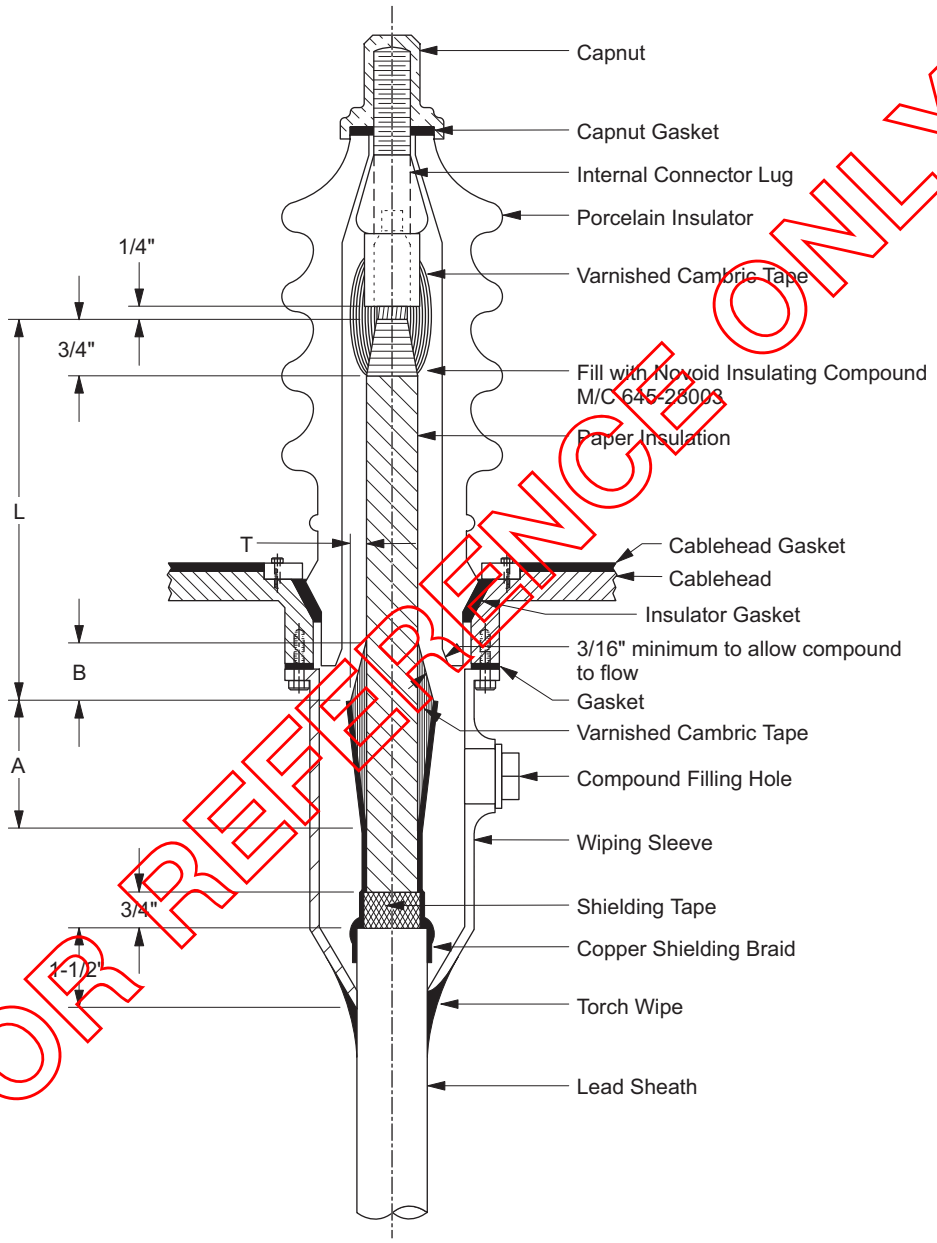
TP 252 SW Terminal — Pothead Type — PILC

Scope TP 252.1 Pothead Termination, Type "RA" Oil Disconnect for 1/C 12/16 kV PILC Cable

Figure TP 252–1: Pothead Termination, Type "RA" Oil Disconnect for 1/C 12/16 kV PILC Cable



FOR REFERENCE ONLY

Dimensions (in)				
Voltage	**L (MIN)**	**A**	**B**	**T**
12 kV	6	3	1-1/2	1/4
16 kV	7-1/2	3-1/2	1-1/2	5/16

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TP 255 Fuse Cabinet Terminal — Poly Cable Wiping Sleeves

Scope TP 255.1 Termination of Polyethylene Insulated Cables in S&C Fuse Cabinet Equipped with Lead Wiping Sleeves

1.0 General Information

This terminal may be used on 12 kV and 16 kV polyethylene insulated NO. 2, 1/0 AWG, or 350 kcmil 1/C aluminum cables. (See Figure TP 255–1 [Sheet 2] for this procedure.)

2.0 Installation

2.1 Saw off wiping nipple to fit diameter of six-inch long lead tube. Scrape and clean nipple and tube, and coat with stearine flux.

2.2 Bind concentric wires approximately nineteen inches from end of cable and unwrap them.

2.3 Pencil cable insulation, install Hylink connector and No. 2 or 4/0 copper wire as shown. For 4/0 the lug must be drilled out to accommodate the larger size.

2.4 Prepare cable to dimensions shown. Be careful not to nick the insulation. Wipe polyethylene insulation clean and remove any remaining particles of semiconductive shielding.

2.5 Disassemble the pothead. Slide the wiping nipple and lead tube over the end of the cable.

2.6 Solder the copper wire to the copper terminal of the pothead.

2.7 Position the six-inch lead tube. Build stress relief cone. Tape the connector as shown.

2.8 Reassemble the pothead, seal the wiping sleeve to the lead tube with solder, using minimum amount of heat. Tape seal the end of the lead tube.

2.9 Reassemble concentric wires over cable and lead tube as shown.

2.10 Install a filler pipe (one inch minimum size) in the filling hole, using reducing fittings as necessary to attach to the pothead body. The pipe must extend above the top of the porcelain bushing. Remove the vent screw, and preheat the pothead body and filler pipe.

2.11 Fill with compound. See JJ 152 for pouring temperature. Potheads must be filled from the bottom up with the pothead in the vertical position to allow the compound to rise evenly and eliminate voids by forcing air up and out at the top.

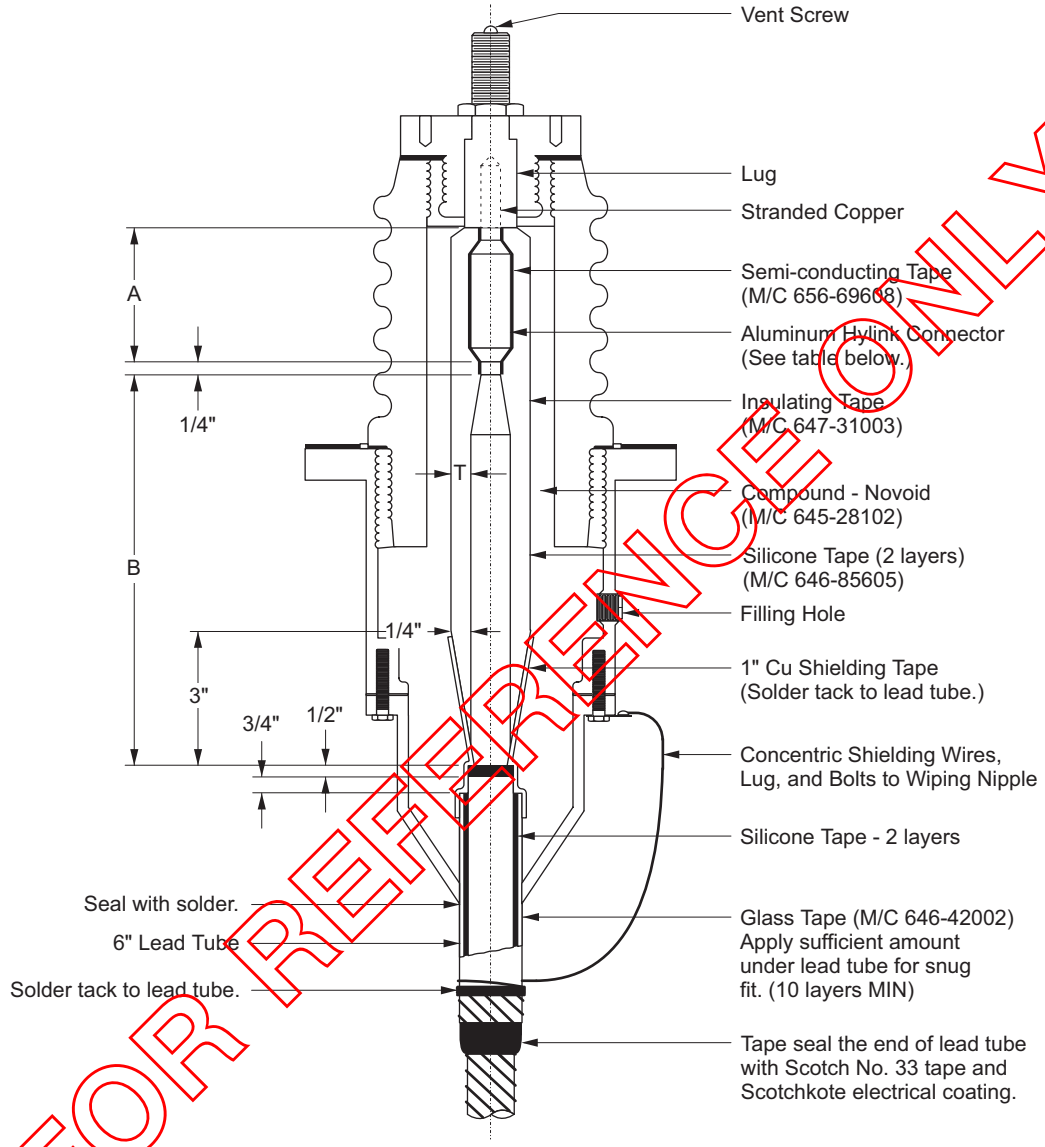
2.12 Replace vent screw and solder closed.

2.13 Pothead may now be energized.

FOR REFERENCE ONLY

Scope TP 255.2 Pothead Termination — S&C Fuse Cabinet 1/C 12/16 kV of Polyethylene Al Cable

Figure TP 255–1: Pothead Termination — S&C Fuse Cabinet 1/C 12/16 kV of Polyethylene Al Cable



FOR REFERENCE ONLY

Copper Size	Aluminum Size	Connector	Material Code	A Inches	B Inches
#2	#2	#2	610-27603	39	
#2	#2	#2 - 1/0	610-27645	39	
4/0*	350 kcmil	4/0 - 350	610-28007	39	

* Lug must be drilled out to accommodate 4/0.

Note(s):

1. This standard applies only to the old style cabinets (M/C 567-40004, -40103, -40509, and -40608) where the live parts are mounted directly on the potheads.

TP 300 Pothead — 1/C — 5 kV PILC

Scope TP 300.1 Pothead Termination, 1/C Capnut Type for 5 kV PILC Cable

1.0 General

These instructions cover 1/C capnut style potheads for 5 kV cable terminations and are also applicable to 1/C cableheads (not stud bushings) used to terminate cables in oil switches and other equipment. (See Figure TP 300–1 [Sheet 3] for this procedure.) Terminals which can be removed from the equipment should be assembled in accordance with these instructions, filled in the upright position, and then reinstalled in the equipment.

2.0 Prepare Wiping Nipple

Measure the cable diameter at the approximate location where the wiping nipple will be installed, and saw off the tapered section of the wiping nipple to fit the cable sheath. Scrape and clean the tapered section, and coat with stearine flux.

3.0 Train, Measure, and Cut Cable

Temporarily mount the pothead in its final position, and form the cable outside the pothead as nearly as possible to its final position. Avoid all sharp bends by using a minimum bending radius of ten times the cable diameter and keeping the cable straight for a distance of at least 6" beyond the end of the conduit or duct and 6 inches below the pothead.

Score the lead sheath for not more than 1/2 its thickness entirely around the cable at a point 1-1/2 inches above the bottom of the wiping nipple. The neoprene jacket, if any, should be removed a distance of approximately 4 inches below the previously scored sheath. Scrape the lead sheath clean for a distance of 3- or 4-inches below the score and immediately cover the cleaned portion with stearine flux.

Determine the length of cable required inside the pothead by measuring the distance from the bottom of the wiping nipple to the full depth of the hole in the terminal lug. This may be done by inserting a stiff wire into the pothead and marking it at the bottom of the wiping nipple. Transfer this measurement to the cable, starting at a point 1-1/2 inches below the previously made score mark, and cut the cable to the proper length.

4.0 Remove Lead Sheath

Disassemble the pothead, and slide the wiping nipple and gasket over the end of the cable and out of the way.

Slit the lead sheath from the score mark to the end of the cable, using a chipping knife in such a way as to avoid damage to the interior of the cable. Tear off the lead sheath at the score mark and remove all burrs and sharp edges.

5.0 Apply Tape Binder

Remove one layer of factory insulation from the end of the cable to the end of the lead sheath. Apply 1 inch varnished cambric tape in half-lapped layers to within approximately 2 inches of the end of the cable. Continue applying tape half-lapped back to the end of the lead sheath, and secure it at this point with a binder of dry linen tape.

FOR REFERENCE ONLY

6.0 Apply Terminal Connector

Remove insulation from the end of the cable for a distance equal to the depth of the hole in the terminal lug plus 1/4 inch. At this point, pencil the insulation for another 3/4 inches, and secure it with a binder of dry linen tape.

Drill 2 small holes in the shoulder of the terminal lug to permit soldering without inverting the conductor. Wrap several protective layers of linen tape over the conductor between the end of the insulation and the terminal lug. Preheat the terminal lug, insert the conductor in the lug, and pour “half and half” solder through the small holes in the shoulder, using a torch to maintain the conductor and the lug at the proper temperature. The lug should be positioned so that any locking fins or other alignment devices will enter the slots at the top of the insulator with a minimum amount of conductor twisting.

Remove the protective linen tapes, and apply half-lapped layers of varnished cambric tape to the area between the end of the insulation and the terminal lug, building up to the diameter of the lug. Apply 2 half-lapped layers across the lug ferrule and over the insulation.

7.0 Complete Pothead Assembly

Insert the cable into the pothead, and hand tighten the capnut on the terminal lug, making sure that the lug fully enters the insulator at the top of the pothead.

Slide gasket and wiping nipple up to the pothead body and assemble to the pothead. Torch wipe the nipple to the sheath, using paper pasters to limit the wipe.

8.0 Fill with Compound

Potheads must be filled from the bottom up with the pothead in the vertical position to allow the compound to rise evenly and eliminate voids by forcing air up and out at the top. Novoid “X” Compound, heated to a temperature of 275°F – 325-°F, is used for filling. The temperature must be measured by a thermometer and should not be materially exceeded because high temperature may damage the cable insulation and will definitely cause excessive shrinkage.

Single-conductor potheads are to be filled in one continuous pour.

Install a filler pipe (1 inch minimum size) in the lowest filling hole, using reducing fittings as necessary to attach to the pothead body. The pipe must extend above the top of the insulator. Remove the capnut and capnut gasket from the top of the terminal.

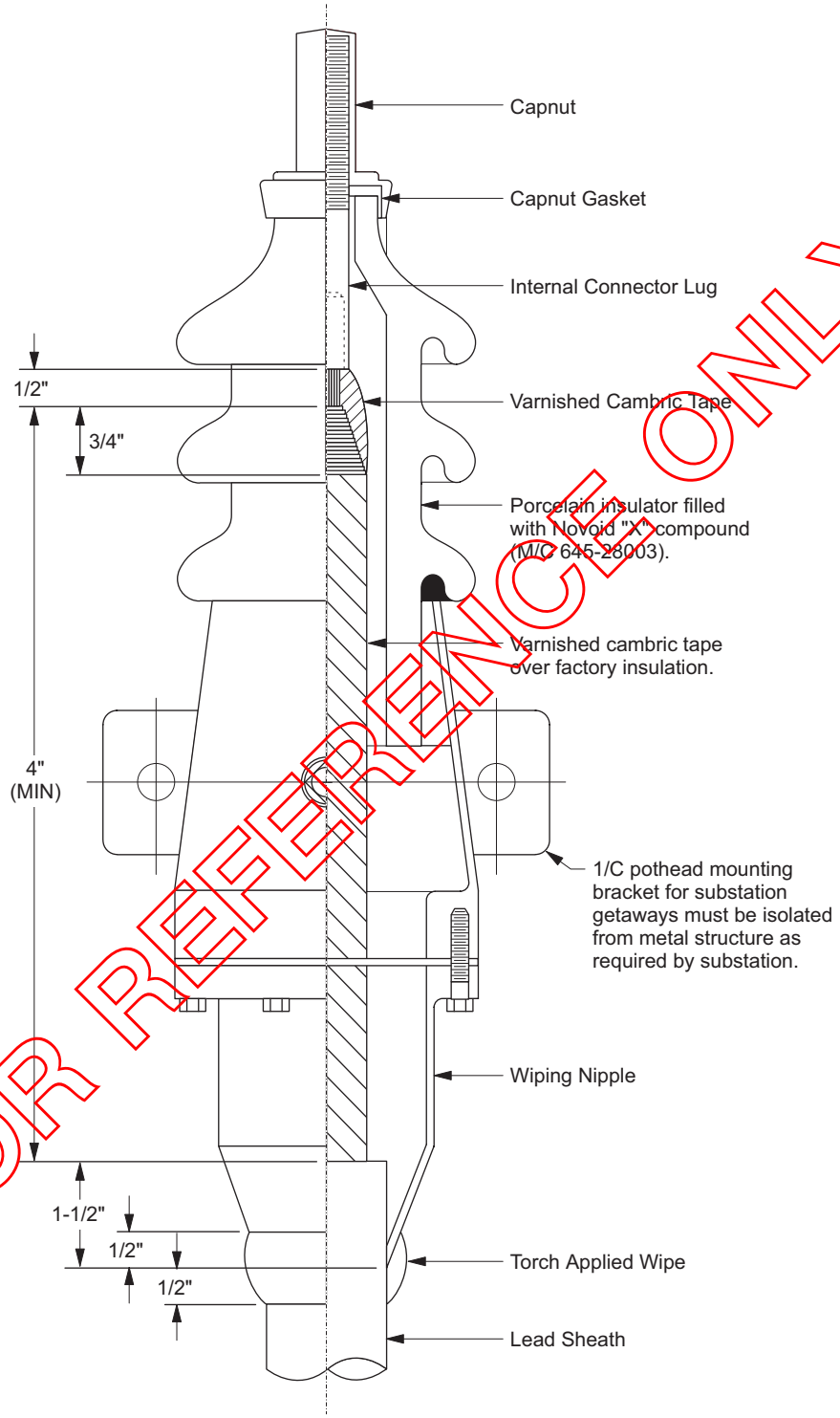
Preheat the pothead body and the filler pipe, and pour hot compound through the pipe until it overflows slightly at the top of the insulator.

Keep the filler pipe hot and full of fluid compound while the pothead is cooling by periodically heating the entire length of pipe (particularly the connection to the pothead body) with a torch and adding additional compound as required. Continue this process until the compound level in the filter pipe remains constant for approximately 15 minutes.

Remove the filler pipe, and install the plug. Thoroughly clean insulator, install capnut gasket (apply a little talc to gasket), and tighten capnut in place. Recheck all bolts and gaskets to make sure they are tight.

FOR REFERENCE ONLY

Figure TP 300–1: Pothead Termination — 1/C Capnut Type for 5 kV PILC Cable



FOR REFERENCE ONLY

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TP 305 Pothead — 3/C — 5 kV PILC

Scope TP 305.1 Pothead Termination, 3/C Capnut Type for 5 kV PILC Cable

1.0 General Instructions

These instructions cover three-conductor capnut style potheads (regardless of body shape) for 5 kV PILC cable terminations on poles, racks, or in air-filled compartments. (See Figure TP 305–1 [Sheet 4] for this procedure.)

2.0 Prepare Wiping Nipple

Measure the cable diameter over the lead sheath. Saw off the tapered section of the wiping nipple to fit the cable sheath. Scrape and clean the remaining tapered section, and coat it with stearine flux. Tin the wiping nipple.

3.0 Train, Measure, and Cut Cable

Temporarily mount the pothead in its final position and form the cable outside the pothead as nearly as possible to its final position. Avoid all sharp bends by using a minimum bending radius of ten times the cable diameter and keeping the cable straight for a distance of at least 6 inches beyond the end of the conduit or duct and 6 inches below the pothead.

Score the lead sheath for not more than one-half its thickness, entirely around the cable at a point 1-1/2 inches above the bottom of the wiping nipple. The neoprene jacket, if any, should be removed a distance of approximately 6 inches below the previously scored sheath. Scrape the lead sheath clean for a distance of 3- to 4-inches below the score. Immediately cover the cleaned portion with stearine flux. Cut the cable off approximately 4 inches above the top of the pothead.

4.0 Remove Lead Sheath

Remove the wiping nipple and gasket from the pothead body and slide over the end of the cable and out of the way.

Slit the lead sheath from the end of the cable to the score mark, using a chipping knife in such a way as to avoid damage to the interior of the cable. Tear off the sheath at the score mark. Remove all burrs and sharp edges.

5.0 Remove Belt Insulation

Apply a binder, made with 3 or 4 turns of 1 inch varnished cambric tape, over the belting tape immediately adjacent to the lead sheath and tie in place with linen tape. Remove the belting tape from the end of the cable to the edge of the binder. (NOTE: The last few layers of belting tape should be torn off to prevent damage to conductor insulation.) Cut fillers at the end of the belt insulation. Apply two, one-half lap layers of 1 inch varnished cambric tape over each conductor from the binder to within approximately 6 inches of the end of each conductor and bind in place with linen tape.

6.0 Shape and Measure Conductors

Shape each conductor into its final position in front of the pothead body and porcelain insulators. Avoid sharp bends in the conductors. Using a level, mark each conductor at the top of its respective insulator with a band of tape.

FOR REFERENCE ONLY

Remove the cover plate and insulators from the pothead body. With the terminal connectors fully inserted into the insulators, apply a tape marker on each terminal stem immediately adjacent to the top of each pothead insulator.

Remove one of the terminal connectors from its pothead insulator. Measure the distance between the connector end of the terminal and the previously applied tape marker on the end of the terminal. Add 1/2 inch and transfer this measurement to the proper conductor, beginning at the lower edge of previously applied tape marker, and bind insulation in place. Remove conductor insulation to this point. Repeat procedure for other two conductors.

7.0 Install Pothead Body

Remove the pothead body from the supporting structure. Slip it over the end of the cable, and mount in its final position. Install the wiping nipple to the bottom of the pothead body. Make sure that the gasket between the wiping nipple and pothead body is in the proper position.

8.0 Cut Conductors to Length

Install the lid gasket, cover plate, and insulators over the ends of the conductors; and temporarily locate them in their final position. For large conductors it may be necessary to remove pothead insulators temporarily to get proper alignment of conductors through the pothead bushings. Mark the conductors at the top of the pothead insulators.

Remove the cover plate and insulators. Measure the length of one of the terminal connectors from the previously applied tape marker to the bottom end of the connector. Subtract from this measurement the depth of the solder hole in the lower end of the connector. Transfer the remaining distance to a point on one of the conductors below the previously applied mark on that conductor. Cut conductor at this point. Repeat procedures for other two conductors.

9.0 Apply Terminal Connector

Apply solder flux to each conductor. Position terminal lugs on each conductor. Make sure that each lug is seated full depth on the conductor. The lug should be positioned so that any locking fins or other alignment devices will enter the slots at the top of the porcelain with a minimum of conductor twisting. It is important that the lug be aligned with the conductor.

Wrap several layers of linen tape around the conductor and over the end of the terminal lug. Be careful not to move the lug up on the conductor. Preheat the terminal lug. Melt “half and half” string solder through the small holes in the connector shoulder until the lug is completely full of solder. Do not move lugs until solder has had a chance to set. This takes only a few minutes. DO NOT FORCE COOL LUGS.

Remove the protective linen tape. Remove sharp burrs and rough edges of solder. Pencil factory insulation as shown on drawing. Apply 1/2 inch varnished cambric tape, half-lapped, to the area between the end of the insulation and the terminal connector, building up to the diameter of the connector. Apply two half-lapped layers of 1 inch varnished cambric tape across the lug ferrule and approximately 1 inch over factory applied conductor insulation.

10.0 Complete Pothead Assembly

Install gasket, cover plate, and insulators in their final position. Make sure that the terminal connectors are fully seated in the pothead insulators. Check pothead insulators for proper alignment. Hand tighten the capnuts. Remove top vent plug in pothead body. Torch wipe the wiping nipple to the lead sheath, using paper pasters to limit the wipe joint.

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11.0 Fill with Compound

Potheads must be filled from the bottom up with the pothead in the vertical position for the compound to rise evenly and eliminate voids by forcing air up and out at the top. Novoid "X" Compound, heated to a temperature of 275°F – 325°F is used for filling. The temperature must be measured by a thermometer and should not be exceeded because high temperatures will damage the cable insulation and cause excessive shrinkage.

Three-conductor potheads are to be filled in two steps, filling the body of the terminal first and allowing this compound to cool and contract before the final pour.

12.0 First Filling

Install filler pipe (1 inch minimum size) in the lowest filling hole, using reducing fittings as necessary to attach to the pothead body. The filler pipe must extend above the level of the top filling hole.

Using a torch, preheat the filler pipe and pothead body. Then pour compound through the filler pipe until it flows out the top filling holes. On this first filling, the compound may be poured at a minimum temperature (275 °F). Allow the compound to cool until the filler pipe can be removed from the filler hole without loss of compound. It is not necessary to keep the filler pipe hot during this initial cooling period.

13.0 Second Filling

Transfer the filler pipe from the bottom to the top filler hole, and install the plug in the bottom hole. Check to see that the filler pipe is long enough to extend above the top of the porcelain insulators. Remove capnuts and capnut gaskets. Also remove any small vent plugs in the cover plate of the pothead and install vent pipes in these vent holes.

The location and arrangement of filling holes and vents varies with different types of potheads. In some cases, both the filling hole and a vent hole are located in the cover plate of the pothead. Regardless of the arrangement, filling must be accomplished by filling through a standpipe connected to the pothead body at the lowest possible point, and all spaces to be filled must be vented at the top.

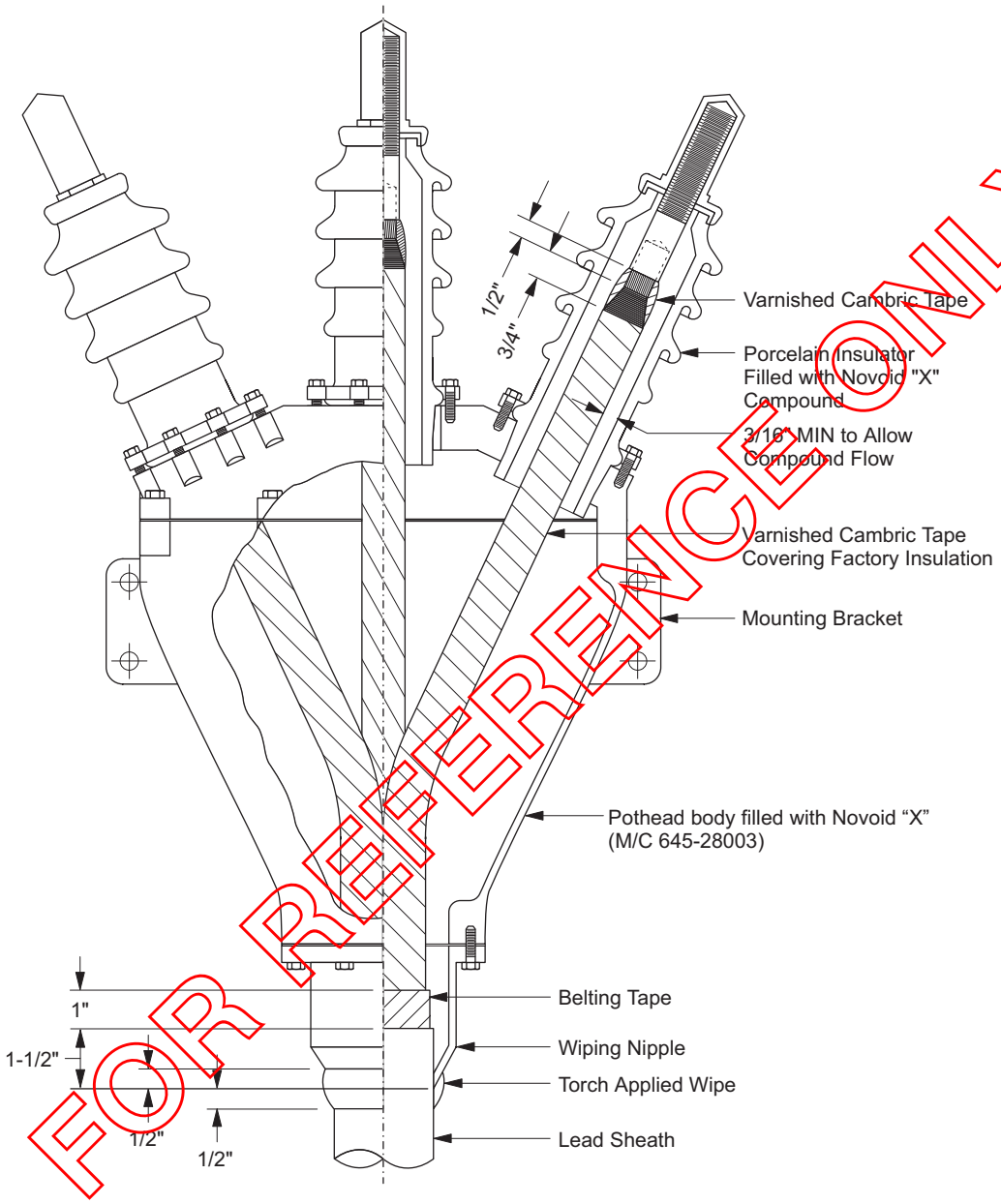
Preheat the filler pipe; and pour compound, at a temperature of approximately 300°F through the pipe until it overflows slightly at the top of each insulator and at the vent pipes.

Keep the filler pipe hot and full of fluid compound while the pothead is cooling by periodically heating the entire length of pipe (particularly the connection to the pothead body) with a torch and adding additional compound as required. Continue this process until the compound level in the filler pipe remains constant for approximately 15 minutes.

Remove vents and filler pipe and install plugs. Thoroughly clean porcelain insulator, install capnut gaskets (apply a little talc to gaskets), and tighten capnuts in place. Recheck all bolts and gaskets to make sure they are tight.

FOR REFERENCE ONLY

Figure TP 305–1: Pothead Termination — 3/C Capnut Type for 5 kV PILC Cable



FOR REFERENCE ONLY

TP 320 Pothead — 1/C — 12/16 kV PILC

Scope TP 320.1 Pothead Termination — 1/C Capnut Type for 12/16 kV PILC Cable

1.0 General

These instructions cover 1/C capnut style potheads for 12 kV and 16 kV PILC cable terminations and are also applicable to 1/C cableheads (not stud bushings) used to terminate cables in oil switches and other equipment. Terminals which can be removed from the equipment should be assembled in accordance with these instructions, filled in the upright position, and then reinstalled in the equipment. (See Figure TP 320–1 [Sheet 4] for this procedure.)

2.0 Prepare Wiping Nipple

Measure the cable diameter at the approximate location where the wiping nipple will be installed, and saw off the tapered section of the wiping nipple to fit the cable sheath. Scrape and clean the tapered section, and coat with stearine flux.

3.0 Train, Measure, and Cut Cable

Temporarily mount the pothead in its final position and form the cable outside the pothead as nearly as possible to its final position. Avoid all sharp bends by using a minimum bending radius of ten times the cable diameter and keeping the cable straight for a distance of at least 6 inches beyond the end of the conduit or duct and 6 inches below the pothead.

Score the lead sheath for not more than one-half its original thickness entirely around the cable at a point 1-1/2 inches above the bottom of the wiping nipple. The neoprene jacket, if any, should be removed a distance of approximately 4 inches below the previously scored sheath. Scrape the lead sheath clean for a distance of 2- to 3-inches below the score and immediately cover the cleaned portion with stearine flux.

Determine the length of cable required inside the pothead by measuring the distance from the bottom of the wiping nipple to the full depth of the hole in the terminal lug. This may be done by inserting a stiff wire into the pothead and marking it at the bottom of the wiping nipple. Transfer this measurement to the cable, starting at a point 1-1/2 inches below the previously made score mark, and cut the cable to the proper length.

4.0 Remove Lead Sheath

Disassemble the pothead and slide the wiping nipple and gasket over the end of the cable and out of the way.

Slit the lead sheath from the score mark to the end of the cable, using a chipping knife in such a way as to avoid damage to the insulation. Tear off the lead sheath at the score mark and remove all burrs and sharp edges. Tie insulation at the end of the sheath with cloth tape. Tape should cover 3/4 inches of shielding.

5.0 Remove Shielding Tapes

Remove the metallized or semiconducting carbon black paper tapes and one layer of insulating paper tapes back to cloth tape. Cut the shielding tapes so that a uniform length extends from the end of the lead sheath.

Normally, the cutback of the metallized paper tapes to within 3/4 inches of the lead sheath will locate the stress relief cone so as to provide adequate surface leakage distance “L.” This distance, shown in the table, is a minimum length. It may be greater and should be adjusted so that the end of the copper

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shielding braid at the peak of the stress cone will be located at or slightly below the bottom of the porcelain insulator. If the inside porcelain bore is not large enough to accommodate the stress cone, lower the stress cone to allow at least 3/16 inches for compound to flow up the porcelain.

6.0 Apply Terminal Connector

Remove insulator from the end of the cable for a distance equal to the depth of the hole in the terminal lug plus 1/4 inch. At this point, pencil the insulation for another 3/4 inches and secure it with a binder of dry linen tape.

Drill small holes in the shoulder of the terminal lug to permit soldering without inverting the conductor. Wrap several protective layers of linen tape over the conductor between the end of the insulation and the terminal lug. Preheat the terminal lug, insert the conductor in the lug, and pour "half and half" solder through the small holes in the shoulder. Use a torch to maintain the conductor and the lug at the proper temperature. The lug should be positioned so that any locking fins or other alignment devices will enter the slots at the top of the porcelain with a minimum amount of conductor twisting.

Remove the protective linen tapes and apply half-lapped layers of varnished cambric tape to the area between the end of the insulation and the terminal lug, building up to the diameter of the lug. Apply two half-lapped layers across the lug ferrule and over the insulation.

7.0 Apply Stress Cone

Starting at the edge of the metallic shielding tape, apply half-lapped layers of oil-packed varnished cambric tape over the conductor insulation to form a stress relief cone of the dimensions shown on the drawing. Remove the cloth tape from the shielding tape.

Starting at the maximum diameter of the stress relief cone, apply one half-lapped layer of 5/8 inch copper braid or other approved shielding tape over the bottom slope of the stress cone, lapping onto the conductor shielding tape and the lead sheath. Solder the braid to the conductor shielding tape and lead sheath and apply a longitudinal solder bead along the length of the braid to prevent slipping.

8.0 Complete Pothead Assembly

Insert the cable into the pothead and hand tighten the capnut on the terminal lug, making sure that the lug fully enters the porcelain at the top of the pothead.

Slide gasket and wiping nipple up to the pothead body and assemble to the pothead. Torch solder the nipple to the sheath, using paper pasters to limit the wipe.

9.0 Fill with Compound

Potheads must be filled from the bottom up with the pothead in the vertical position to allow the compound to rise evenly and eliminate voids by forcing air up and out at the top. Novoid "X" Compound, heated to a temperature of 275- to 325- °F, is used for filling. The temperature must be measured by a thermometer and should not be exceeded because high temperatures will damage the cable insulation and cause excessive shrinkage.

Single-conductor potheads are to be filled in one continuous pour.

Install a filler pipe (1 inch minimum size) in the lowest filling hole, using reducing fittings as necessary to attach to the pothead body. The pipe must extend above the top of the porcelain insulator. Remove the capnut and capnut gasket from the top of the terminal.

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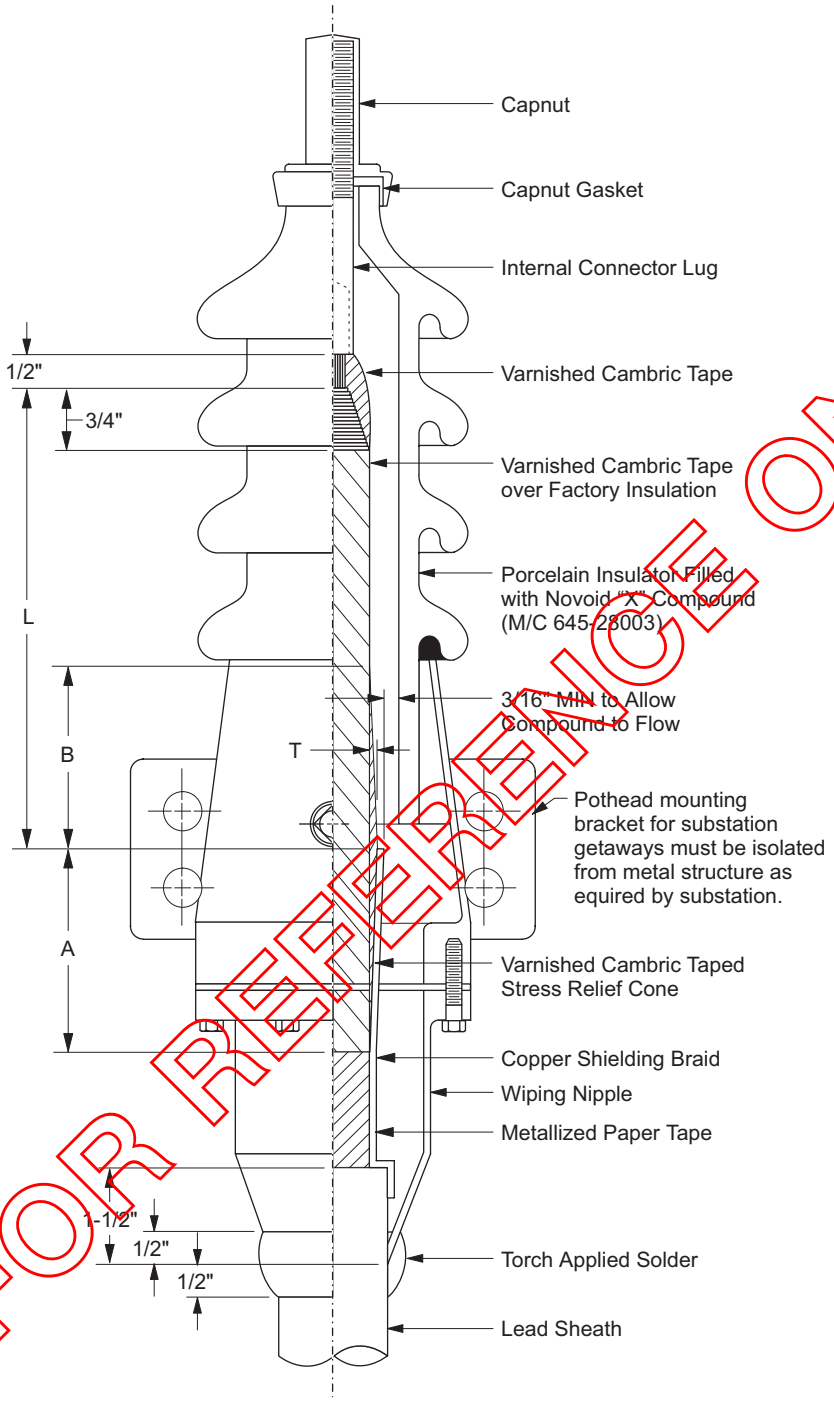
Preheat the pothead body and the filler pipe, and pour hot compound through the pipe until it overflows slightly at the top of the porcelain.

Keep the filler pipe hot and full of fluid compound while the pothead is cooling by periodically heating the entire length of pipe (particularly the connection to the pothead body) with a torch and adding additional compound as required. Continue this process until the compound level in the filler pipe remains constant for approximately 15 minutes.

Remove the filler pipe and install plug. Thoroughly clean porcelain insulator, install capnut gasket (apply a little talc to gasket), and tighten capnut in place. Recheck all bolts and gaskets to make sure they are tight.

FOR REFERENCE ONLY

Figure TP 320–1: Pothead Termination — 1/C Capnut Type for 12/16 kV PILC Cable



Voltage	L (in)	A (in)	B (in)	T (in)
12 kV	6	3	3	1/4
16 kV	7-1/2	3-1/2	3-1/2	5/16

FOR REFERENCE ONLY

TP 325 Pothead — 3/C — 12/16 kV PILC

Scope TP 325.1 Pothead Termination, 3/C Capnut Type for 12/16 kV PILC Cable

1.0 General

These instructions cover 3/C Capnut style potheads (regardless of body shape) for 12 kV and 16 kV PILC cable terminations and are also applicable to 3/C cableheads, (not stud type bushings) used to terminate cables in oil switches and other equipment. (See Figure TP 325–1 [Sheet 4] for this procedure.)

2.0 Prepare Wiping Nipple

Measure the cable diameter at the approximate location where the wiping nipple will be installed and saw off the tapered section of the wiping nipple to fit the cable sheath. Scrape and clean the tapered section and coat with stearine flux.

3.0 Train, Measure, and Cut Cable

Temporarily mount the pothead in its final position and form the cable, outside the pothead, as nearly as possible to its final position. Avoid all sharp bends by using a minimum bending radius of ten times the cable diameter and keeping the cable straight for a distance of at least six inches beyond the end of the conduit or duct and six inches below the pothead.

Score the lead sheath not more than one-half its thickness, entirely around the cable at a point one and one-half inches above the bottom of the wiping nipple. Scrape the lead sheath clean for a distance of three or four inches below the score and immediately cover the cleaned portion with stearine flux.

Determine the length of cable required inside the pothead for each conductor by measuring the distance from the bottom of the wiping nipple to the full depth of the hole in the terminal connector. This may be done by inserting a stiff wire into the pothead, forming it to the same contour as will be assumed by each conductor and marking it at the bottom of the wiping nipple. Transfer this measurement for one of the outside conductors to the cable, starting at a point one and one-half inches below the previously made score mark and cut the cable to the proper length.

4.0 Remove Lead Sheath

Disassemble the pothead and slide the wiping nipple, gasket, and pothead body over the end of the cable and out of the way.

Slit the lead sheath from the score mark to the end of the cable, using a chipping knife in such a way as to avoid damage to the interior of the cable. Tear off the sheath at the score mark so as to leave a bell on the end of the sheath. Remove all burrs and sharp edges.

5.0 Remove Binder Tape and Conductor Shielding Tapes

Remove bronze binder tape from the end of the cable to the end of the lead sheath and tack solder the bronze tape to the lead sheath.

Remove the metallic shielding tape on each conductor to a point approximately two inches from the end of the lead sheath. Cut the shielding tape on each conductor so that a uniform length extends from the end of the lead sheath and tack solder the end in place. Remove the metallized or semiconducting carbon black paper tapes and one layer of insulating paper tape from the end of the cable to the previously terminated shielding tape.

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Normally the cutback of the shielding tapes to within two inches of the lead sheath will locate the stress cone so as to provide adequate surface leakage distance “L.” This distance, shown in the table, is a minimum length. It may be greater and should be adjusted so that the end of the copper shielding braid at the peak of the stress cone will be located below the bottom of the porcelain tube.

6.0 Apply Terminal Connector

Re-check measurements and cut off each conductor to the proper length. Remove insulation from the end of the cable for a distance equal to the depth of the hole in the terminal lug plus one-fourth inch. At this point, pencil the insulation for an additional three-fourths inch and secure it with a binder of dry linen tape.

Drill two small holes in the shoulder of the terminal connector to permit pouring solder without inverting the conductor. Wrap several protective layers of linen tape over the conductor between the end of the insulation and the terminal connector. Preheat the terminal lug, insert the conductor in the lug and pour “half and half” solder through the small holes in the connector shoulder, using a torch to maintain the conductor and terminal connector at the proper temperature. The lug should be positioned on the conductor so that any locking fins or other alignment devices will enter the slots at the top of the porcelain with a minimum amount of conductor twisting.

Remove the protective linen tapes and apply half-lapped layers of varnished cambric tape to the area between the end of the insulation and the terminal connector, building up to the diameter of the lug. Apply two half-lapped layers across the lug ferrule and over the insulation.

7.0 Apply Stress Cone

Starting at the edge of the metallic shielding tape, apply half-lapped layers of oil-packed varnished cambric tape over the conductor insulation to form a stress relief cone of the dimensions shown on the drawing.

Starting at the maximum diameter of the stress relief cone, apply one half-lapped layer of five-eighth inch copper tinsel braid or other approved shielding tape over the bottom slope of the stress cone, lapping onto the conductor shielding tape. Solder the tinsel braid to the conductor shielding tape and apply a longitudinal solder bead along the length of the tinsel braid on each conductor to prevent slipping.

8.0 Complete Pothead Assembly

Check that the porcelain bushings are properly installed in the pothead cover plate. Insert conductors into the porcelain bushings and hand tighten the capnuts, making sure that the terminal connectors are fully seated in the porcelain at the top of the bushings. Assemble pothead body and cover plate, making sure that the gasket is properly seated. Bring wiping nipple and gasket up to the pothead body and bolt in place. Solder wipe the nipple to the lead sheath.

9.0 Fill with Compound

Potheads must be filled from the bottom up with the pothead in the vertical position to allow the compound to rise evenly and eliminate voids by forcing air up and out at the top. Novoid “X” Compound, heated to a temperature of 275- to 325- °F, is used for filling. The temperature must be measured by a thermometer and should not be exceeded because high temperature may damage the cable insulation and will definitely cause excessive shrinkage.

Three-conductor potheads are to be filled in two steps, filling the body of the terminal first and allowing this compound to cool and contract before the final pour.

FOR REFERENCE ONLY

9.1 First Filling

Install filler pipe (one-inch minimum size) in the lowest filling hole, using reducing fittings as necessary to attach to the pothead body. The filler pipe must extend above the level of the top filling holes.

Using a torch, preheat the filler pipe and pothead body. Then pour compound through the filler pipe until it flows out the top filling holes. On this first filling, the compound may be poured at a minimum temperature (275 °F). Allow the compound to cool until the filler pipe can be removed from the filler hole without loss of compound. It is not necessary to keep the filler pipe hot during this initial cooling period.

9.2 Second Filling

Transfer the filler pipe from the bottom to the top filler hole and install the plug in the bottom hole. Check to see that the filler pipe is long enough to extend above the top of the porcelain bushings. Remove capnuts and capnut gaskets. Also remove any small vent plugs in the cover plate of the pothead and install vent pipes in these vent holes.

The location and arrangement of filling holes and vents varies with different types of potheads and in some cases both the filling hole and a vent hole are located in the cover plate of the pothead. But regardless of the arrangement, filling must be accomplished by filling through a standpipe connected to the pothead body at the lowest possible point and all spaces to be filled must be vented at the top.

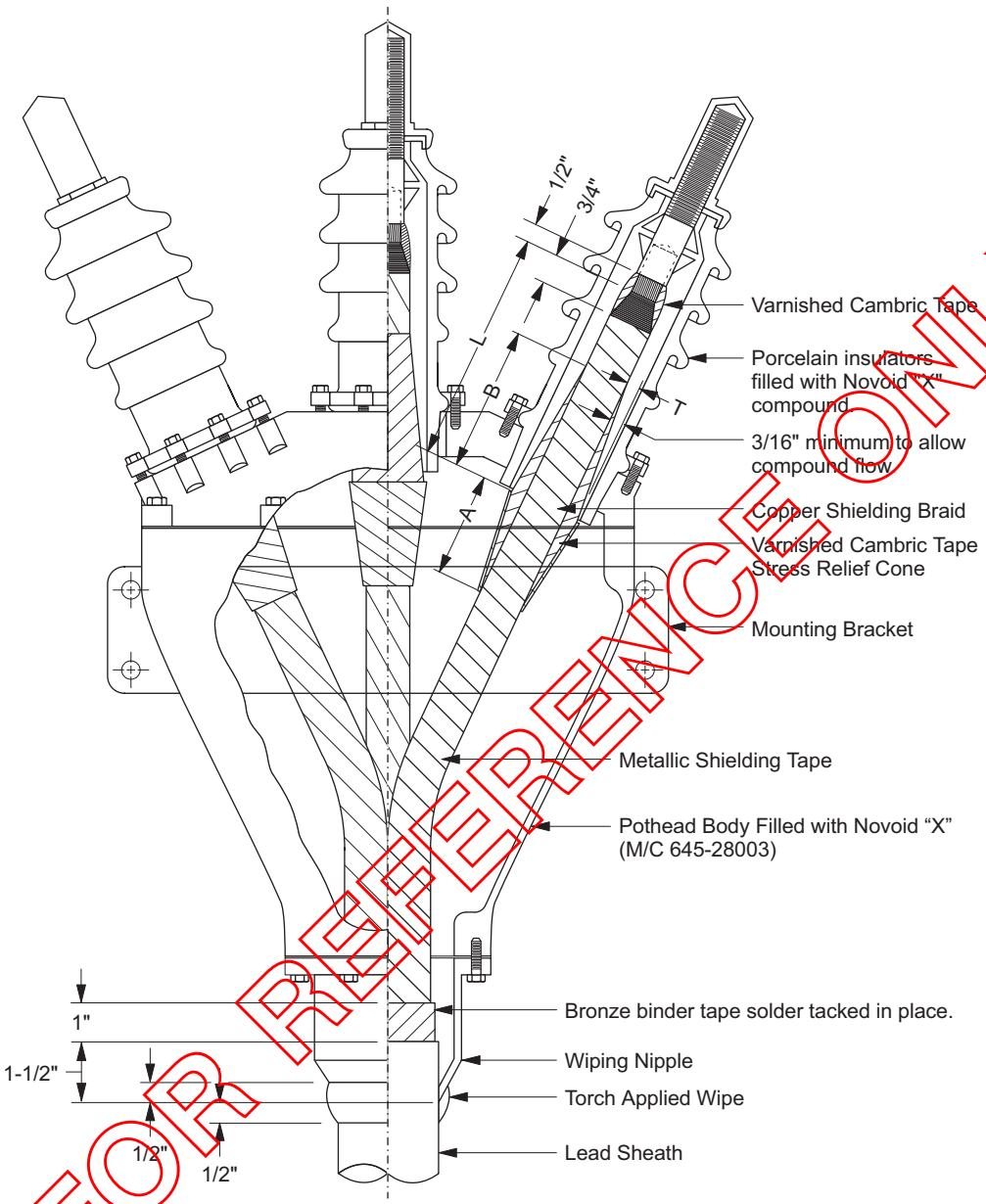
Preheat the filler pipe and pour compound, at a temperature of approximately 300 °F, through the pipe until it overflows slightly at the top of each porcelain and at the vent pipes.

Keep the filler pipe hot and full of fluid compound while the pothead is cooling by periodically heating the entire length of pipe (particularly the connection to the pothead body) with a torch and adding additional compound as required. Continue this process until the compound level in the filler pipe remains constant for approximately 15 minutes.

Remove vent and Filler pipes and install plugs. Thoroughly clean porcelains, install capnut gaskets (apply a little talc to gaskets) and tighten capnuts in place. Recheck all bolts and gaskets to make sure they are tight.

FOR REFERENCE ONLY

Figure TP 325–1: Pothead Termination — 3/C Capnut Type for 12/16 kV PILC Cable



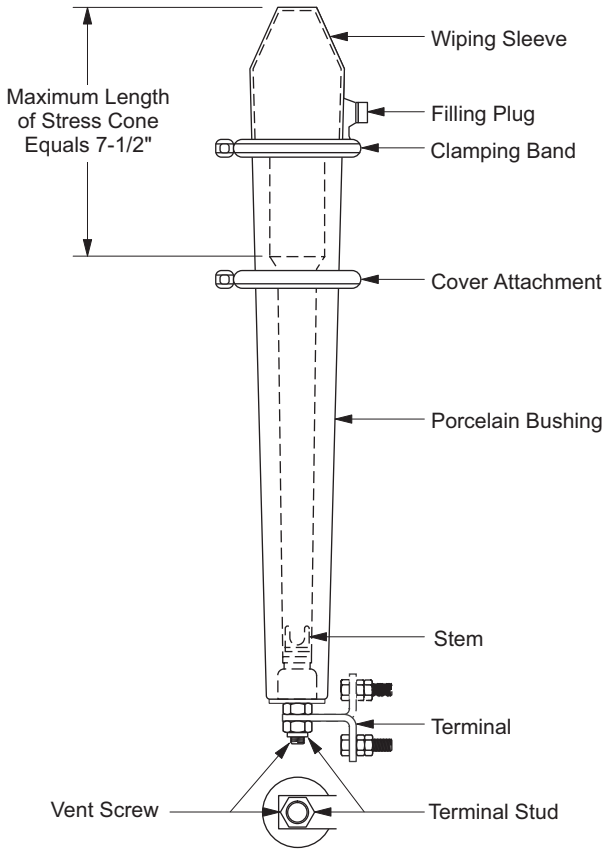
FOR REFERENCE ONLY

	Dimensions (inches)			
Voltage	**L**	**A**	**B**	**T**
12 kV	6	3	3	1/4
16 kV	7-1/2	3-1/2	3-1/2	5/16

TP 340 Pothead — 12/16-kV — Modified Transformer

Scope TP 340.1 Pothead Termination for 12/16-kV Transformers Modified for PILC Cable

Figure TP 340–1: Pothead Termination for 12/16-kV Transformers Modified for PILC Cable



1.0 Installation

1.1 Remove bushings from transformer. Slide wipe sleeve onto cable. Solder stem to cable conductor.

1.2 Place cable with stem attached temporarily in final position in bushing. Position wipe sleeve and index sheath.

1.3 Remove bushing. Slide sleeve back on cable. Cut and bell sheath proper distance from index mark. Bind cable tapes and build stress cones in accordance with standards for 1/C potheads at selected voltage.

1.4 Assemble cable in bushing. Attach terminal to stud. Attach wipe sleeve to bushing. Wipe sleeve to cable sheath. Fill with oil insoluble compound through filler pipe while bushing is held with stud end up. After final filling, place vent screw and solder over.

1.5 Insert filled bushing into transformer. Attach to cover and connect at terminal board.

Note(s):
1. Size No. 1 for 167 kVA 1Ø and smaller is limited to #2 AWG wire and 17 kV cable insulation.

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TP 360 Pothead — Heat Shrink Repair

Scope TP 360.1 Zipper-Type Heat Shrink Sleeve

This sleeve is to be used on all flat-angle potheads to prevent moisture from entering any points of lead fatigue. Choose the appropriate kit from the dimensions of pothead base and cable size.

Table TP 360–1: Zipper-Type Heat-Shrink Sleeve

Material Code	Raychem Part No.	Installation Range[1/] (in)	Nominal Length[2/] (in)
656-00900	HVS-LR-75/15-1200	0.65–2.65	48
656-00892	HVS-LR-160/42-1200	1.80–5.70	48
656-00884	HVS-LR-200/50-1200	2.15–7.10	48

[1/] Do not apply this sleeve on energized cables if cracks in lead sheath are noticed.
[2/] The diameter of the splice/cable must be within this range.

Note(s):
1. Sleeves can be cut to size for small repairs or to facilitate installation. The remaining portion can be used as another kit (sufficient mastic is supplied to complete two repairs.
2. Refer to manufacturer's instructions supplied with kit for complete installation procedures.

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TP 400 Indoor Terminal — 1/C — 5 kV R/L Cable

Scope TP 400.1 Indoor Termination for 1/C 5 kV Shielded, R/L Insulated Cable

1.0 Starting the Job

Form the cables as nearly as possible into their final position. Avoid all sharp bends by using a minimum bending radius of ten times the cable diameter.

2.0 Install Cable Terminal

Expose the conductor a distance equal to the connector depth plus one-half inch. Use care to avoid nicking the conductor strands. Install the proper size closed end terminal.

3.0 Expose Cable Insulation

Remove jacket, shielding, and bedding tapes to dimensions shown on the drawing. Tie shielding in place by tacking lightly with solder.

NOTE

Do not ring cut these tapes, as great care should be taken to avoid cutting the insulation.

Clean exposed insulation with “white” gasoline. Wipe dry with clean, dry cloth.

4.0 Apply Seal at Terminal

Taper the insulation as shown on the drawing. Fill all voids in the terminal with Scotch No. 23 tape. Apply Scotch No. 23 tape over exposed conductor, terminal, and factory insulation as shown on the drawing.

5.0 Complete the Termination

Apply two-half lapped layers of Scotch No. 23 tape over terminal and insulation as shown on the drawing.

NOTE

Start first layer at connector, taping downward, and wrap second layer back to terminal. Apply last few inches of tape without stretching.

6.0 Install Ground Strap

The location of the ground strap should be not less than six inches nor more than three feet from the lower end of the termination.

Remove the cable jacket to form a 2" x 4" window, exposing the metallic shielding tape. Build a 1/8" x 1" x 3" solder pad on the shielding tape. Solder the ground strap (1/2 inch tinned Belden braid) to the solder pad.

Apply Scotch No. 23 tape, half-lapped, over and around ground strap and cable. Use care to make a watertight seal.

FOR REFERENCE ONLY

7.0 Complete the Installation

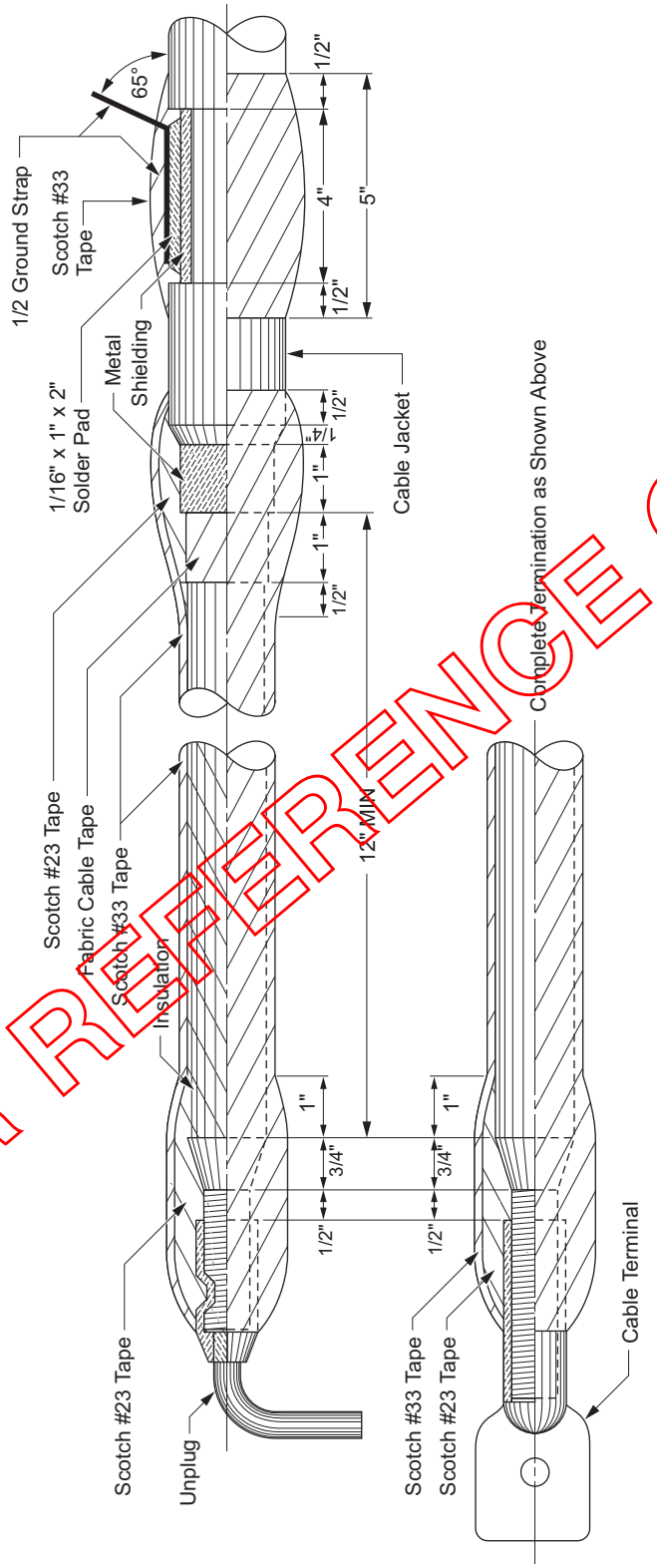
Connect ground strap to ground. Connect exposed cable terminal in permanent location..

NOTE

Entire termination shall be kept clear of other phase cables or structures.

FOR REFERENCE ONLY

Figure TP 400–1: Single Conductor — 5 kV — Shielded, Rubber-Like Insulated Cable — Indoor Termination



FOR REFERENCE ONLY

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TP 405 Pothead — 1/C — 5–16 kV R/L Cable

Scope TP 405.1 Pothead Termination, 1/C Capnut Type for 5 kV, 12 kV and 16 kV Rubber-Insulated, Shielded Cable

1.0 Train, Measure, and Cut Cable

Temporarily mount the pothead in its final position and form the cable outside the pothead as nearly as possible to its final position. Avoid all sharp bends by using a bending radius of ten times the cable diameter and keeping the cable straight for a distance of at least six inches beyond the end of the conduit or duct and six inches below the pothead.

Mark the cable even with the bottom of the stuffing box. Determine the length of cable required inside the pothead by measuring the distance from the bottom of the stuffing box to the full depth of the soldering hole in the terminal connector. This may be done by inserting a stiff wire fully into the pothead and marking it at the bottom of the stuffing box. Transfer this measurement to the cable, starting at the previously made mark and cut the cable to the proper length.

Remove the stuffing box assembly from the pothead and slip it out of the way over the end of the cable, making sure that it is faced correctly for final assembly.

2.0 Apply Terminal Connector

Remove the terminal connector form the pothead. Remove jacket, shielding tapes, and insulation from the cable for a distance one-half inch greater than the depth of the hole in the connector.

Drill two small holes through the shoulder of the connector to permit soldering without inverting the cable.

Install the connector on the conductor and position it so that locking fins or other alignment devices will enter the top of the pothead with a minimum amount of conductor twisting.

Wrap linen tape between the end of the connector and the cable insulation to limit the flow of solder. Solder the connector in place by melting half and half solder through the small holes.

After soldering, remove the protective linen tapes.

3.0 Remove Cable Jacket

Remove the cable jacket for a distance equal to L + A + 1 inches. The length (L) shown on the drawing is a minimum length. It may be greater and should be adjusted so that the end of the shielding braid at the peak of the stress cone will be located approximately at the bottom of the porcelain tube when the cable is assembled in the pothead.

CAUTION In this, and in the following steps, do not ring cut the jacket, shielding tapes or insulation and use care to avoid damaging these components.

4.0 Remove and Terminate Shielding Tapes

Remove the metallic shielding tape for a distance equal to L + A inches. Cut the tape around the cable so that a uniform length of 1 inch extends beyond the end of the outer jacket. Tack solder the turns of shielding tape together. Also, remove any paper tapes which might be used and cut them off even with the metallic shielding tape.

FOR REFERENCE ONLY

Remove the fabric cable tapes (may be semiconducting tapes) to a point 1/2 inch from the end of the shielding tape and cut off so that a uniform length of 1/2 inch extends beyond the shielding.

5.0 Prepare the Cable Insulation

Pencil the insulation below the terminal connector for a distance 1-1/2 inches and buff the pencil smooth with aloxcite cloth.

Wipe the entire surface of the exposed insulation with a clean cloth dampened with "white" gasoline and make certain that any semiconducting compound residue has been removed.

6.0 Apply Stress Cone and Cover Insulation

Starting at the edge of the fabric (or semiconducting) cable tapes, apply half-lapped layers of dry packed Fibremat tape over the conductor insulation to form a stress relief cone of the dimensions shown on the drawing. Taper the stress relief cone smoothly.

Starting at the peak of the stress cone, apply one-half-lapped layer of copper shielding braid over the Fibremat build-up and the fabric cable tape and lapping onto the shielding tape. Solder the copper shielding braid to the cable shielding tape.

Apply half-lapped layers of dry packed Fibremat tape over the conductor and the pencilled insulation below the terminal connector, building up to the diameter of the factory insulation and lapping onto the connector. Continue two of the half-lapped layers over the insulation from the connector to the edge of the shielding braid at the peak of the stress cone.

7.0 Complete Pothead Assembly

Insert the cable into the pothead and temporarily tighten the capnut, making sure that the connector is fully seated in the pothead.

Bring the stuffing box assembly up to the pothead and bolt in place. Tighten the gland nut to compress the gaskets and seal the entrance.

8.0 Attach Ground Strap

Starting at a point 2 inches below the bottom of the stuffing box, remove approximately 1-1/2 inches of the cable jacket to expose the shielding tape. Solder one end of a 3/4 inch Belden braid ground strap around the cable shielding tape at this point and clamp the other end under on of the stuffing box mounting bolts. Connect the system ground to this jumper.

9.0 Fill with Compound

The pothead must be filled from the bottom up, with the pothead in the vertical position to allow the compound to rise evenly and force out any entrapped air.

"Novoid X" compound is used for filling. It should be poured at a temperature of 275°F – 325°F. Temperatures should be measured by a thermometer and must not be exceeded because overheating can damage the insulation and will result in excessive compound shrinkage.

The pothead should be filled in one continuous pouring operation.

Install a filler pipe (1 inch minimum size) in the lowest filling hole, using reducing fittings as required to attach to the pothead body. The pipe must extend above the top of the porcelain bushing.

Remove the capnut and capnut gasket from the top of the pothead.

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Preheat the pothead body and the filler pipe.

Pour compound through the filler pipe until flows out the top of the pothead. Keep the filler pipe hot and full of fluid compound while the pothead is cooling by periodically heating the entire length of pipe (particularly the connection to the pothead body) with a torch and adding compound as required. Continue this process until the compound level in the filler pipe remains constant for approximately 15 minutes.

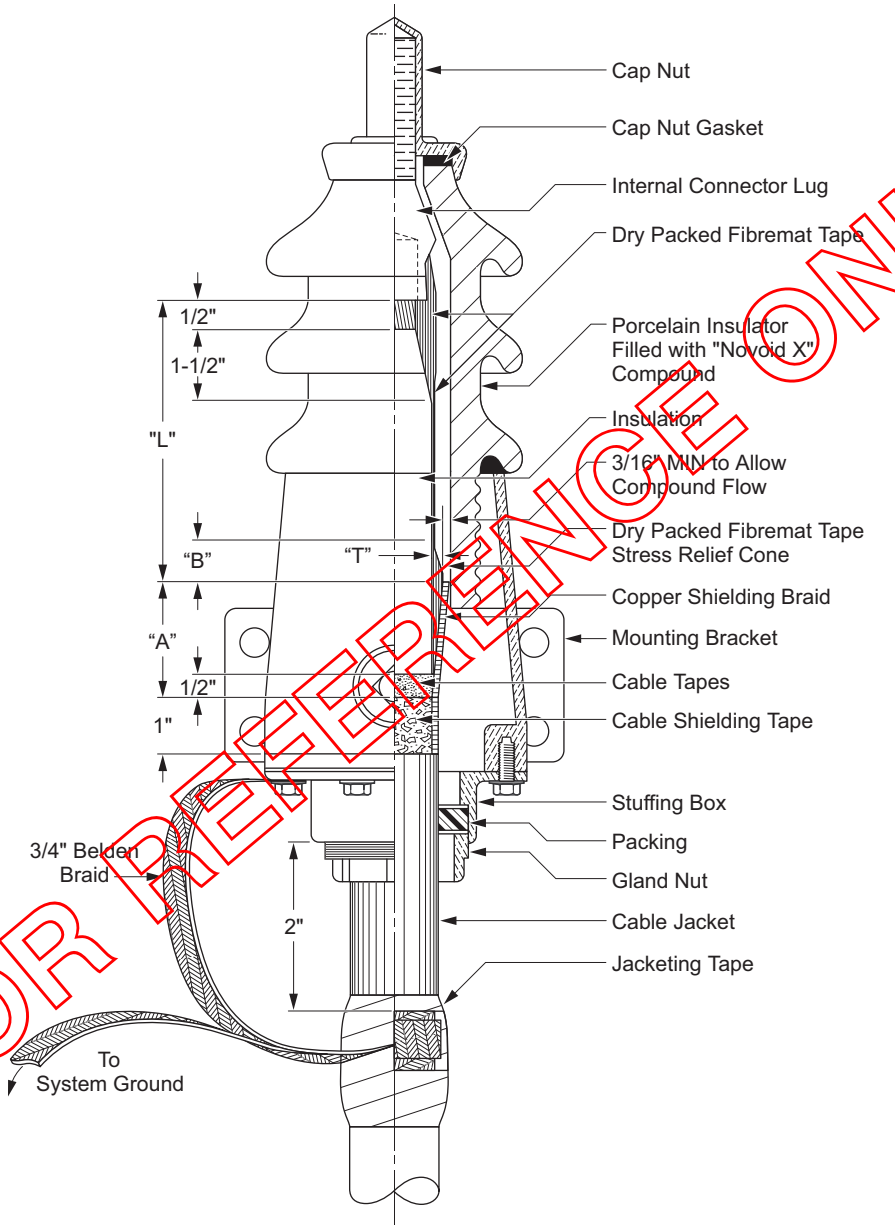
Remove filler pipe and install the plug. Thoroughly clean the porcelain insulator, install capnut gasket (apply a small amount of talc to the gasket) and tighten capnut in place.

Recheck all bolts and gaskets to make sure they are tight.

FOR REFERENCE ONLY

Scope TP 405.2 **Pothead Termination — 1/C Capnut Type 5 kV, 12 kV, 16 kV Shielded Rubber-Like Insulated Cable**

Figure TP 405–1: Pothead Termination — 1/C Capnut Type 5 kV, 12 kV, 16 kV Shielded Rubber-Like Insulated Cable



FOR REFERENCE ONLY

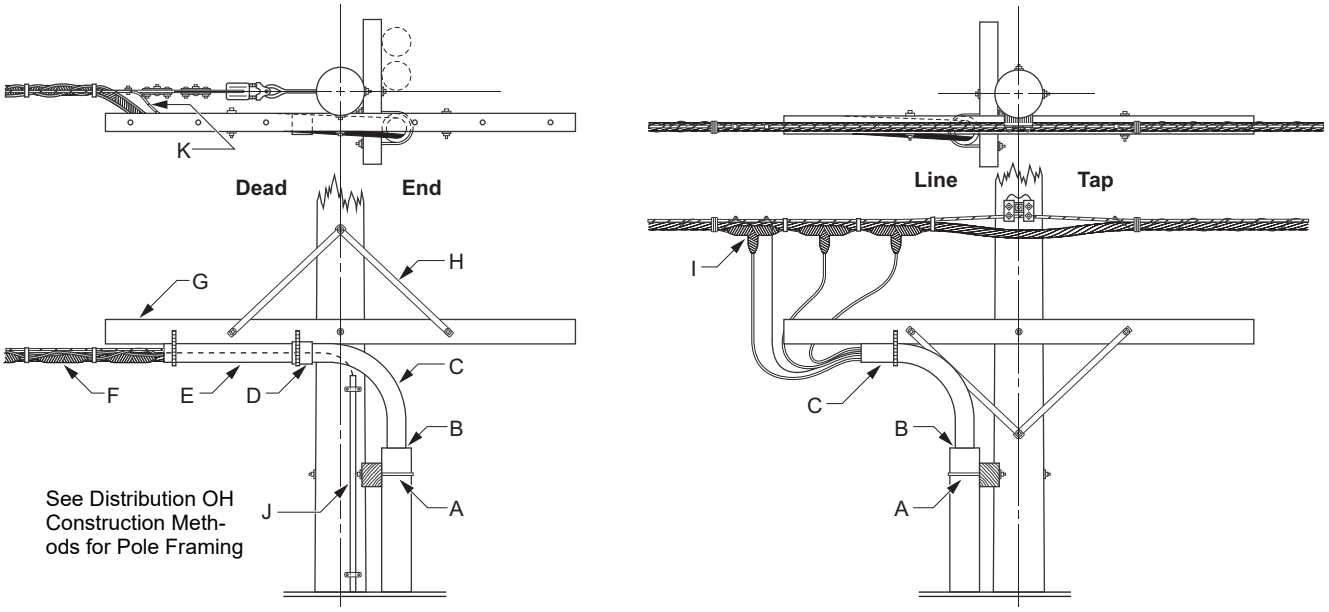
Table TP 405–1: Pothead Termination Data

Voltage (kV)	"L" MIN (in)	"L" (in)	"L" (in)	"L" (in)
5	6	2	1	1/8
12	7	3-1/2	1-3/4	1/4
16	9	4-5/8	2-1/4	5/16

TP 500 Aerial Cable Terminal

Scope TP 500.1 Riser Cable Terminal to Aerial Cable

Figure TP 500–1: Joining PILC or Synthetic Cable Risers to Aerial Cable



Legend

A. Riser grip supporting cables at top of conduit.
B. Fiber reducer from conduit cover fiber to fiber elbow.
C. Fiber 90 degree elbow strapped to arm. Use 3 inch normal or 4 inch for substation getaway or other large high voltage circuit.
D. Angle coupling.
E. Fiber conduit strapped to arm.
F. Straight splice to aerial cable. See Section JJ for appropriate splicing method and oil stop if required.
G. 8 ft cross arm.
H. Flat brace.
I. Tee splice to aerial cable.
J. Ground wire under molding where required.
K. Ground conductor from conduit.

Note(s):

1. See DUG CR 150 for placement of riser conduit warning labels.

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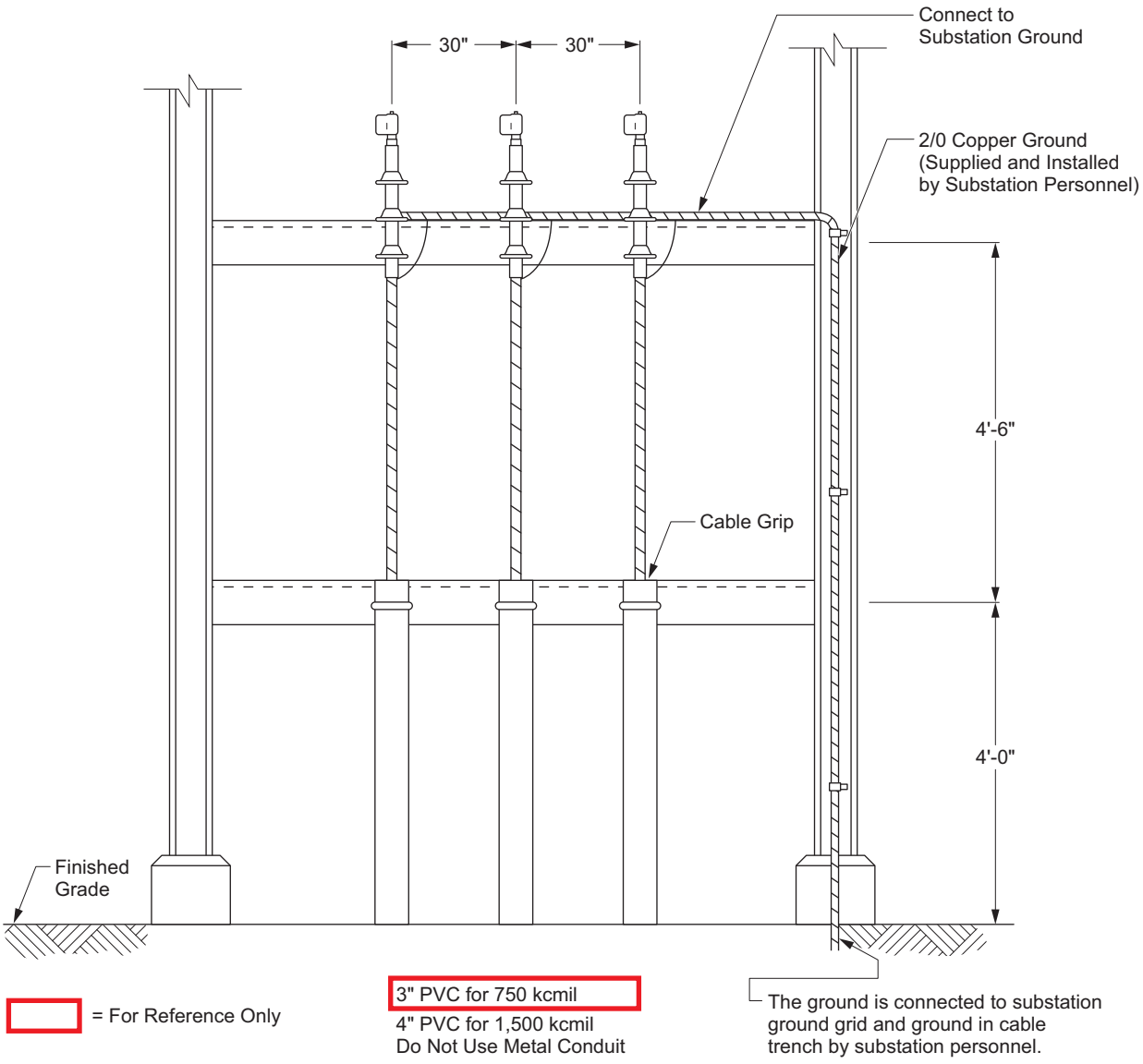
TP 542 35 kV 3Ø Substation

Scope TP 542.1 Typical Pothead Installation Substation Underground Getaways — 34.5 kV CLP Cables (750 kcmil and 1,500 kcmil)

Figure TP 542–1: Typical Pothead Installation Substation Underground Getaways — 34.5 kV CLP Cables (750 kcmil and 1,500 kcmil)



Note(s):

1. Single conductor pothead mounting brackets, which are equipped with a grounding terminal, should have the concentric neutral wires of the cable pass through the grounding terminal and then be terminated in a bolted connector with the substation copper ground wire. In no case should a galvanized bolt be used as part of the grounding system.
2. One 2/0 copper ground (supplied and installed by substation personnel) for each circuit.

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TP 544 12/16 kV, 34.5 kV 3Ø, 3-Wire Substation

Scope TP 544.1 Typical Pothead Installation Substation Underground Getaways

Figure TP 544–1: Typical Pothead Installation Substation Underground Getaways

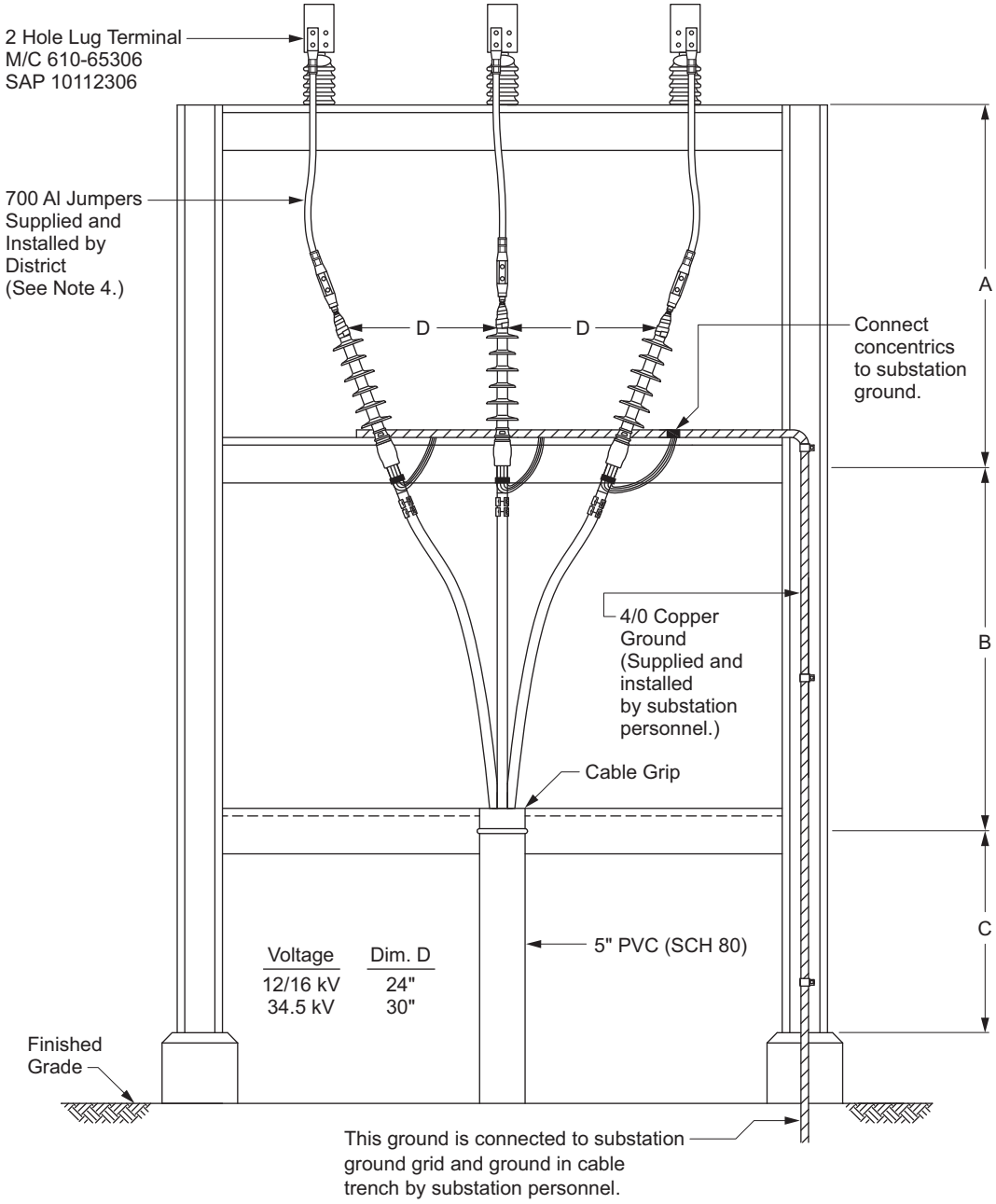

Table TP 544–1: Rack Height Dimensions

Rack Size	A	B	C
15' Rack	6'-7"	5'-0"	3'-5"
18'-6" Rack	4'-6"	6'-0"	4'-6"

Note(s):

1. The two outer potheads should be mounted at an approximate 20 degree angle to the mounting surface.
2. Single conductor pothead mounting brackets, which are equipped with a grounding terminal, should have the concentric neutral wires of the cable pass through the grounding terminal and then be terminated in a bolted connector with the substation copper ground wire. In no case should a galvanized bolt be used as part of the grounding system.
3. One 2/0 copper ground (supplied and installed by substation personnel) for each circuit.
4. Install jumper between top of pothead and termination point. Size jumper to match expected loading. Typically, a 700 Al, 600 V conductor can be used for 600 A. The insulation can remain on the conductor.
5. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.

TP 546 12/16 kV 3Ø, 4-Wire Substation

Scope TP 546.1 Typical Pothead Installation Substation Underground Getaways — 12/16 kV CLP Cables

Figure TP 546–1: Typical Pothead Installation Substation Underground Getaways — 12/16 kV CLP Cables

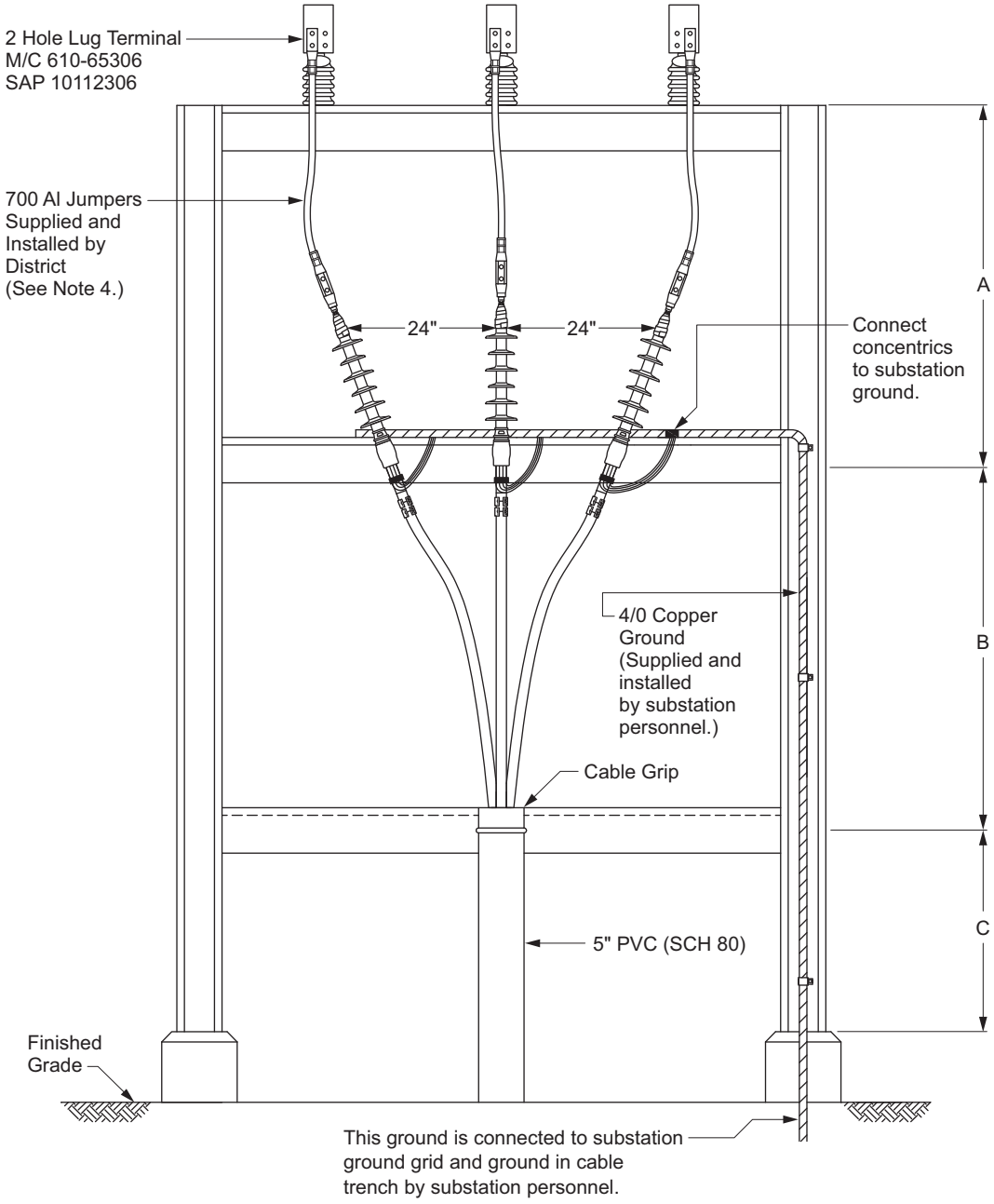

Table TP 546–1: Rack Height Dimensions

Rack Size	A	B	C
15' Rack	6'-7"	5'-0"	3'-5"
18'-6" Rack	4'-6"	6'-0"	4'-6"

Note(s):

1. The two outer potheads should be mounted at an approximate 20 degree angle to the mounting surface.
2. Single conductor pothead mounting brackets, which are equipped with a grounding terminal, should have the concentric neutral wires of the cable pass through the grounding terminal and then be terminated in a bolted connector with the substation copper ground wire. In no case should a galvanized bolt be used as part of the ground system.
3. One 4/0 copper neutral (supplied and installed by substation personnel) for each circuit.
4. Install jumper between top of pothead and termination point. Size jumper to match expected loading. Typically, a 700 Al, 600 V conductor can be used for 600 A. The insulation can remain on the conductor.
5. Per DOH, DC 535, Wildlife Protection shall be constructed and installed as applicable for insulators, taps, leads, arresters, cable terminations, and equipment bushings.

Transformers
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TX 100 Pad-Mounted Transformer Switches

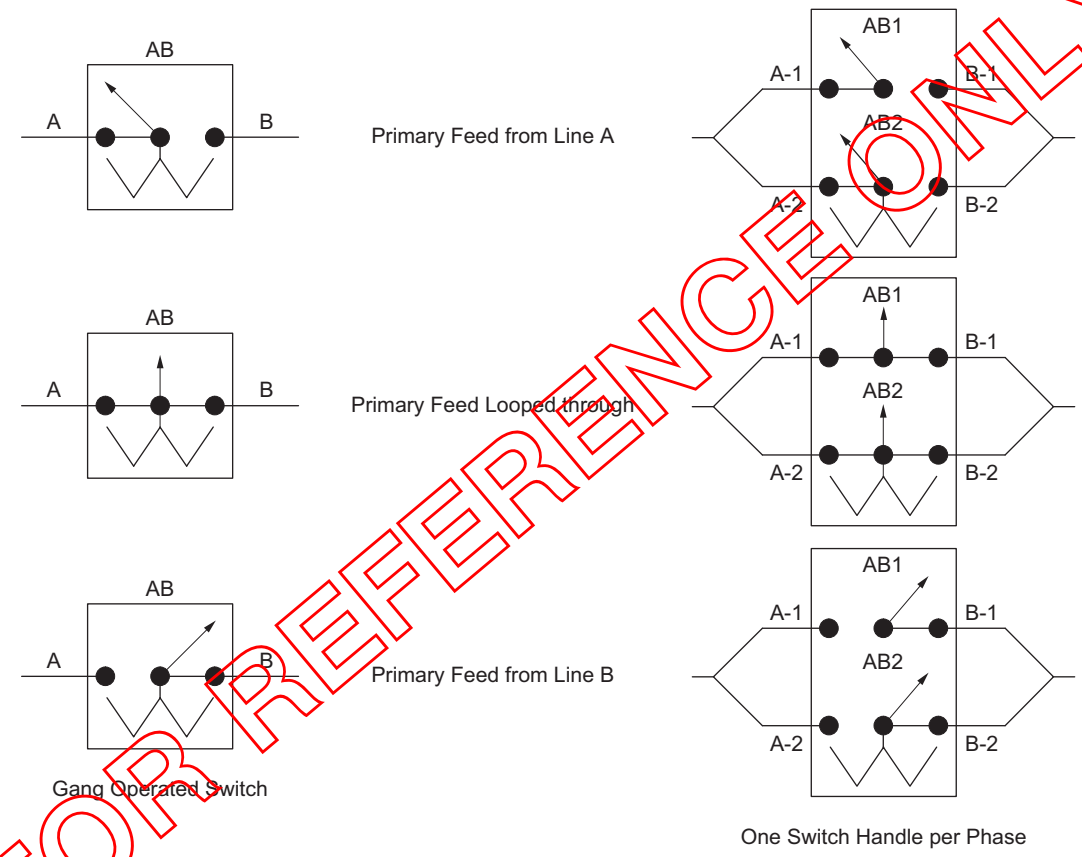
Scope TX 100.1 Pad-Mounted Transformer Switches — 1Ø

1.0 General Information

There are many different types of pad-mounted transformers installed on the Edison system. The older types are all live front. Some of these are switched and some are nonswitched. Those that are switched may have either a single handle or two handles. Some are gang operated and some are just a single switch. Refer to schematic in primary compartment before doing any switching.

The following diagrams show the various type switches that may be found in pad-mounted transformers.

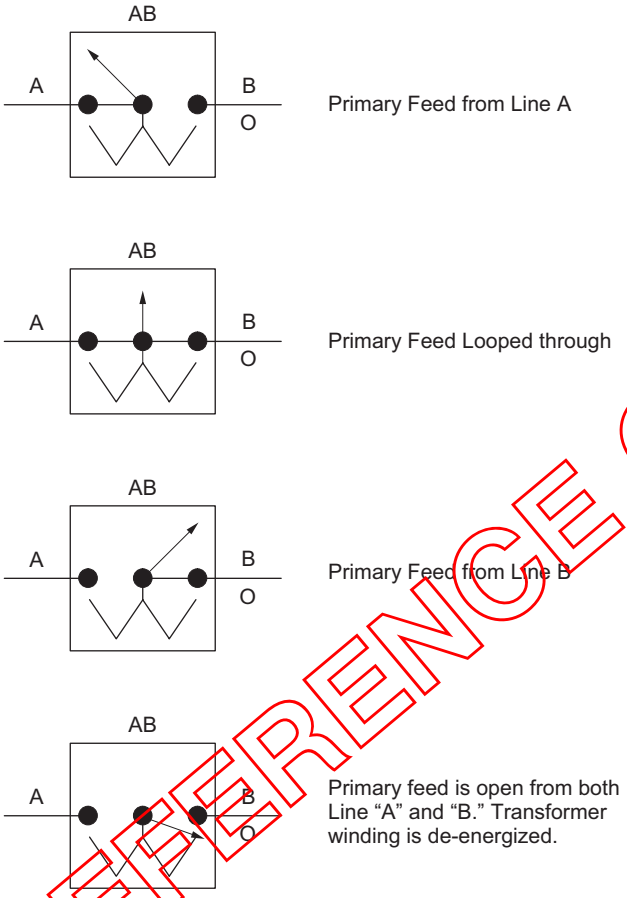
Figure TX 100–1: Switched Pad-Mounted Transformers Group 1 — Single Phase and Three Phase



FOR REFERENCE ONLY

Normally, this transformer will be a 12 kV or 16 kV transformer. It may have one switch handle per phase or have a single handle, gang operated switch. It should be noted that to switch from Line A to Line B there will be a parallel between Line A and Line B as the switch travels through AB.

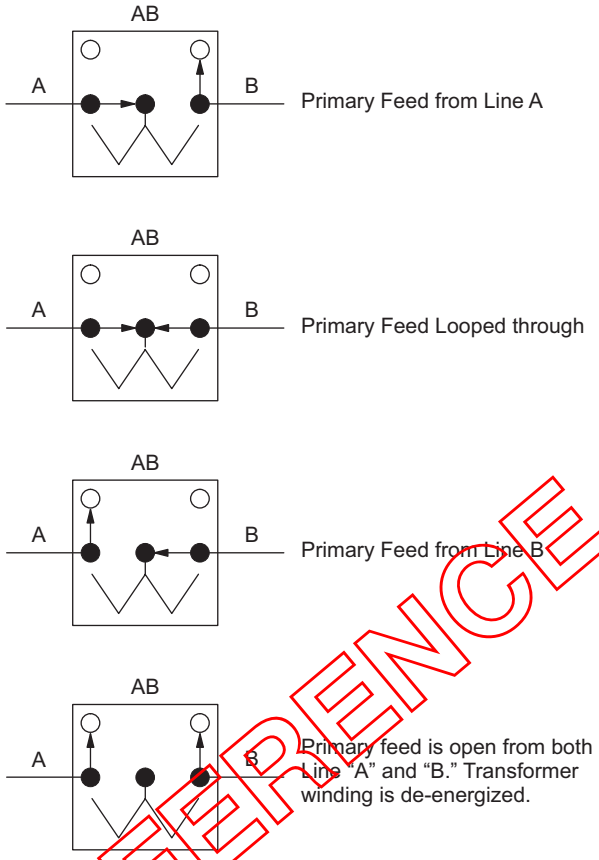
Figure TX 100–2: Switched Pad-Mounted Transformers Group 1 — Single Phase



FOR REFERENCE ONLY

Normally, this transformer will be a 12 or 16 kV transformer. It will have one switch handle operating a gang operated rotary switch. It should be noted that when operating this switch, there will be a momentary load dropping effect. The switch may be rotated 360 degrees clockwise or counterclockwise.

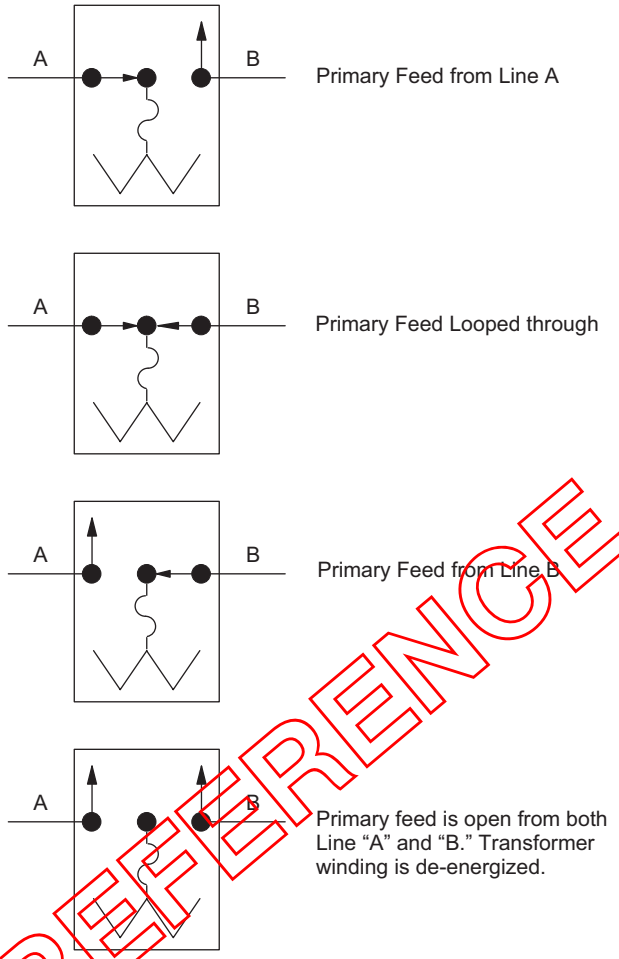
Figure TX 100–3: Switched Pad-Mounted Transformers Group 3 — Single Phase



This transformer may be installed on a 6.9 kV, 9.4 kV, 12 kV, or 16 kV systems. It has two switch handles operating independently of one another, as shown above.

FOR REFERENCE ONLY

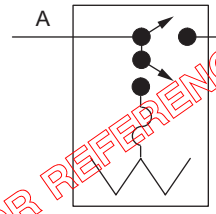
Figure TX 100–4: Switched Pad-Mounted Transformers Group 4 — Three Phase (75 kVA and 150 kVA)



FOR REFERENCE ONLY

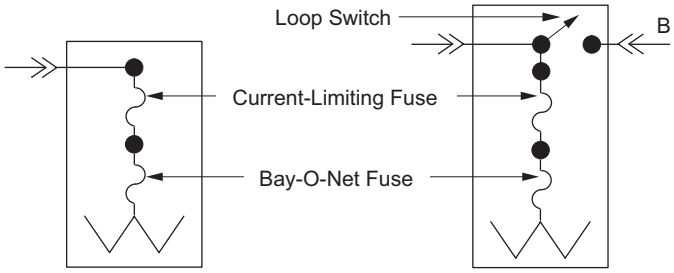
This transformer will normally be a 12 kV or 16 kV transformer, dead-front transformer. To remove the fuses, which are a C.L. type, Switch “A” or “B” must be in the OPEN position.

Figure TX 100–5: Switched Pad-Mounted Transformers Group 5 — Three Phase (75–500 kVA)



FOR REFERENCE ONLY

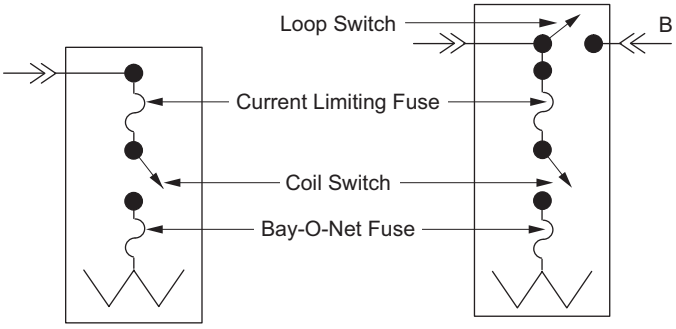
Figure TX 100–6: Switched Pad-Mounted Transformers Group 5 — Three Phase (45–500 kVA)



Radial-Type Bayonet-Fused Transformer
Equipped with load-break elbows, Bay-O-Net fuses, and internal CLFs.

Loop-Type Bayonet-Fused Transformer
Equipped with load-break elbows, Bay-O-Net fuses, internal CLFs, and a loop ("B") switch.

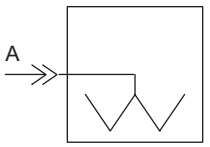
Figure TX 100–7: Switched Pad-Mounted Transformers Group 5 — Three Phase (45–500 kVA)



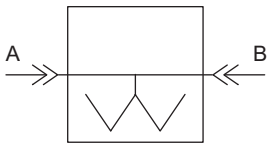
Radial-Type Bayonet Fused Transformer
(Equipped with koad-break elbows, Bay-O-Net fuses [See Note 2.], internal CLFs, and a coil switch.)

Loop-Type Bayonet Fused Transformer
(Equipped with load-break elbows, Bay-O-Net fuses [See Note 2], internal CLFs, a coil switch, and a loop switch.)

Figure TX 100–8: Nonswitched Pad-Mounted Transformers Group 1 — Single Phase or Three Phase



Primary Feed from One Direction



Primary Feed Looped through

Note(s):
1. These transformers may be installed on 4 kV, 6.9 kV, 9.4 kV, 12 kV, or 16 kV systems.
2. For Bay-O-Net fuse selection, refer to the Distribution Operations and Maintenance Policies and Procedures (DOM) Manual, TR-2.

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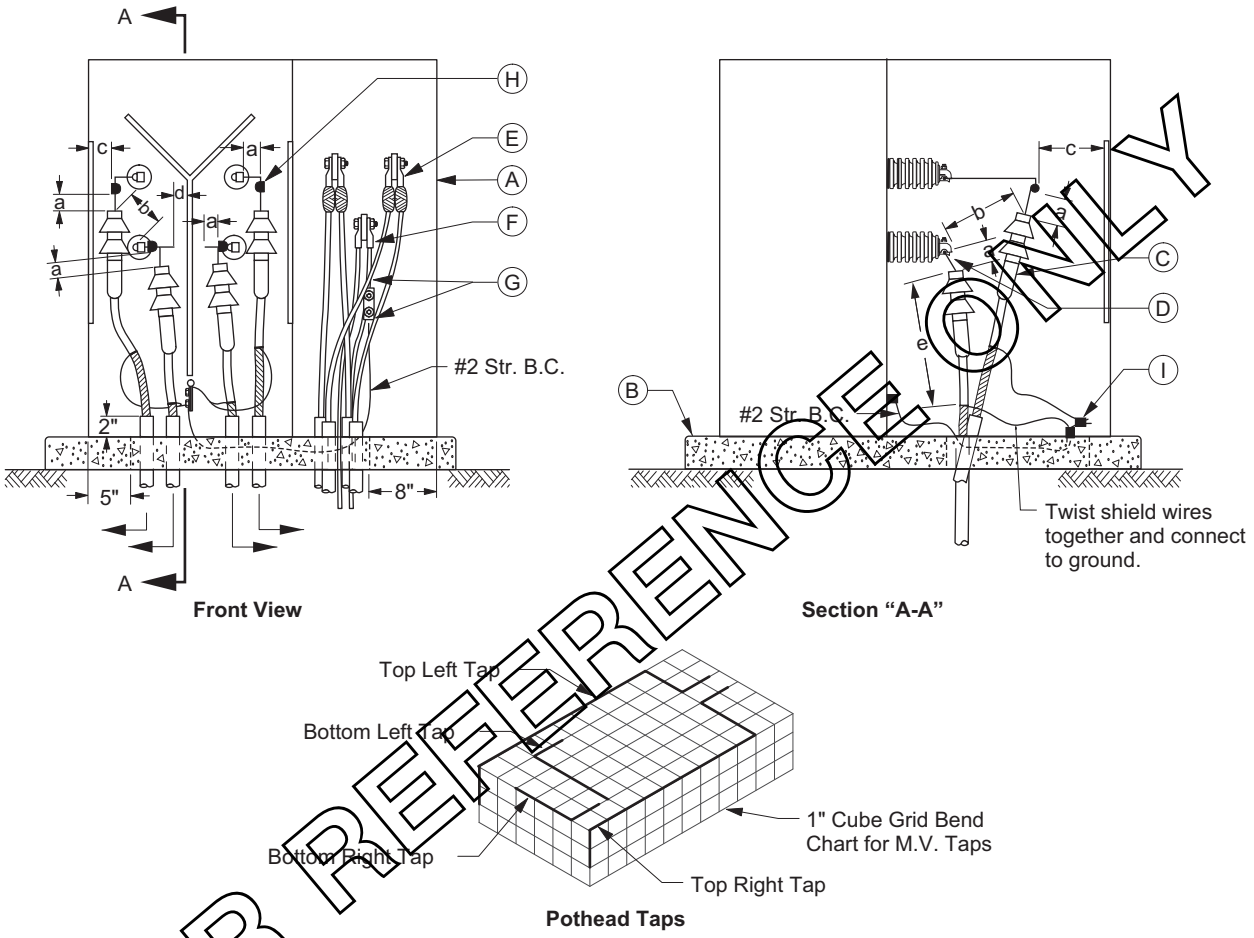
TX 150 Clearances — Pad-Mounted Transformer — Live Front — 12/16 kV

Scope TX 150.1 Typical Clearance on Live Front 12/16 kV Pad-Mounted Transformer

Figure TX 150–1: Typical Clearance on Live Front 12/16 kV Pad-Mounted Transformer



FOR REFERENCE ONLY

Table TX 150–1: Typical Clearance on Live Front 12/16 kV Pad-Mounted Transformer

Material			Minimum Clearances — 12 kV and 16 kV		
Item	Description	Quantity			
A	Transformer, Pad-Mounted	1	a	Bare Copper accessible for Grounding Clamps	1-1/2"
B	Precast Concrete Transformer Pad	1	b	Phase to Phase	8"
C	Terminal Pothead – Epoxy Resin Filled	4	c	Phase to Case Insulation Barrier	2-1/2"
D	Hyplug Tinned – Copper – 10" Long Shank	4	d	Phase to Center Insulation Barrier	1-1/2"
E	Hyplug Tinned – Aluminum	4	e	Phase to Cable Shielding Termination	16"
F	Hyplug Tinned – Copper	2			
G	Hyplug Tinned – Copper #2 str	4			
H	Fargo Type – Hot Stick Connector – #2 str	4			
I	Split Bolt Connector – #2 str	2			

Note(s):
1. Clearances apply to all conductors in primary compartment.
2. Dimensions listed may be for either mechanical or electrical conditions.

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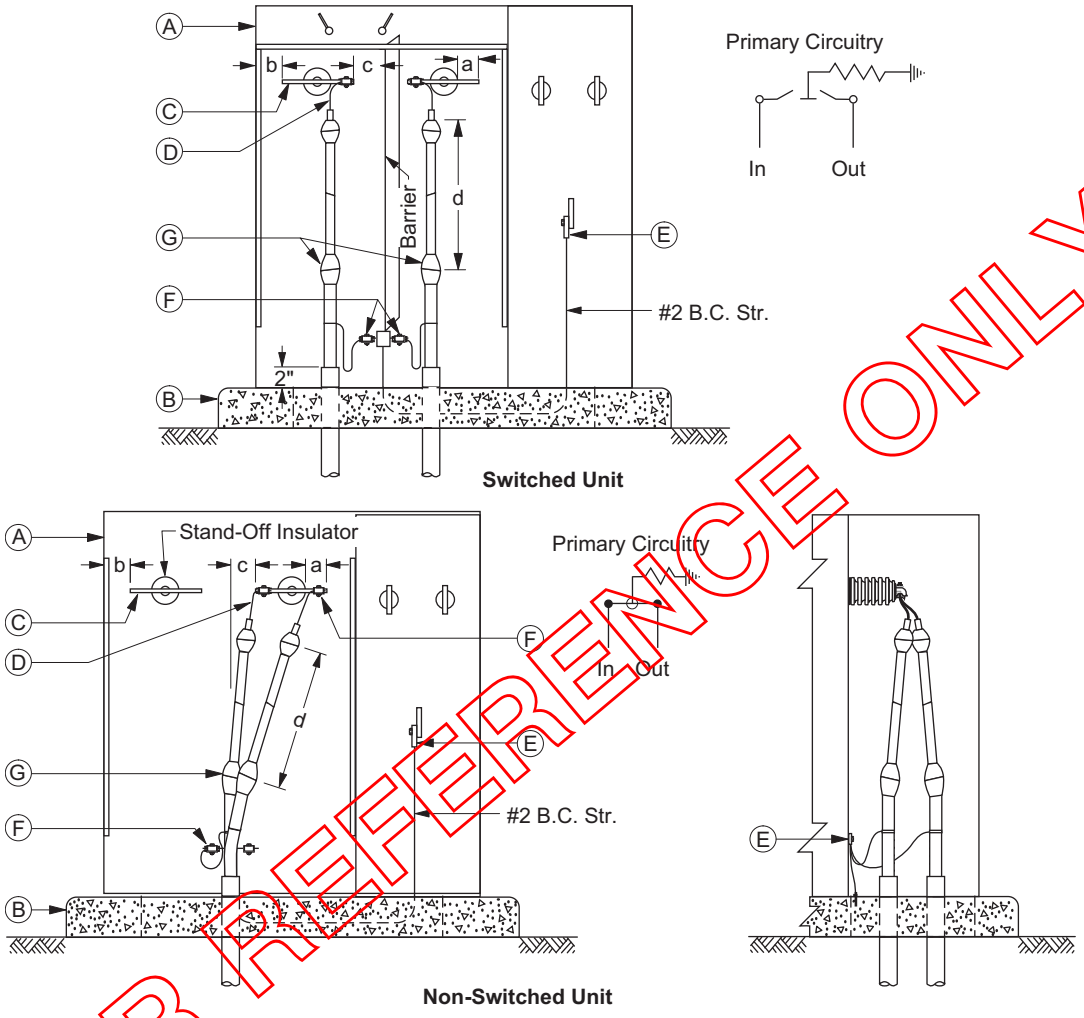
TX 152 Clearances — Pad-Mounted Transformer — Live Front — 4.1 kV, 6.9 kV, and 9.4 kV

Scope TX 152.1 Typical Clearance on Live Front 4.1 kV, 6.9 kV, and 9.4 kV Pad-Mounted Transformer

Figure TX 152–1: Typical Clearance on Live Front 4.1 kV, 6.9 kV, and 9.4 kV Pad-Mounted Transformer



FOR REFERENCE ONLY

Table TX 152–1: Typical Clearance on Live Front 4.1 kV, 6.9 kV, and 9.4 kV Pad-Mounted Transformer

Material			Minimum Clearances — 6.9 kV and 9.4 kV		
Item	Description	Quantity			
A	Transformer, Pad-Mounted	1	a	Bare Copper accessible for Grounding Clamps	1-1/2"
B	Precast Concrete Transformer Pad	1	b	Phase to Case Insulation Barrier	2-1/2"
C	#2 B.C. solid 4" long (MIN)	2	c	Phase to Center Insulation Barrier	1-1/2"
D	Hyplug – Tinned Copper – Long Shank (cut and bend to fit)	2	d	Phase to Semiconducting Material of Stress Cone	13"
E	Hyplug – Tinned Copper – #2 str	2	**Note(s):** 1. Clearances apply to all conductors in primary compartment. 2. Dimensions listed may be for either mechanical or electrical conditions.		
F	Fargo Type – Hot Stick Connector – #2 str	4			
G	Stress Cone – ESA	2			

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TX 160 Anchoring, Sealing, and Stenciling Pad-Mounted Equipment

Scope TX 160.1 General Requirements for Anchoring, Sealing, and Stenciling Pad-Mounted Equipment

1.0 Anchoring

All pad-mounted equipment shall be anchored at time of installation. Figure TX 160–1.1 (Sheet 1) and Figure TX 160–1.2 (Sheet 1) illustrate typical installations with hold-down washers supplied by manufacturers. A minimum of two of these anchors are to be used for each cabinet.

Adjustable inserts are provided in most precast pads. For poured-in-place pads and some precast pads, holes for anchor bolts must be drilled to fit the specific equipment being used.

Figure TX 160–1: Anchoring Pad-Mounted Equipment

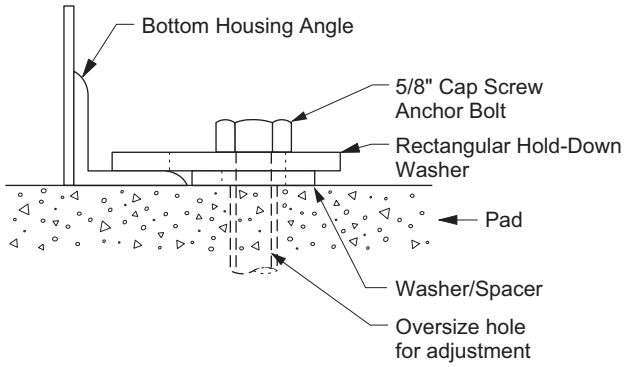


Figure TX 160–1.1

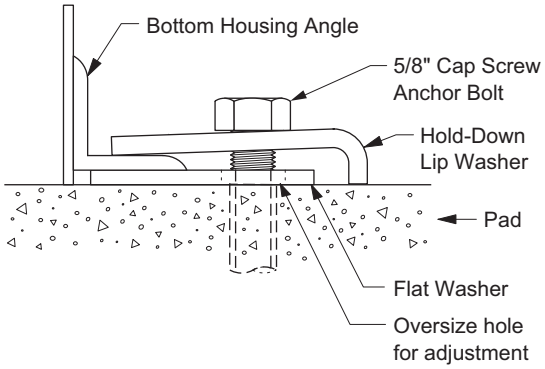


Figure TX 160–1.2

2.0 Sealing

The gaps between concrete pads and pad-mounted equipment shall be sealed to prevent a wire from entering from the outside into the compartment with exposed live parts. Refer to G.O. 128, 34.4. This will also prevent tampering, reduce moisture entry, and deter rodents and vermin from nesting inside the equipment after the equipment is closed and locked.

2.1 Sealing Procedure

A. Clean around the concrete pad and padmount to remove any dirt or debris in order for the sealant to adhere properly.

B. Before applying sealant, carefully follow instructions on the cartridge. Open sealant by cutting at a 45 degree angle at the 1/2 mark. See Figure TX 160–2.1 (Sheet 2).

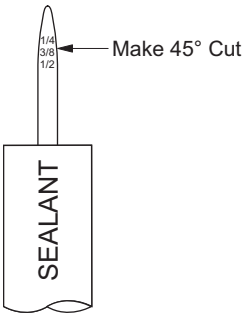
C. Apply sealant completely around equipment between the concrete pad. and in the “pad unistrut.” See Figure TX 160–2.2 (Sheet 2)

D. Larger gaps or holes may require the use of concrete mortar or steel plates.

2.2 Maintenance

A. Replace any sealant that may be loose or broken. Seal completely around equipment as noted in Step C. (Sheet 1) If new sealant will not adhere to existing sealant, remove existing sealant, clean surface with solvent, and follow the above “Sealing Procedure.”

Figure TX 160–2: Sealing Pad-Mounted Equipment



Item	SAP Number
Sealant	10061306
Caulking Gun	10144789

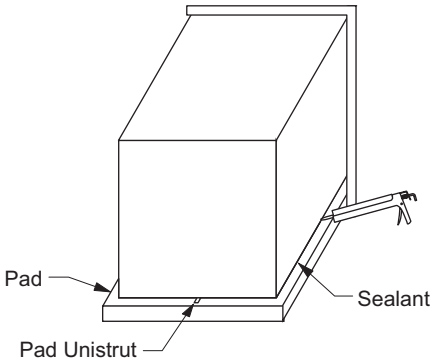


Figure TX 160–2.1

Figure TX 160–2.2

3.0 Stencilling

3.1 All pad-mounted equipment is to be marked “HIGH VOLTAGE.” Locate sign 6 inches from the top of the doors for small padmounts and a maximum of 5 feet above the pad on large padmounts. The “HIGH VOLTAGE–KEEP OUT” sign (Form #14-174-106) may be used to satisfy this requirement.

3.2 All pad-mounted equipment shall have the structure number permanently affixed using Scotchlite decals. The structure number shall be installed in the upper left-hand corner of the padmount door. Additional Scotchlite numbers may be placed in other locations to assist in locating equipment not easily seen, for example, on the back of a transformer only visible from the street.

3.3 Other identifying information, for example, switch number and compartment number or “LF” for Live Front transformers, shall also be affixed to the door surface, preferably in the same general location as the structure number.

3.4 Two decals (Form #14-174-116 for transformers, and Form #14-174-117 for switches) depicting required working distance for workmen around pad-mounted equipment are used to assist customers in understanding Edison's requirements for working clearances. These decals should be affixed to pad-mounted equipment in areas where customers may install fences, shrubs, pool equipment, or other obstacles that may interfere with Edison work practices. These decals are to be used in addition to the “HIGH VOLTAGE” stencil or the “HIGH VOLTAGE–KEEP OUT” decal. See Figure TX 160–3 (Sheet 3).

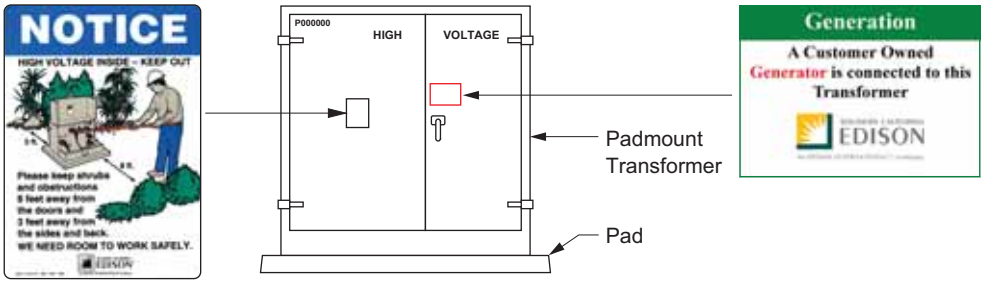
3.5 Pad-mounted transformers with external tap changers in cabinets will require a decal stating “DE-ENERGIZED OPERATION ONLY” (SCE Form #14-174-102) near tap changer.

3.6 PME switches shall be marked PME with the device number, the structure number, and also the fuse type for each fused position, either CL for current-limiting fuses or SML for those positions equipped with expulsion-type power fuses. Fuse marking shall be located approximately in the center of the corresponding door.

3.7 Vacuum fault interrupter/switch units such as COOPER VFI, G&W PVI, and S&C Vista gear shall be marked VFI with the device and the structure number. Units with multiple switch and fault interrupter units shall also be marked “Switch 1”, “Switch 2”, “FI1”, and “FI2” as appropriate for the configuration installed. The marking shall be located approximately in the center of the corresponding door.

3.8 All commercial pad-mounted transformers with connected generation shall be marked with a decal (Form #15-39) to identify a customer generator. Refer to Figure TX 160–3 (Sheet 3).

Figure TX 160–3: Labeling Pad-Mounted Equipment



Live Front Labels

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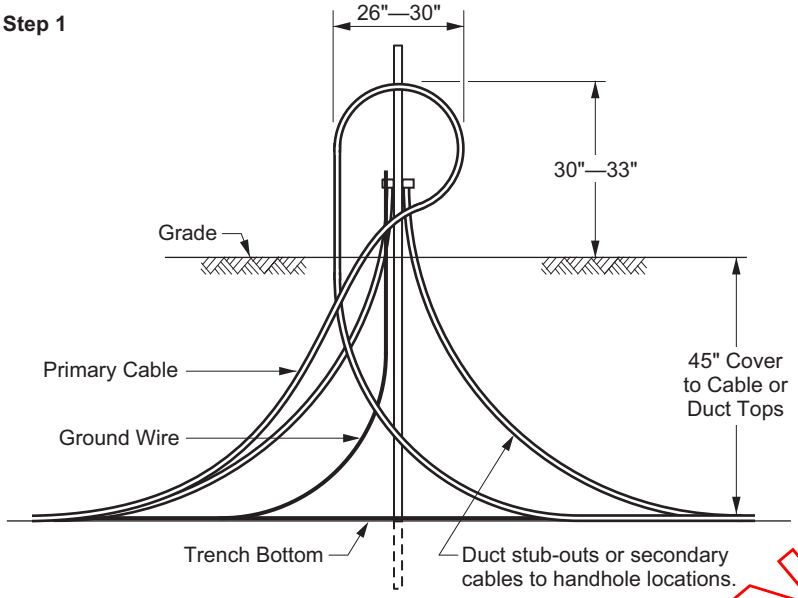
TX 170 Transformer By-Pass Installation — Lot Sales

Scope TX 170.1 Typical Transformer By-Pass Installation for Lot Sales — (Padmount)

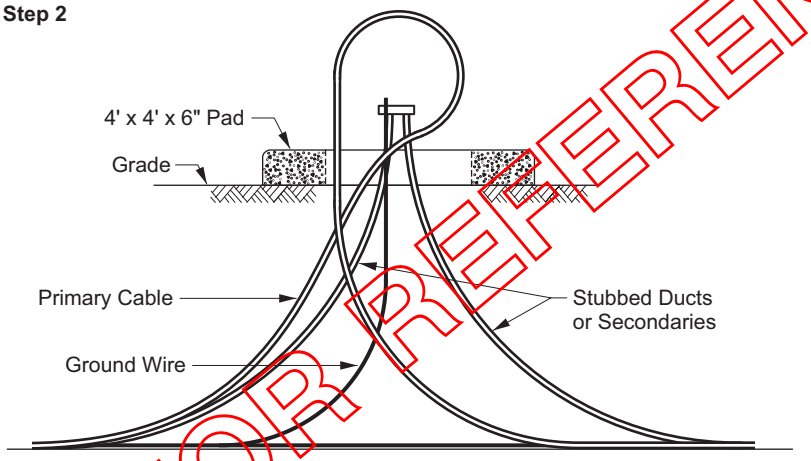
Figure TX 170–1: Typical Transformer By-Pass Installation for Lot Sales — (Padmount)

Step 1



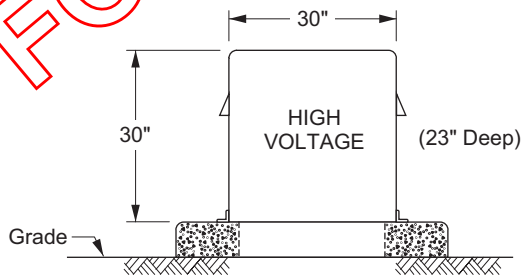
Note(s):
1. Lay cables in trench with loops, as shown, at all future transformer locations.
2. Stake may be used to support cables during backfilling.
3. Primary must be to left and secondaries or duct stub-outs to right of opening, when facing what will be the front of the pad.
4. Install ground wire in trench.

Step 2



Note(s):
1. Backfill trench; compact earth; prepare area under pad.
2. Put pad in place guiding looped cables and duct through 18" x 26" opening in pad.
3. Remove stake.
4. Do not remove duct from cables.

Step 3



Note(s):
1. Place cable housing over cables completely covering opening in pad.
2. Ground housing with 3/8" bolt through hole provided in bottom angle.
3. Securely bolt housing in place.
4. Paint on, or attach, High Voltage sign on each side of enclosure without vent.

Note(s):
1. Housing is green in color, weighs approximately 125 pounds and is reusable. Housing may be ordered with M/C 655-32749.

FOR REFERENCE ONLY

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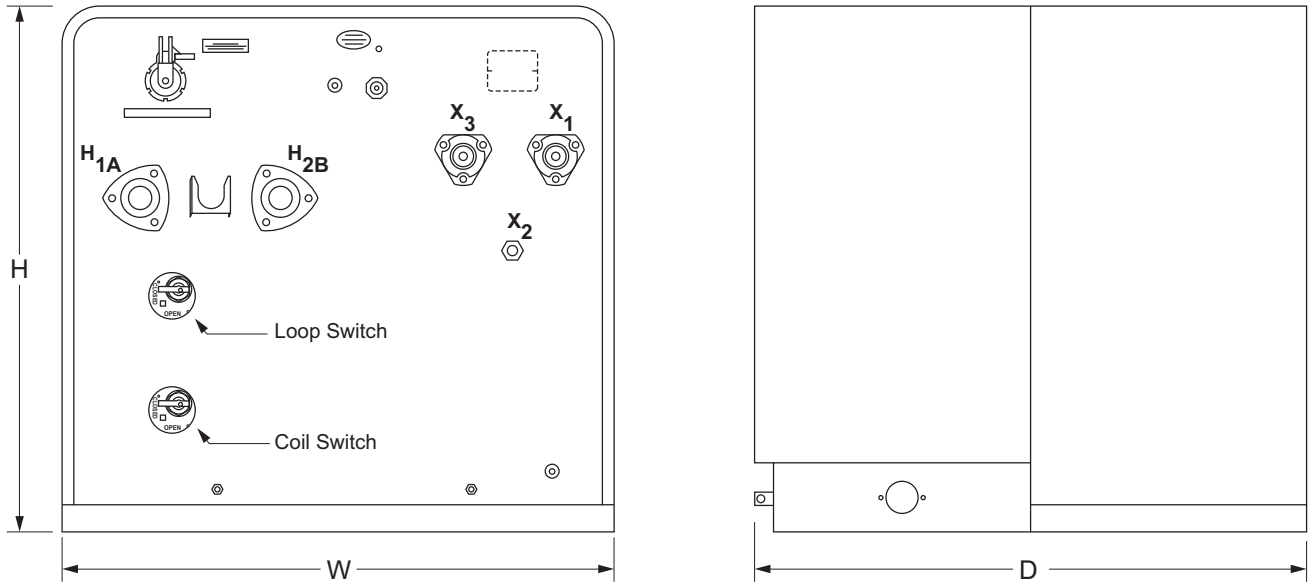
TX 180 Typical Padmount and Submersible Transformer Weight and Dimensions

Scope TX 180.1 Typical Single Phase Padmount Transformer Weight and Dimensions

Figure TX 180–1: Typical Single Phase Padmount Transformer Dimensions



The following dimensions are approximate and are a combination of the various makes and voltages normally used on SCE system.

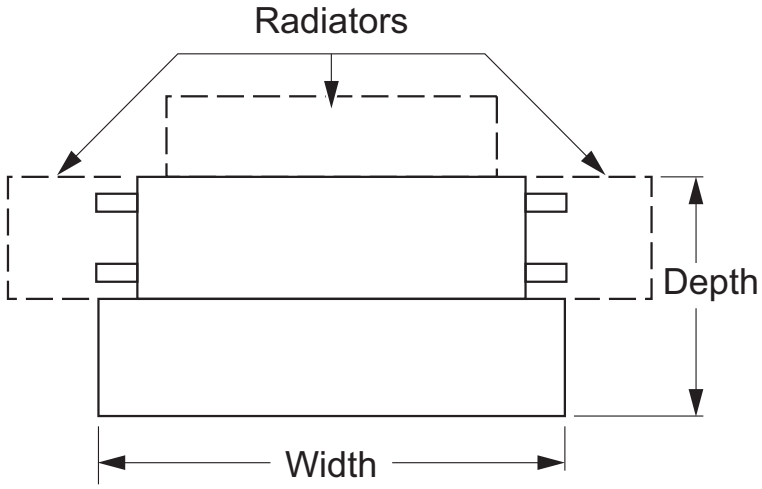
Table TX 180–1: Typical Dimensions Single-Phase Pad-Mounted Transformers

kVA	Weight (lbs)	Dimension		
		H (in)	W (in)	D (in)
25	1100	35	37	36
50	1500	35	38	42
75	1600	35	38	44
100	1700	37	42	44
167	1800	37	42	44

Note(s):
1. These are all maximum weights and dimensions for each category.

Scope TX 180.2 Typical Three Phase Padmount Transformer Weight and Dimensions

Figure TX 180–2: Typical Three Phase Padmount Transformer Dimensions



The following dimensions are approximate and are a combination of the various makes and voltages normally used on SCE system.

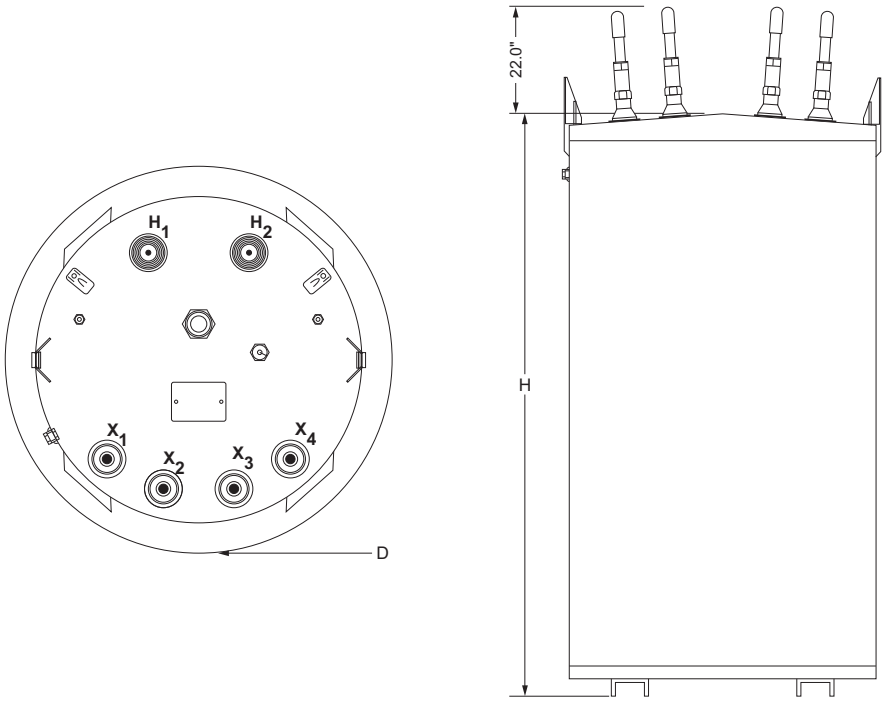
Table TX 180–2: Typical Dimensions Three-Phase Pad-Mounted Transformers

kVA	Weight (lbs)	Dimension		
		H (in)	W (in)	D (in)
75	3400	77	68	53
150	4100	77	73	53
300	5500	77	74	65
500	7200	77	74	70
750	8700	77	77	70
1000	10300	77	83	71
1500	14400	77	87	72
2500	19200	80	91	76
3750	23600	80	100	76
5000	28000	84	95	74

Note(s):
1. These are all maximum weights and dimensions for each category.
2. Radiators are not included in the maximum dimensions.

Scope TX 180.3 Typical BURD Transformer Weight and Dimensions

Figure TX 180–3: Typical BURD Transformer Dimensions



The following dimensions are approximate and are a combination of the various makes and voltages normally used on the SCE system.

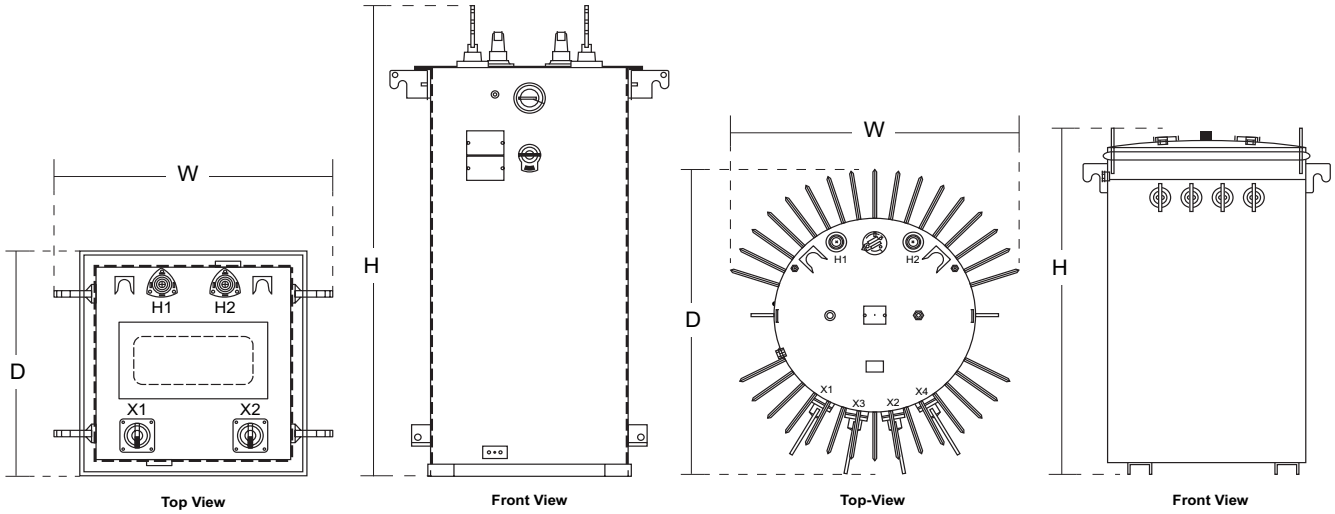
Table TX 180–3: Typical BURD Transformer Dimensions

kVA	Radial System			Long Beach Network ONLY		
	Weight (lbs)	H (in)	D (in)	Weight (lbs)	H (in)	D (in)
25	700	61	24	—	—	—
50	1000	69	27	—	—	—
75	1300	69	27.5	—	—	—
100	1500	69	27.5	—	—	—
167	2800	69	33	3000	63	39

Note(s):
1. These are all maximum weights and dimensions for all categories.

Scope TX 180.4 Typical Subway Transformer Weight and Dimensions

Figure TX 180–4: Typical Single-Phase Subway Transformer Dimensions



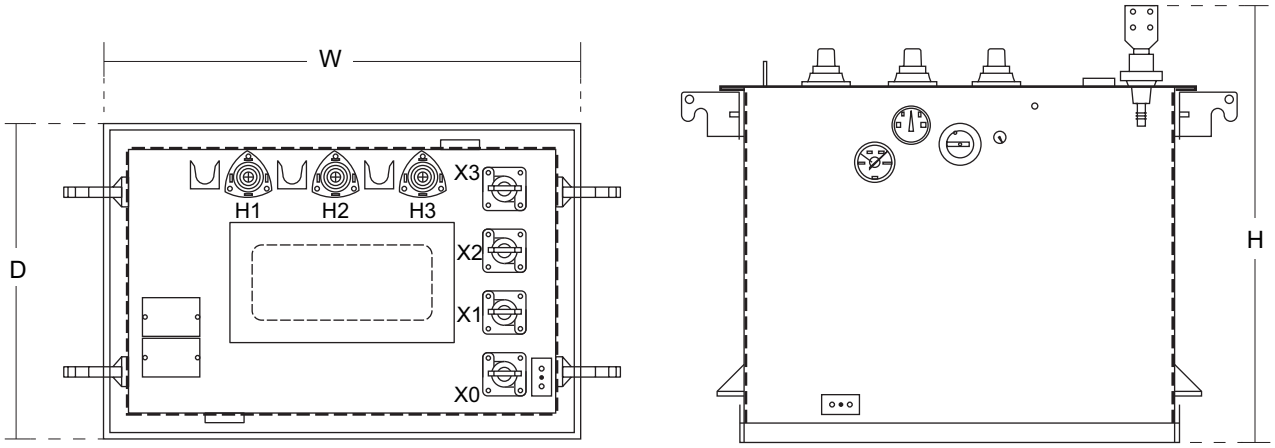
The following dimensions are approximate and are a combination of the various makes and voltages normally used on the SCE system.

Table TX 180–4: Typical Single Phase Subway Transformer Dimensions

kVA	Radial System			
	Weight (lbs)	H (in)	W (in)	D (in)
100	1450	46	28	28
167	2900	61	45	35
250	3000	49	39	39
333	4800	71	44	41
500	6300	80	47	42

Note(s):
1. These are all maximum weights and dimensions for all categories.
2. For dimensions of transformers not listed in the table above, contact field engineering.

Figure TX 180–5: Typical Three-Phase Subway Transformer Dimensions



Top View

Front View

The following dimensions are approximate and are a combination of the various makes and voltages normally used on the SCE system.

Table TX 180–5: Typical Three-Phase Subway Transformer Dimensions

kVA	Radial System				Long Beach Network ONLY			
	Weight (lbs)	H (in)	W (in)	D (in)	Weight (lbs)	H (in)	W (in)	D (in)
75	2900	48	60	34	—	—	—	—
150	3200	54	61	34	—	—	—	—
225	3200	47	57	41	—	—	—	—
250	3900	53	60	34	—	—	—	—
300	4900	62	63	33	4800	75	37	39
500	5900	76	68	41	6800	80	50	39
750	7800	82	67	45	—	—	—	—
1000	9100	79	73	47	—	—	—	—

Note(s):
1. These are all maximum weights and dimensions for all categories.
2. For dimensions of transformers not listed in the table above, contact field engineering.

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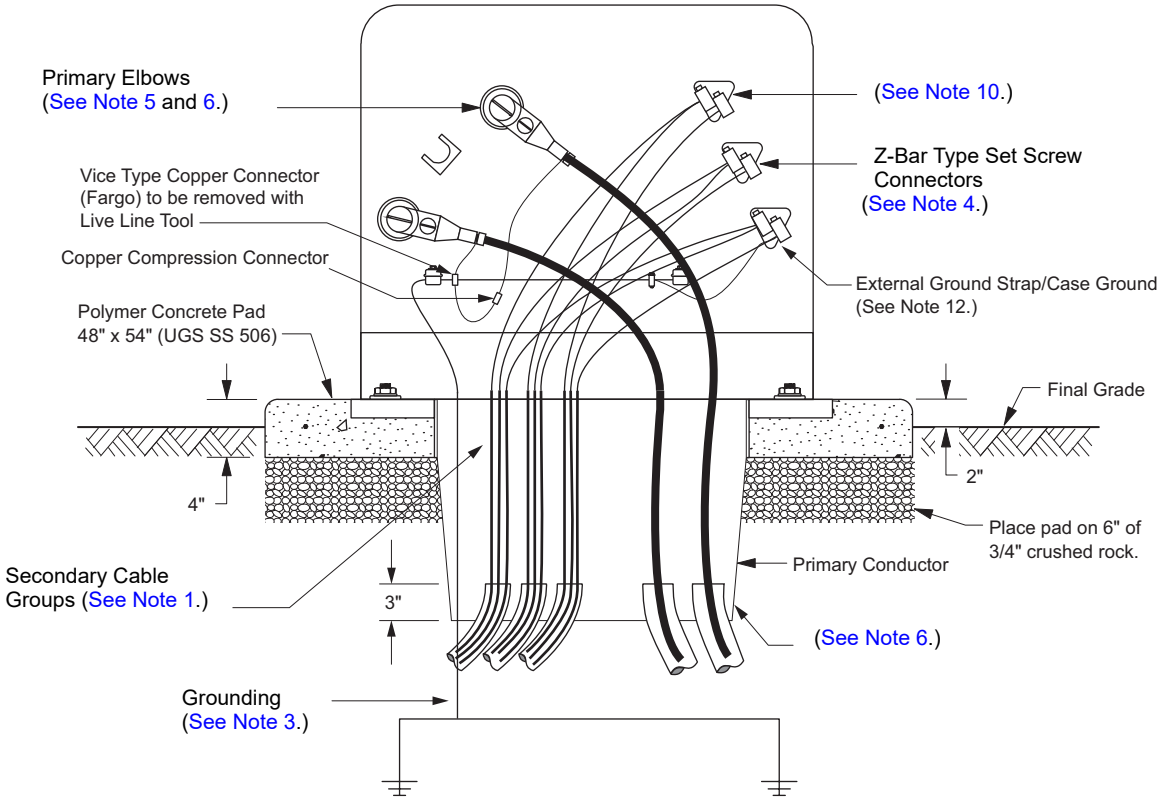
TX 190 Single-Phase Pad-Mounted Transformers (All Primary Voltages)

Scope TX 190.1 Single-Phase Mini-Pad-Mounted Transformers

Figure TX 190–1: Typical Single-Phase Mini-Pad-Mounted Transformer



Note(s):

1. A maximum of 6 secondary cable runs can be placed into a mini-pad-mounted transformer. One cable run is either a secondary or a service run (maximum 350 kcmil). Additionally, up to two #8 streetlight runs may be added.
2. See US 170 for single-phase pad-mounted transformer polymer concrete pad and proper cable configuration.
3. For installation of grounding materials, see GR 110.
4. See JJ 125 and TP 115 for z-bar type set-screw connector and installation.
5. See TP 150 and TP 161 for primary load-break elbows and installation.
6. A 17" x 30" x 15" plastic handhole (SAP 10117726) shall be inverted and installed under the cable opening of the pad, for new construction or when an existing pad requires replacement. The existing conduits can remain in place. This will provide adequate cable slack for operation of the load-break elbows.
7. To add an additional run, a load-break feedthrough insert can be installed. For 6.9 kV, use SAP 10117353. For 9.4 kV, use SAP 10117451. Feedthrough inserts are designed to be rotated 180 degrees after tightening to facilitate optimum cable placement.
8. For anchoring, sealing, and stenciling requirements, see TX 160.
9. Seal the bottom of the opening around the conduits with a thin layer of Redi-Crete or liquid asphalt emulsion for rodent control. Drive 2–1 inch diameter PVC pipes through to act as drains.
10. Terminal markings are shown in the wiring schematics. Terminal markings for 6930 V are shown as X3, X2, X1. For 9430 V and above, they are shown as X1, X2, X3.
11. Service conduits shall be sealed or plugged when the transformer is located above the customer's meter panel.
12. Preferred: Connect the open end of the bare copper equipment ground conductor (#2 AWG; SAP 10109330) directly to the base of the X2 ground strap, see Figure TX 190–2 (Sheet 2). A flat connector (SAP 10111308) should be crimped to the end of the bare copper conductor to facilitate that connection.
    Alternate: X2 may also be grounded from the secondary connector (z-bar, straight bar) to the equipment ground. Foreman may choose grounding construction based on site conditions and available secondary connections.

Figure TX 190–2: Grounding Connection

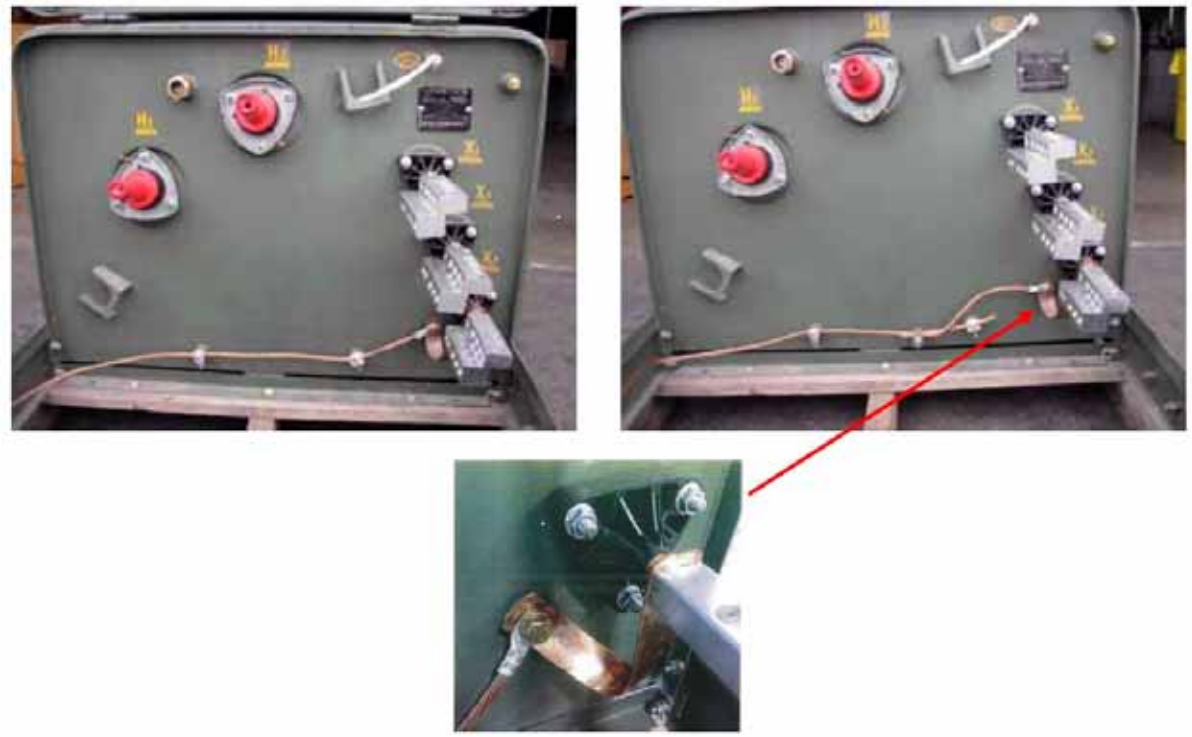
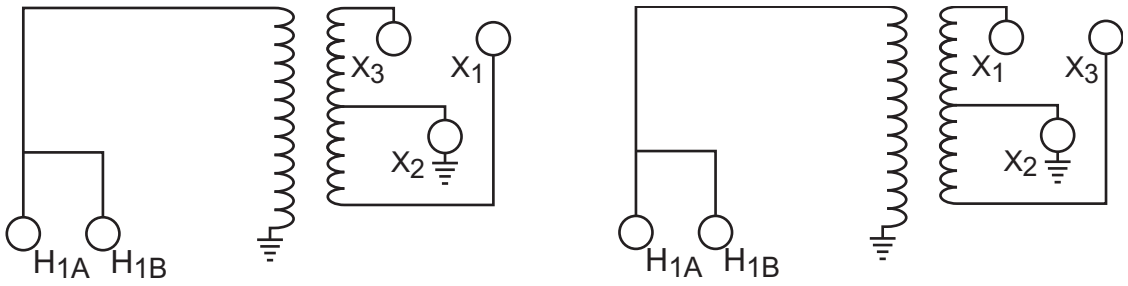


Figure TX 190–2.1 Grounding Connection (Preferred)

Figure TX 190–2.2 Grounding Connection (Alternate)

Figure TX 190–3: Phase to Neutral, Non-Switched, Non-Fused Wiring Schematic



Additive Polarity
12000GRDY/6930V

Subtractive Polarity
16340GRDY/9430V

Table TX 190–1: Phase to Neutral, Non-Switched, Non-Fused List

Without Taps

HV	LV	kVA	SAP
12000GRDY/6930	240/120	25	10103921
			10178097 1/
		50	10104094
			10178093 1/
		75	10104057
			10178095 1/
		100	10104293
			10205785 1/
		167 2/	10104390
16340GRDY/9430	240/120	25	10103922
		50	10104056
		75	10104058
		100	10104292
		167 2/	10104393

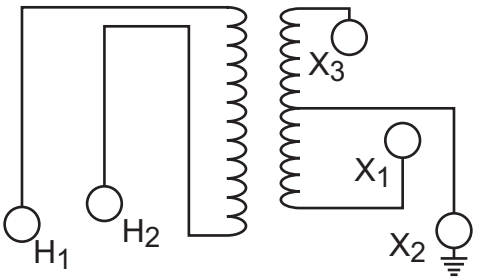
With Taps

None

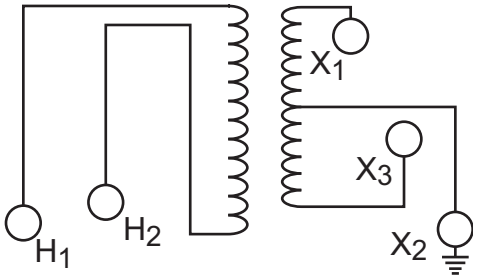
1/ Super-quiet design: This transformer shall only be installed when approved by Field Engineering

2/ 167kVA transformers shall only be used for replacing existing overloaded transformers.

Figure TX 190–4: Phase to Phase, Non-Switched, Non-Fused Wiring Schematic



Additive Polarity
4800V



Subtractive Polarity
12000V and 16340V

Table TX 190–2: Phase to Phase, Non-Switched, Non-Fused Lists

Without Taps

HV	LV	kVA	SAP
12000	240/120	25	10103932
			10103953 1/
			10178099 2/
		50	10104055
		75	10104088
			10104131 1/
			10178091 2/
		100	10104274
			10104314 1/
16340	240/120	25	10103933
		50	10104090
		75	10104091
		100	10104275

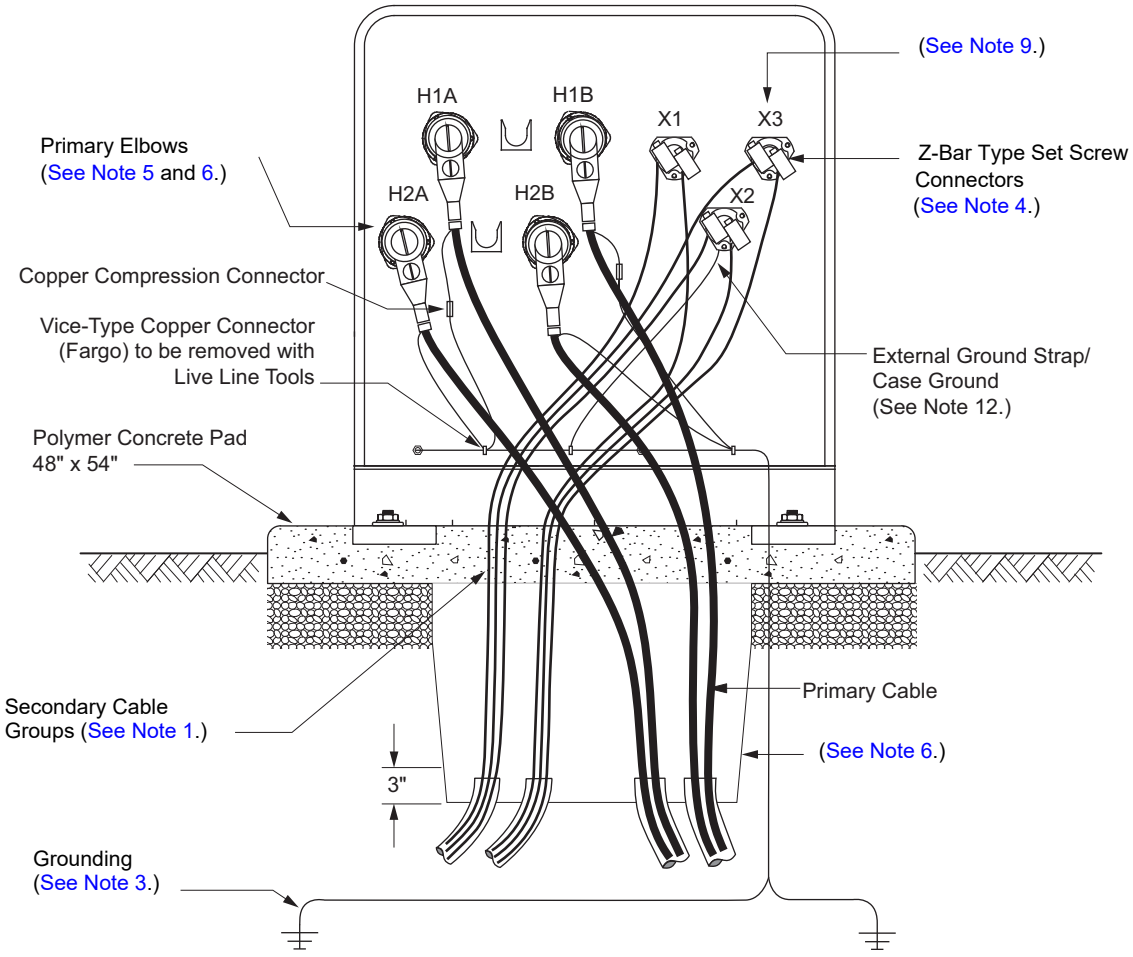
With Taps

HV	LV	kVA	SAP
4800	240/120	75	10104085
12000	240/120	50	10104112
		100	10104305

1/ Transformer is designed with a Stainless Steel Tank with standard exterior paint.
2/ Super-quiet design: This transformer shall only be installed when approved by Field Engineering.

Scope TX 190.2 Single-Phase, Standard Size Pad-Mounted Transformers

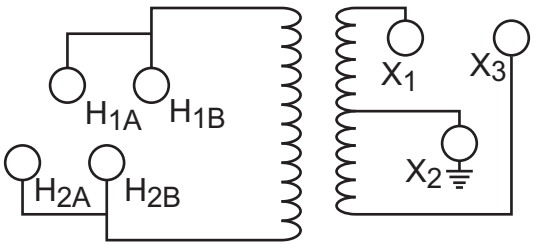
Figure TX 190–5: Typical Single-Phase, Standard Size Pad-Mounted Transformer



Note(s):

1. A maximum of 6 secondary cable runs can be placed into a pad-mounted transformer. One cable run is either a secondary or a service run (maximum 350 kcmil). Additionally, up to two additional #8 streetlight runs may be added.
2. See US 170 for single-phase pad-mounted transformer polymer concrete pad and proper cable configuration.
3. For installation of grounding materials, see GR 110.
4. See JJ 125 and TP 115 for z-bar type set-screw connector and installation.
5. See TX 150 and TP 161 for primary load-break elbows and installation.
6. A 17" x 30" x 15" plastic handhole (SAP 10117726) shall be inverted and installed under the cable opening of the pad. This will provide adequate cable slack for operation of the load-break elbows.
7. For anchoring, sealing, and stenciling requirements, see TX 160.
8. Seal the bottom of the opening around the conduits with a thin layer of Redi-Crete liquid asphalt emulsion. Drive 2 one-inch diameter PVC pipes through to act as drains.
9. Terminal markings are shown in the wiring schematics. Terminal markings for 6930 V are shown as X3, X2, X1. For 9430 V and above they are shown as X1, X2, X3
10. Service conduits shall be sealed or plugged when the transformer is located above the customer's meter panel.
11. Preferred: Connect the open end of the bare copper equipment ground conductor (#2 AWG; SAP 10109330) directly to the base of the X2 ground strap, see Figure TX 190–2 (Sheet 2). A flat connector (SAP 10111308) should be crimped to the end of the bare copper conductor to facilitate that connection.
    Alternate: X2 may also be grounded from the secondary connector (z-bar, straight bar) to the equipment ground. Foreman may choose grounding construction based on site conditions and available secondary connections.

Figure TX 190–6: Phase to Phase, 2-Circuit, Non-Switched, Non-Fused Wiring Schematic



Subtractive Polarity
12000V and 16340V

Table TX 190–3: Phase to Phase, 2-Circuit, Non-Switched, Non-Fused List

Without Taps

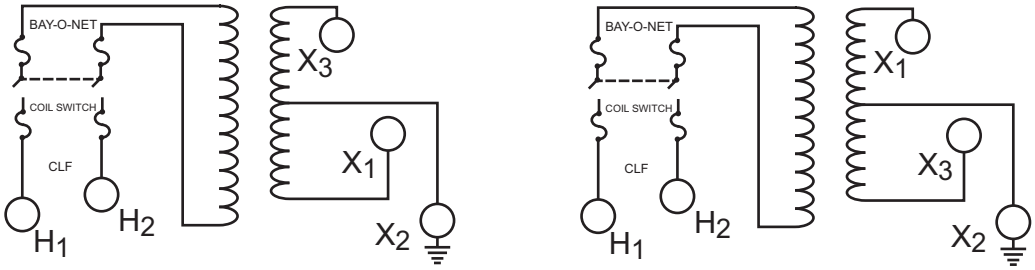
HV	LV	kVA	SAP
12000	240/120	25	10103976
		50	10104155
		75	10104218
		100	10104333
		167[1/]	10104392
16340	240/120	25	10103984
		50	10104163
		75	10104226
		100	10104345
		167[1/]	10104391

With Taps

None

[1/] 167kVA transformers shall only be used for replacing existing overloaded transformers.

Figure TX 190–7: Phase to Phase, Single Circuit, Switched, Fused Wiring Schematic



Additive Polarity
2400/4160Y and 4160V

Subtractive Polarity
12000V and 16340V

Table TX 190–4: Phase to Phase, Single Circuit, Switched, Fused Lists

Without Taps

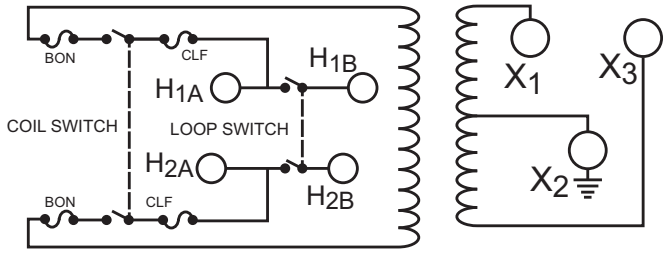
HV	LV	kVA	SAP
2400/4160Y[1/]	240/120	25	10103947
4160	240/120	50	10104127
		75	10104128
12000	240/120	25	10103945
			10178094[2/]
		50	10104093
			10178098[2/]
			10178092[3/]
		75	10104103
		100	10104299
	480/240	25	10103949
		50	10159474
16340	240/120	50	10104104
		75	10104105
			10178090[3/]
		100	10104300

With Taps

HV	LV	kVA	SAP
2400/4160Y[1/]	240/120	50	10104106
		75	10104107
		100	10104302
12000	240/120	25	10103950
		50	10104110
		75	10104111
		100	10104304
16340	240/120	25	10103946

[1/] The 2400/4160V designs shall only be installed phase-to-phase on the 2400V 3-wire system OR phase-to-neutral on the 4160V 4-wire system when an isolated neutral system is utilized (i.e. high fire risk areas). For SCE's standard phase-to-neutral design for radial installation, see Table TX 190–7 (Sheet 10).
[2/] Transformer is designed with a Stainless Steel Tank with standard exterior paint.
[3/] Super-quiet design: This transformer shall only be installed when approved by Field Engineering.

Figure TX 190–8: Phase to Phase, 2-Circuit, Switched, Fused Wiring Schematic



Subtractive Polarity
12000V and 16340V

Table TX 190–5: Phase to Phase, 2-Circuit, Switched, Fused List

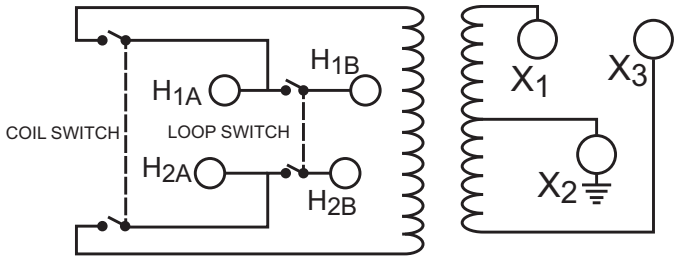
Without Taps

HV	LV	kVA	SAP
12000	240/120	50	10183542
		100	10183543
16340	240/120	50	10183541
		100	10183544

With Taps

None

Figure TX 190–9: Phase to Phase, 2-Circuit, Switched, Non-Fused Wiring Schematic



Subtractive Polarity
12000V and 16340V

Table TX 190–6: Phase to Phase, 2-Circuit, Switched, Non-Fused List

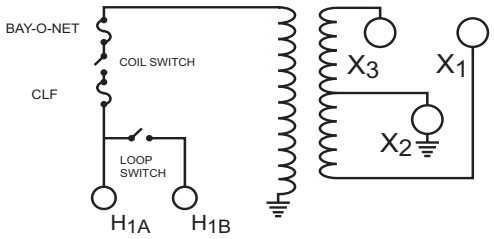
Without Taps

HV	LV	kVA	SAP
12000	240/120	50	10104125
		75	10104129
		100	10104312
16340	240/120	50	10104126
		100	10104310

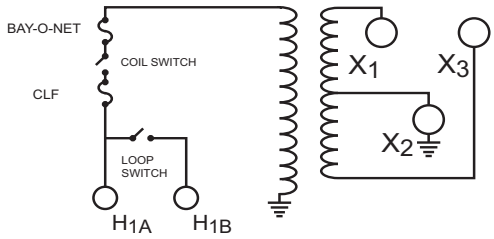
With Taps

None

Figure TX 190–10: Phase to Neutral, Switched, Fused Wiring Schematic



Additive Polarity
4160GRDY/2400V
12000GRDY/6930



Subtractive Polarity
16340GRDY/9430

Table TX 190–7: Phase to Neutral, Switched, Fused List

Without Taps

HV	LV	kVA	SAP
4160GRDY/2400[1/]	240/120	50	10159138[2/]
		100	10159140[2/]
12000GRDY/6930	240/120	50	10104124
		75	10211572
		100	10104301[2/]
			10104311
16340GRDY/9430	240/120	50	10104123
		75	10211574
		100	10104309

With Taps

None

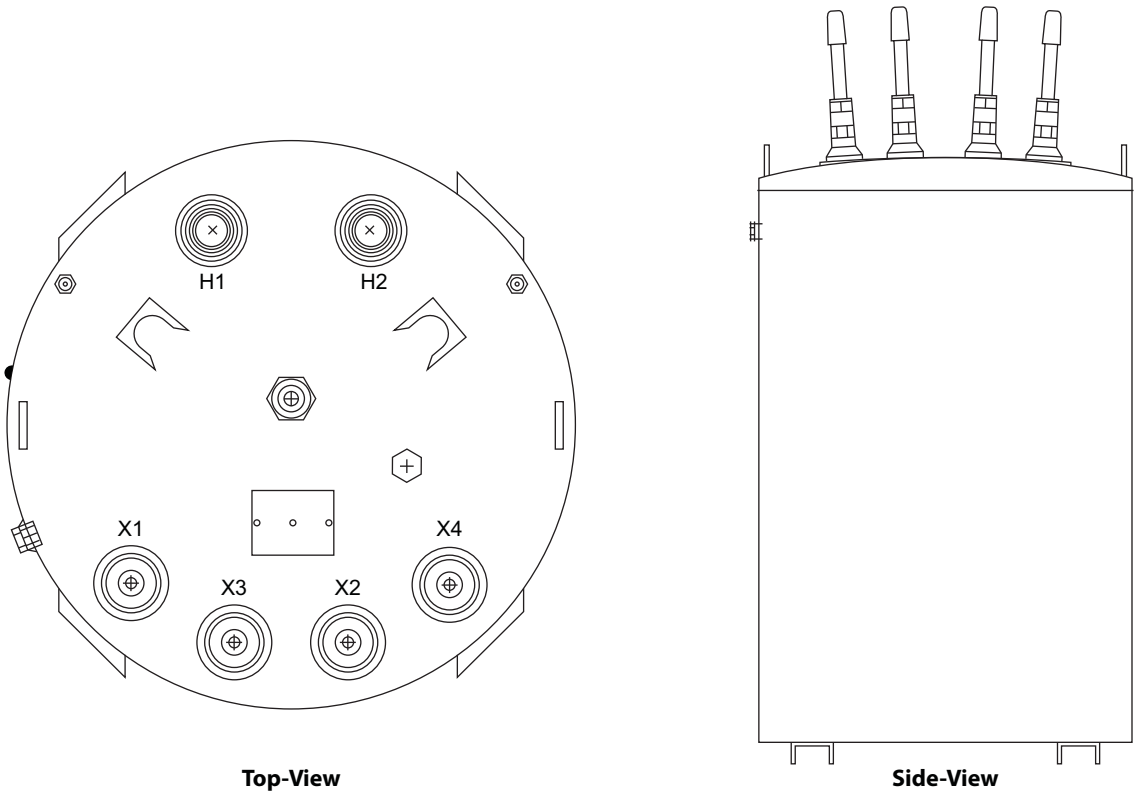
[1/] The 4160GRDY/2400V transformer is SCE's standard phase-to-netral design for typical radial construction. If the transformer needs to be installed phase-to-phase on the 2400V system 3-wire system OR on a 4160V 3-wire isolated neutral conductor system (i.e. high fire risk areas), see Table TX 190–4 (Sheet 7).

[2/] This design only has a coil switch.

TX 192 Single-Phase BURD Transformers (All Primary Voltages)

Scope TX 192.1 Typical Single-Phase, BURD Transformers

Figure TX 192–1: Typical Single-Phase, BURD Transformer

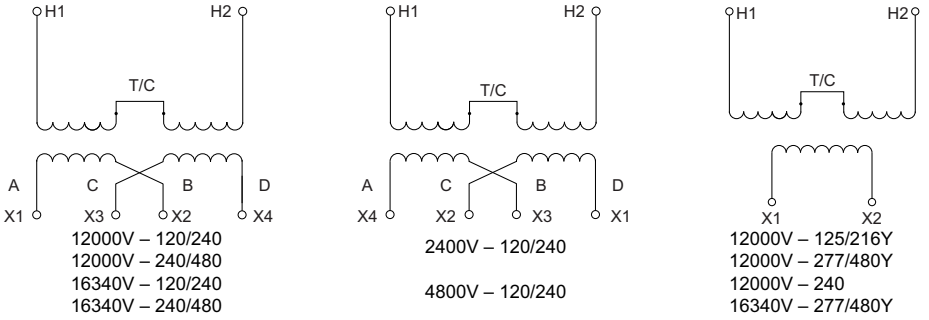


Top-View **Side-View**

Note(s):

1. For the most accurate transformer wiring & rating information, always consult transformer nameplate.
2. TTR and Megger tests shall always be performed on each transformer after it has been installed in the structure (prior to the leads being connected).
3. For installation of grounding materials, see GR-110. All ground connections shall utilize Copper-to-Copper connectors ONLY.
4. Refer to DDS-6 Table 6-8 for secondary run and structure requirements.
5. If equipped, the transformer tap changer is designed for de-energized operation only.
6. Always relieve the transformer tank pressure by pulling PRV ring before removing Bay-O-Net fuse holders from the tank. See DOM TR-3 for BON fuse removal.
7. For primary load-break elbows and installation, see TP-150 and TP-161.

Figure TX 192–2: Single-Circuit, Non-Fused, Non-Switched Wiring Schematics



Note(s):

1. Tap changer (T/C) shown in schematics above may or may not be equipped. See tables below.

Table TX 192–1: Single-Circuit, Non-Fused, Non-Switched, BURD Transformer

Without Taps

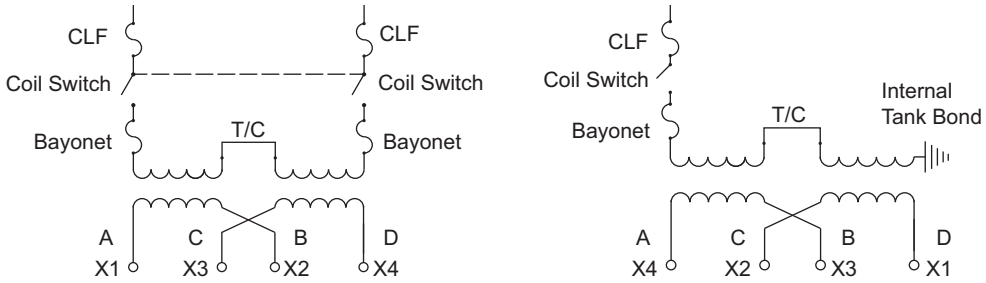
HV	LV	kVA	SAP
2400	120/240	50	10104136
		100	10104321
		167	10104399
4800	120/240	100	10210012
12000	120/240	25	10103912
		50	10104040
		75	10104043
		100	10104265
	240	50	10209430[c/]
	240/480	25	10103920
		50	10104073
		100	10104291
	277/480Y	25	10103924
		50	10104076
		75	10104081
		100	10104288
16340	120/240	25	10103911
		50	10104039
		75	10104045
		100	10104263
	240/480	25	10103923
		50	10104074
		100	10104287
	277/480Y	25	10103925
		50	10104077
		75	10104082

With Taps

HV	LV	kVA	SAP
12000	120/240	167	10104387[a/]
	125/216Y	100	10204228[b/]
		167	10204227[b/]
	277/480Y	167	10104385[a/]
16340	120/240	167	10104388[a/]
	277/480Y	167	10104386[a/]

[a/] Top mounted spades.
[b/] For Long Beach network installation ONLY
[c/] For Open-Wye/Open-Delta direct replacement only, see DUG TX-280.

Figure TX 192–3: Single-Circuit, Fused, Switched Wiring Schematic



12000V – 120/240
12000V – 240/480
16340V – 120/240

4160GRDY/2400V – 120/240

Note(s):
1. Tap changer (T/C) shown in schematics above may or may not be equipped. See tables below.

Table TX 192–2: Single-Circuit, Fused, Switched, BURD Transformer

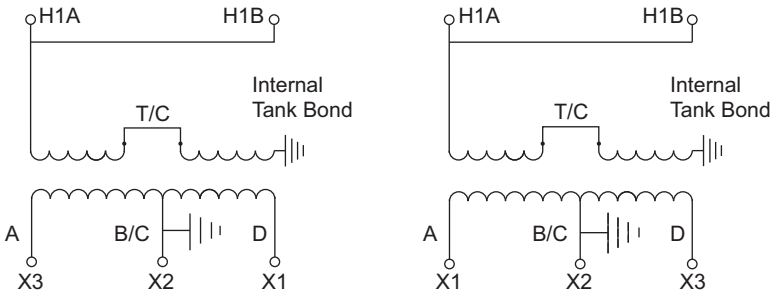
Without Taps

HV	LV	kVA	SAP
12000	120/240	25	10103944
		50	10104087
		75	10104068
		100	10104298
	240/480	50	10209421
16340	120/240	25	10103943
		50	10104089
		75	10104086
		100	10104283

With Taps

HV	LV	kVA	SAP
4160GRDY/2400	120/240	25	10104099
		50	10104100
		75	10104101
		100	10104102
		167	10104098
12000	120/240	75	10104280

Figure TX 192–4: Two-Circuit, Non-Fused, Non-Switched Wiring Schematic



12000GRDY/6930 – 240/120

16340GRDY/9430 – 240/120

Note(s):
1. Tap changer (T/C) shown in schematics above may or may not be equipped. See tables below.
2. X2 is internally bonded to the tank, DO NOT bank these transformers.

Table TX 192–3: Two-Circuit, Non-Fused, Non-Switched, BURD Transformer

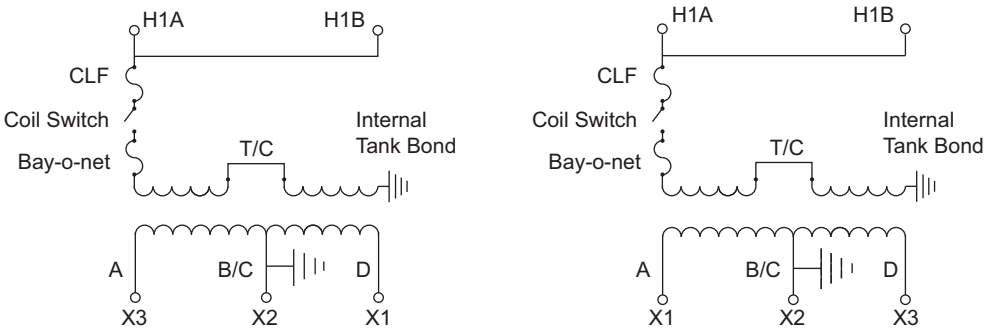
Without Taps

HV	LV	kVA	SAP
12000GRDY/6930	240/120	25	10103910
		50	10104041
		75	10104044
		100	10104264
16340GRDY/9430	240/120	25	10103909
		50	10104037
		75	10104042
		100	10104266

With Taps

None

Figure TX 192–5: Two-Circuit, Fused, Switched Wiring Schematics



12000GRDY/6930 – 240/120

16340GRDY/9340 – 240/120

Note(s):
1. Tap changer (T/C) shown in schematics7 above may or may not be equipped. See tables below.
2. X2 is internally bonded to the tank, DO NOT bank these transformers.

Table TX 192–4: Two-Circuit, Fused, Switched, BURD Transformer

Without Taps

HV	LV	kVA	SAP
12000GRDY/6930	240/120	25	10103917
		50	10104053
		75	10104071
		100	10104273
16340GRDY/9430	240/120	25	10103918
		50	10104092
		75	10104054
		100	10104297

With Taps

None

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TX 194 Subway Transformers (All Primary Voltages)

Scope TX 194.1 Typical Single-Phase Subway Transformers

Figure TX 194–1: Typical Single-Phase (Round), Single-Circuit Transformer

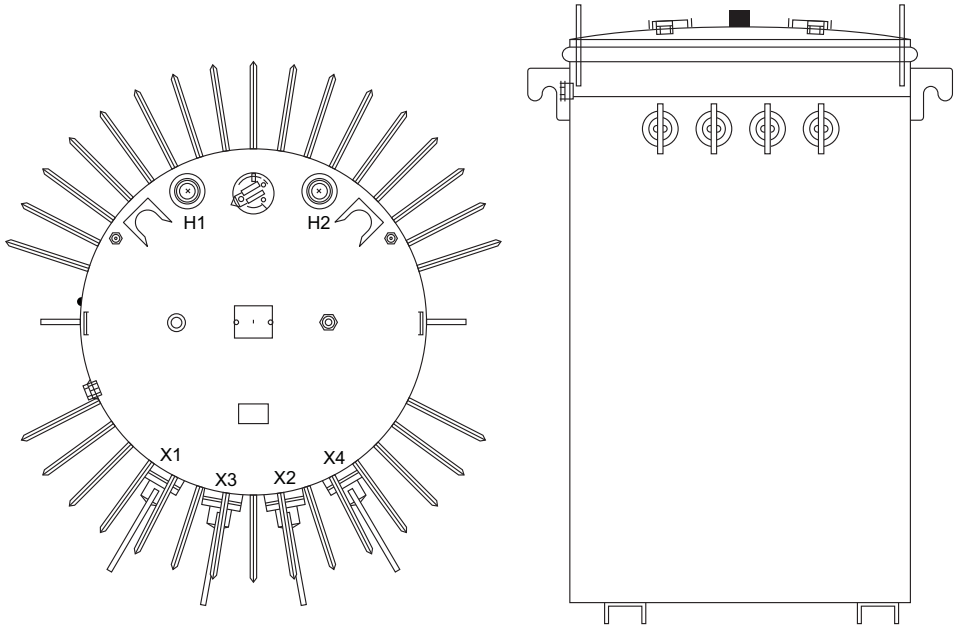
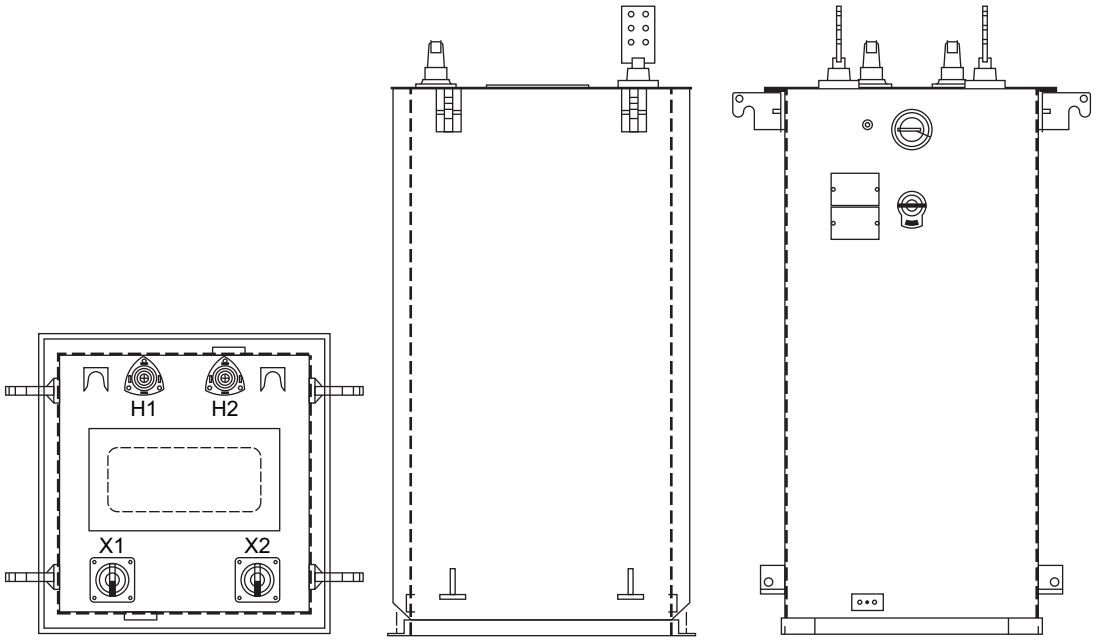


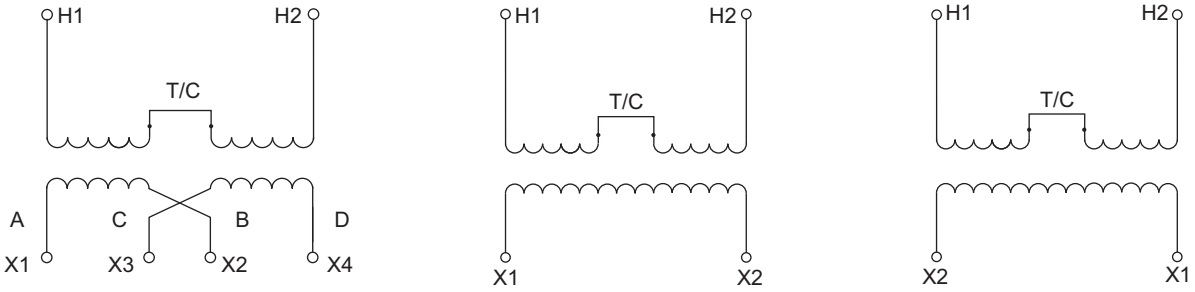
Figure TX 194–2: Typical Single-Phase (Rectangular), Single-Circuit Subway Transformer



Note(s):

1. For the most accurate transformer wiring & rating information, always consult transformer nameplate.
2. TTR and Megger tests shall always be performed on each transformer after it has been installed in the structure (prior to the leads being connected).
3. For installation of grounding materials, see GR-110. All ground connections shall utilize Copper-to-Copper connectors ONLY.
4. Refer to DDS-6 Table 6-8 for secondary run and structure requirements.
5. If equipped, the transformer tap changer is designed for de-energized operation only.
6. Always relieve the transformer tank pressure by pulling PRV ring before removing Bay-O-Net fuse holders from the tank. See DOM TR-3 for BON fuse removal.
7. For primary load-break elbows and installation, see TP-150 and TP-161.

Figure TX 194–3: Single-Phase, Non-Switched, Non-Fused, Subway Transformer Wiring Schematic



12000V – 120/240
12000V – 240/480
16340V – 120/240
16340V – 240/480

12000V – 277/480Y
12000V – 2400
16340V – 277/480Y
16340V – 2400

6930V – 2400

Note(s):
1. 1. Tap changer (T/C) shown in schematics above may or may not be equipped. See tables below.

Table TX 194–1: Single-Circuit, Non-Fused, Non-Switched, Subway Transformer

Without Taps

None

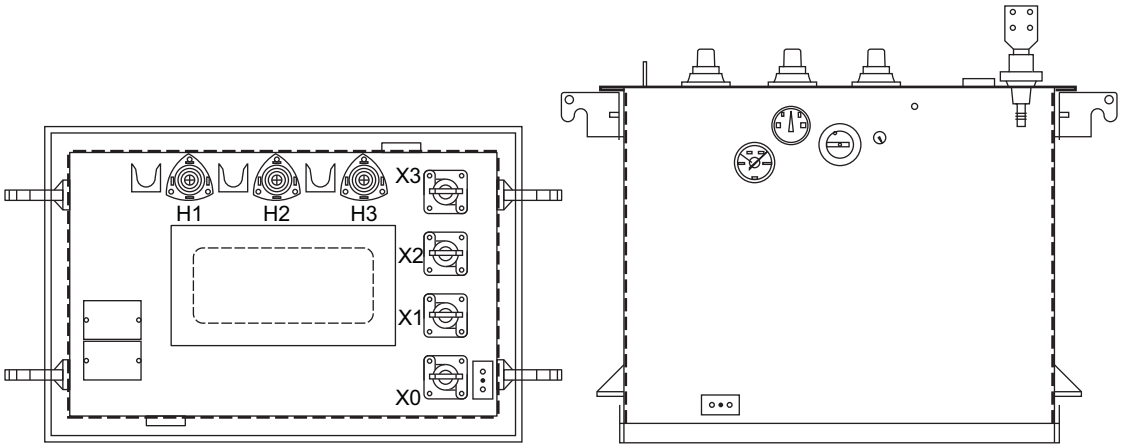
With Taps

HV	LV	kVA	SAP
6930	2400	100	10168491
12000	120/240	333	10171325[a/]
	240/480	333	10104500
	277/480Y	250	10104446
		333	10104503
		500	10104550[a/]
	2400	100	10168452
		500	10183361[a/]
16340	120/240	250	10104472
		333	10104508[a/]
		500	10183362[a/]
	240/480	333	10104518
	277/480Y	250	10104476
		333	10104509
		500	10104551[a/]
	2400	167	10104428[a/]
		500	10104560[a/]

[a/] This design is a rectangular design.

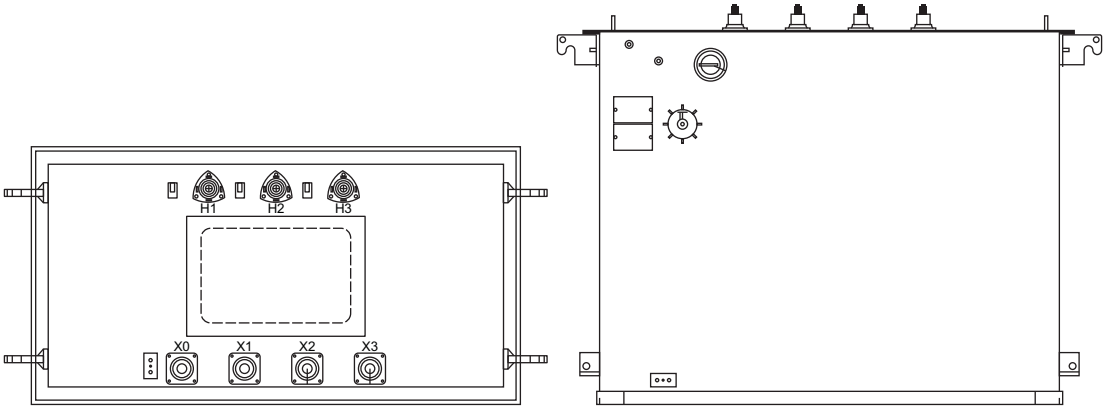
Scope TX 194.2 Typical Three-Phase, Subway Transformers

Figure TX 194–4: Typical Three-Phase, Single-Circuit Subway Transformer (L-Configured HV/LV Bushings)



Top View Front View

Figure TX 194–5: Typical Three-Phase, Single-Circuit Subway Transformer (Parallel-Configured HV/LV Bushings)

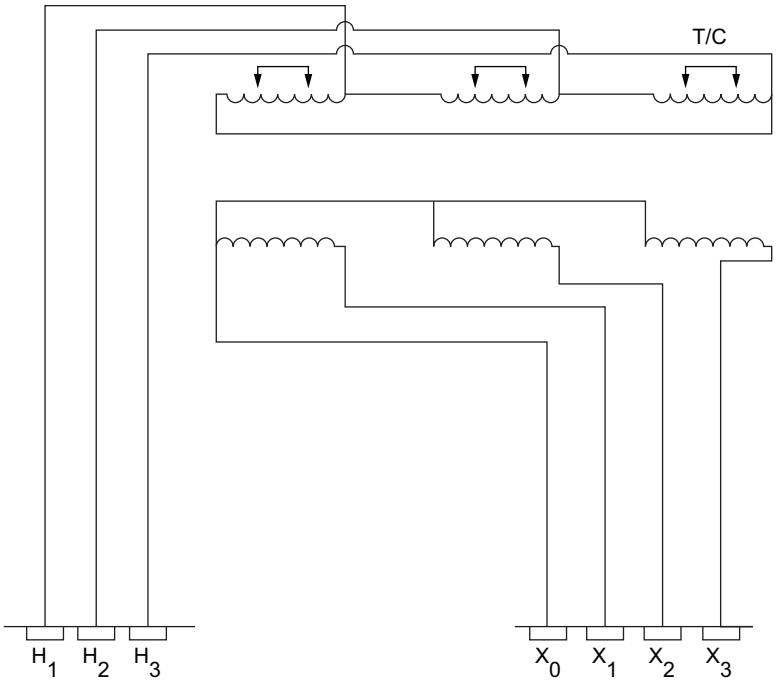


Top View Front View

Note(s):

1. For the most accurate transformer wiring & rating information, always consult transformer nameplate.
2. TTR and Megger tests shall always be performed on each transformer after it has been installed in the structure (prior to the leads being connected).
3. For installation of grounding materials, see GR-110. All ground connections shall utilize Copper-to-Copper connectors ONLY.
4. Refer to DDS-6 Table 6-8 for secondary run and structure requirements.
5. If equipped, the transformer tap changer is designed for de-energized operation only.
6. Always relieve the transformer tank pressure by pulling PRV ring before removing Bay-O-Net fuse holders from the tank. See DOM TR-3 for BON fuse removal.
7. For primary load-break elbows and installation, see TP-150 and TP-161.

Figure TX 194–6: Delta-Wye, Non-Switched, Non-Fused, Subway Transformer Wiring Schematic



Note(s):
1. Tap changers (T/C) shown in schematic above may or may not be equipped. See tables below.

Table TX 194–2: Delta-Wye, Non-Switched, Non-Fused, Subway Transformer

Without Taps

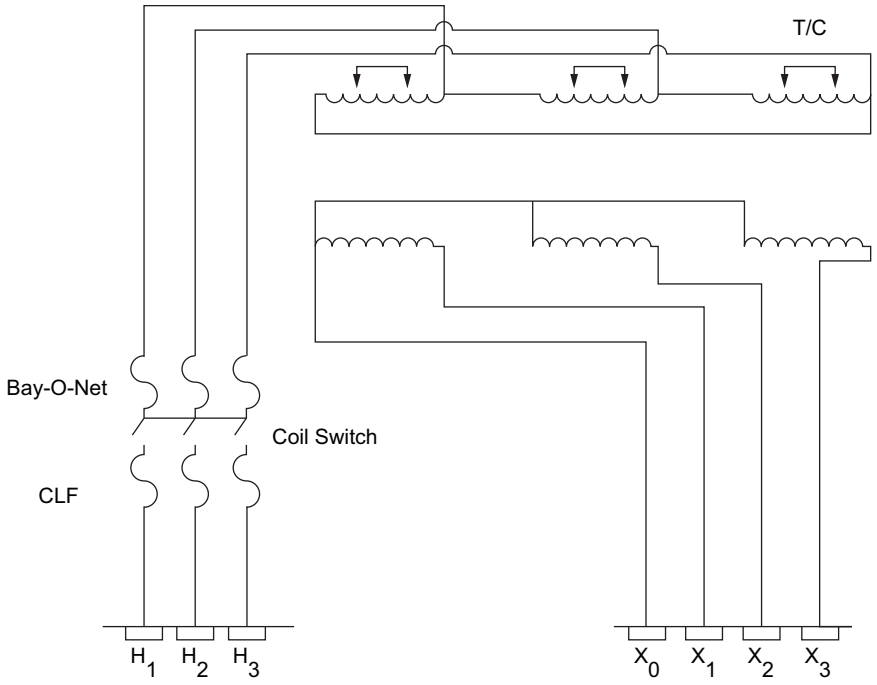
HV	LV	kVA	SAP
4160	208Y/120	45	10104713
		75	10104714
		150	10104715
		225	10104716
		300	10104717
12000	480Y/277	300	10104751
16340	480Y/277	500	10104778

With Taps

HV	LV	kVA	SAP
12000	208Y/120	500	10104733
	216Y/125	300	10204226[a/]
		500	10204224[a/]
	480Y/277	1500	10181564
	4160Y/2400	2500	10180820
16340	208Y/120	75	10104757

[a/] For Long Beach network installation ONLY.

Figure TX 194–7: Delta-Wye, Switched, Fused, Subway Transformer Wiring Schematic



Note(s):
1. Tap changers (T/C) shown in schematic above may or may not be equipped. See tables below.

Table TX 194–3: Delta-Wye, Single-Circuit, Switched, Fused, With Taps, Subway Transformer

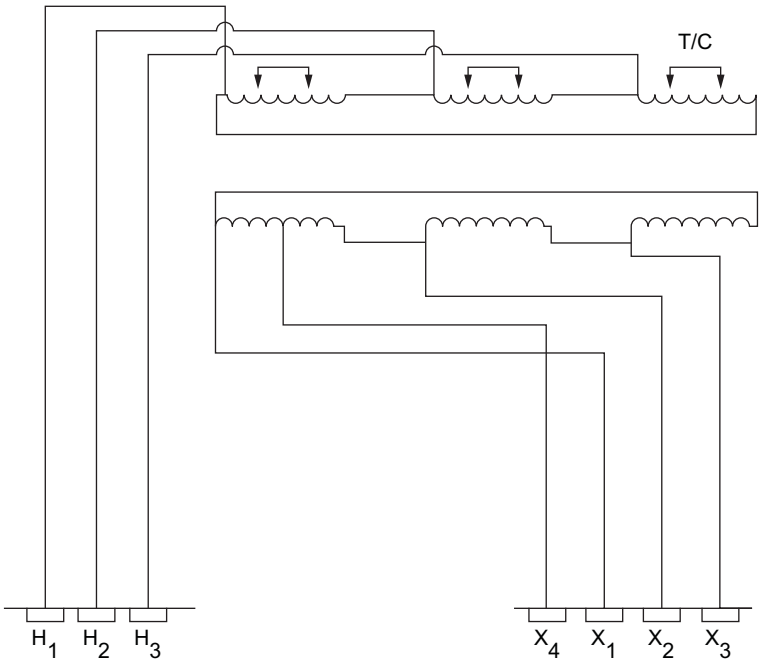
Without Taps

None

With Taps

HV	LV	kVA	SAP
12000	208Y/120	500	10170822
		750	10170823
		1000	10170824
	480Y/277	500	10170825
		750	10170826
		1000	10170827
16340	208Y/120	500	10168236
		750	10168235
		1000	10168234
	480Y/277	500	10170828
		750	10170829
		1000	10168233

Figure TX 194–8: Delta-Delta (4W with Mid-Tap), Non-Switched, Non-Fused, Subway Transformer Wiring Schematic



Note(s):
1. Tap changers (T/C) shown in schematic above may or may not be equipped. See tables below.

Table TX 194–4: Delta-Delta (4W with Mid-Tap), Non-Switched, Non-Fused, Subway Transformer

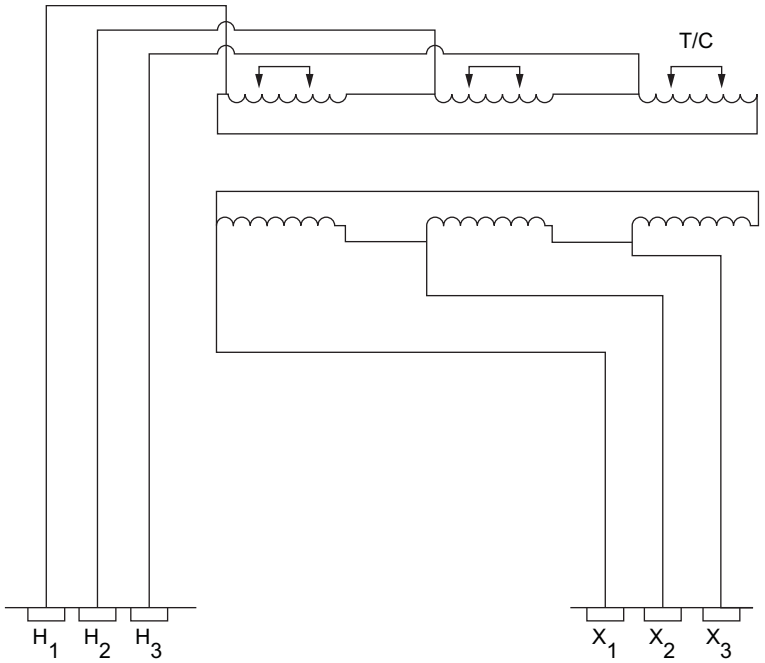
Without Taps

HV	LV	kVA	SAP
4160	240/480V 4W	150	10104711
		225	10104722
		300	10104723
12000	240/480V 4W	300	10104739
		500	10104740
16340	240/480V 4W	45	10104768
		225	10104771

With Taps

HV	LV	kVA	SAP
12000	120/240V 4W	250	10104462
	240/480V 4W	75	10104735
		150	10104737
16340	240/480V 4W	150	10104770
		300	10104772

Figure TX 194–9: Delta-Delta (3-Wire), Non-Switched, Non-Fused, Subway Transformer Wiring Schematic



Note(s):
1. Tap changers (T/C) shown in schematic above may or may not be equipped. See tables below.

Table TX 194–5: Delta-Delta (3-Wire), Non-Switched, Non-Fused, Subway Transformer

Without Taps

HV	LV	kVA	SAP
4160	240	45	10104720
		225	10104704
		300	10104707
		500	10104708
12000	240	45	10104734
	480	45	10104742

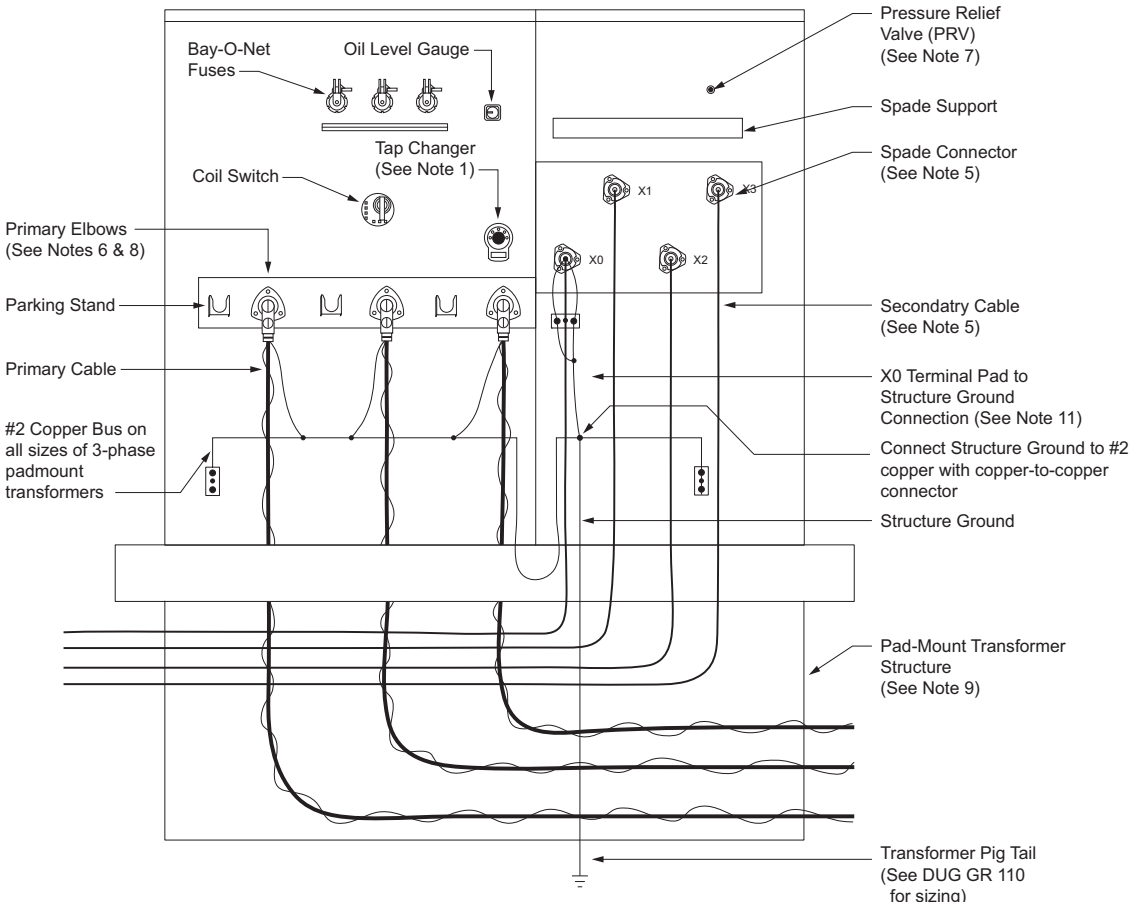
With Taps

None

TX 195 Three-Phase Pad-Mounted Transformers (All Primary Voltages)

Scope TX 195.1 Typical Three-Phase, Single Circuit Pad-Mounted Transformers

Figure TX 195–1: Typical Three-Phase, Single Circuit Pad-Mounted Transformer



Note(s):

1. The transformer tap changer is designed for de-energized operation only. DO NOT operate tap changer under load.
2. Transformer components shown in the figure above (that is, Bay-O-Net fuses, coil switch, secondary spades and supports) are typical of most transformer designs; however SCE has approved designs where these components have been purposely omitted from the design.
3. TTR and Megger tests shall always be performed on each transformer after it has been installed on the structure (prior to the leads being connected).
4. For installation of grounding materials, see GR 110. All ground connections shall utilize Copper-to-Copper connectors ONLY.
5. Secondary runs shall never exceed structure requirements detailed in DDS-6 Table 6-8.
6. Feed-thru bushing inserts shall NOT be installed on 3-phase pad-mounted transformers.
7. Always relieve the transformer tank pressure by pulling PRV ring before removing Bay-O-Net fuse holders from the tank.
8. For primary load-break elbows and installation, see TP 150 and TP 161.
9. For anchoring, sealing, and stenciling requirements, see TX 160.
10. For transformers with wye secondaries, ground X0 as show in Figure TX 195–2 [Sheet 2].
    Preferred: Use 1-hole hylugs #2 (SAP 10111308) and 2/0 (SAP 10111311). Remove factory installed ground bolt holding the X0 copper ground straps to the tank; install hylug of the equipment ground on top of the copper ground straps and reinstall the bolt. Do not install hylug to an empty position on the ground pad.
    Alternate: Install hylug to secondary spade. Do not stack secondary lugs on top of grounding hylug; invert grounding hylug when installing on top of a secondary lug.
11. For transformers with wye secondaries, serving ONLY 480 volt, 3-phase, 3-wire service, lift the X0 ground copper strap off the transformer tank during transformer installation. Refer to ESR-1, Section 6.1 and DUG, figure GR 140-4. See Figure TX 195-2.3 for example.

Figure TX 195–2: Approved X0 Grounding Connections

Figure TX 195–2.1 Approved X0 Grounding Connections (Preferred)

Figure TX 195–2.2 Approved X0 Grounding Connections (Alternate)

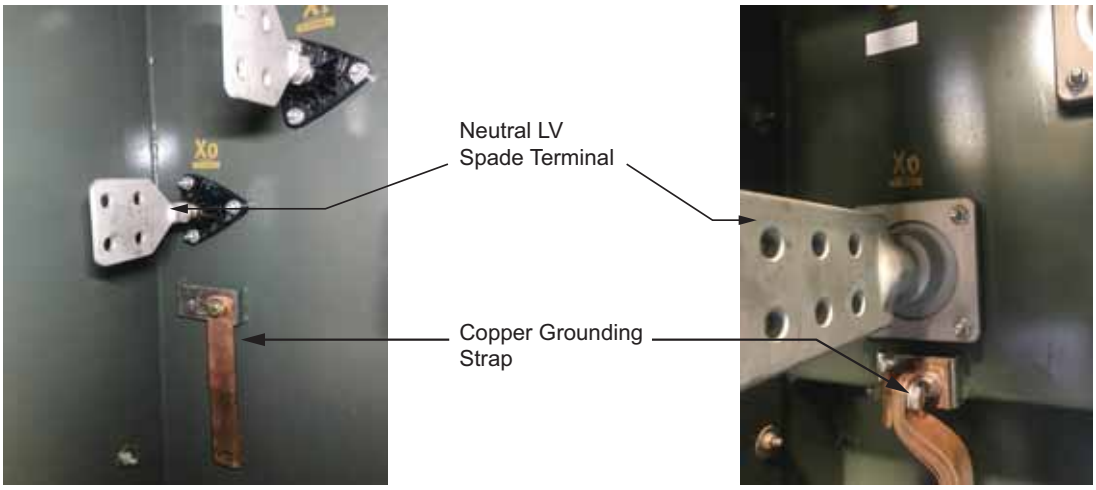


Figure TX 195–2.3 Exception to X0 Grounded Terminal Connection is ONLY Applicable for Transformers with WYE Secondaries, Serving 480-volt, 3-phase, 3-wire Service.

Note(s):

1. Remove the X0 ground copper strap off the neutral LV spade terminal and leave the copper grounding strap bolted onto the transformer tank , ONLY during installation of a transformer dedicated for 480V, 3-phase, 3-wire service.

Figure TX 195–3: Delta-Wye, Single-Circuit, Switched and Fused Transformer Wiring Schematic

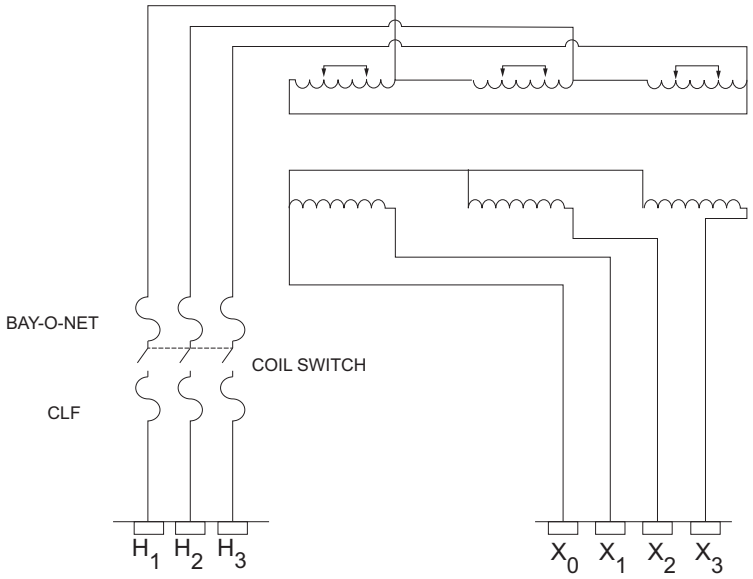


Table TX 195–1: Delta-Wye, Single-Circuit, Switched and Fused Transformer List

HV	LV	kVA	SAP Number
4160	208Y/120	75	10104649
		150	10104653
		300	10104651
	480Y/277	75	10104606
		300	10104598
12000	208Y/120	75	10104683
		75	10178901[a/]
		150	10104641
		300	10104680
		500	10104695
		750	10103705
		1000	10103706

Table TX 195–1: Delta-Wye, Single-Circuit, Switched and Fused Transformer List *(Continued)*

HV	LV	kVA	SAP Number
12000	480Y/277	75	10104684
			10104618[a/]
		150	10104633
		300	10104688
		500	10104693
		750	10103711
		1000	10103712
			10180837[a/]
	4160Y/2400	150	10104616
		750	10103709
		1000	10103710
16340	208Y/120	75	10104655
		150	10104642
		300	10104662
		500	10104697
		750	10103715
		1000	10103716
	480Y/277	75	10104658
		150	10104643
		300	10104678
		500	10104699
			10213134[b/]
		750	10103721
			10213829[b/]
		1000	10103722
			10213830[b/]
	4160Y/2400	300	10104615
		750	10103719
		1000	10103720

[a/] Denotes the transformer is designed with a 304 Stainless Steel Tank with standard exterior paint

[b/] This transformer is an FM Global approved design. This transformer shall only be installed when FM Global requirements need to be met. This transformer code will always be set to “Key 96” in the SAP system. Contact Field Engineering and Apparatus Strategies to get approval to special order.

Figure TX 195–4: Delta-Wye, Single-Circuit, Switched and Non-Fused Transformer Wiring Schematic

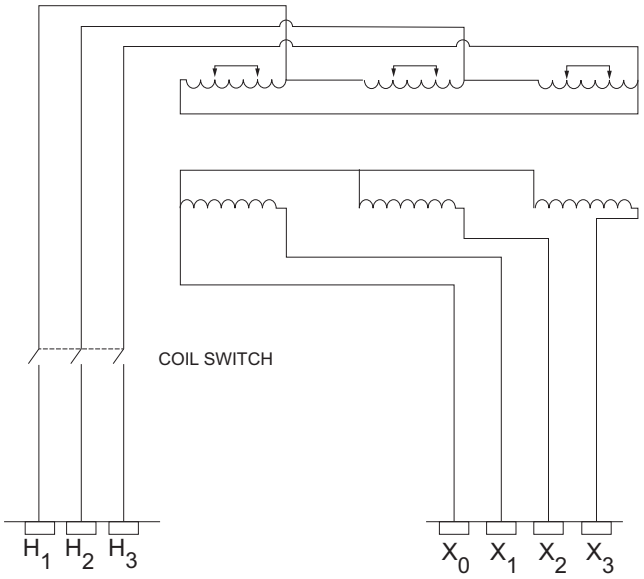


Table TX 195–2: Delta-Wye, Single-Circuit, Switched and Non- Fused Transformer List

HV	LV	kVA	SAP
4160	480Y/277	750	10103727
		1000	10103728
24940	208Y/120	750	10103726
	480Y/277	75	10180274
		150	10180275
		300	10104619
		500	10180277
		750	10180278
34400	480Y/277	500	10104596
		750	10213873
		1000	10171170

Figure TX 195–5: Delta-Wye, Single-Circuit, Non-Switched and Non-Fused Transformer Wiring Schematic

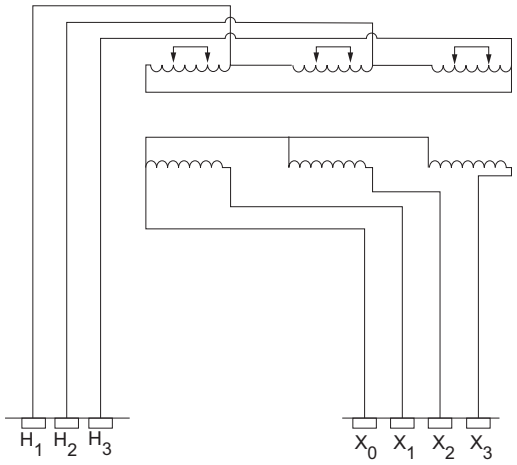


Table TX 195–3: Delta-Wye, Single-Circuit, Non-Switched and Non-Fused Transformer List

HV	LV	kVA	SAP
4160	480Y/277	1500	10103729
12000	480Y/277	1500	10103694
		2500	10103661
		3750	10103745
	4160Y/2400	1500	10103734
		2500	10103736
		3750	10103681
16340	480Y/277	1500	10103687
			10213831[a/]
		2500	10103666
			10213135[a/]
		3750	10103731
	4160Y/2400	1500	10103735
			10103697[b/]
		2500	10103737
		3750	10103738
34400	480Y/277	750	10103657
		1000	10103678
		1500	10103659
		2500	10103640
		3750	10203824
	12000Y/6930	5000	10103730
	12470Y/7200	3750	10103760

= For Reference Only

[a/] This transformer is an FM Global approved design. This transformer shall only be installed when FM Global requirements need to be met. This transformer code will always be set to "Key 96" in the SAP system. Contact Field Engineering and Apparatus Strategies to get approval to special order. SCE Protection needs to also be engaged to ensure that transformer protection meets FM Global's I2t requirements.

[b/] Super-quiet design.

Figure TX 195–6: Delta-Grounded Wye, Single-Circuit, Switched and Fused Transformer Wiring Schematic

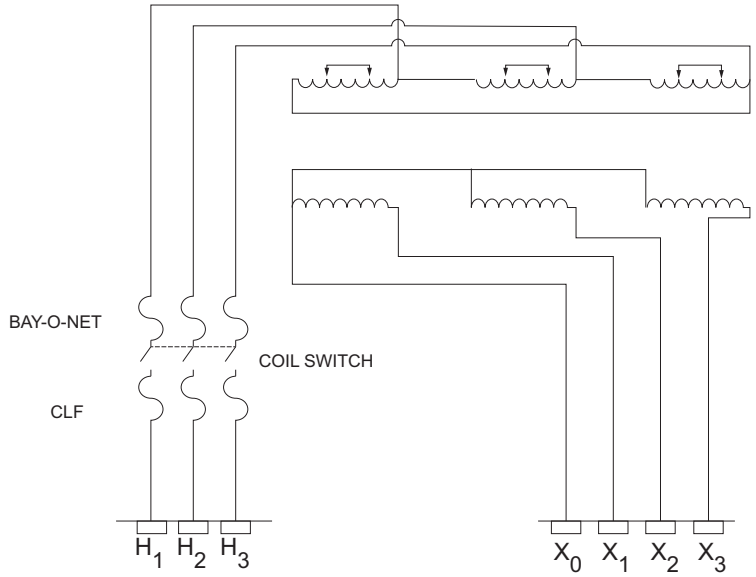


Table TX 195–4: Delta-Grounded Wye, Single-Circuit, Switched and Fused Transformer List

HV	LV	kVA	SAP
12000	12000GRDY/6930	500	10104592

Figure TX 195–7: Delta-Grounded Wye, Single-Circuit, Non-Switched, Non-Fused and Tapped Transformer Wiring Schematic

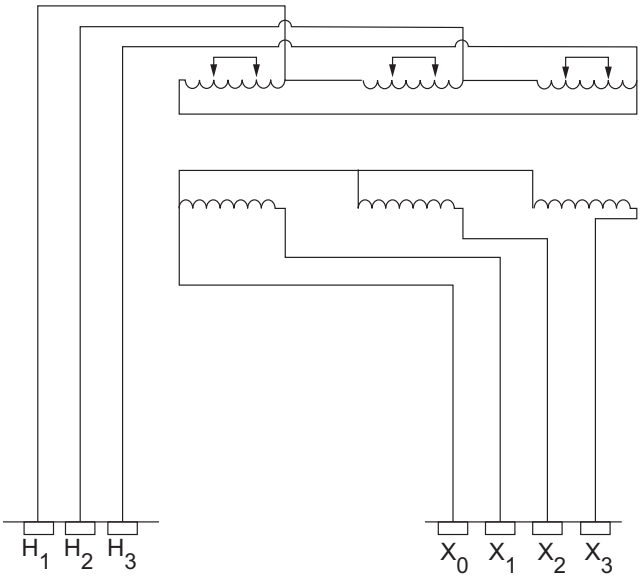


Table TX 195–5: Delta-Grounded Wye, Single-Circuit, Non-Switched and Non-Fused Transformer List

HV	LV	kVA	SAP
34400	4160GRDY/2400	2500	10103636
		3750	10103634
	1200GRDY/6930	5000	10103730

Figure TX 195–8: Delta-Delta, Single-Circuit, Switched and Fused Transformer Wiring Schematic

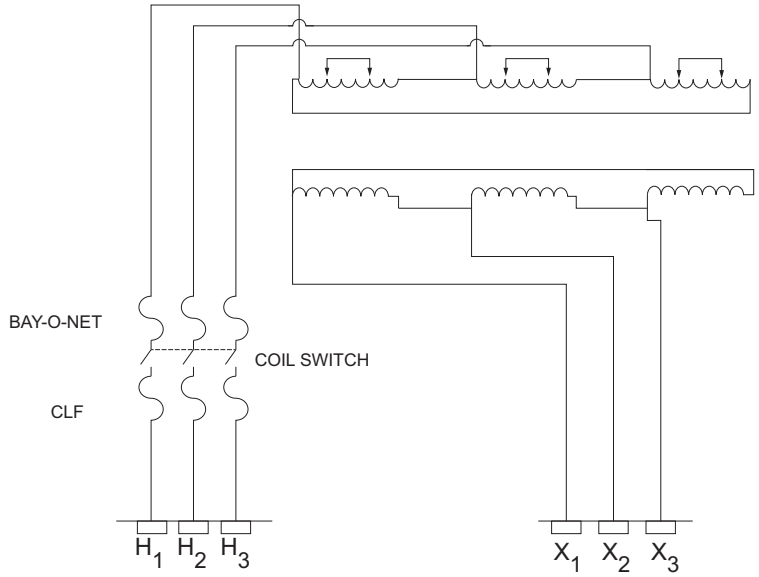


Table TX 195–6: Delta-Delta, Single-Circuit, Switched and Fused Transformer List

HV	LV	kVA	SAP
12000	240	75	10104686
		150	10104634
		300	10104644
		500	10184631
		750	10103707
		1000	10103708
	2400	750	10103713
		1000	10103714
	4800	500	10204666
16340	240	75	10104656
		150	10104639
		300	10104675
		500	10104702
		750	10103717
		1000	10103718
	2400	750	10103723
		1000	10103724

Figure TX 195–9: Delta-Delta, Single-Circuit, Non-Switched and Non-Fused Transformer Wiring Schematic

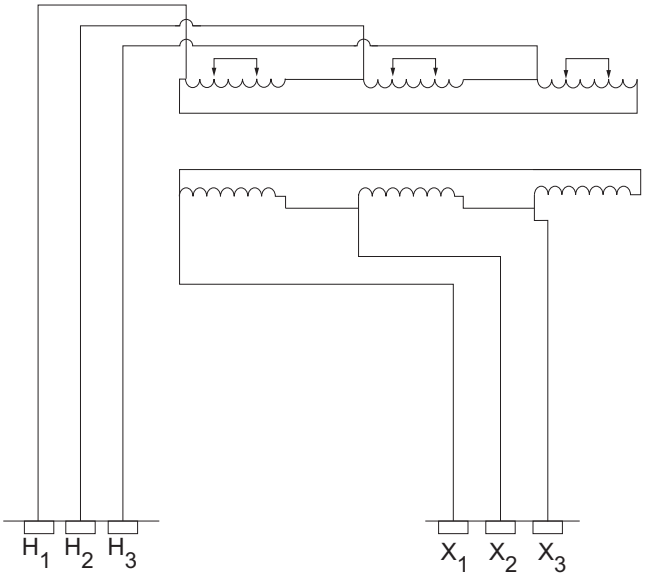


Table TX 195–7: Delta-Delta, Single-Circuit, Non-Switched and Non-Fused Transformer List

HV	LV	kVA	SAP
12000	240	1500	10103693
	2400	1500	10103733
		2500	10103662
		3750	10103671
16340	2400	1500	10103688
		2500	10103668
		3750	10103672
	12000	2500	10103744

Figure TX 195–10: Delta-Delta (120/240V 4W), Single-Circuit, Switched and Fused Transformer Wiring Schematic

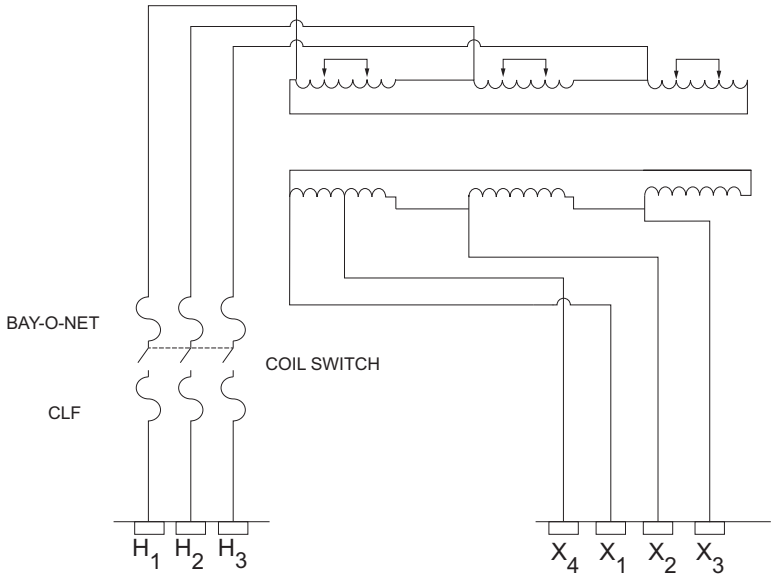


Table TX 195–8: Delta-Delta (120/240V 4W), Single-Circuit, Switched and Fused Transformer List

HV	LV	kVA	SAP
12000	120/240V 4W	75	10179005
		300	10179007
		500	10169118
		750[a/]	10168288
13800	120/240V 4W	750[a/]	10172451
16340	120/240V 4W	75	10179006
		300	10179008
		500	10179009
		750[a/]	10208084
34400	120/240 4W	750[a/ b/]	10175221

[a/] For substation station light and power use only.
[b/] Transformer for 34400 HV, 120/240 LV with SAP 10175221 is not fused.

Figure TX 195–11: Delta-Zig/Zag, Single Circuit, Non-Switched and Non-Fused Transformer Wiring Schematic

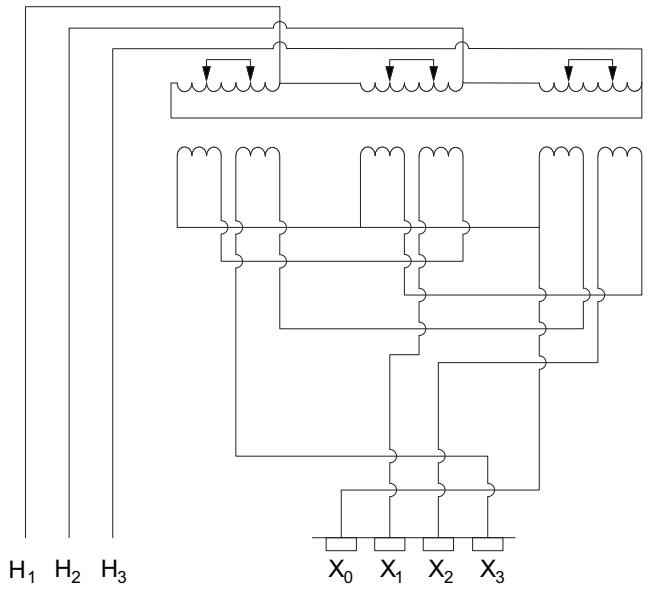
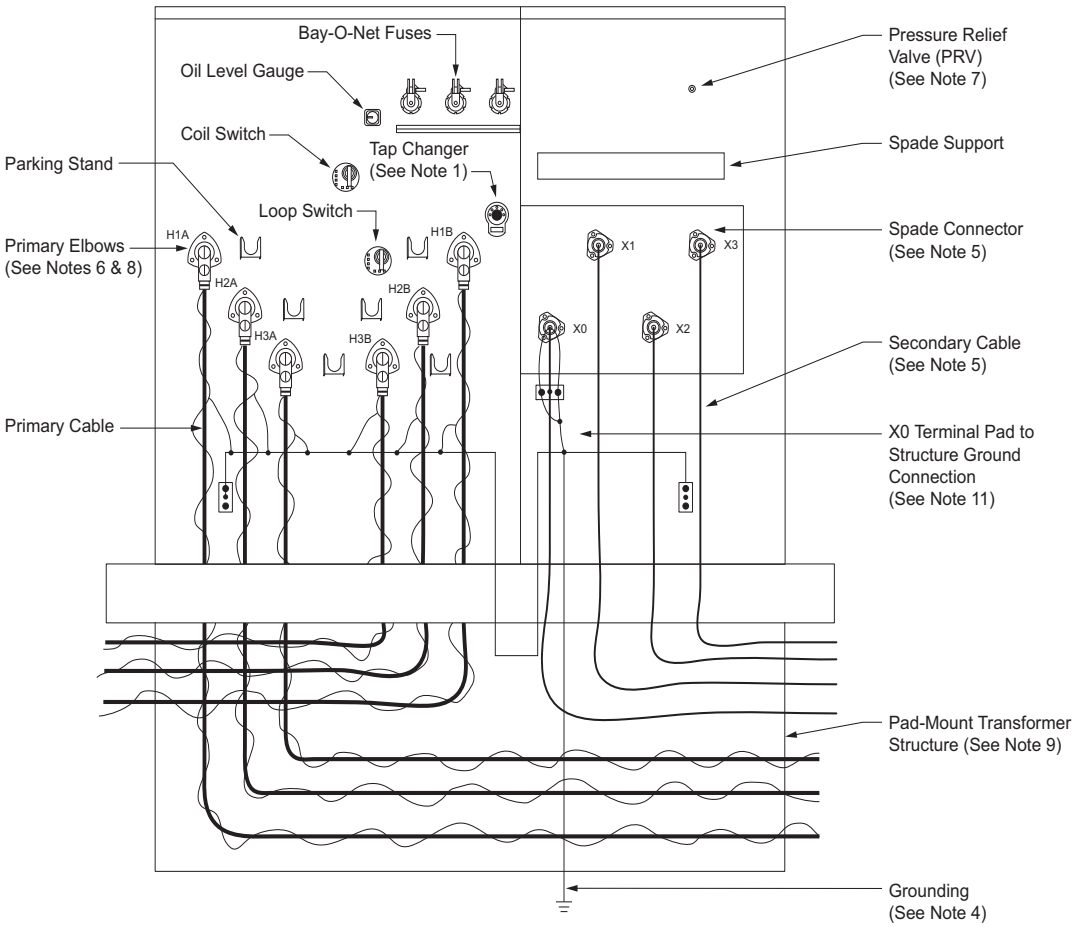


Table TX 195–9: Delta-Zig/Zag, Single Circuit, Non-Switched and Non-Fused Transformer List

HV	LV	kVA	SAP
12000	12000ZZ/6930	1500	10217416

Scope TX 195.2 Typical Three-Phase, 2-Circuit Pad-Mounted Transformers

Figure TX 195–12: Typical Three-Phase, 2-Circuit Pad-Mounted Transformers



Note(s):

1. The transformer tap changer is designed for de-energized operation only. DO NOT operate tap changer while energized.
2. Transformer components shown in the figure above (that is, secondary spades and supports) are typical of most transformer designs; however SCE has approved designs where these components have been purposely omitted from the design.
3. TTR and Megger tests shall always be performed on the transformer after it has been installed on the structure (prior to the leads being connected).
4. For installation of grounding materials, see GR 110. All ground connections shall utilize Copper-to-Copper connectors ONLY.
5. Secondary runs shall never exceed structure requirements detailed in DDS-6 Table 6-8.
6. Feed-thru bushing inserts shall NOT be installed on 3-phase pad-mounted transformers.
7. Always relieve the transformer tank pressure by pulling PRV ring before removing Bay-O-Net fuse holders from the tank.
8. For primary load-break elbows and installation, see TP 150 and TP 161.
9. For anchoring, sealing, and stenciling requirements, see TX 160.
10. For transformers with wye secondaries, ground X0 as show in Figure TX 195–2 [Sheet 2].
    Preferred: Use 1-hole hylugs #2 (SAP 10111308) and 2/0 (SAP 10111311). Remove factory installed ground bolt holding the X0 copper ground straps to the tank; install hylug of the equipment ground on top of the copper ground straps and reinstall the bolt. Do not install hylug to an empty position on the ground pad.
    Alternate: Install hylug to secondary spade. Do not stack secondary lugs on top of grounding hylug; invert grounding hylug when installing on top of a secondary lug.
11. For transformers with wye secondaries, serving ONLY 480-volt, 3-phase, 3-wire service, lift the X0 ground copper strap off the transformer tank during transformer installation. Refer to ESR-1, Section 6.1 and DUG, figure GR 140-4. See Figure TX 195-2.3 for example.

Figure TX 195–13: Delta-Wye, 2-Circuit, Switched and Fused Transformer Wiring Schematic

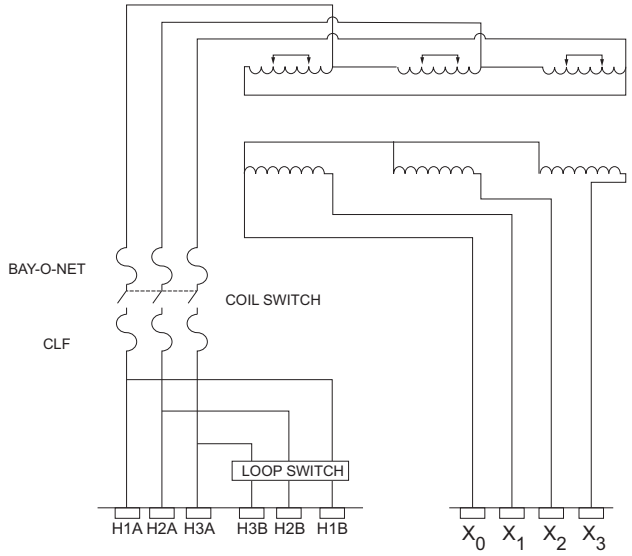


Table TX 195–9: Delta-Wye, 2-Circuit, Switched and Fused Transformer List

HV	LV	kVA	SAP
12000	208Y/120	75	10104682
		150	10104636
		300	10104681
		500	10104696
	480Y/277	75	10104687
		150	10104632
		300	10104689
		500	10104694
16340	208Y/120	75	10104661
		150	10104637
		300	10104677
		500	10104698
	480Y/277	75	10104659
		150	10104638
		300	10104679
		500	10104700

Figure TX 195–14: Delta-Delta, 2-Circuit, Switched and Fused Transformer Wiring Schematic

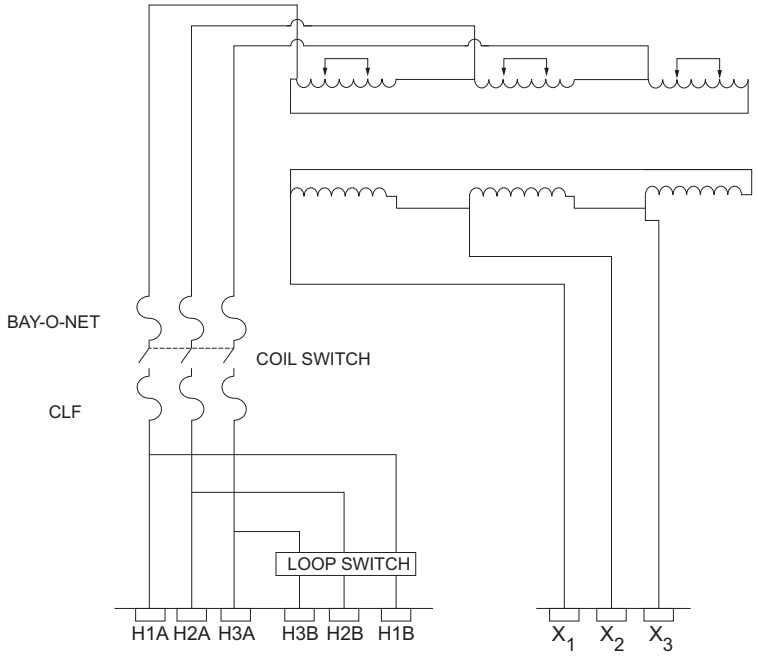


Table TX 195–10: Delta-Delta, 2-Circuit, Switched and Fused Transformer List

HV	LV	kVA	SAP
16340	240	75	10104657
16340	240	500	10104701

TX 197 Three-Phase 12, 16, and 33 kV Pad-Mounted Voltage Regulator

Scope TX 197.1 Three-Phase 12, 16, and 33 kV Pad-Mounted Voltage Regulator

1.0 Application

Installation of the 12, 16, and 33 kV Pad-Mounted voltage regulator shall be installed on a Precast Slab Box specified in UGS SS 535.

A 4-way Pad-Mounted switch (Bypass switch) shall be used for this installation (see DUG Table AP 200–1) using the structure specified in UGS SS 538. Refer to Figure TX 197–1 for connection configuration.

NOTE For pole-mounted voltage regulator construction standards, see DAP AP 180.

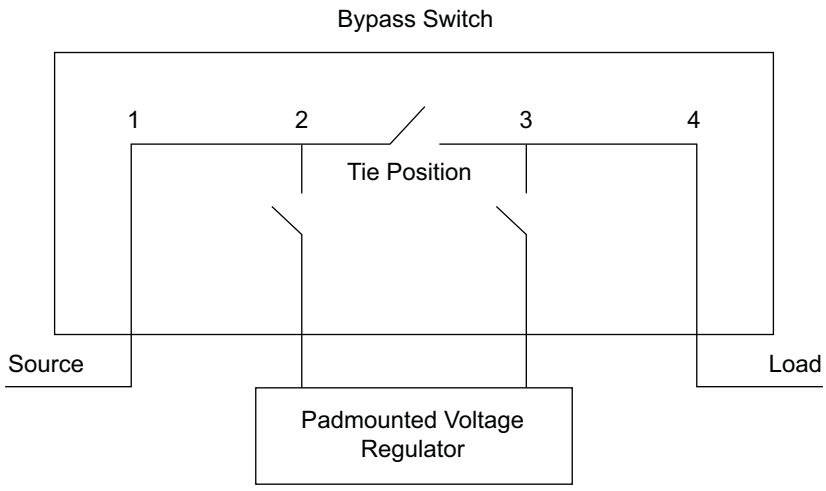
2.0 Voltage Regulator Control and Automation

The voltage regulator shall come supplied with three single phase CL7 controls (SAP 10209157) from the manufacturer. The controls shall be automated for monitoring and control. Three radios are required for automation and are ordered separately (SAP 10175268). Refer to DOM standard section TR-4 for Netcom radio details.

3.0 Voltage Regulator Prior to Commissioning After Construction

After installation of the voltage regulator, the equipment needs to be commissioned by Distribution Apparatus Test. The construction crew shall configure the equipment for Distribution Apparatus Test as follows: Verify that position 2 and position 3 of the Bypass Switch are open and the Tie Position is closed (Reference Figure 197-1). Power and Control Function switches should be “OFF.”

Figure TX 197–1: Typical Switch configuration for connected Pad-Mounted Voltage Regulator



Scope TX 197.2 Three-Phase 12, 16 and 33 kV Pad-Mounted Voltage Regulator (Closed DELTA)

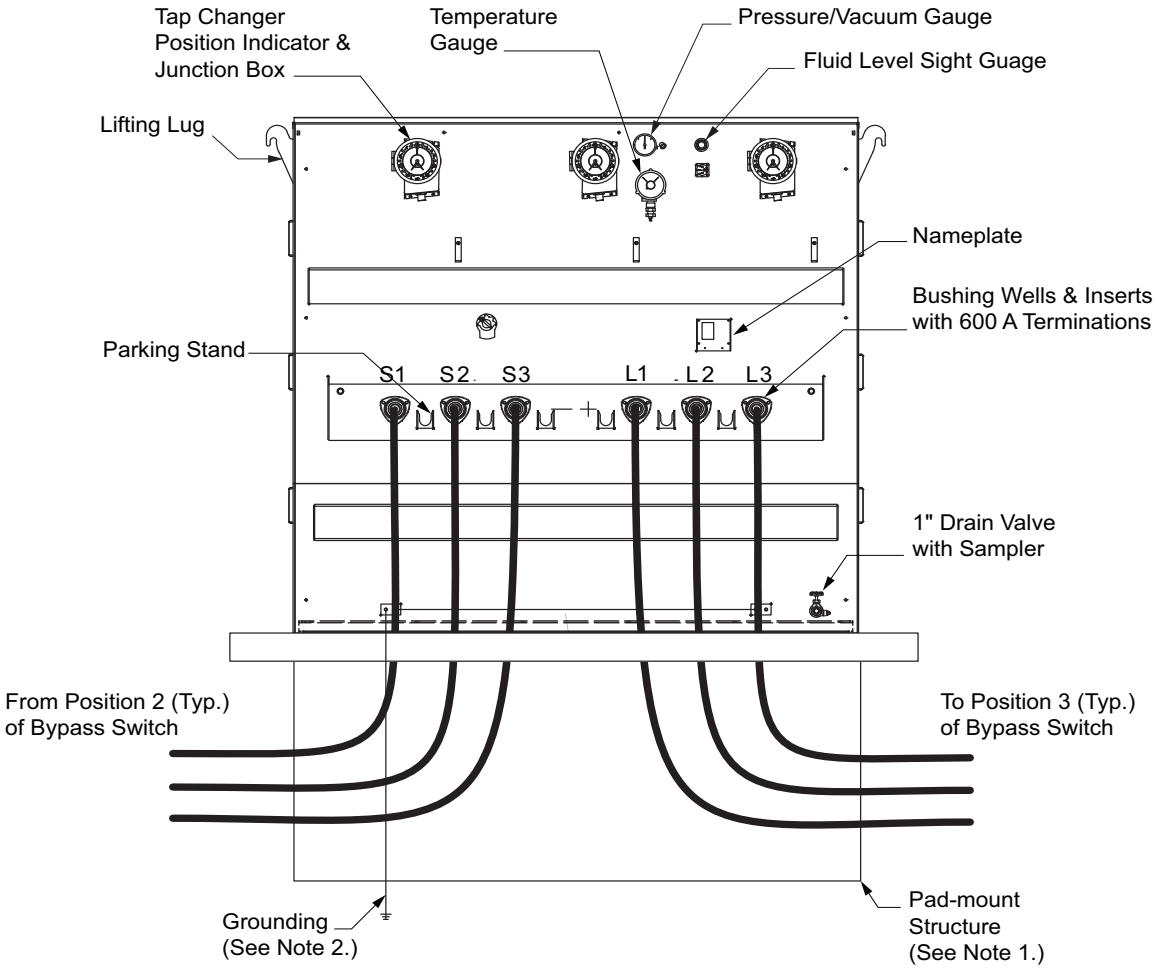
Table TX 197–1: Closed DELTA Voltage Regulators kVA Ratings, Weight, Dimensions and SAP Numbers

System Voltage	kVA	AMP	SAP	Weight (lbs.)	Height (in.)	Width (in.)	Depth (in.)	Oil (Gallons)	Cable Termination
12 kV	144	100	10212384	10,090	74.7	85.4	70.8	468	200 Bushing Well
	288	200	10212386	12,230	77.7	89	74.24	593	200 Bushing Well
	432	300	10212388	18,633	94.5	90	88.6	739	600 A Bushing
	576	400	10212390	21,911	98.7	97.5	93.1	871	600 A Bushing
	667	463	10210967	21,903	98.7	106.5	100.2	909	600 A Bushing
	833	578	10210968	24,789	99.7	100.5	107.8	1027	600 A Bushing
16.34 kV	200	100.4	10212434	11,200	78.7	93.3	80.3	530	600 A Bushing
	400	200.8	10212436	17,978	98.7	95.8	93.1	789	600 A Bushing
	667	335	10212438	21,798	98.7	106.5	100.2	889	600 A Bushing
34.5 kV	690	200	10205793	28,606	100	115.8	110.9	1210	600 A Bushing

Note(s):

1. Closed DELTA voltage regulators can regulate up to +/- 15%. If needed, percent (%) regulation can be reduced to accommodate larger load currents than what is listed in the table above. Contact Field Engineering for any questions.

Figure TX 197–2: Typical Three-Phase, Pad-Mounted Voltage Regulator (Closed DELTA)



Note(s):

1. See UGS SS 535 for structure details.
2. For installation of grounding materials, see DUG GR 110. All ground connections shall utilize Copper-to-Copper connectors only.
3. For anchoring, sealing, and stenciling requirements, see TX 160.
4. Maintain a minimum clearance of 8 feet on door side of the pad-mounted voltage regulator and 3 feet of clearance on all non-door sides, from the edge of the pad.
5. Use Cable Racks and Hooks in DUG RS 110.

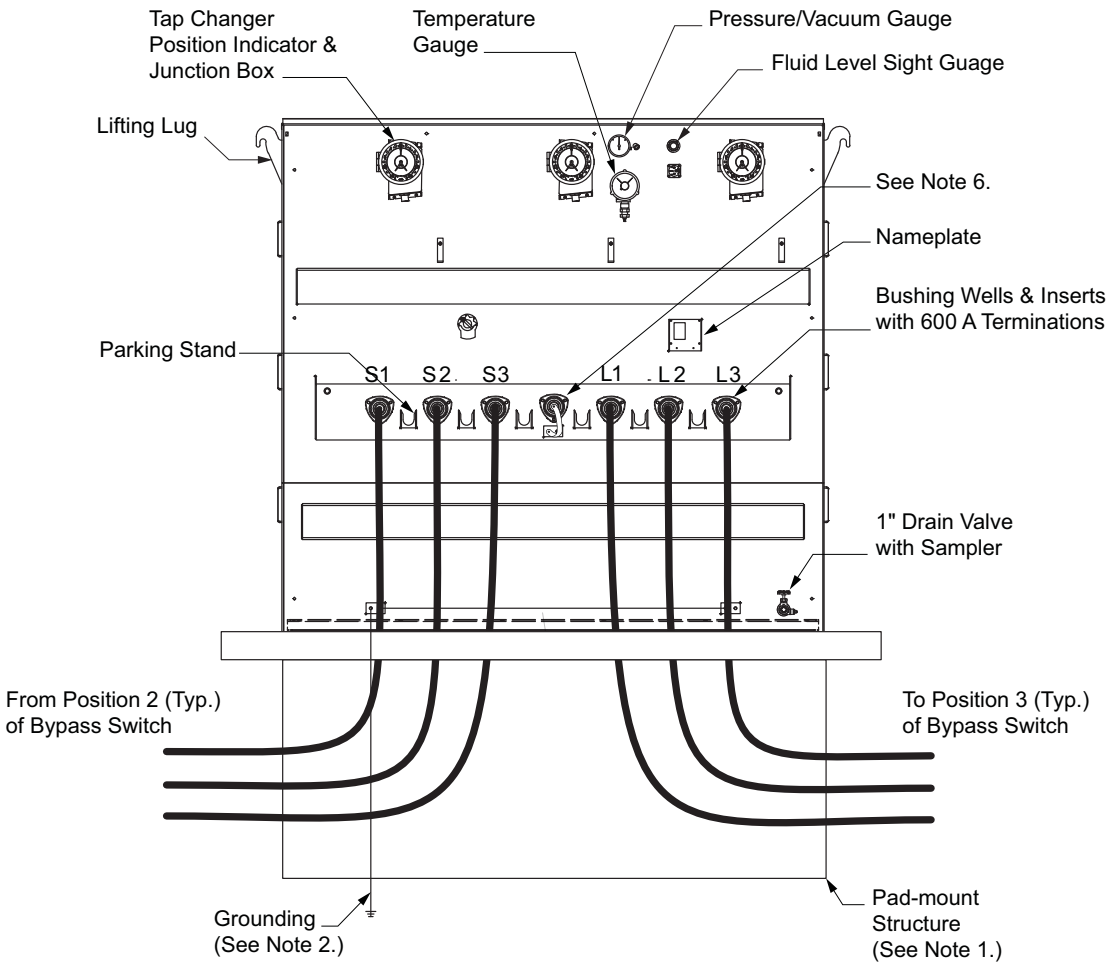
Scope TX 197.3 Three-Phase 12, 16, and 33 kV Pad-Mounted Voltage Regulator (WYE)

Table TX 197–2: WYE Voltage Regulators kVA Ratings, Weight, Dimensions, and SAP Numbers

System Voltage	kVA	AMP	SAP	Weight (lbs.)	Height (in.)	Width (in.)	Depth (in.)	Oil (Gallons)	Cable Termination
12 kV	144	100	10212385	10,090	74.7	85.4	70.8	468	200 Bushing Well
	288	200	10212387	12,230	77.7	89	74.24	593	200 Bushing Well
	432	300	10212389	18,633	94.5	90	88.6	739	600 A Bushing
	576	400	10212431	21,911	98.7	97.5	93.1	871	600 A Bushing
	667	463	10212432	21,903	98.7	106.5	100.2	909	600 A Bushing
	833	578	10212433	24,789	99.7	100.5	107.8	1027	600 A Bushing
16.34 kV	144	100	10212435	10,090	74.7	85.4	70.8	468	200 Bushing Well
	288	200	10212437	12,230	77.7	89	74.24	593	200 Bushing Well
	667	335	10212439	28,606	100	115.8	110.9	1210	600 A Bushing

Note(s):
1. WYE voltage regulators can regulate up to +/- 10%. If needed, percent (%) regulation can be reduced to accommodate larger load currents than what is listed in the table above. Contact Field Engineering for any questions.

Figure TX 197–3: Typical Three-Phase, Pad-Mounted Voltage Regulator (WYE)

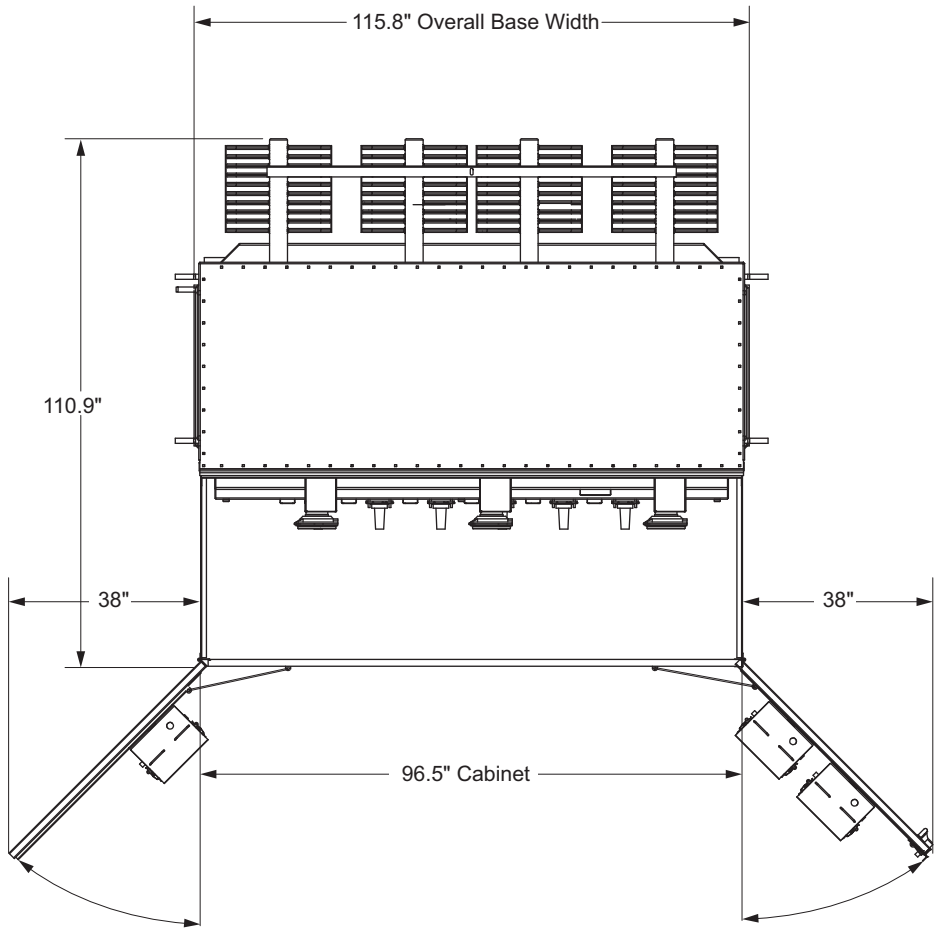


Note(s):

1. See UGS SS 535 for structure details
2. For installation of grounding materials, see GR 110. All ground connections shall utilize Copper-to-Copper connectors only.
3. For anchoring, sealing, and stenciling requirements, see TX 160.
4. Maintain a minimum clearance of 8 feet on door side of the pad-mounted voltage regulator and 3 feet of clearance on all non-door sides, from th edge of the pad.
5. Use cable racks and hooks in DUG RS 110.
6. SL bushing is connected with a grounding copper strap to the Tank grounding Pad.

Scope TX 197.4 Three-Phase 12, 16 and 33 kV Pad-Mounted Voltage Regulator - Plan View

Figure TX 197–4: Typical Three-Phase, Pad-Mounted Voltage Regulator – Plan View



TX 200 Pad-Mounted Transformer Spade Extensions

Scope TX 200.1 3Ø Pad-Mounted Transformer Secondary Spade Extensions

Figure TX 200–1: 3Ø Pad-Mounted Transformer Secondary Spade Extensions

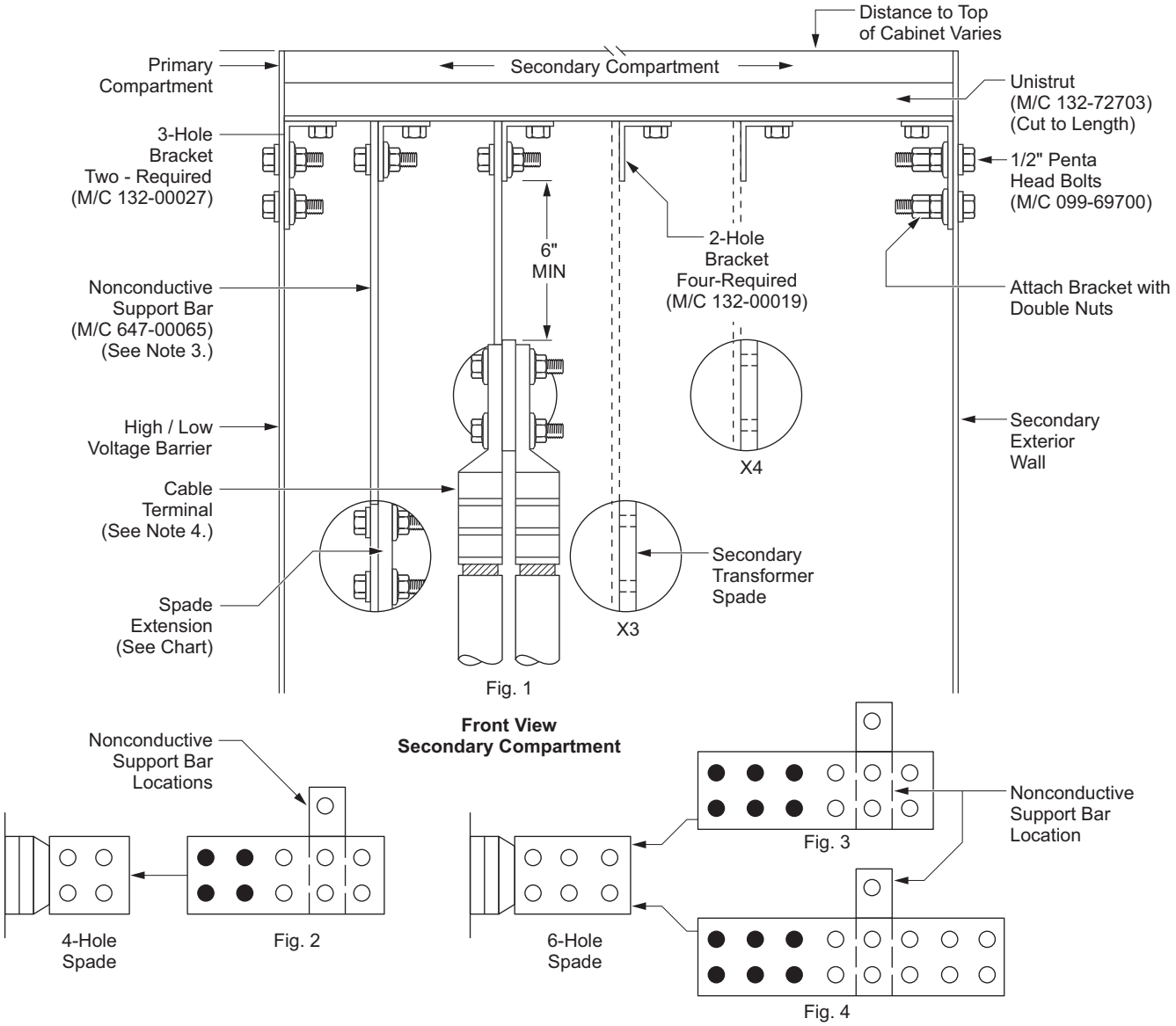


Table TX 200–1: 3Ø Pad-Mounted Transformer Secondary Spade Extensions

Transformer Size	Figure Number	Spade Extensions	Material Code	MAX No. of Conductors
500 kVA & Below	2	10 Hole	606-00038	8
750 kVA & Above	3	12 Hole	606-00020	10
	4	16 Hole	606-00012	14

1.0 Instructions

1.1 Attach spade extensions (Figure 2, 3, or 4) to transformer spades.

1.2 Cut and install unistrut with 1/2-inch bolts as shown. Center unistrut bracket holes to middle of support bar extension location shown at Figure 2, 3, or 4. Maintain a minimum of 6 inches between top of spade extension and bottom of 2-hole bracket.

1.3 Cut support bar to required lengths.

NOTE One 6 foot long support bar is normally long enough for all four secondary positions.

Drill 9/16-inch holes and attach with 1/2-inch bolts as shown in Figure TX 200–1 (Sheet 1).

1.4 Use only aluminum trimmed straight lugs (for lugs, see TP 100).

TX 205 Low Voltage Bushing for Single-Phase Pad-Mounted Transformer

Scope TX 205.1 Threaded Stud Low Voltage Bushings for Single-Phase Pad-Mounted Transformer

Figure TX 205–1: Threaded Stud Low Voltage Bushings for Single-Phase Pad-Mounted Transformer

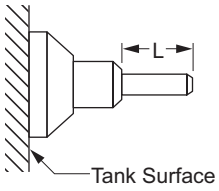


Table TX 205–1: Threaded Stud Low Voltage Bushings for Single-Phase Pad-Mounted Transformer

kVA Rating	Thread Size	Minimum L
25-75	0.625-11 UNC-2A	1.25
100-167	1.000-14 UNC-2A	1.75

Note(s):

1. All single-phase pad-mounted transformers 25–167-kVA will be furnished with threaded studs on the low-voltage bushing side. Threaded set-screw connectors (preferred) or threaded spade terminals (alternate) need to be installed at field locations.
2. Transformer manufacturer to provide locknut for each bushing.
3. On 6.9 kV and 9.4 kV transformers, the neutral connection will be the same as the low-voltage bushing (threaded stud).
4. This threaded stud connection is designed for use with threaded set-screw connectors. See JJ 125.
5. Threaded spade terminals (see TP 110) are available for use with this type of threaded stud bushing.

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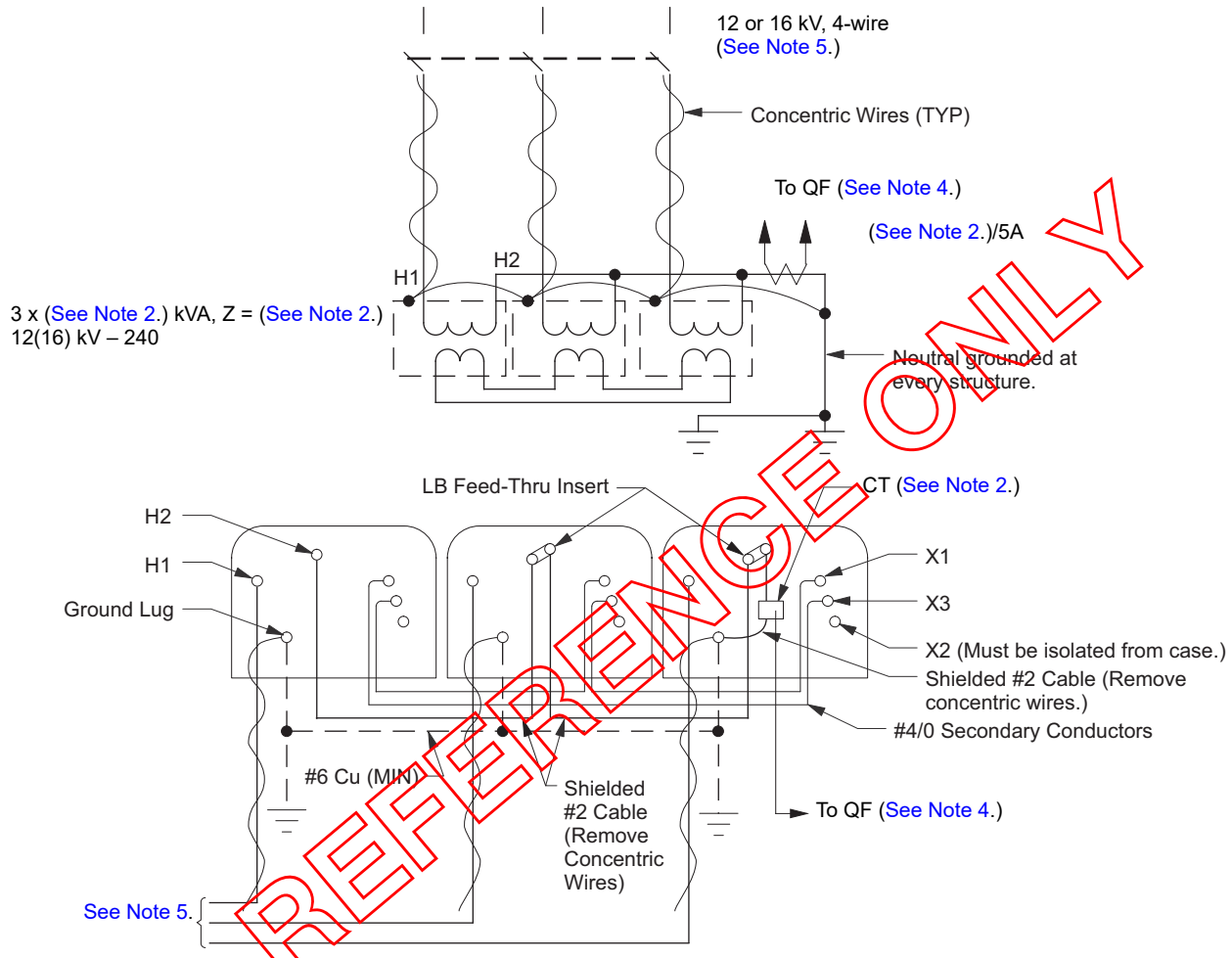
TX 210 12/16 kV, 75–300 kVA Ground Bank

Scope TX 210.1 Connections for Installing of Ground Bank using Mini-Pad Single-Phase Transformers for Underground 12/16 kV 4-Wire Systems

Figure TX 210–1: Connections for Installing of Ground Bank using Mini-Pad Single-Phase Transformers for Underground 12/16 kV 4-Wire Systems



FOR REFERENCE ONLY

CAUTION DO NOT energize until CT secondary conductors have been terminated at both ends.

Note(s):

1. The above drawings are diagrammatic. For more details see typical requirements for installation of single-phase mini-pad transformers in TX 190.
2. The transformers kVA rating and impedance and the current transformer ratio are specified by the Protection Department.
3. The X2 terminal on two transformers must be isolated from the transformer case if it is not already so. SSID shall make the necessary internal revisions. SSID shall then affix sign “X2 isolated for ground bank.”
4. QF will install 1 inch conduit and pull CT secondary conductors from its relay cabinet to the transformer terminal cabinet with CT SCE will terminate conductors at CT

5. To 3-pole, 2-way switch, use one of the following switches:
6. OH, Omni-Rupter™ Switch, M/C 557-00553, (Refer to the Distribution Apparatus Construction Standards (DAP) manual, AP 336)
7. UG, Pad-Mounted SF_6 Switch, M/C 535-00534 (See SE 260)
8. UG, Vault, BURD SF_6 Switch, M/C 535-00757 (See SE 150)

FOR REFERENCE ONLY

TX 213 12/16 kV QF Ground Bank — Using BURD Transformers in Above Ground Enclosure

Scope TX 213.1 12/16 kV QF Ground Bank — Using BURD Transformer in Above Ground Enclosure

1.0 General Information

1.1 This transformer bank configuration was intended to utilize non-switched and non-fused BURD transformers in an above ground enclosure to create a ground bank. This configuration is no longer approved for new construction. For construction of ground banks see DUG TX 240 for details.

1.2 When replacing or upgrading this ground bank, every effort should be made to utilize the phase-to-phase BURD transformers found in Table TX 213-1. Phase-to-phase BURD transformers may be used in lieu of phase-to-ground BURD transformers found in Table TX 213-2.

1.3 Phase-to-ground BURD transformers found in Table TX 213-2 may be used but shall be modified by SSID, see Figure TX 213-1 Note 4, prior to installation.

2.0 Material Information

Table TX 213–1: 12000 V and 16340 V BURD Transformers

	12000 V	16340 V
KVA	SAP	SAP
75	10104043	10104045
100	10104265	10104263

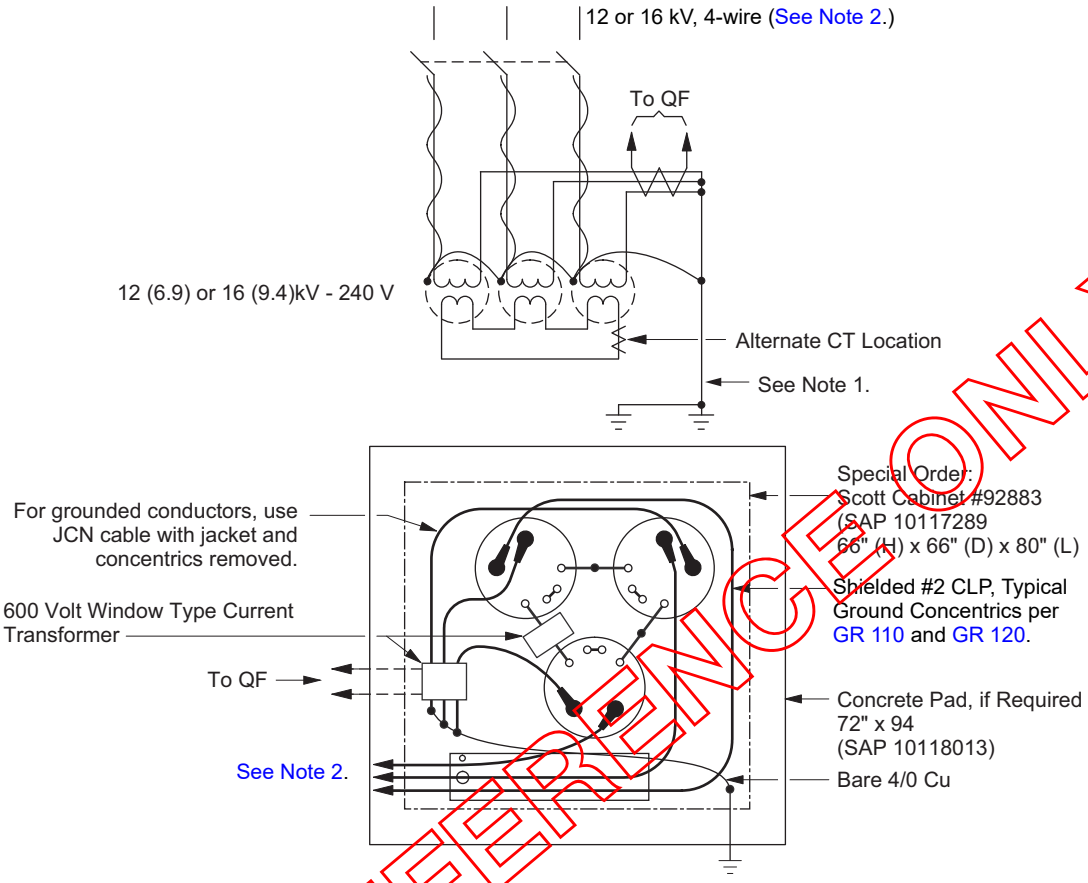
Table TX 213–2: 6930 V and 9430 V BURD Transformers

	6930 V	9430 V
KVA	SAP	SAP
25	10103910	10103909
50	10104041	10104037
75	10104044	10104042
100	10104264	10104266

FOR REFERENCE ONLY

3.0 Dimensions and Connections

Figure TX 213–1: 12/16 kV QF Ground Bank — Using BURD Transformer in Above Ground Enclosure



CAUTION DO NOT energize until CT secondary conductors have been terminated at both ends.

FOR REFERENCE ONLY

Note(s):

1. For grounding and bonding methods, see GR 110 and GR 120.
2. To 3-pole, 2-way switch, use one of the following switches:
   a. OH, Omni-Rupter™ Switch (SAP 10107119). Refer to DAP AP 336.
   b. UG, Pad-Mounted SF_6 Switch (SAP 10106404). See SE 260.
   c. UG, Vault, BURD SF_6 Switch (SAP 10106426). See SE 150.
3. Transformer kVA and impedance, CT ratio, and CT location are specified by Protection Department.
4. SSID shall make all necessary internal modifications to the transformers listed in Table TX 213-2 The modifications are as follows:
   a. Isolate the X2 terminal of each transformer from the transformer tank. SSID shall affix sign “X2 ground isolated.”
   b. Isolate the primary winding from the transformer tank and connect the winding to the primary bushing (H1B).
   c. Remove the direct connection between H1A and H1B. SSID shall re-label the primary terminals H1 and H2 respectively.
   d. SSID shall modify nameplate to show final transformer schematic. See Figures TX 213-2 and TX 213-3 for an example.
5. Phase-to-phase transformers may be used in lieu of phase-to-ground transformers when necessary. Voltage base correction calculations shall be completed in order to determine ground bank impedance. Internal modifications are not required for transformers listed in Table TX 213-1.
6. QF will install 1-inch conduit and pull CT secondary conductors from its relay cabinet to the transformer terminal cabinet with CT. SCE will terminate conductors at CT.
7. Apparatus Test and Field Engineering shall be contacted for commissioning tests prior to energizing or placing equipment in service.

Figure TX 213–2: Example of original 16340GRDY/9430V Transformer Nameplate

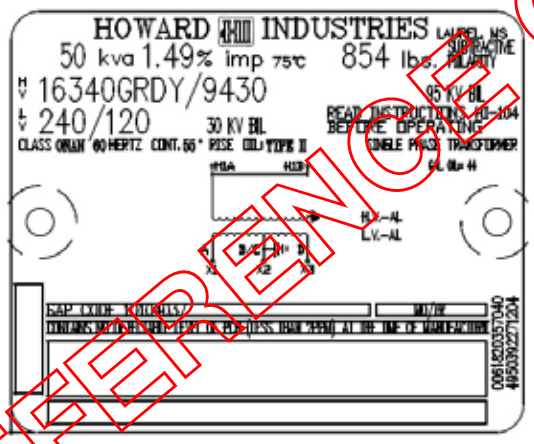
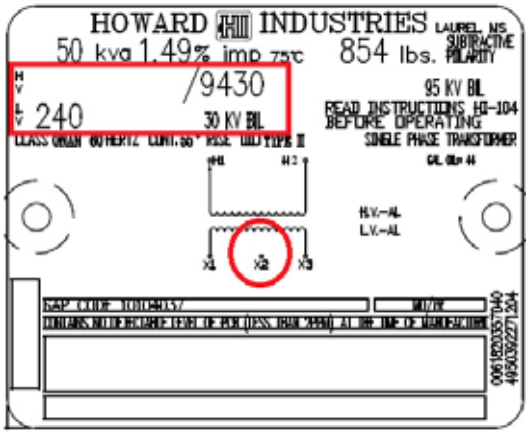


Figure TX 213–3: Example of modified 16340GRDY/9430 Transformer Nameplate



FOR REFERENCE ONLY

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TX 215 12/16 kV QF/WDAT Ground Fault Detector

Scope TX 215.1 12/16 kV QF/WDAT Ground Fault Detector Vault Wall Mounted

Figure TX 215–1: 12 kV Ground Fault Detector Schematic

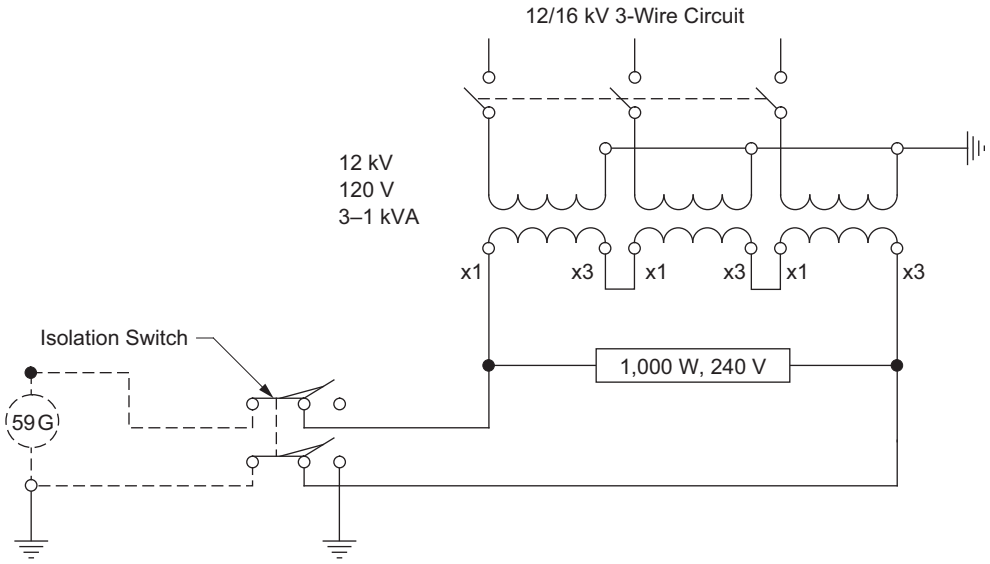


Figure TX 215–2: 16 kV Ground Fault Detector Schematic

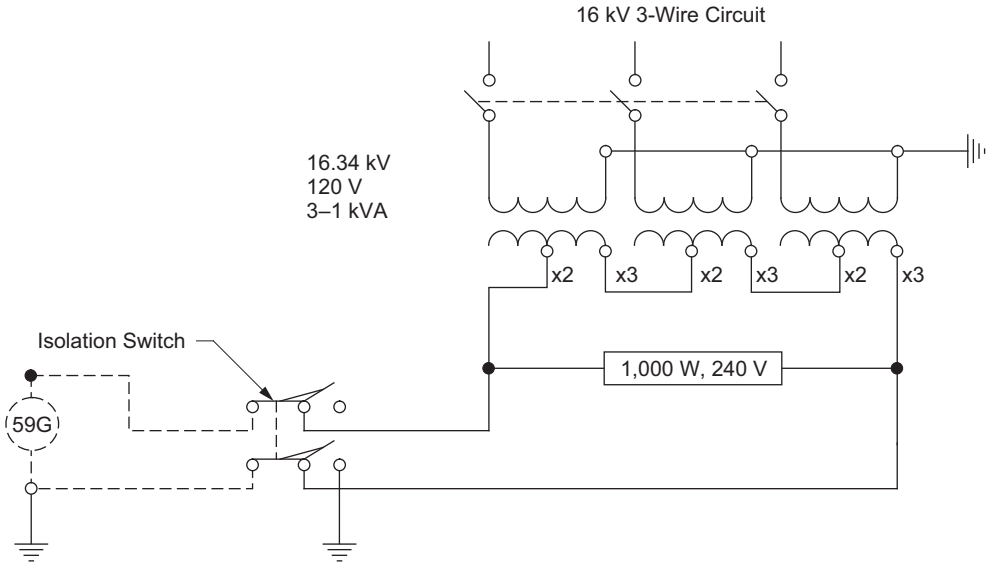
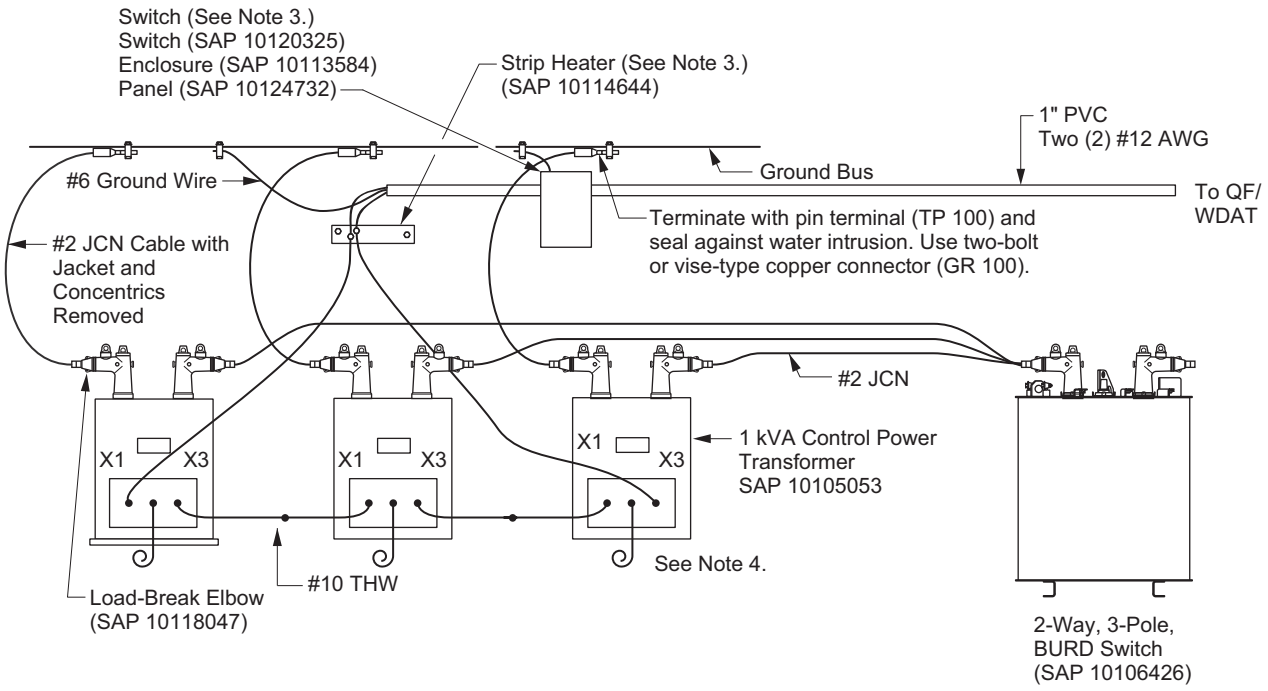


Figure TX 215–3: 12/16 kV Ground Fault Detector Vault Wall Mounted Installation (Nonsubmersible Applications Only)



Note(s):

1. See GR 100 for grounding and bonding requirements.
2. Use mounting bracket (SAP 10104924) for wall mounting.
3. Switch and strip heater to be mounted high on the wall. They are not intended for submersible applications.
4. Connect secondary pigtails according to Figure TX 215–1 (Sheet 1) or Figure TX 215–2 (Sheet 1) (12 kV connection shown). Tape unused pigtails.

TX 220 Pad-Mounted Ground Detector Installation for 3-Wire, 2.4 kV, 4.8 kV, 12 kV, 16 kV, or 33 kV Circuits

Scope TX 220.1 Pad-Mounted Ground Detector Installation for 3-Wire, 2.4 kV, 4.8 kV, 12 kV, 16 kV, or 33 kV Circuits

Figure TX 220–1: Ground Fault Detector Schematic

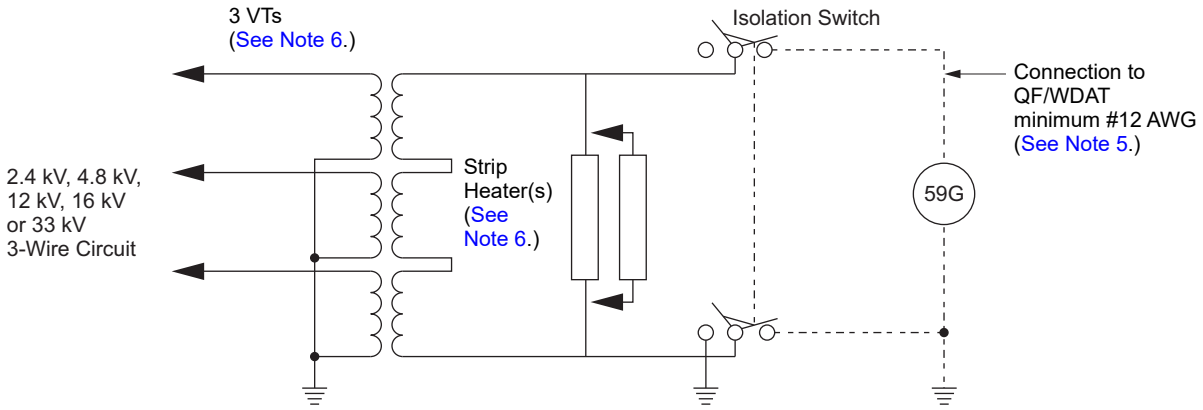


Figure TX 220–2: Ground Fault Detector Padmount Fabrication

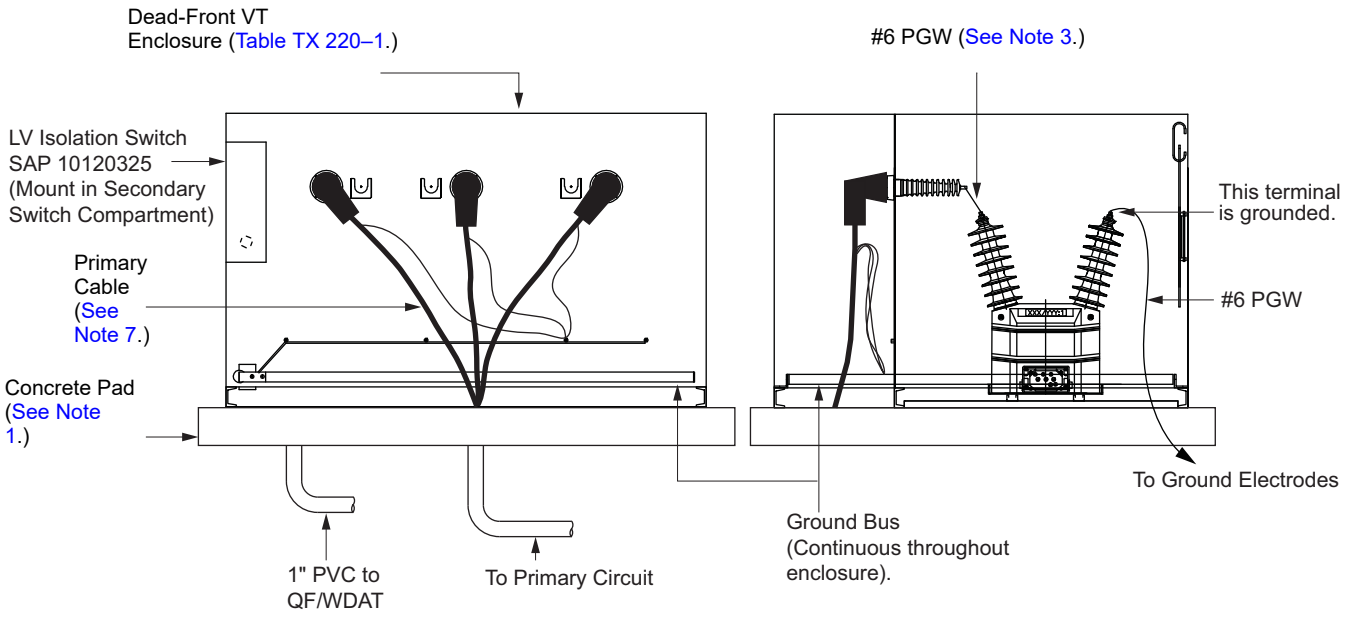


Table TX 220–1: Appropriate Enclosure, VT, and Number of Strip Heaters

System Voltage	Enclosure SAP Number (See See Note 8.)	VT Rating	VT SAP Number	Strip Heaters
2.4 kV	10107333	2.4 kV, 750 VA	10105896	1
4.8 kV	10107333	7.2 kV, 1500 VA	10106084	2
12/16 kV	10107333	12/16 kV, 500 VA	10105091	1
33 kV	10180669	33 kV, 1000 VA	10167672	1

Note(s):

1. Install concrete pad and grounding according to instructions for Pad #3 in the UGS Manual, Section SS 504.
2. Adjust unistrut rails as required for VT mounting.
3. Minimum phase-to-ground clearance is 15" for 33 kV, 12" for 16 kV and below; Preferred phase-to-ground clearance is 18" for 33 kV, 15" for 16 kV and below.
4. Strip heater (SAP 10114644) is used as load resistor (not space heater). Install on unistrut within the VT compartment.
5. Power producer shall route VT secondary wires (#12 AWG minimum) and conduit from the 59G relay to the ground detector. SCE shall make connections.
6. Select appropriate VT and number of strip heaters from Table TX 220–1 (Sheet 1). The VTs shall not be fused. Remove the secondary fuse from the transformer terminal box and replace it with a 14mm x 51mm copper link (SAP 10173871).
7. Minimum primary cable size is 4/0 for 33 kV and 1/0 for 16 kV and below. 33 kV cable terminated with 600 A dead-break elbows; 16 kV and below cable terminated with 200 A load-break elbows.
8. Enclosure supplied with ground bus, adjustable unistrut for VT mounting, and 600 A dead-break bushings (33 kV) or 200 A universal bushing wells and inserts (16 kV and below). Other items in enclosure are provided and installed by SCE.

Figure TX 220–3: 25 kV Ground Fault Detector Cabiney Dimentions (Scott Engineering)
SAP 10107333

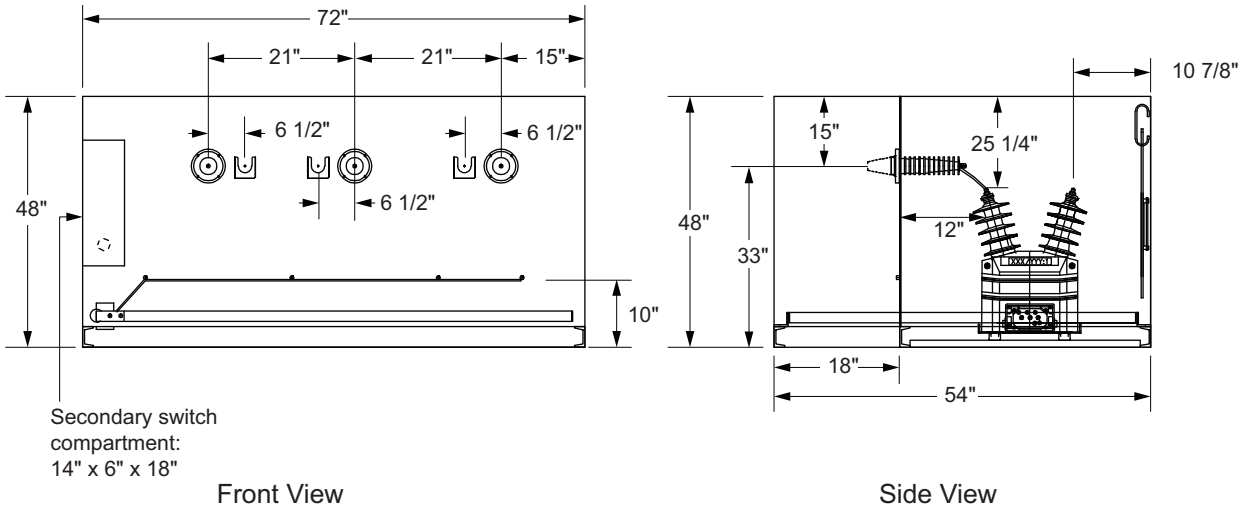


Figure TX 220–4: 38 kV Ground Fault Detector Cabinet Dimensions (Scott Engineering)
SAP 10180669

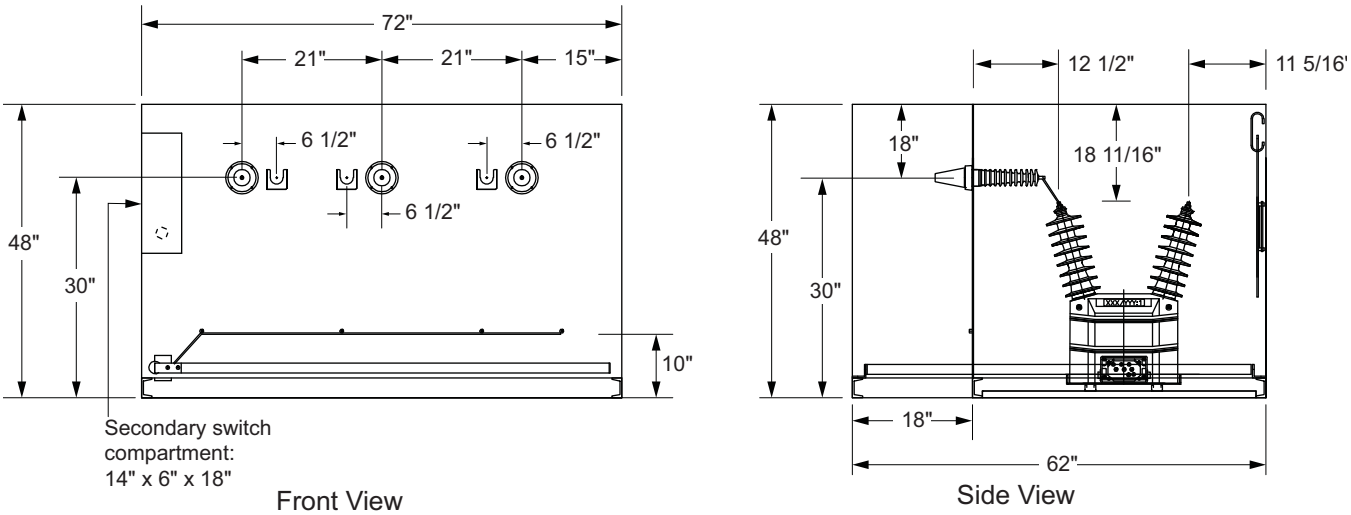
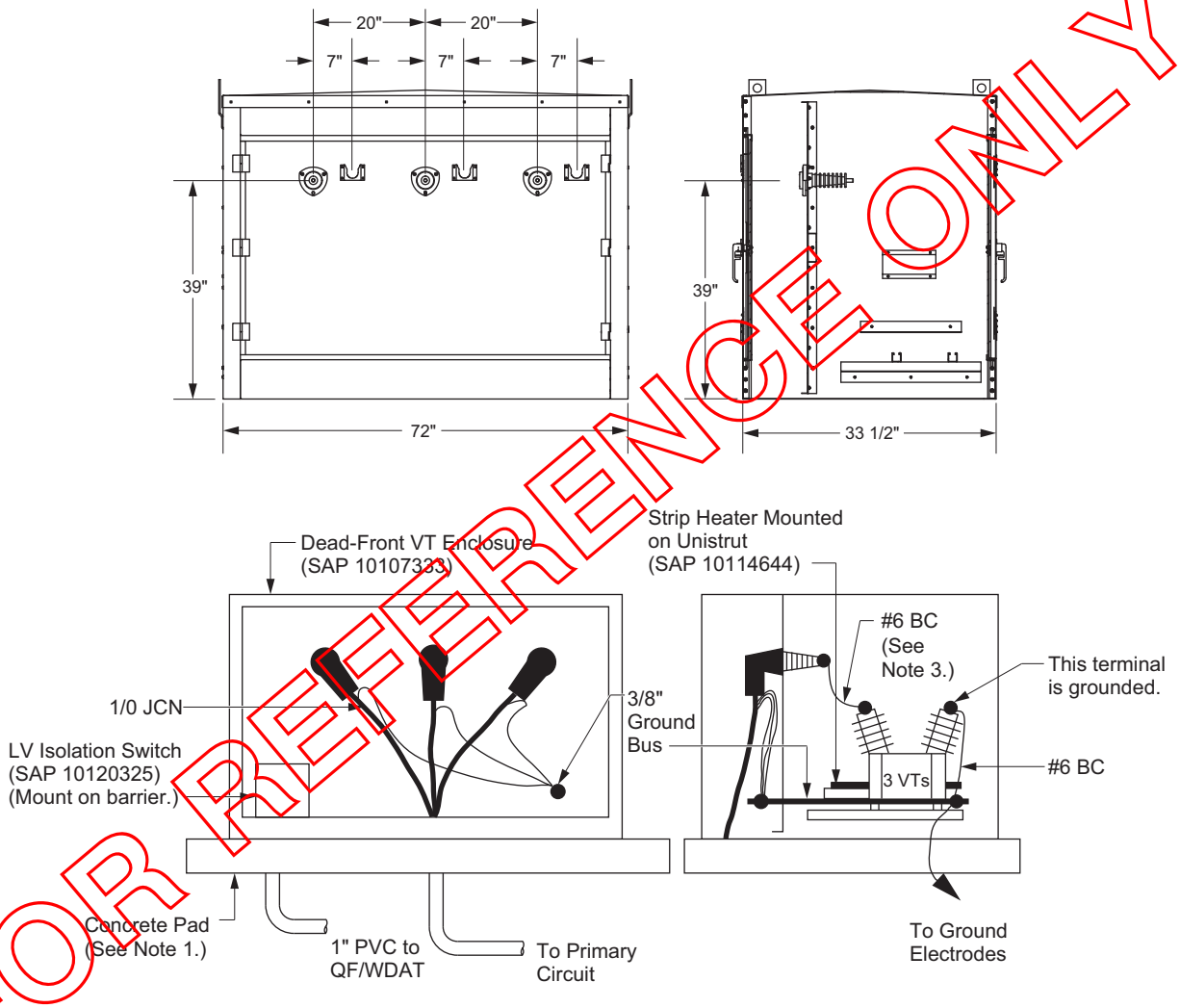


Figure TX 220–5: 25 kV Ground Fault Detector Cabinet (Meter Devices)
SAP 10107333



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TX 230P Pad-Mounted Rapid Earth Fault Current Limiting (REFCL) Isolation Bank for 12/16 kV Three-Wire Systems (PILOT)

Scope TX 230P.1 Pad-Mounted REFCL Isolation Bank for 12/16 kV Three-Wire Systems

1.0 General Information

The Pad-Mounted REFCL isolation bank is applied to reduce the ground fault current for a section of a three-wire circuit.

2.0 Material Information

2.1 Delta/Zig-Zag Isolation Transformer

Table TX 230P–1: 12000 V and 16000 V Delta Zig-Zag Isolation Transformers

	1200 V	16340 V
KVA	**SAP**	**SAP**
1500	10214716	—

2.2 Voltage Sensing Transformer

Table TX 230P–2: 12000 V and 16000 V Mini-Pad-Mounted Transformers

	12000GRDY / 6390	16340 GRDY / 9430
KVA	**SAP**	**SAP**
25	10103921	—

PILOT

3.0 Installation Detail

3.1 Existing Three-Phase Overhead Remote Electronic Recloser

The Pad-Mounted REFCL Isolation Bank shall be installed downstream of an existing three-phase RAR. An additional three-phase RAR will be installed on the load-side of the isolation bank.

See DAP AP 510.4 for Three-Phase Overhead Remote Electronic Recloser installation and construction details.

3.2 Primary Dip Pole and Primary Riser Pole

An overhead Omni-Rupter switch shall be install ed downstream of the existing three-phase RAR to be used as a primary dip pole. An additional overhead Omni-Rupter switch shall be installed directly downstream of the pad-mounted structures to be used as a primary riser pole.

See DAP AP 336.4 for installation and construction details. See TX 230P–1 for construction details on routing the voltage sensing measurement from the primary dip pole to the existing three-phase RAR.

3.3 Bypass Remote Controlled Switch

An automated overhead Omni-Rupter switch shall be installed downstream of the primary dip pole as a means to bypass the Pad-Mounted REFCL Isolation Bank. See DAP AP 337.2 for installation and construction details.

3.4 Delta/Zig-Zag Isolation Transformer

The pad-mounted delta/zig-zag isolation transformer will be installed downstream of the automated overhead Omni-Rupter switch.

See Table TX 230P–1 for pad-mounted delta/zig-zag isolation transformer selection. See TX 195 for Delta/Zig-Zag Isolation Transformer installation and construction requirements.The isolation transformer shall be installed on a 10' x 12' slab with a 5' x 8'-6" x 5' box. See UGS SS 535 for installation and construction details of the slab box. An insulated cable shall be connected to secondary neutral spade of the delta/zig-zag isolation transformer and routed through a dedicated conduit to the voltage sensing transformer.

3.5 Voltage-Sensing Transformer

A non-switched, non-fused, phase to neutral mini-pad-mounted transformer shall be used to detect the voltage on the secondary neutral of the delta/zig-zag isolation transformer.

SeeTX 190.1 for the mini-pad-mounted transformer installation and construction requirements. See Table TX 230P–2 for mini-pad-mounted transformer selection. The mini-pad-mounted transformer shall be installed on a 48" x 54" polymer concrete pad. See UGS SS 506 for installation and construction details of the polymer concrete pad. The secondary neutral cable of the delta/zig-zag isolation transformer shall be connected to H1A of the mini-pad-mounted transformer and H1B shall be capped. The secondary cables of the mini-pad-mounted transformer shall be routed in conduit through the slab box for the delta/zig-zag transformer to a riser at the overhead RCS pole.

3.6 Vacant Pad-mount Structure (For Future Use)

Route 1-5" and 2-3" conduit from the voltage-sensing transformer to the vacant pad-mount structure. See UGS SS 530 for installations and construction requirements of the 8' x 10' x 6" slab box for the vacant pad-mount structure. From the vacant structure route the primary conductor to the primary riser pole in 5" conduit.

Figure TX 230P–1: Primary Dip Pole Voltage-Sensing Riser Construction Details

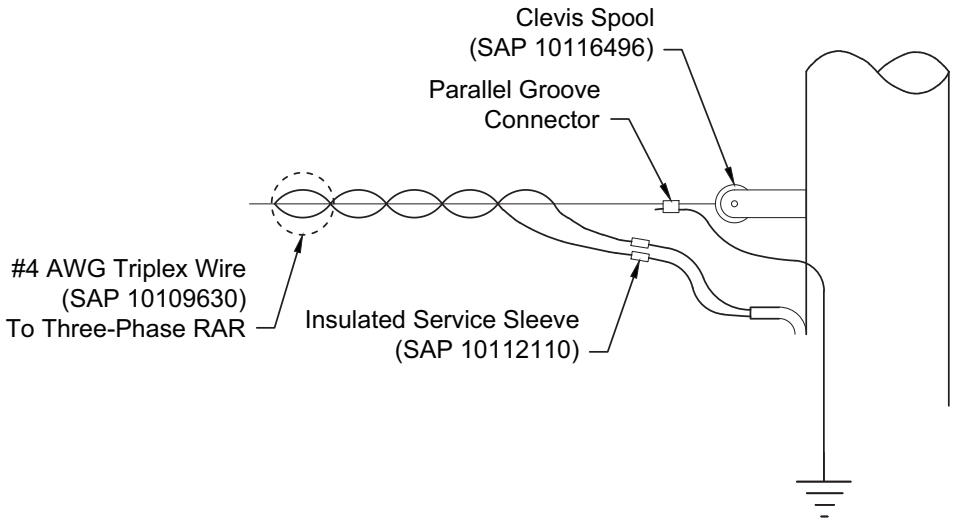

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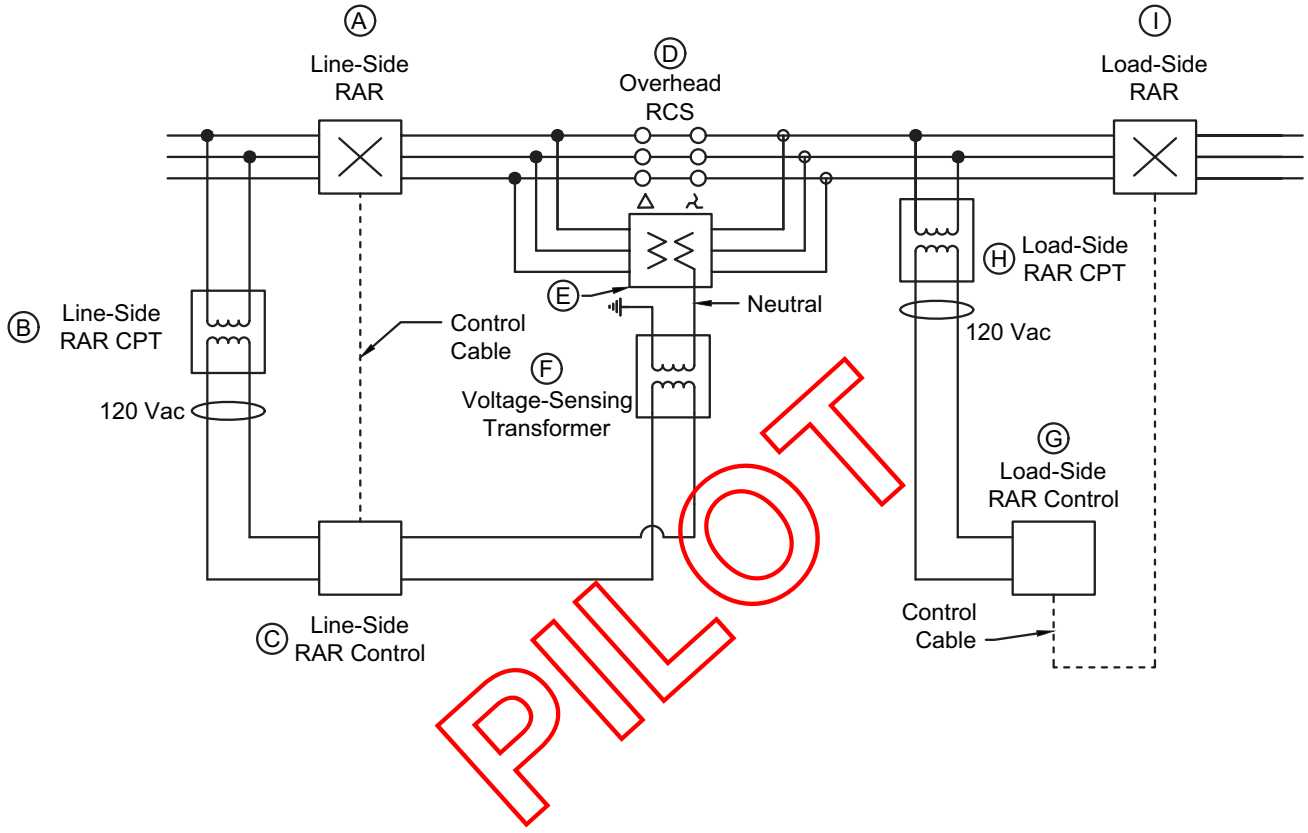
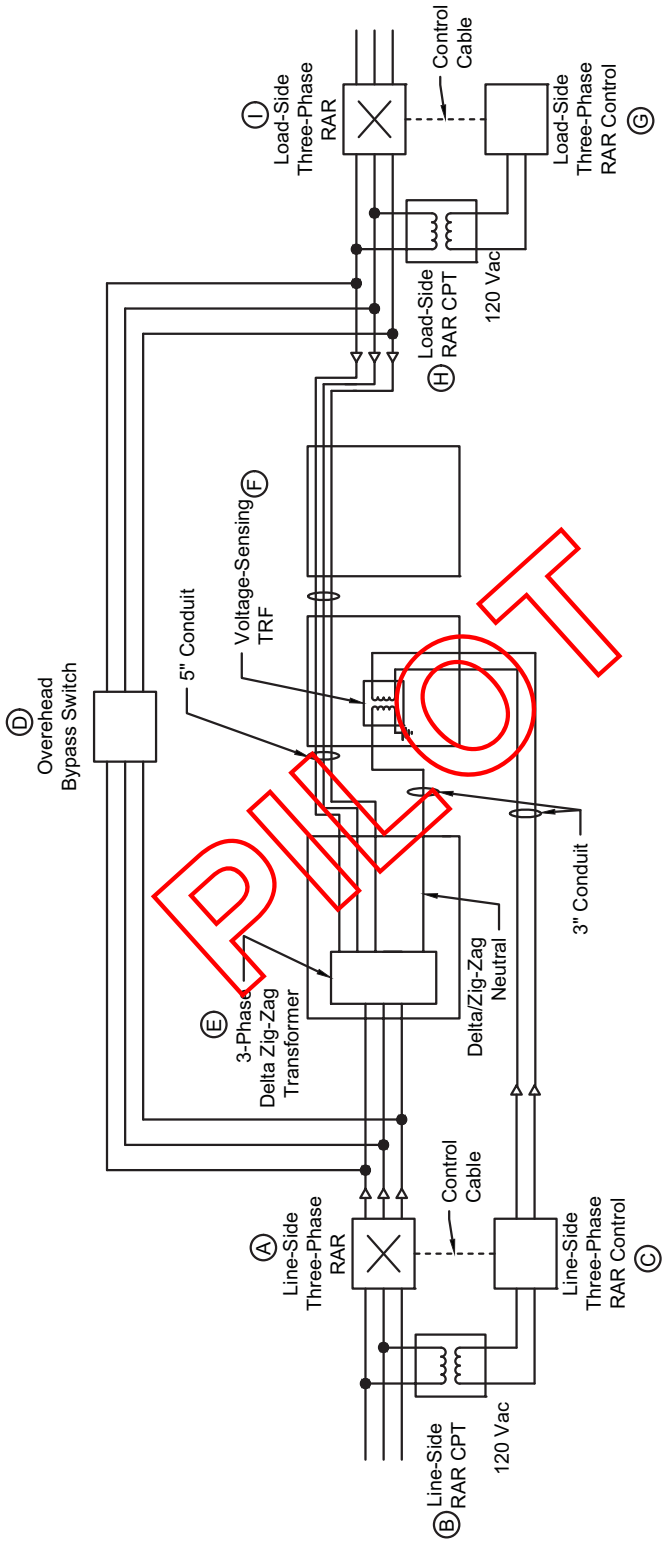
Figure TX 230P–2: REFCL Padmount Isolation Bank Connection Schematic



PILOT

Figure TX 230P–3: REFCL Padmount Isolation Bank Schematic Diagram



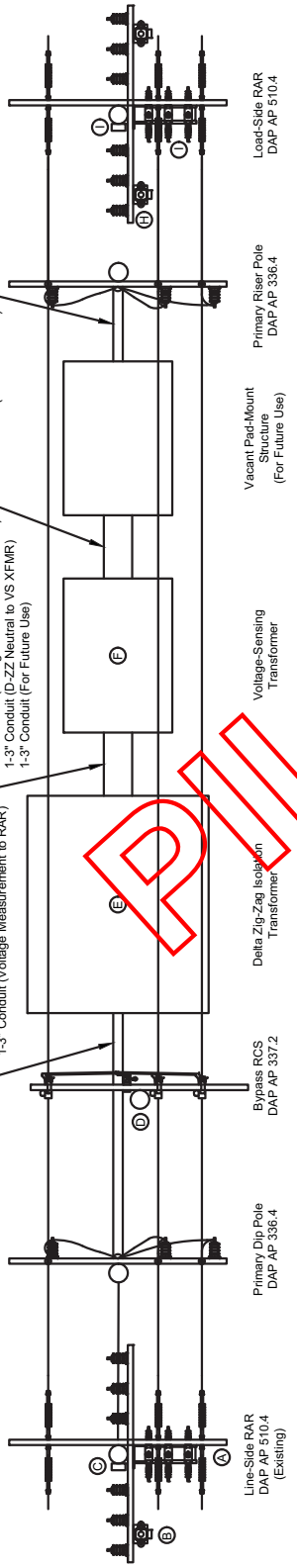


Figure TX 230P–4: REFCL Padmount Isolation Bank Construction Layout (Actual Physical Placement)

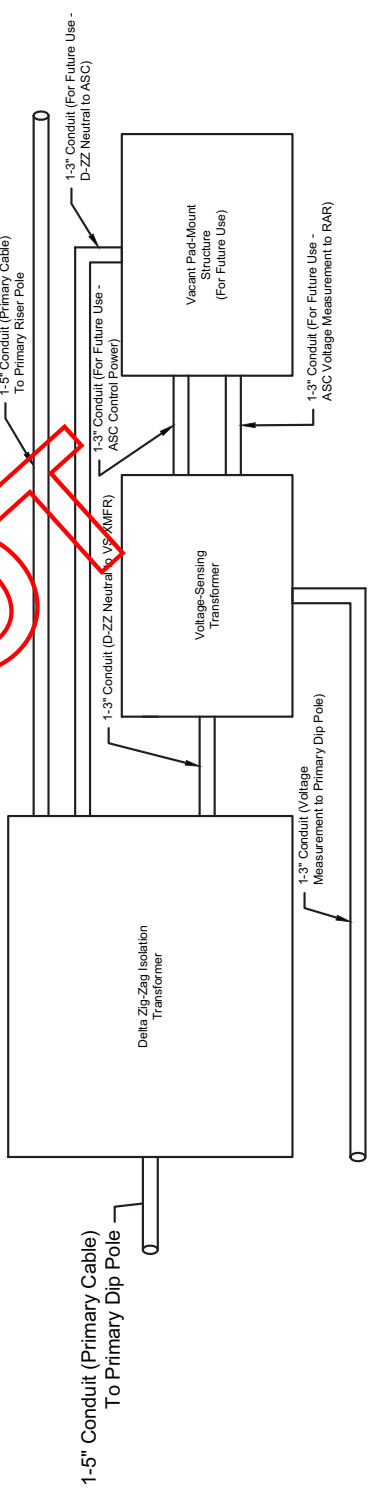


Figure TX 230P–5: REFCL Padmount Isolation Bank Conduit Termination Diagram

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Scope TX 230P.2 Pad-Mounted REFCL Isolation Bank for 12/16 kV Three-Wire Systems

1.0 General Information

The Pad-Mounted REFCL isolation bank is applied to allow grounding system conversions on distribution circuits. These installations typically convert from a solidly grounded system to an ungrounded or resonant grounded system.

2.0 Installation Details

2.1 Three-Phase Remote Electronic Recloser

The Pad-Mounted REFCL Isolation Bank shall be installed immediately downstream of a three-phase RAR. Recloser installation and construction details are provided in DAP AP 510 and DUG AP 210.

2.2 Primary Dip Pole and Primary Riser Pole

Riser and dip poles may be needed based on site conditions for existing construction applications. Disconnectable means and switches on the riser and dip poles are not required for these installations, however when pole space allows a switch should be included following standard construction practice.

See DAP AP 336 and DAP AP 338.

2.3 Overhead Bypass Switch

An optional overhead switch is depicted in Figure TX 230P–6 (Sheet 8) and Figure TX 230P–7 (Sheet 8), which allows switching flexibility as a box loop around the complete isolation bank installation. This switch is not required however application of this switch should be considered when overhead line facilities are being modified to serve the isolation bank. The overhead switch may help avoid the addition of guying or support to the existing overhead facilities in addition to providing the operational flexibility.

2.4 Bypass Remote Controlled Switch (RCS)

The Tie position on the bypass switch of the Isolation bank shall be constructed as an RCS. Refer to DUG AP 200 for installation requirements for the bypass switch and DUG SE 286 for installation requirements for the UAD to the gas switch. The construction standards detail the preferred application using pad-mounted bypass switches, however these switches are also available in below grade configurations as an alternate option for construction.

Control power to the RAR, RCS and additional equipment for the isolation bank is provided by a 25 kVA mini-pad or BURD transformer. This transformer shall not serve any other loads. The standards identify application of pad-mounted transformers, however BURD transformers may be applied in unique cases where space requires below grade facilities.

PILOT

2.5 Delta/Zig-Zag Isolation Transformer

The pad-mounted delta/zig-zag isolation transformer shall be installed downstream of the three-phase RAR. See Table TX 230P–1 for pad-mounted delta/zig-zag isolation transformer selection. See TX 195 for delta/zig-zag isolation transformer installation and construction requirements. The isolation transformer shall be installed on a 10' x 12' slab with a 5' x 8'-6" x 5' box. See UGS SS 535 for installation and construction details of the slab box. An insulated cable shall be connected to secondary neutral connection of the delta/zig-zag isolation transformer and routed through a dedicated conduit to the voltage sensing transformer. See Figure TX 230P–8 (Sheet 9) and Figure TX 230P–9 (Sheet 9) for connection details.

2.6 Voltage-Sensing Transformer

A non-switched, non-fused, phase to neutral mini-pad-mounted transformer shall be used to detect the voltage on the secondary neutral of the delta/zig-zag isolation transformer. See TX 190.1 for the minipad-mounted transformer installation and construction requirements. See Figure TX 230P–2 (Sheet 1) for minipad-mounted transformer selection. The mini-pad-mounted transformer shall be installed on a 48" x 54" polymer concrete pad. See UGS SS 506 for installation and construction details of the polymer concrete pad. The secondary neutral cable of the delta/zig-zag isolation transformer shall be connected to H1A of the mini-pad-mounted transformer and H1B shall be capped. See Figure TX 230P–8 (Sheet 9) and Figure TX 230P–9 (Sheet 9) accordingly for these connection details.

2.7 Inductor Cabinet

Route 1-5" and 2-3" conduit from the voltage-sensing transformer to the inductor cabinet. Install 1/0 size cable betwen the voltage sensing transformer using 1/0 lugs. Apparatus test shall be responsible for configuring the inductor selection switches. The main breaker for the inductor cabinet shall be left open awaiting configuration from the Apparatus test. Refer to DUG AP 220P for installation standards for the inductor cabinet.

PILOT

Figure TX 230P–6: REFCL Padmount Isolation Bank Single Line Diagram (Padmount RAR)

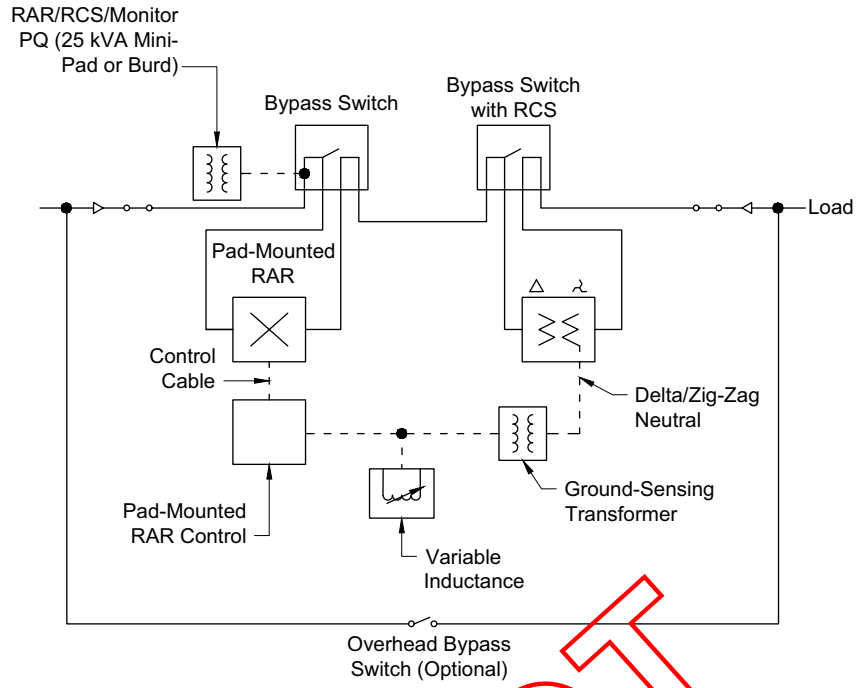
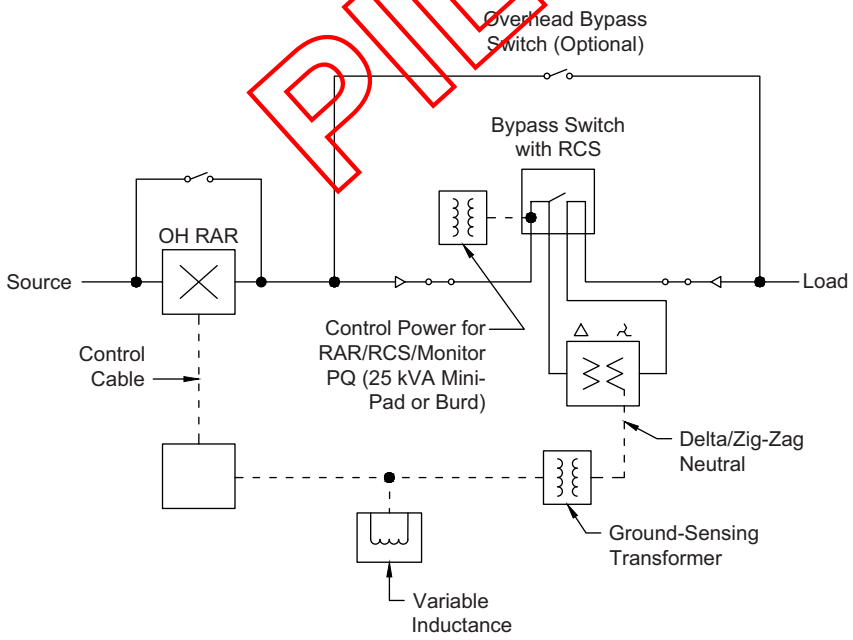


Figure TX 230P–7: REFCL Padmount Isolation Bank Single Line Diagram (Overhead RAR)



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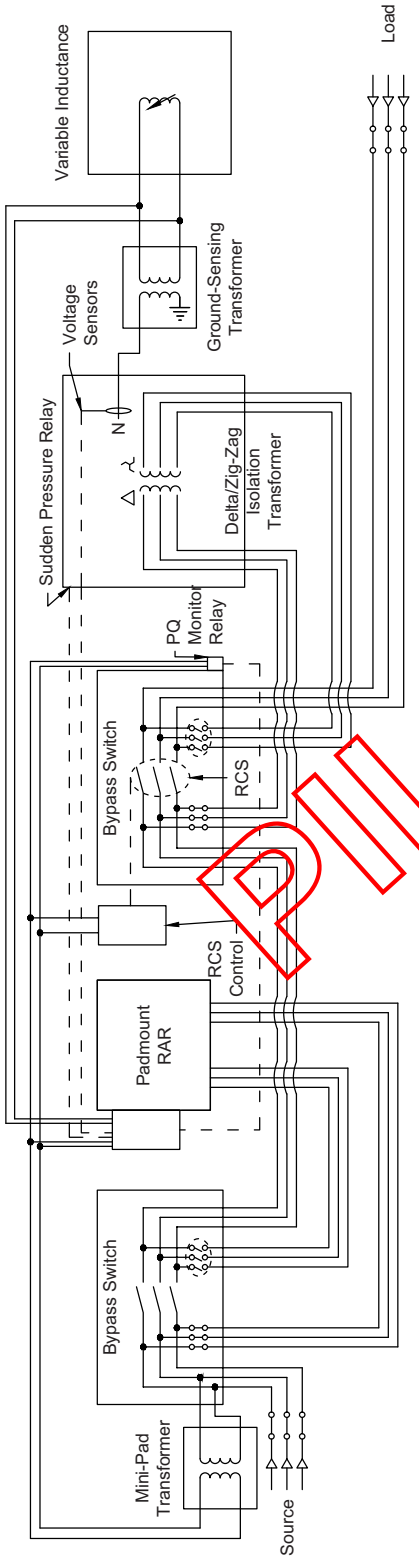


Figure TX 230P–8: REFCL Padmount Isolation Bank Wiring Diagram (UG RAR)

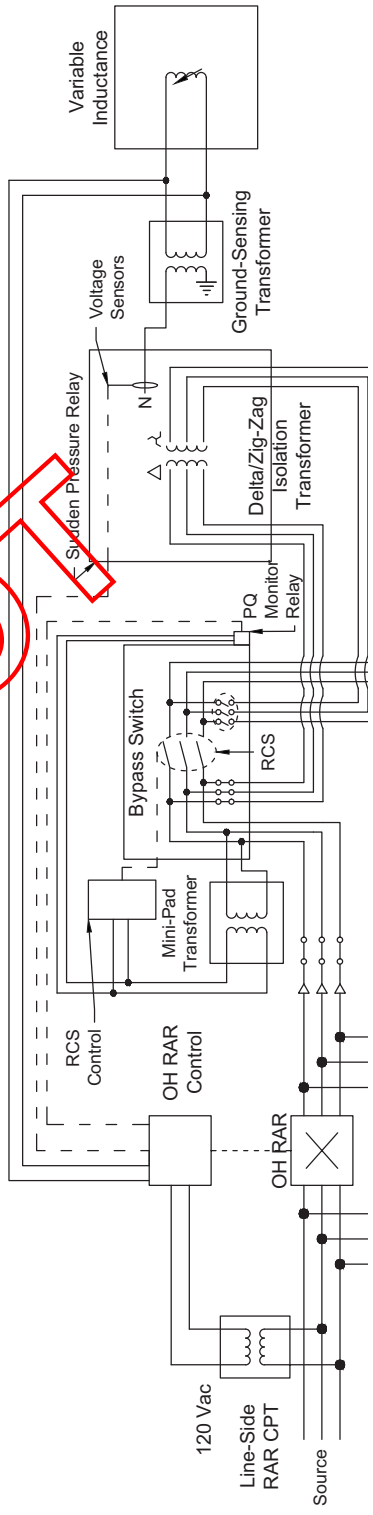
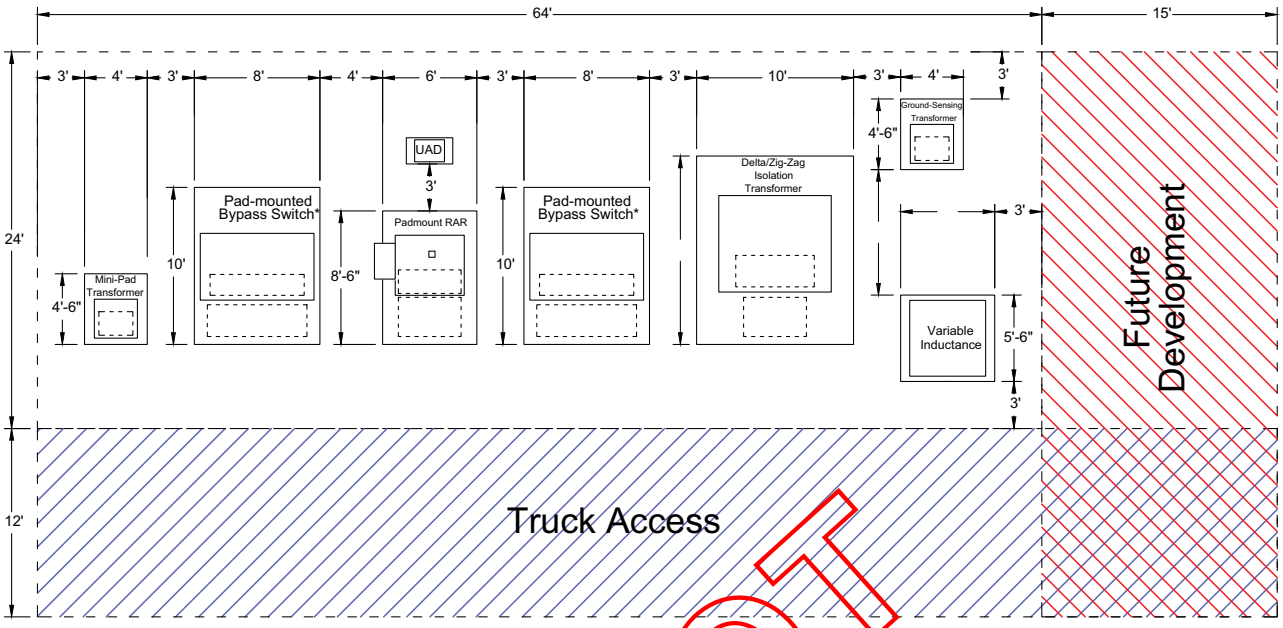


Figure TX 230P–9: REFCL Padmount Isolation Bank Wiring Diagram (OH RAR)

PILOT

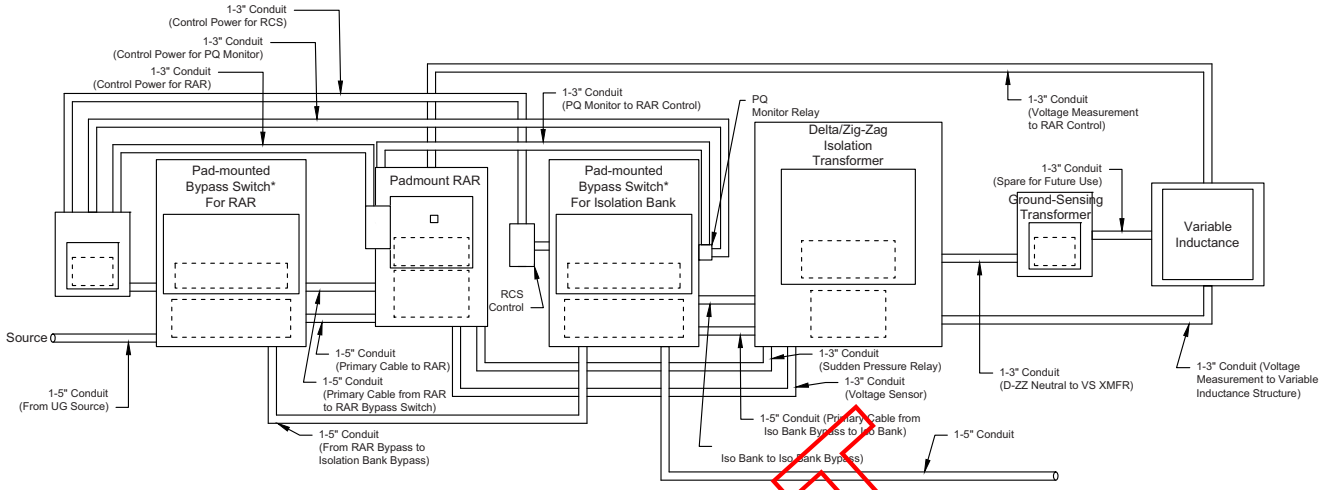
Figure TX 230P–10: REFCL Padmount Isolation Bank Structure Placement and Space Requirements (UG Source)



* May be submersible as an alternative option. Refer to DUG AP 200.

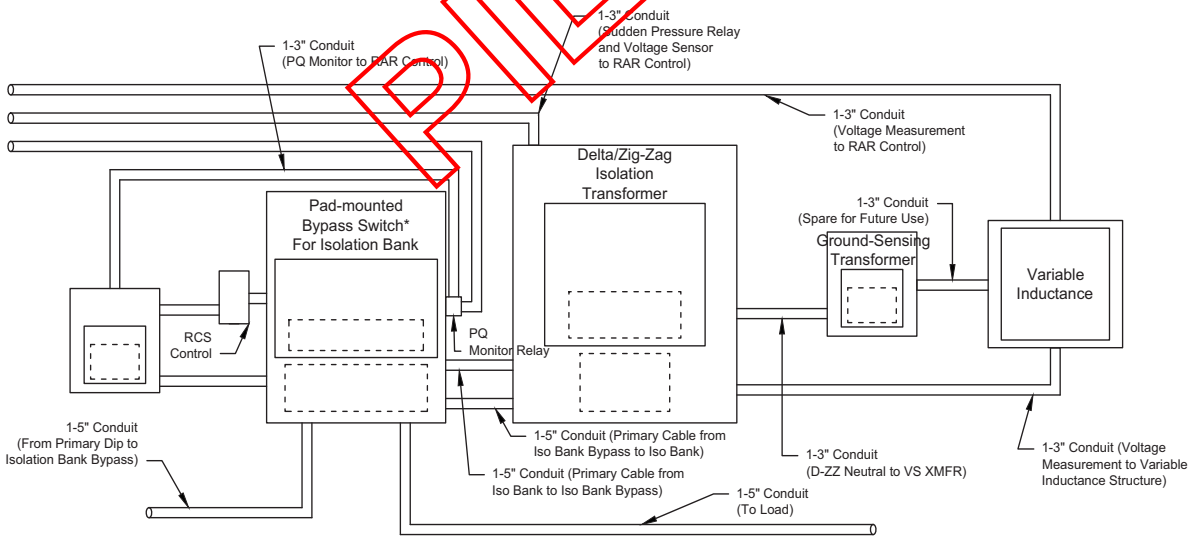
PILOT

Figure TX 230P–11: REFCL Padmount Isolation Bank Conduit Termination Diagram (UG RAR)



* Bypass switch may be submersible as an alternative option. Refer to DUG AP 200.

Figure TX 230P–12: REFCL Padmount Isolation Bank Conduit Termination Diagram (OH RAR)



* Bypass switch may be submersible as an alternative option. Refer to DUG AP 200.

PILOT

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TX 240 Pad-Mounted Grounding Transformer Installation Requirements

Scope TX 240.1 Installation of a Wye-Delta Transformer for Ground-Fault Relaying Scheme — Used for Power Producer Interconnection on Four-Wire Distribution Circuit

Figure TX 240–1: Typical Installation — Front View

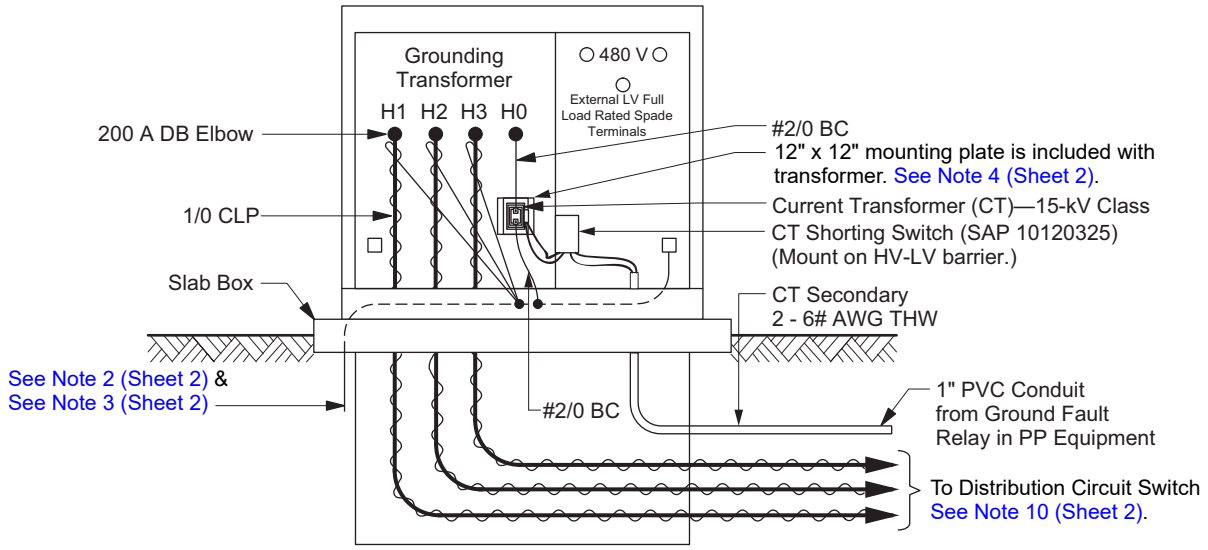


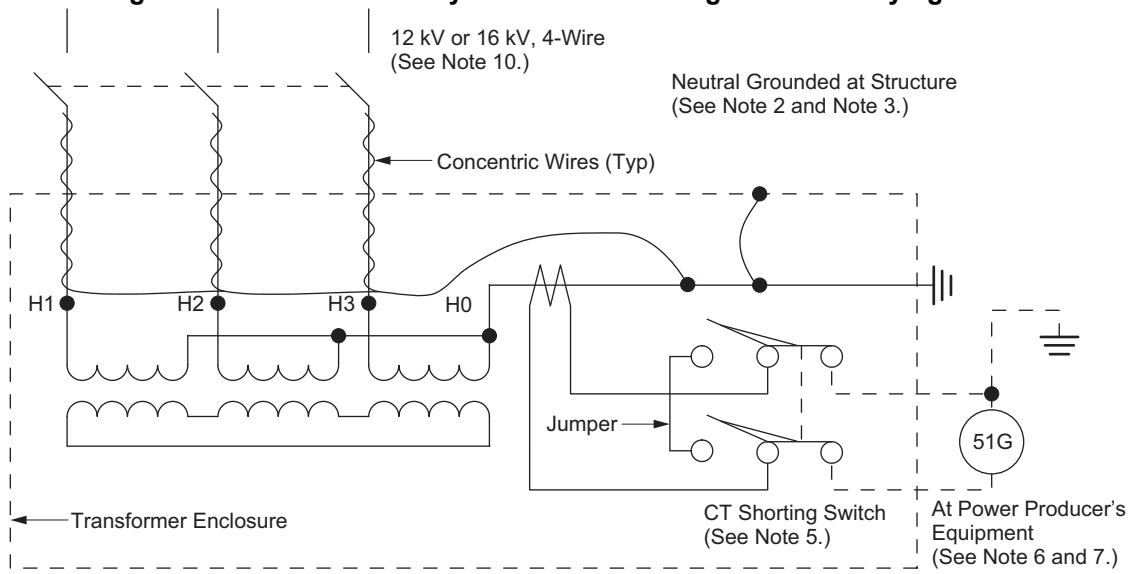
Table TX 240–1: Wye-Delta Pad-Mounted Grounding Transformers
See Note 1 (Sheet 2)

kVA	Impedance	SAP Number		Slab Box per UGS 530
		12 kV	16.34 kV	
225	3%	10104593	10104611	6' × 8'-6"
500	4%	10104613	10104614	6' × 8'-6"
1,000	5.75%	10103699	10103703	6' × 8'-6"
1,500	5.75%	10103698	10103702	8' × 10'
2,500	5.75%	10103682	10103701	8' × 10'

Table TX 240–2: Current Transformers
See Note 1 (Sheet 2)

CT Ratio	SAP Number
50:5	10106066
100:5	10106067
200:5	10106068
300:5	10106069
400:5	10106070
600:5	10106071

Table TX 240–3: Connections for Installation of Ground Bank Using Three-Phase Transformer for Underground 12/16 kV 4-Wire Systems and Including Ground Relaying Schematic



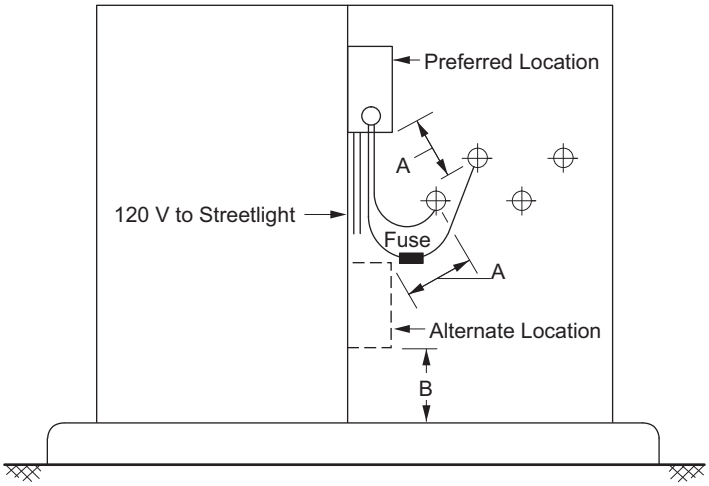
Note(s):

1. Distribution Field Engineering, coordinating with Protection Engineering, will specify transformer kVA rating and CT ratio.
2. Refer to Underground Structures Standards (UGS) Manual, SS 530, for slab box instructions and grounding requirements.
3. See GR 110 for grounding installation procedure.
4. CT Mounting Plate, included with pad-mounted grounding transformer, requires holes drilled to match CT footprint.
5. CT Shorting Switch, DPDT, (SAP 10120325), installation and operating requirements:
6. Power producer company shall route secondary CT wires and conduit from their 51G relay to the grounding transformer. SCE shall make connections to the CT Shorting Switch.
7. One CT secondary conductor shall be grounded at the power producer end.
8. When the ground bank is connected to the system, the CT secondary must either be shunted with the CT Shorting Switch or connected to the power producer's 51G relay in order to avoid dangerously high voltage at the CT secondary terminals.
9. Whenever the power producer's generator is connected to the system, the CT Shorting Switch must be set in the non-shorting or operating position so that the CT is connected to the 51G relay.
10. Ground bank requires one of the following 3-pole, 2-way switches for isolation:
11. OmniRupter Switch, SAP 10107119 (Refer to Distribution Apparatus Construction Standards (DAP), AP 336.)
12. Pad-mounted SF_6 Switch, SAP 10106404. (See SE 260.)
13. Vault, BURD SF_6 Switch, SAP 10106426. (See SE 150.)
14. PME-3, standard type SAP 10107295or stainless steel type SAP 10107303. See PD 337. Different PME configurations can be used based on circuit design.

TX 250 120V Service from 277/480V Pad-Mounted Transformer

Scope TX 250.1 Procedures for Installing a 1 kVA Dry Transformer in a 277/480V Pad-Mounted Transformer for Streetlights, and other Low Wattage Systems

Figure TX 250–1: Installing a 1 kVA Dry Transformer in a 277/480V Pad-Mounted Transformer

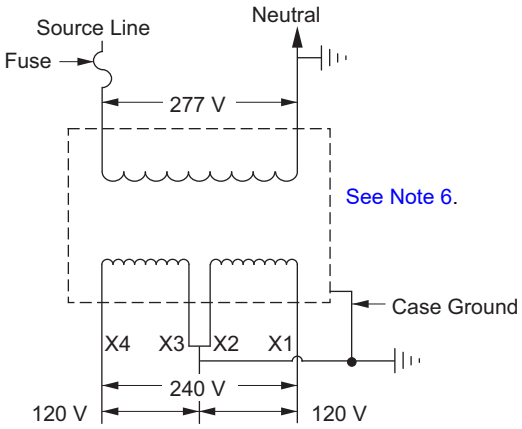


Minimum Clearances:
A = 6"
B = 12"

Transformer Data:
Manufacturer: Acme Electric Corp.
Size: 1 kVA
Voltage: 277 V - 120 x 240
Material Code: 493-00361

Minimum Wire Size for Dry-Type Transformer:
Primary #12 meter code wire
Secondary two #8 TW

Fuse and Fuseholder Data:
Fuseholder: Inline type for #12 meter code wire
Material Code: 567-19404
Fuse: 10 Am
Material Code: 568-01814



See Note 6.

OUTPUT CONNECTIONS			
Volts	Connect	Output Lines	
		1	2
120	X1 TO X3 X2 TO X4	X1	X4
120/240	X2 TO X3	X1 X2	X4
240	X2 TO X3	X1	X4

Note(s):
1. Use dry-type transformer as template for bolt pattern and secure transformers to center panel **ONLY.**
2. Connect dry-type transformer to low-voltage phase and neutral bushing.
3. De-energize primary prior to mounting dry-type transformer on live front transformers.
4. When serving streetlights from a dry transformer a maximum of 2–9,500 lumen or smaller HPSV lights or 1 larger unit, and a maximum voltage drop of 2 percent.
5. Other low wattage systems are limited to 800W (120V x 7.4A x 0.9 PF) including starting current and 2 percent maximum voltage drop on cable.
6. Transformer winding configurations may vary. See manufacturer's transformer schematic for actual winding connections.

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TX 280 6.9 kV BURD – Open-Wye Primary to Open-Delta Secondary

Scope TX 280.1 6.9 kV BURD – Open-Wye Primary to Open-Delta Secondary

1.0 General Information

This transformer bank configuration was intended to serve 120/240V 3-phase, 4-wire service when only 2 primary phases exist on a radial. This installation is no longer approved for new construction.

Before replacing or upgrading any transformer in this configuration, every effort should be made to:

1. Pull in the third-phase and install a three-phase padmount transformer.
2. If option 1 is not technically feasible, pull in the third-phase and convert the bank to an Open-Delta/Open-Delta BURD configuration.
3. If option 2 is not technically feasible, replace the transformers as detailed below.

2.0 Material Information

Each bank will consist of one transformer from Table 280-1 and one transformer from Table 280-2. The transformer in Table 280-2 is a non-standard transformer that has a 2-wire, 240V secondary connection. This design eliminates the potential for grounding the secondary windings in 2 locations. See tables below for material selection.

Table TX 280–1: "Lighter Pot" – SCE Standard Transformer

BURD Transformers Non-Fused, Non-Switched, and Looped (with Standard Secondary Connections)	
kVA	12000GRDY/6930
	SAP Number
25	10103910
50	10104041
75	10104044

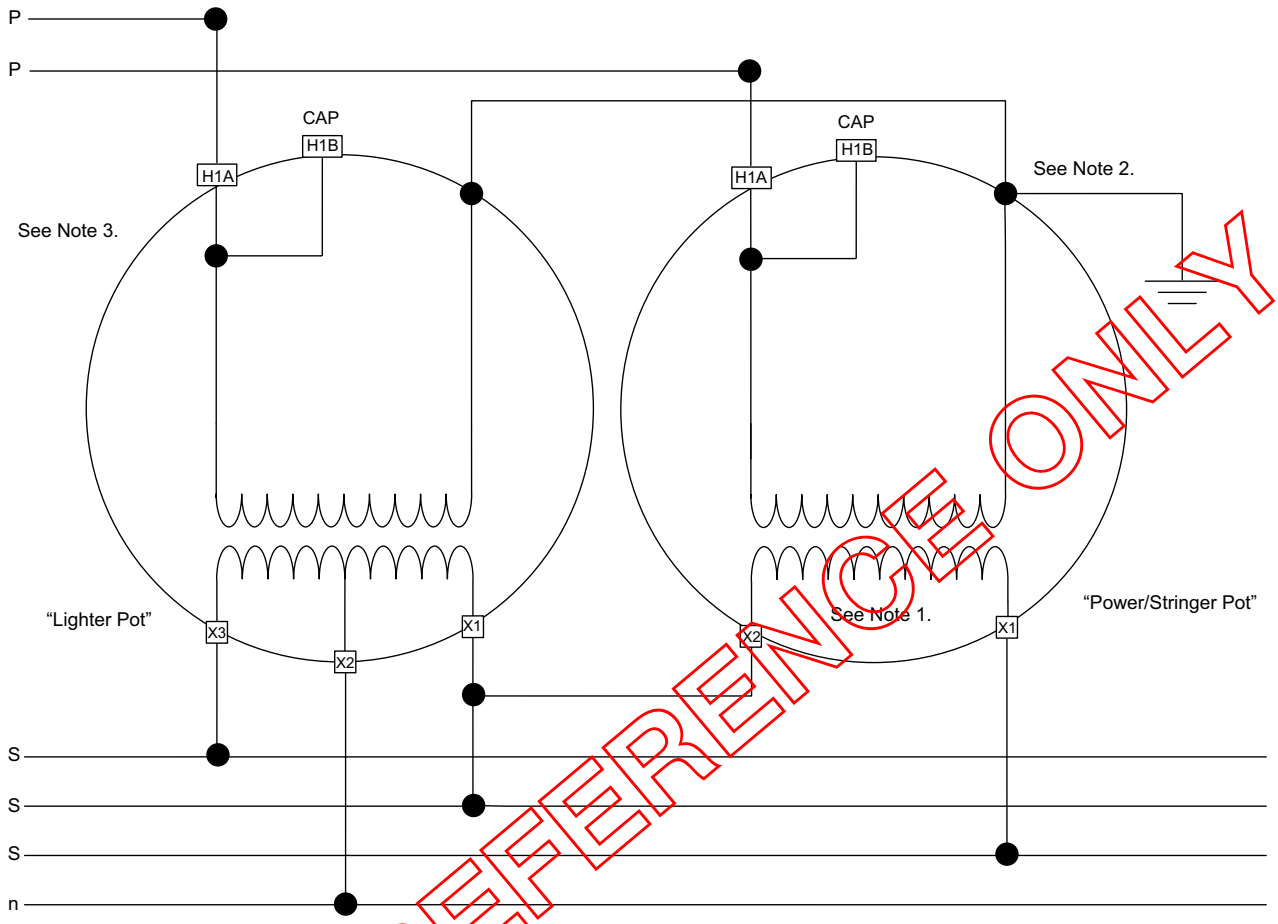
Table TX 280–2: TX 280-2: "Power Pot" – Special Transformer

BURD Transformer Non-Fused, Non-Switched, and Looped (with 2-wire 240V Secondary Connection Only)	
kVA	12000GRDY/6930
	SAP Number
50	10209430

FOR REFERENCE ONLY

3.0 Dimensions and Connections

Figure TX 280–1: 6.9 kV Open-Wye/Open-Delta Wiring Schematic (BURD)



FOR REFERENCE ONLY

Note(s):

1. The "Power/Stinger Pot" has been specifically designed by Apparatus Engineering for this application. The two-wire, 240 V secondary will eliminate the possibility of grounding the secondary in multiple locations.
2. Transformer tanks shall be bonded together and grounded to the structure ground system. Concentric neutrals shall be connected as shown in DUG GR-120.
3. Contact the Distribution Circuit Mapping Group to add "See DUG TX-280 for Replacement" adjacent to the structure to alert field crews and planning that they are dealing with a non-standard bank.

TX 300 Installation Requirements For Dedicated Control Power For Underground Automated Equipment

Scope TX 300.1 Control Power Transformers for Underground Automated Equipment

1.0 General Information

1.1 Control power for underground automated equipment is provided as follows:

A. 25 kVA, 12 kV or 16 kV, Pad-mounted Bay-O-Net fused transformer (Preferred).
See Scope TX 300.2

B. 1 kVA, 12/16 kV, Solid dielectric transformer for submersible applications.
See Scope TX 300.3

C. 25 kVA, 6.9 kV or 9.4 kV, BURD transformer for ferroresonance mitigation.
See Scope TX 300.4

D. 25 kVA, 33 kV, Pad-mounted transformer for 33 kV applications.
See Scope TX 300.5

Scope TX 300.2 25 kVA, 12 kV or 16 kV, Pad-Mounted Bay-O-Net Fused Transformer

1.0 General Information

1.1 Single phase pad-mounted transformer is the preferred control power transformer for automated equipment, and provides 120 V to power the control unit for a remote control switch (RCS), remote control interrupter (RCI), or remote-controlled automatic recloser (RAR).

1.2 The minimum primary cable size is 1/0 stranded CLP.

1.3 The minimum wire size to connect transformer secondary leads is #12 AWG for both black (hot) and white (neutral) insulated wires.

1.4 Bar-type connectors shall be applied to connect the secondary leads that are used.

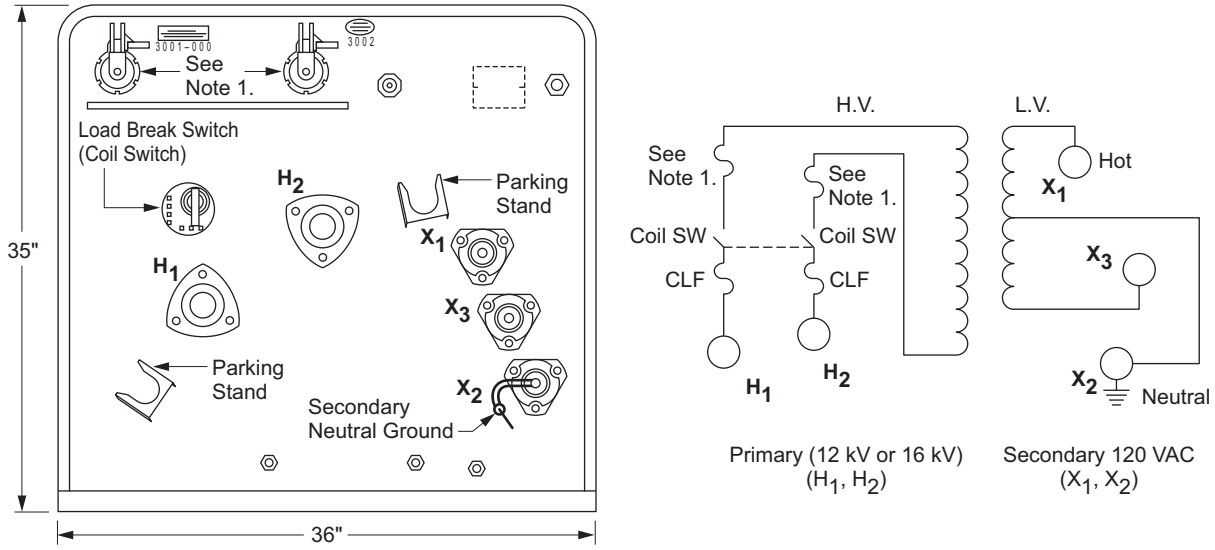
2.0 Material Information

Table TX 300–1: SAP Numbers

Description	SAP Number
12 kV 1Ø Pad-Mounted Transformer, 25 kVA	10103945
16 kV 1Ø Pad-Mounted Transformer, 25 kVA	10103946
6 A Current Sensing Bay-O-Net Fuse Link	10108455

3.0 Dimensions and Connections

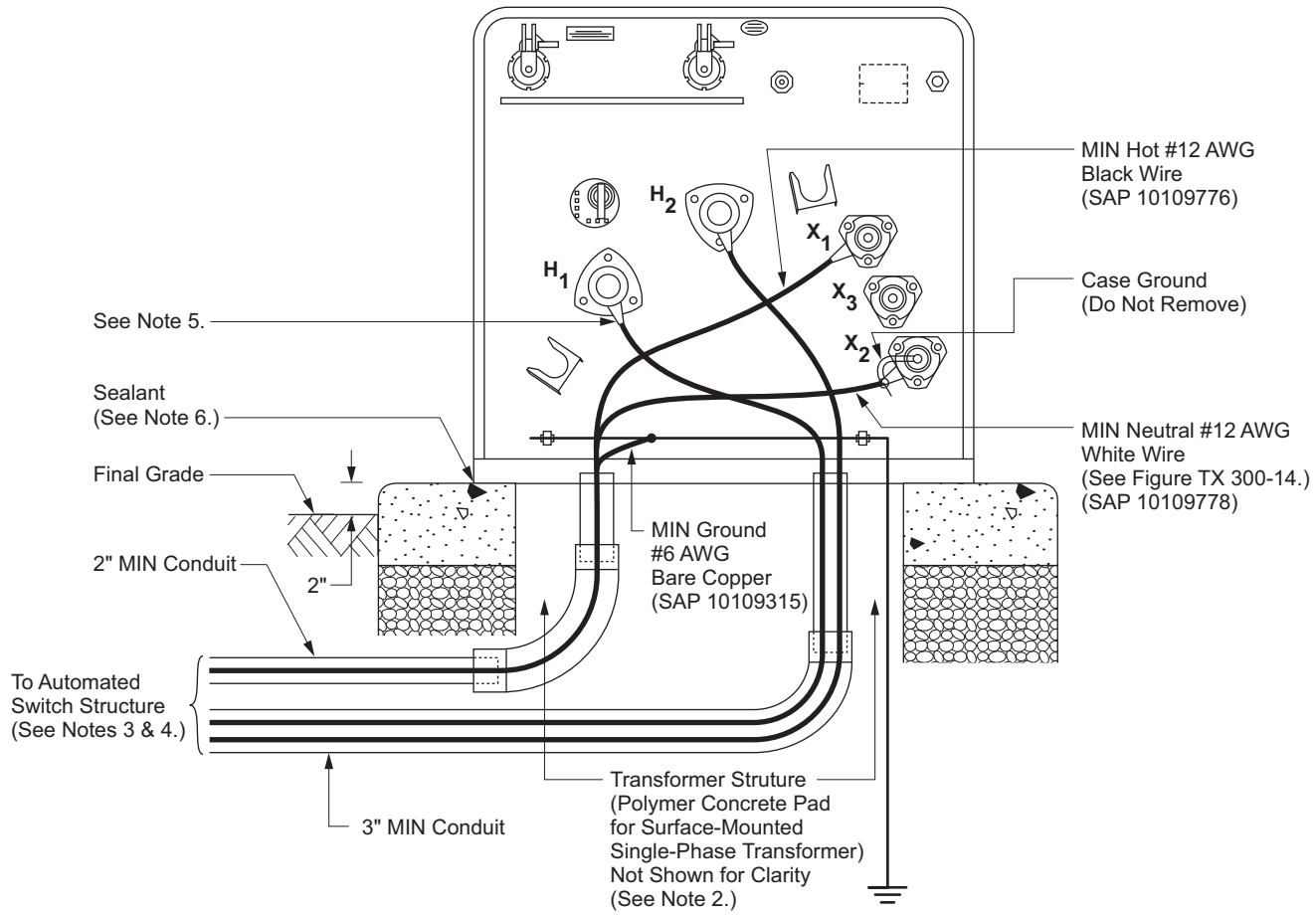
Figure TX 300–1: 12 kV and 16 kV Single Phase Pad-Mounted Transformers and Schematics



12 kV or 16 kV Single Phase Pad-Mounted Transformer
(SAP 10103945 or SAP 10103946)

Note(s):
1. For 25 kVA, 12 kV and 16 kV single phase transformers use 6 A Current Sensing Bay-O-Net Fuse Link (SAP 10108455). Refer to DOM TE-3.
2. The 16 kV transformer has a tap-changer that should not be used.

Figure TX 300–2: Connection Diagram to Provide Control Power by Using a Dedicated 1Ø Pad-Mounted Transformer



Note(s):

1. For installation of grounding materials, see GR 110.
2. For Polymer Concrete Pad for Surface-Mounted Single Phase Transformer refer to UGS SS 506.
3. Conduits between dedicated pad-mounted transformer and other pad-mounted equipment shall be installed per UGS CD 120.
4. The dedicated pad-mounted transformer shall be installed on the Line (Source) of automated switch position.
5. For pad-mounted transformer primary load-break elbows and installation see TP 150 and TP 161.
6. Gaps between concrete slabs or pads and pad-mounted equipment shall be sealed to prevent a person from passing a wire or other conducting material into the compartment with exposed live parts. See General Order 128, Section 34.3. This will also prevent tampering, reduce moisture entry, and deter rodent/vermin nesting inside the equipment. Use sealant (SAP 10061306) and caulking gun (SAP 10144789).
7. Install Electrical Safety Sign (SAP 10135323) on dedicated pad-mounted transformer and at source position. Sign reads, "VOLTAGE SOURCE FEEDS RCS - MAKE RCS NO._____ CONTROL LOCAL & NON-AUTO BEFORE DE-ENERGIZING."
8. Maintain a minimum clearance of 8 feet on door side of the pad-mounted transformer and a minimum of 3 feet clearance on all non-door sides of the pad-mounted transformer.

Figure TX 300–3: Secondary 120 VAC Neutral and Grounding Connection at Pad-Mounted Transformer (X2)

Note(s):

1. For bar type connector and installation on pad-mounted transformer see JJ 125 and TP 115.
2. Crimp #12 AWG black wire and #12 AWG white wire using Hylinks (SAP 10110726) before installing in Bar-Type Connector to prevent an incorrect connection.
3. Terminate #12 AWG stranded black wire (HOT), #12 AWG white wire (NEUTRAL) and #6 AWG bare copper (GROUND) from secondary pad-mounted transformer (X1 and X2 terminals) inside PAD.

Scope TX 300.3 1 kVA, 12/16 kV, Solid Dielectric Transformer for Submersible Applications

1.0 General Information

1.1 The ABB VIL-12S 16,340/12,000-120 V (S#923A317G03) solid-dielectric control transformer is a submersible design that can provide 120 V to power the control unit for an underground remote control switch (RCS), remote control interrupter (RCI), or remote-controlled automatic recloser (RAR).

A. The ABB transformer primary termination comes equipped with two bushing wells with bale tabs for installation of deadbreak bushings and elbows.

B. The ABB transformer has a three-wire, tapped secondary to provide 120 V for either 12,000 V or 16,340 V primary input, and rated for 1 kVA.

1.2 The first version of the ABB VIL-12S solid dielectric control transformer was rated at 16430/12000-120 V (S# 923A317G01, See Figure TX-6). The secondary connection wire colors are also different (See Figure TX-7). This older version is acceptable for use, but is no longer supplied by the manufacturer.

1.3 The minimum primary cable size is 1/0 stranded CLP.

1.4 The minimum wire size to connect transformer secondary leads is #12 AWG for both black (hot) and white (neutral) insulated wires.

1.5 DO NOT cut the unused secondary lead. Seal, tape, and roll to prevent water intrusion through the unused lead.

1.6 Submersible connector bars should be applied to connect the secondary leads that are used.

1.7 A Scott Engineering ES-287 stainless steel mounting frame/bracket should be mounted to the structure wall for the ABB control power transformer to be placed off of the floor and above the water line. The transformer should also be installed on the equipment side of the structure when possible, and the mounting frame/bracket is to be grounded. Do not mount the ABB control power transformer directly to the wall of a structure.

1.8 The dedicated submersible transformer shall be installed on the line (source) side of the automated switch position.

2.0 Material Information

For ABB control power transformer installations, use the following material numbers:

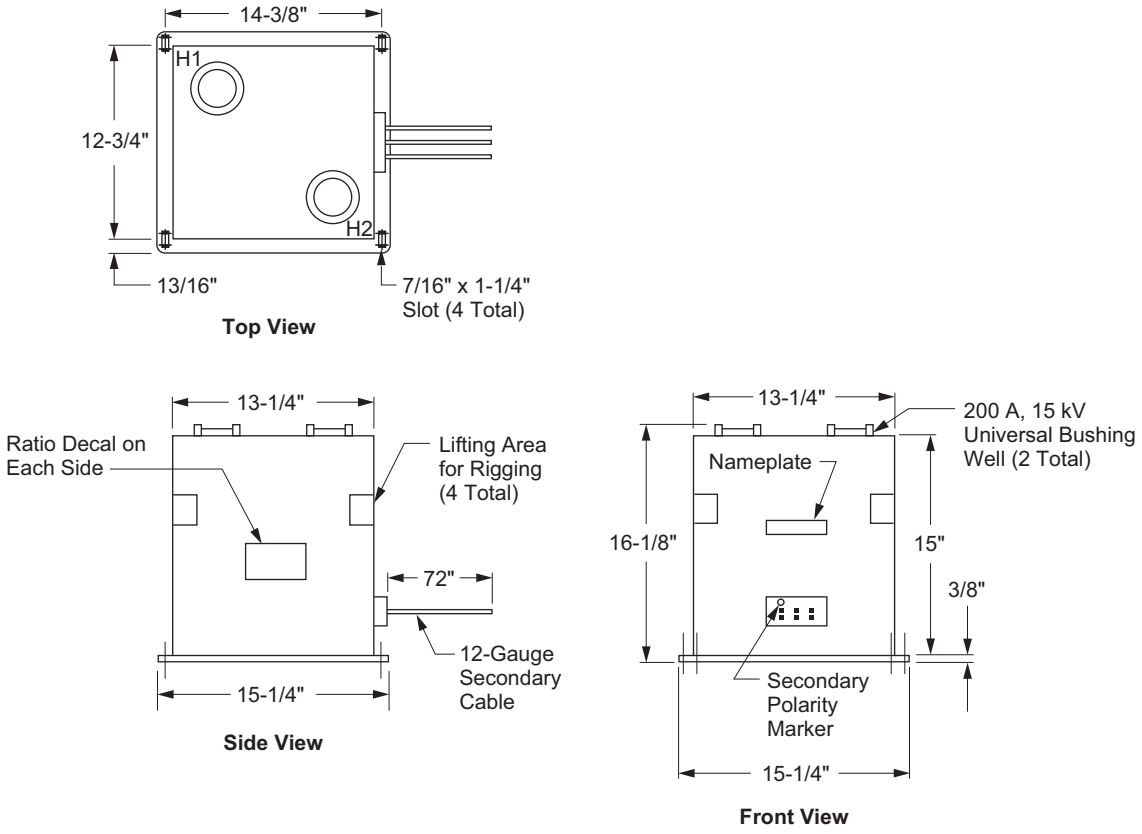
Table TX 300–2: SAP Numbers

Description	SAP Number
Control Power Transformer	10105053
Mounting Frame for Control Transformer (es-287)	10104924
Low-Profile Mounting Frame for Control Transformer (es-294)[1/]	10104932

[1/] For use in slab box installations

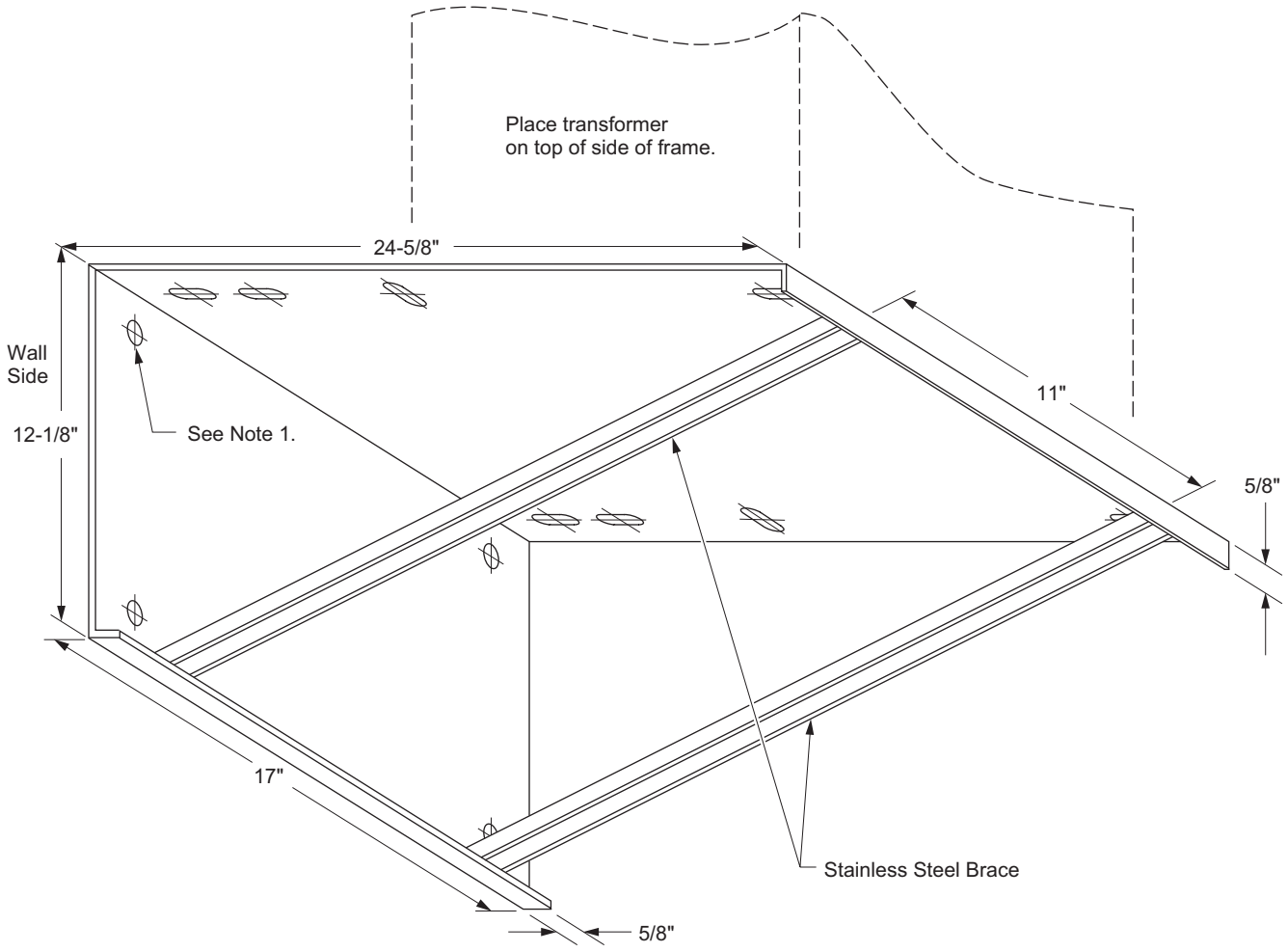
3.0 Dimensions and Connections

Figure TX 300–4: ABB VIL-12S Control Power Transformer



Note(s):
1. All dimensions are in inches.
2. This transformer is designed for vertical mounting only.
3. Approximate weight is 195 lbs. Lift by sling only at lifting areas (4).

Figure TX 300–5: Scott Engineering ES-287 Stainless Steel Mounting Frame

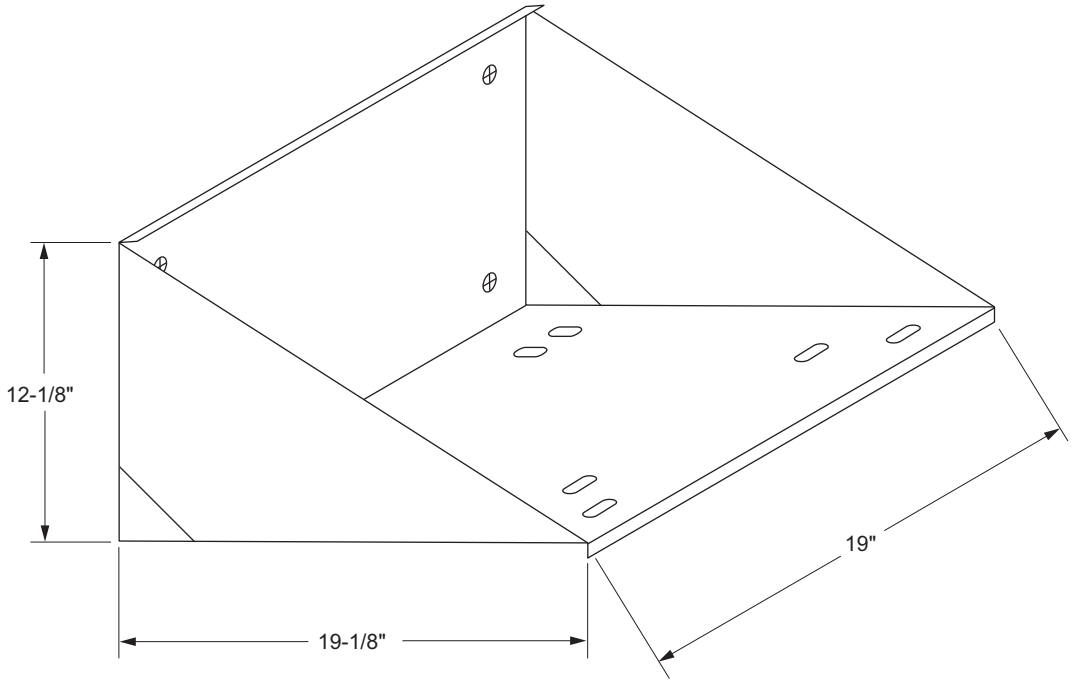


Bottom View

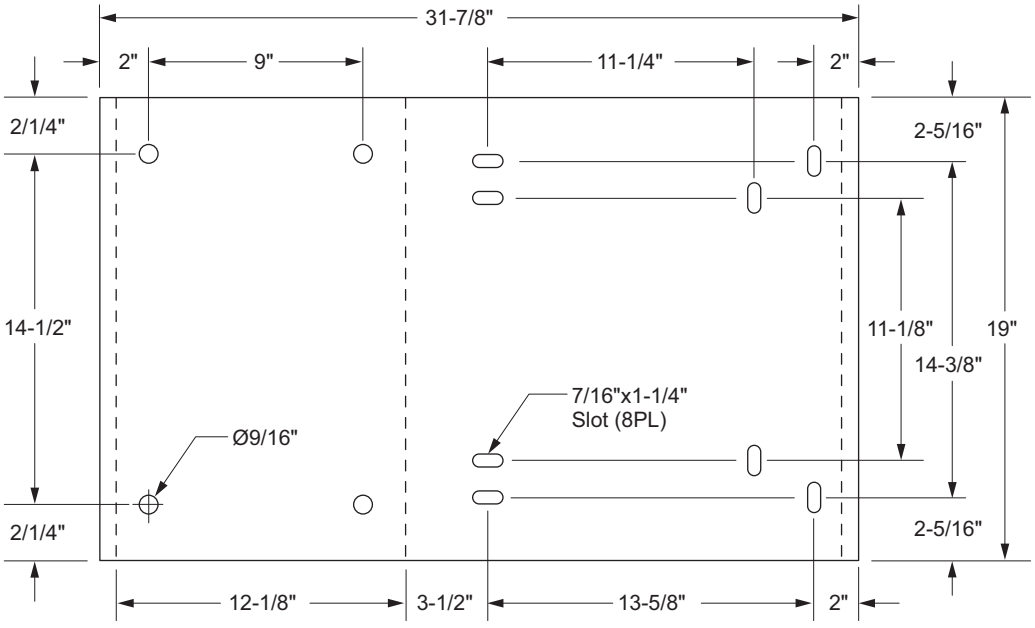
Note(s):

1. Use four (4) 1/2" x 5-1/4" anchor bolts (SAP 10072180) to attach to structure wall.

Figure TX 300–6: Scott Engineering ES-294 Low-Profile Stainless Steel Mounting Frame



Side View



Dimension Detail

Note(s):
1. Use four (4) 1/2" x 5-1/4" anchor bolts (SAP 10072180) to attach to structure wall.

Figure TX 300–7: Typical Control Power Transformer on Mounting Frame in Tub Vault below PME

Figure TX 300–8: Nameplate for ABB VIL-12S 16340/12000-120 V Control Power Transformer (S# 923A317G03)

Figure TX 300–9: Secondary Connections for ABB VIL-12S 16340/12000-120 V Control Power Transformer (S# 923A317G03)

Figure TX 300–10: Nameplate for ABB VIL-12S 16430/12000-120 V Control Power Transformer (S# 923A317G01)

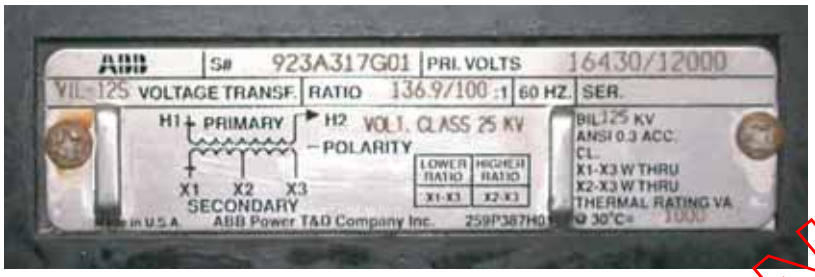
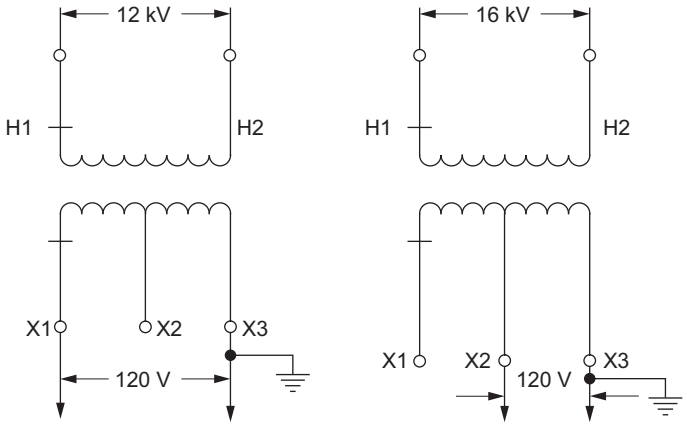


Figure TX 300–11: Secondary Connections for ABB VIL-12S 16430/12000-120 V Control Power Transformer (S# 923A317G01)

FOR REFERENCE ONLY

Figure TX 300–12: 12 kV/16 kV Primary/Secondary Connections



To RCS or RAR Controller **To RCS or RAR Controller**

Scope TX 300.4 25 kVA, 6.9 kV or 9.4 kV, BURD Transformer for Ferroresonance Mitigation

1.0 General Information

1.1 25 kVA BURD transformers are to be used for submersible installations that present a ferroresonance condition.

1.2 The minimum primary cable size is 1/0 stranded CLP.

1.3 The minimum wire size to connect transformer secondary leads is #12 AWG for both black (hot) and white (neutral) insulated wires.

1.4 Submersible connector bars should be applied to connect the secondary leads that are used.

1.5 The dedicated BURD transformer shall be installed on the line (source) side of the automated switch position

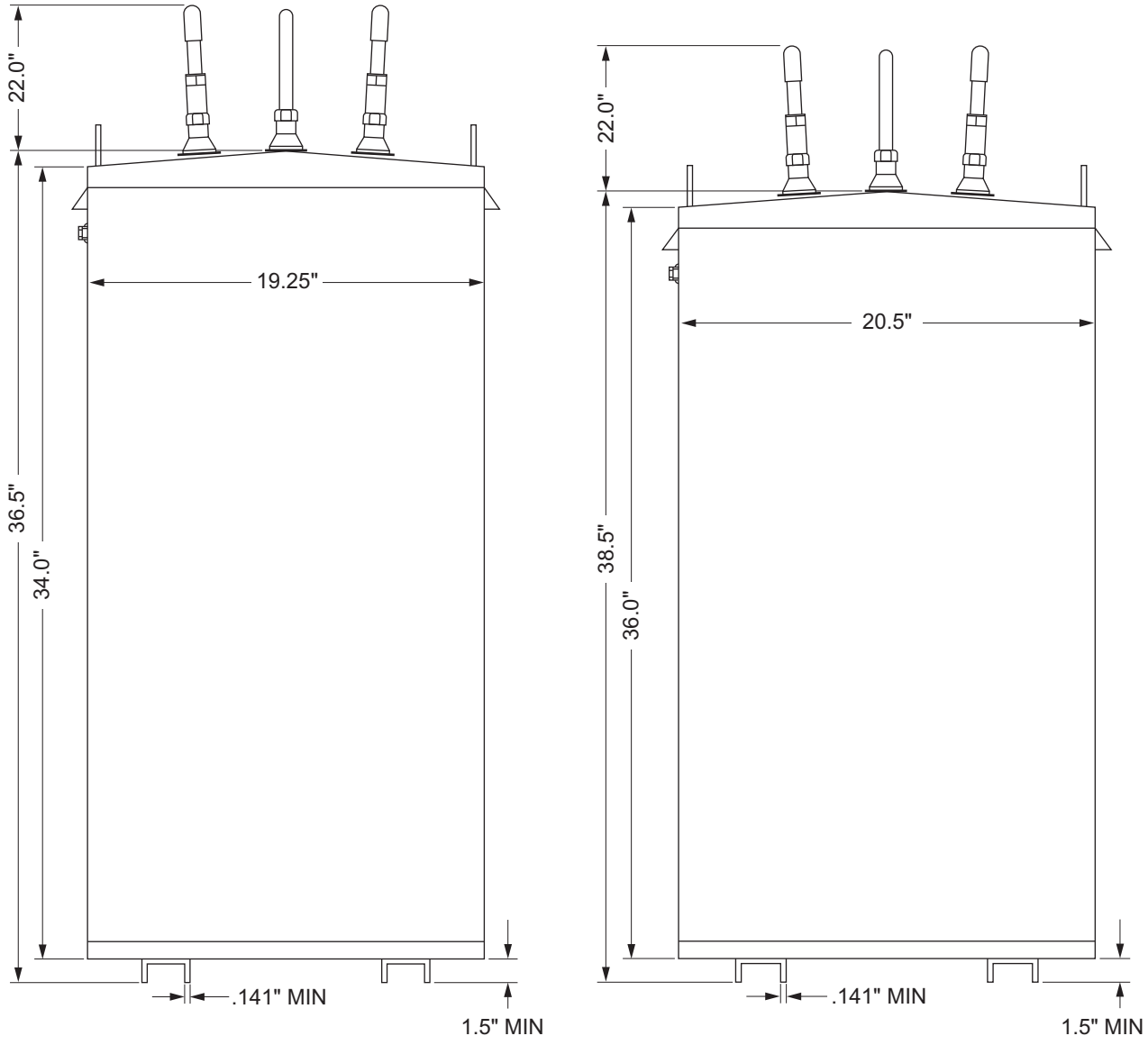
2.0 Material Information

Table TX 300–3: SAP Numbers

Description	SAP Number
25 kVA, 6.9 kV/120 V, Fused/Switched BURD	10103917
25 kVA, 9.4 kV/120 V, Fused/Switched, BURD	10103918

3.0 Dimensions and Connections

Figure TX 300–13: Transformer Details

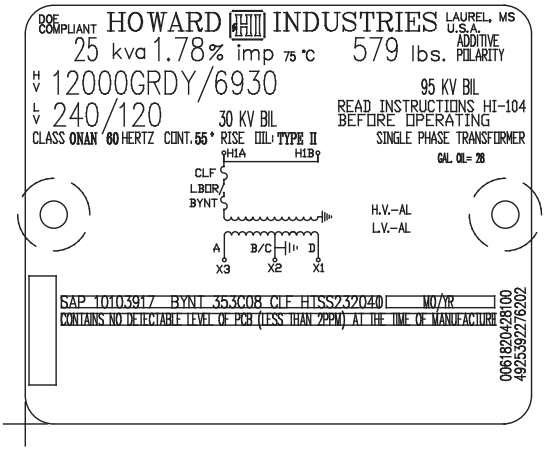


SAP 10103917
6.9 kv

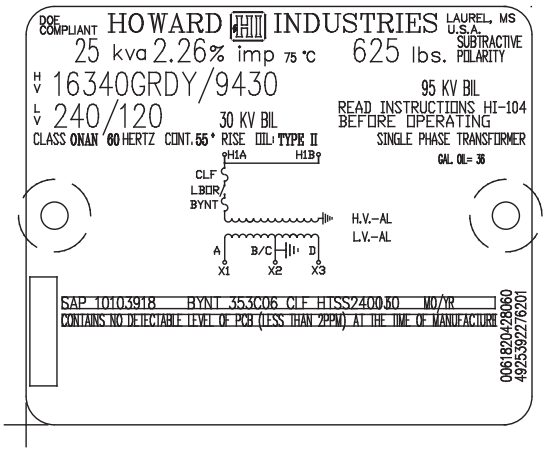
SAP 10103918
9.4 kv

Note(s):
1. All dimensions are in inches.
2. Approximate weight of SAP 10103917 is 579 lbs.
3. Approximate weight of SAP 10103918 is 625 lbs.

Figure TX 300–14: Nameplates



SAP 10103917
6.9 kv



SAP 10103918
9.4 kv

Scope TX 300.5 25 kVA, 33 kV, Pad-Mounted Transformer for 33 kV Applications

1.0 General Information

1.1 The single-phase 33 kV pad-mounted transformer is used to provide dedicated control power for automated equipment – remote control switch (RCS), remote control interrupter (RCI), or remote-controlled automatic recloser (RAR) – on the 33 kV system.

1.2 The minimum primary cable size is 4/0 stranded CLP.

1.3 The minimum wire size to connect transformer secondary leads is #8 AWG for both black (hot) and white (neutral) insulated wires.

1.4 Secondary leads shall be connected to the load side of the fuse block.

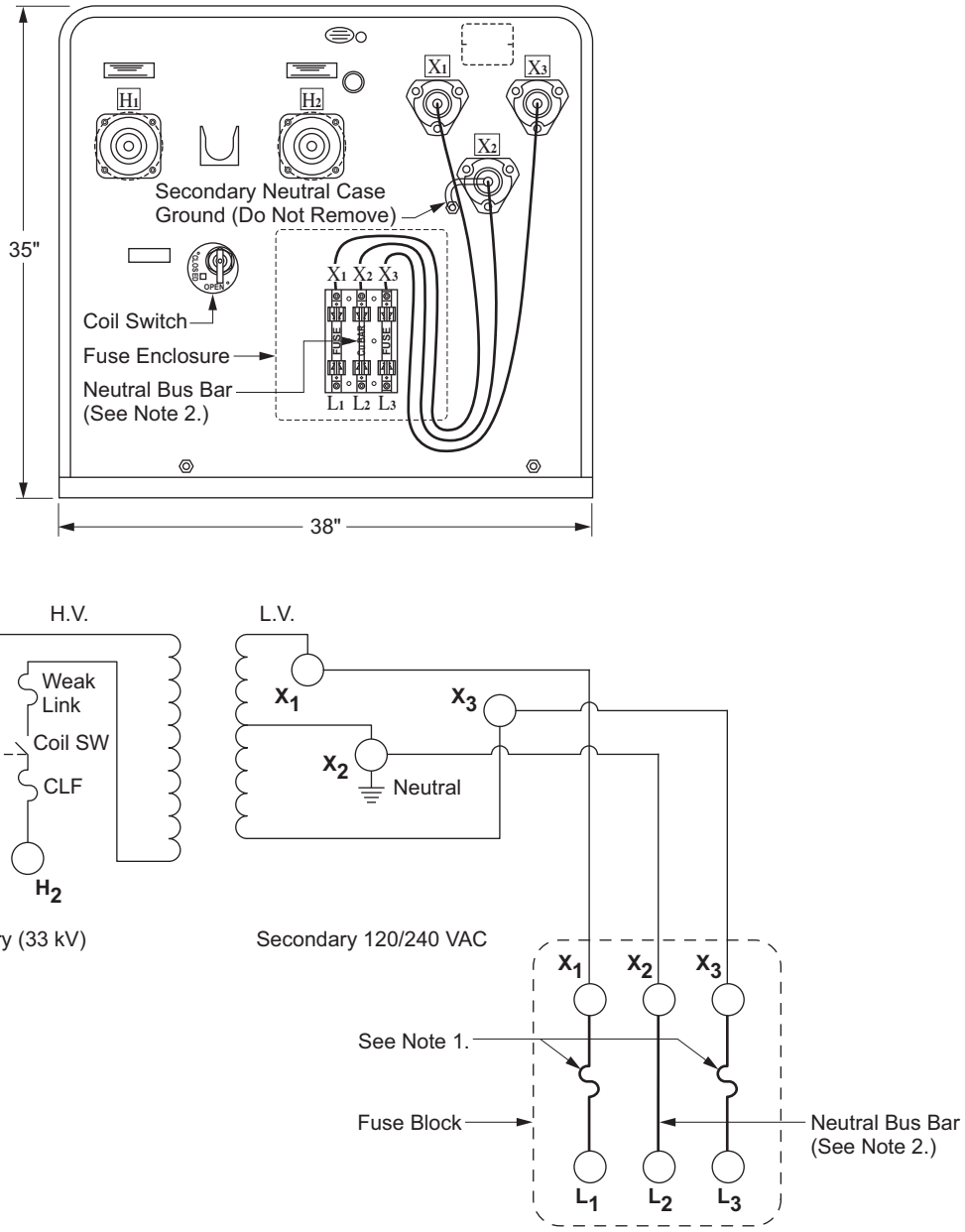
2.0 Material Information

Table TX 300–4: SAP Numbers

Description	SAP Number
Dedicated 33 kV, 1 Ø, Pad-Mounted Transformer	10215152
100 A AJT100 Class J Fuse	10177634

3.0 Dimensions and Connections

Figure TX 300–15: 33 kV Single Phase Pad-Mounted Transformer and Schematic

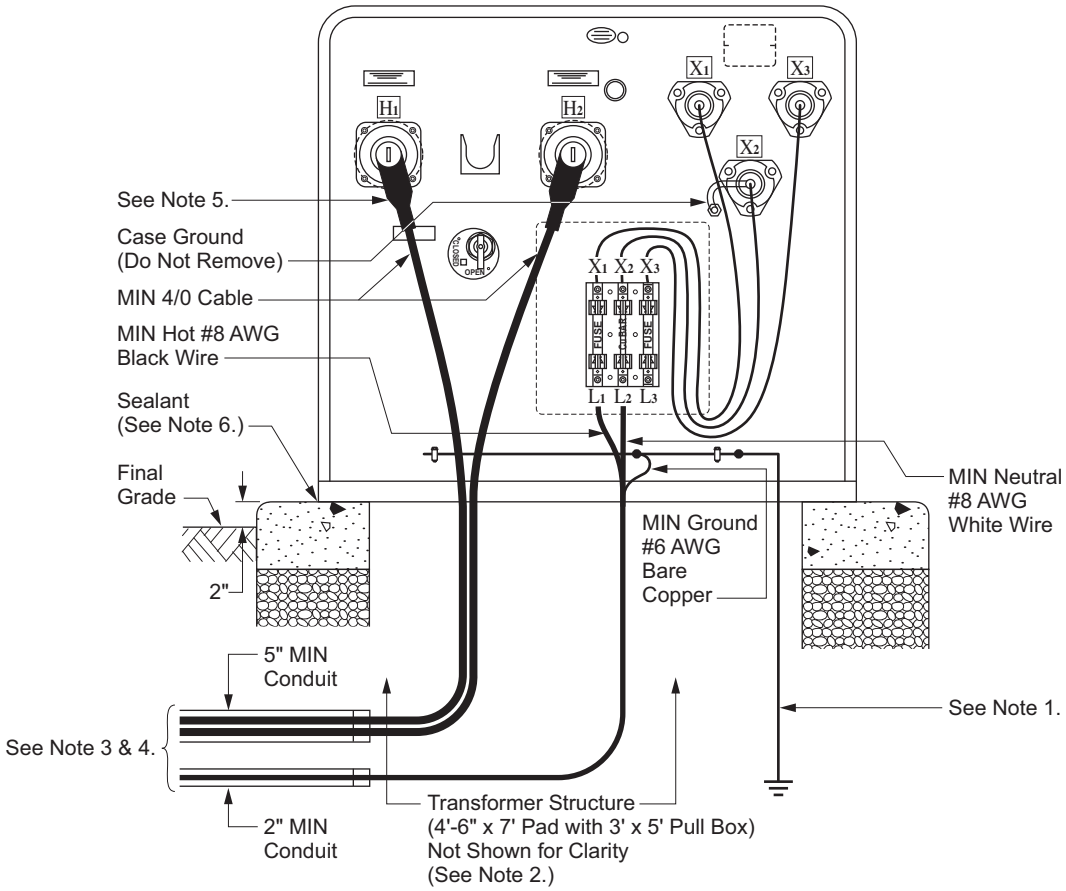


33 kV Single Phase Pad-Mounted Transformer
(SAP 10215152)

Note(s):

1. For 33 kV, single phase 25 kVA transformers (SAP 10215152), use two (2) 100 A AJT100 Class J fuses (SAP 10177634).
2. Do not remove neutral bus bar from fuse block.

Figure TX 300–16: Connection Diagram to Provide Control Power for Underground Automated Equipment



Note(s):

1. For installation of grounding materials and methods, see DUG GR 110.
2. For Precast Concrete 4'-6" x 7' slab with 3' x 5' pull box (SAP 10117565), refer to UGS SS 500, Table SS 500-1 and UGS SS 536.
3. Conduits between dedicated pad-mounted transformer and other pad-mounted equipment shall be installed per UGS CD 120.
4. The dedicated pad-mounted transformer shall be installed on the line (source) side of an automated position.
5. For pad-mounted transformer primary 600-amp elbow installations, see JJ 661.
6. Gaps between concrete slabs or pads and pad-mounted equipment shall be sealed to prevent a person from passing a wire or other conducting material into the compartment with exposed live parts. See General Order 128, Section 34.3. This will also prevent tampering, reduce moisture entry, and deter rodent/vermin nesting inside the equipment. Use sealant (SAP 10061306) and caulking gun (SAP 10144789).
7. Install Electrical Safety Sign (SAP 10136323) on dedicated pad-mounted transformer and at source position. Sign reads: "VOLTAGE SOURCE FEEDS RCS - MAKE RCS NO._____ CONTROL LOCAL & NON-AUTO BEFORE DE-ENERGIZING."
8. Maintain a minimum clearance of 8 feet on door side of the pad-mounted transformer and a minimum of 3 feet clearance on all non-door sides of the pad-mounted transformer.

TX 301P Installation Procedure to Provide Control Power for Underground Automated Equipment

Scope TX 301P.1 Elastimold Control Power Transformer (Phase-to-Ground Installation) Pilot

1.0 General Information

1.1 The Elastimold 6930/9430-120V solid dielectric control power transformer is a submersible design that can provide 120 V power to an underground remote-control switch (RCS), remote-control interrupter (RCI), remote-controlled automatic recloser (RAR), or universal remote-control interrupter (URCI).

A. The primary of the Elastimold transformer is equipped with a universal bushing well that accepts a load break insert for a load-break connection.

B. The Elastimold transformer has a tapped secondary to provide 120 V for either 6930 V or 9430 V primary input, and rated for 750 VA.

1.2 The minimum wire size to connect transformer secondary leads is #12 AWG.

1.3 Primary neutral must be connected to the base plate using #2 AWG stranded copper minimum

1.4 The control cable from the PT includes four conductors. Two conductors will be used for 120 V power. Two conductors will be sealed and insulated. Do not use green (ground) conductor. Seal and insulate the end of the wire.

1.5 Use vinyl (33) tape to insulate the unused secondary leads.

1.6 For below grade installations, use either 3M Aqua Seal or a Raycam Gel Wrap to seal the unused conductor and jacket to prevent water intrusion.

1.7 Submersible connectors (SAP 10121501) should be applied to each used secondary lead to allow for a secure connection to the control cable. These connectors directly accept conductors ranging from 14 AWG to 1/0. The PT leads are 16 AWG; therefore, 16-14 AWG compression splices (SAP 10111369) are required. Insert the 16 AWG wire from the PT into the correct end of the compression splice. Then insert the 14 AWG end of the compression splice into the submersible connector and tighten until a secure connection is achieved (see Figure TX 301P-5).

1.8 A Scott Engineering ES-294 stainless steel mounting frame/bracket, See Figure TX 300-6) should be mounted to the structure wall for the Elastimold control power transformer to be placed off of the floor and above the water line. The transformer should also installed on the equipment side of the structure when possible, and the mounting frame/bracket is to be grounded.

1.9 The dedicated submersible transformer shall be installed on the line (source) side of the automated switch position.

PILOT

2.0 Material Information

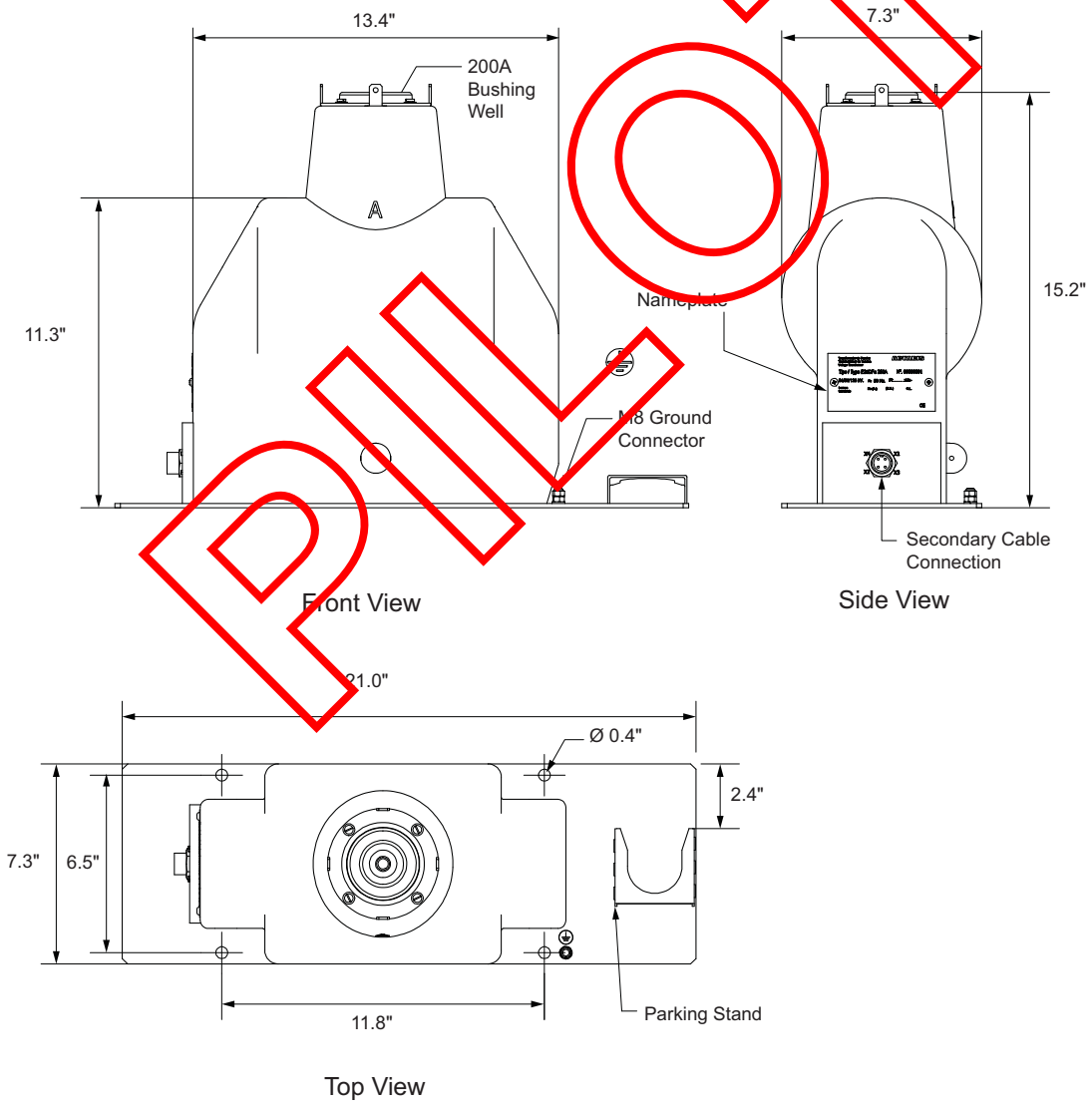
For Elastimold control power transformer installations, use the following material numbers:

Table TX 301P–1: Material Numbers

Description	SAP Number
Elastimold Control Power Transformer	10183531
Low-Profile Mounting Frame for Control Transformer (ES-294)	10104932
3-Way Submersible Connector	10181501
16-14 AWG Compression Splice	10111369

3.0 Dimensions and Connections

Figure TX 301P–1: Elastimold Control Power Transformer



PILOT

Figure TX 301P–2: Elastimold Control Power Transformer Nameplate

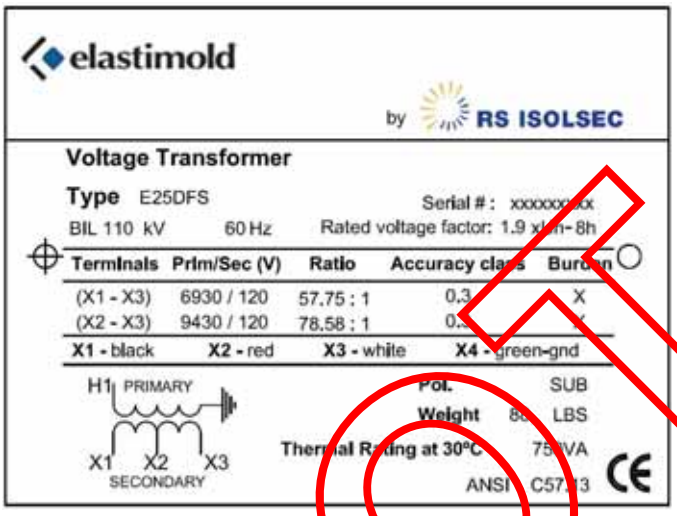
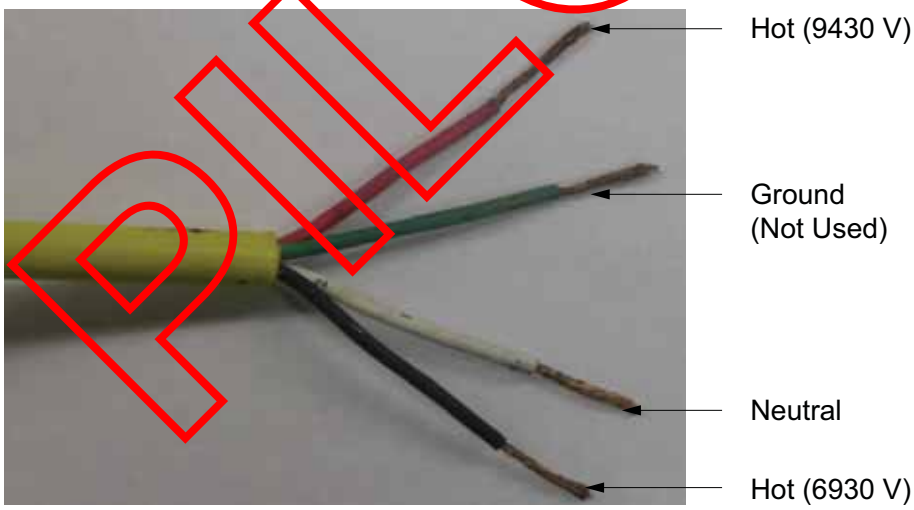
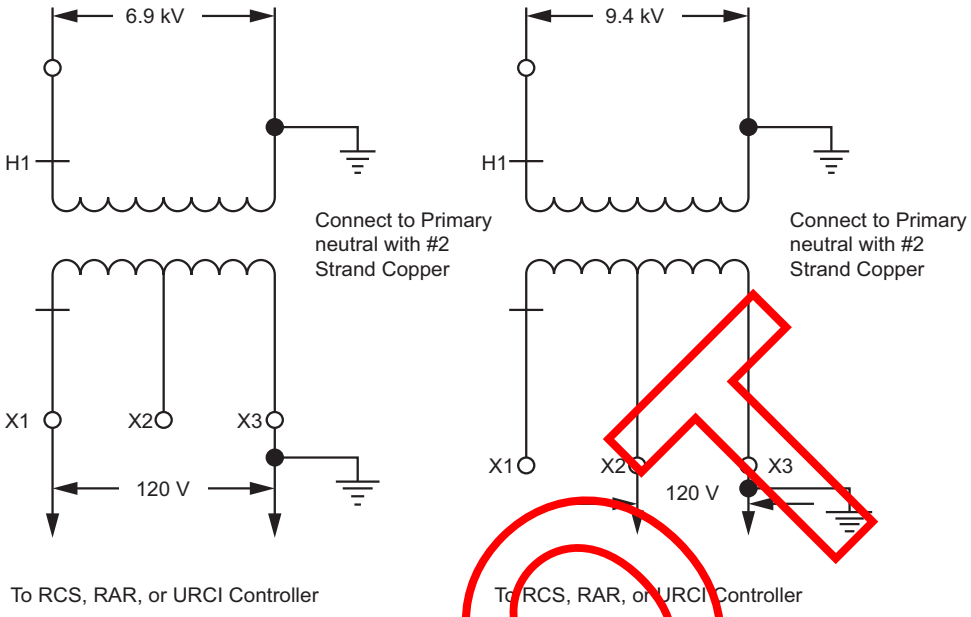


Figure TX 301P–3: Secondary Control Cable Leads



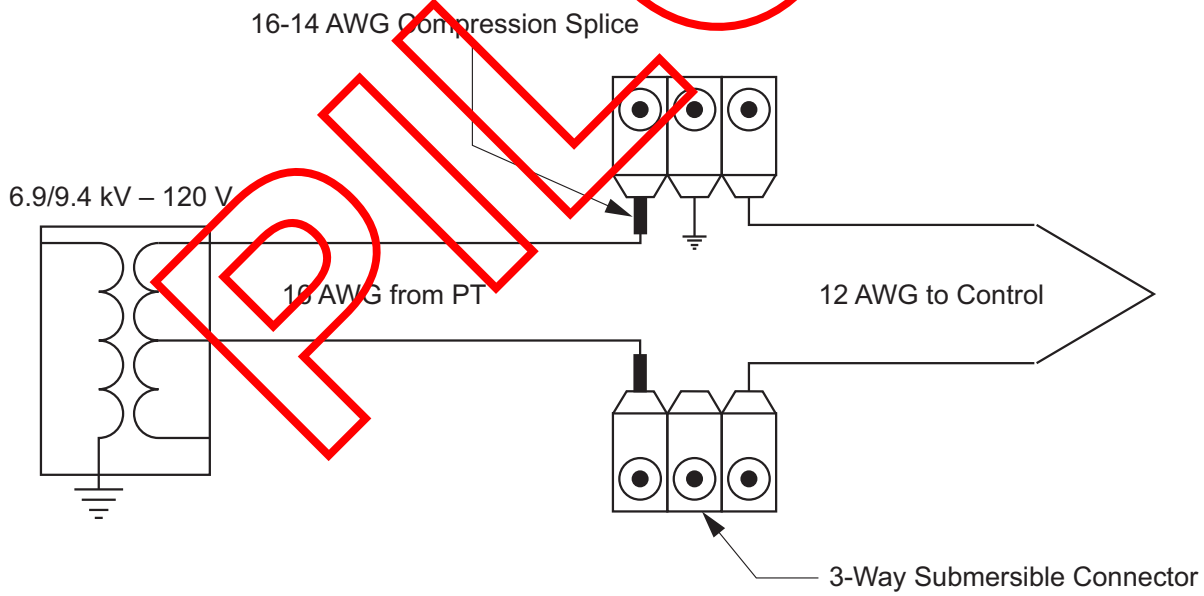
PILOT

Figure TX 301P–4: 6.9 kV/9.4 kV Primary Secondary Connections



PILOT

Figure TX 301P–5: General Wiring Diagram



Note(s):
1. See General Information, Section 1.7 for more detail.

TX 400 Clearances and Dimensions for 12/16 kV Three-Phase Subway Transformers

Scope TX 400.1 12/16 kV Three-Phase Subway Transformers Clearances and Dimensions

1.0 General Information

1.1 This standard provides the clearances and dimensions for 12/16 kV three-phase subway transformer located inside a customer-owned transformer room.

2.0 Clearances for 12/16 kV Three-Phase Subway Transformers

2.1 A minimum clearance of 3 feet shall be maintained on the back and sides of the subway transformer. A minimum of 8 feet shall be maintained in front of the transformer in order for the crews to manually operate the transformer safely.

Table TX 400–1: Typical Dimensions for 12/16 kV Three-Phase Subway Transformers

kVA	12/16 kV			
	Height (in)	Width (in)	Depth (in)	Weight (lb)
500	84	72	44	6,000
750	84	72	44	8,000
1,000	84	72	44	10,000

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TX 500P Transformer Monitors

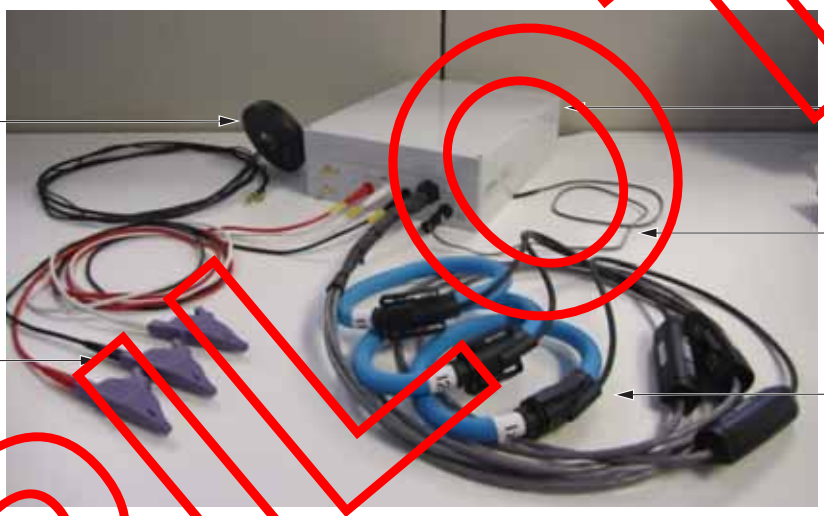
Scope TX 500P.1 Transformer Monitors with External Antenna

1.0 General Information

1.1 The National Renewable Energy Laboratory (NREL) has developed a line of Distribution Monitoring Units (DMU) for monitoring voltage, current, and calculated parameters on the secondaries of pad-mounted transformers. The DMUs employ clip on connectors for power and voltage sensing. The DMUs use clip Rogowski (CT) coils to measure current. A hockey-puck type combined cellular and GPS antenna is provided which is mounted in a 5/8 inch hole drilled in the top of the air box of the pad-mounted transformer. The device streams data to an NREL server via the cell modem automatically.

The Pilot has been approved to be installed only in the Foothill, San Joaquin, and Antelope Valley Districts.

Figure TX 500P–1: Transformer Monitor with External Antenna



PILOT

Note(s):
1. The DMU pictured is for a single phase pad mounted transformer. A three phase unit has one additional voltage clip. Each item is labeled for proper connection.

2.0 Installation

The case is a white watertight plastic enclosure with exterior dimensions of 9¼" x 11¾" x 3½". It is intended to mount or sit inside the transformer case with its long side vertically oriented and the front panel facing up. The front panel of the box contains all of the necessary connection points for the antenna, current sensors (CT coils), and voltage alligator clamps.

NOTE

The temperature sensor connection will not be used during this project.

2.1 Both the cellular and GPS antennae are contained within the Laird Technologies GPST821/18503P tri-band antenna. This antenna is a hockey puck shaped device with a diameter of 4 inches and a height of 1-3/4 inches. Mounting of the antenna requires a 5/8 inch hole drilled into the top of the padmount airbox for the antenna to face skyward. See Figure TX-500P-2.

A. For single phase transformers drill a 5/8 inch hole on the roof section of the door approximately 4 inches from the back edge and 15 inches from the right edge, so the hole is aligned between the secondary and primary terminations. Install the rubber gasket based antenna and bolt into place using the supplied nut and washer, See Figure TX-500P-3. Route the antennae cable along the transformer wall between the primary and secondary area.

B. For three-phase transformers drill a 5/8 inch hole 4 inches from the right edge of the airbox and 4 inches from the front of the padmount door. Install the rubber gasket based antenna and bolt into place using the supplied nut and washer, See Figure TX-500P-3.

Figure TX 500P–2: Three-Phase Mounting

Figure TX-500P-3: Antenna Mounting Detail

PILOT

2.2 For single phase transformers, the DMU shall be placed on the pad within the air box adjacent to the secondary cables. Crews may use plastic tie wraps to secure DMU from movement within the airbox. The DMU should be mounted with the DMU connections facing up.

2.3 For three phase padmount transformers, the DMU shall be installed within the secondary compartment side wall using the large 2 inch magnets provided. The DMU may mount on either side of secondary cable compartment to maximize clearances and working space. Use the small magnetic cable attachments to securely route antennae and connection leads to the DMU location.

2.4 Connecting the DMU Leads

Once the DMU and leads are securely in-place with magnets, install the cable leads into the top of the DMU:

Potential (phase) leads connection points on the top of the DMU are clearly marked and color-coded to aid with installation.

Figure TX 500P–4: DMU Connection Points

The potential (phase) leads are colored coded and marked “BROWN-A, ORANGE-B, YELLOW-C, and the Neutral lead is coded “White”. These connections use plug-in type terminals and are easily installed or removed from the DMU.

PILOT

The following steps should be used to connect the antenna leads and all other cabling leads to the DMU:

- First, connect the GPS/cell leads to the DMU at the appropriate connection points indicated on the DMU. Tighten connector(s) snug, but do not over tighten as the base connector may twist.
- Second, install the single plug-in connection for the flexible blue-colored CT's harness into the DMU. This connector must be aligned with a female slot opening found in the DMU connector. Once aligned, push connector down into the DMU and tighten plastic hold down nut until snug. Do not over-tighten plastic hold-down nut.
- Next, insert the potential (phase) leads onto the DMU unit to match the color-coded phase markings. These leads are push-in style male connections which seat inside a female connector. Insert each lead and push down until base of male connector is completely seated into the female connector.

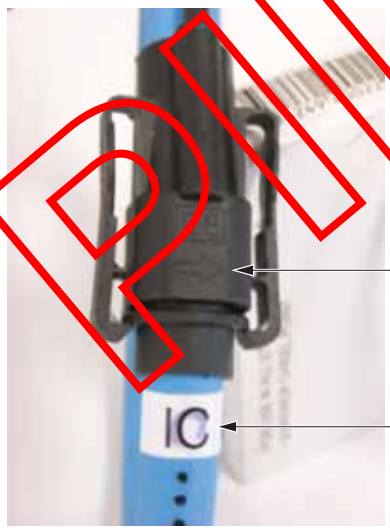
The following steps should be used for installing the current coils and potential (phase) leads onto the distribution transformer:

IMPORTANT:

- The current coil and potential lead phase identifications must match each other when installed and connected to the padmount transformer.

  For example, VA (Brown) potential lead and the current coil marked "A", must be connected to the same secondary bus phase.
- In addition, the small arrow found on the black colored portion of the CT coil must point in the direction of load when the CT is installed.

Figure TX 500P–5: CT Coil Installation Details



PILOT

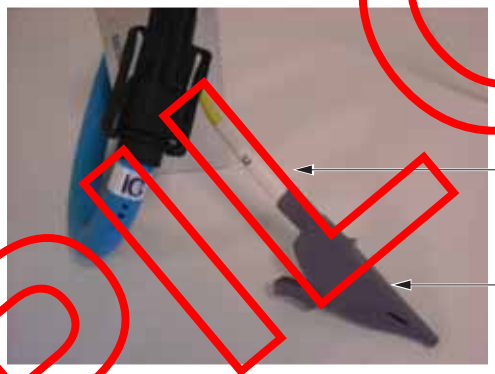
Place flexible CT coils around secondary cables or secondary bus bars. **Arrows identified on CT coils must point in the direction of the customer's load:**

- Open flexible CT coil and place around cables or secondary bus terminal. Flexible CT is limited to 4 inch inside clearance once closed. Insert male end of coil into female end and snap together until completely enclosed. Continue installation on all three phases. Note the placement of CT coil phase markings and the potential (A, B, C) leads must be connected to match CT phases.

Installation of potential (phase) leads onto the distribution transformer: The potential (phase) leads consists of flexible 600 V instrumentation cable; similar to SCE's cable used on apparatus test equipment. The cable connector consists of an alligator style spring held connector. Each connector is phase marked (A, B, C) and has the leads color-coded to reflect the connections made at the top of the DMU. The Neutral lead is white and does not contain a color coded reference.

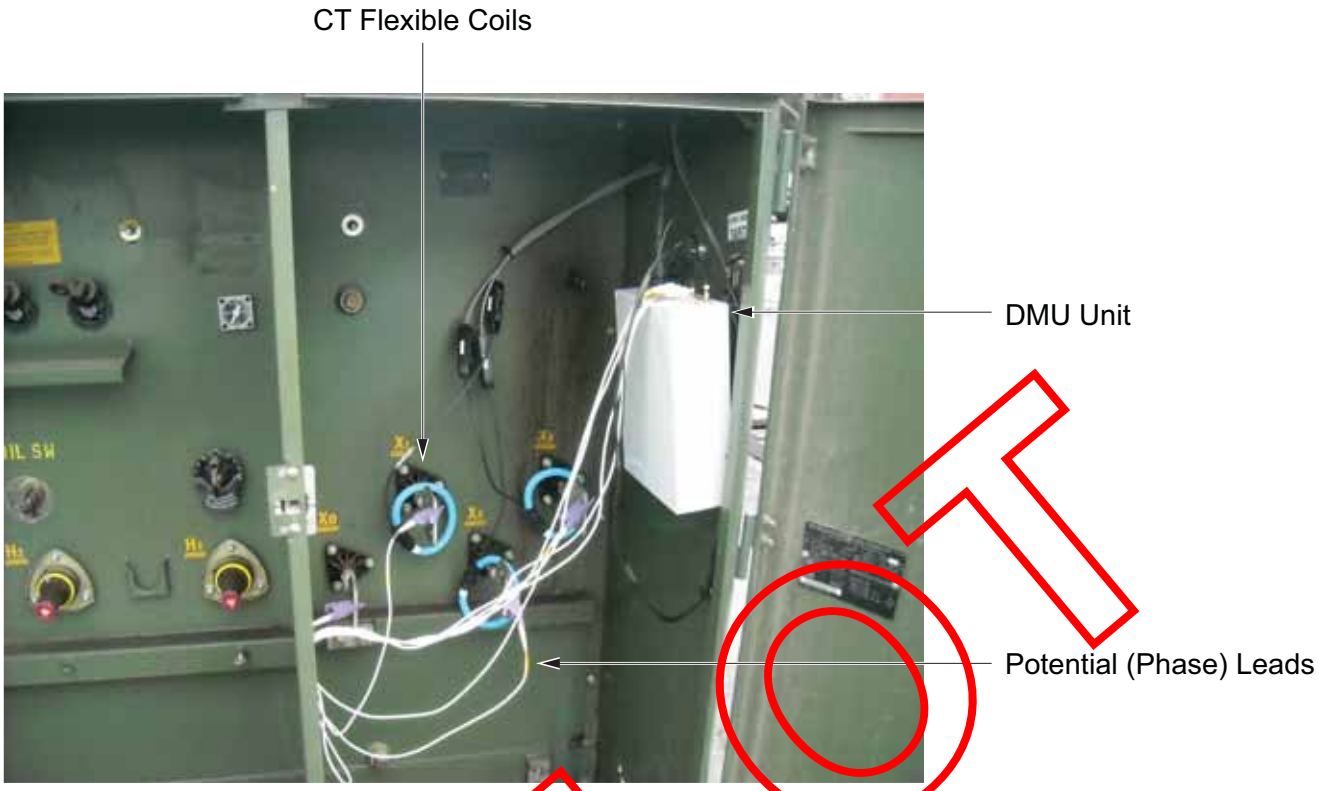
- Connect the neutral lead (white) from the DMU unit onto the neutral secondary bus termination at the padmount transformer. Clip the alligator style connector to an exposed hy-lug mounting bolt if possible to gain a secure firm connection.
- Connect the potential (phase) leads to the remaining secondary terminations to match the phases indicated on the CT coils. Clip the alligator style connector to an exposed hy-lug mounting bolt if possible to gain a firm secure connection.

Properly secure or re-route all cable leads as required to ensure proper closing of padmount compartment door without damaging or pinching cables.



PILOT

Figure TX 500P–6: NREL Three-phase Installation Example (without secondaries)



PILOT

3.0 Operations

When properly installed and energized, the NREL DMU metering device will automatically start and begin streaming data to NREL without further actions or monitoring by SCE. The organization sponsoring the installation (Advanced Technology) should provide support for the installation and verify proper operation with NREL.

An SCE contact name and number shall be placed with each installed DMU unit for questions by field crews. Temporary pilot decals shall be placed on the transformer enclosure to notify Troubleman or Field crews of DMU installation. SCE contact person is responsible to keep track of DMU units deployed in the field, and their status.

4.0 Removal

The DMU may be removed whenever necessary to work on the transformer or at the completion of the project for which it was installed.

4.1 Remove the voltage clamps from the secondary bus

4.2 Remove the CT coils from the secondary leads

4.3 Remove the DMU itself.

4.4 The antenna hole should be sealed with a 3/8 inch x 1 inch carriage bolt, nut and two 3/8 inch stainless steel washers as shown below in Figure TX 500P–7.

NOTE

This type of hardware is similar to the hardware provided by the transformer manufacturer installed on the padmount transformer.

4.5 Each DMU unit installed will be provided with the necessary hardware for installation when the antenna is removed.

4.6 4.6 Contact Advanced Technology or sponsoring organization if DMU is not reinstalled on transformer during a transformer replacement.

SCE Program Manager: Russ Neal (714) 895-0300 or Russell.Neal@sce.com

4.7 All permanently removed DMU units shall be returned to Advanced Technology. DMU units are not to be discarded in event of removal.

PILOT

Figure TX 500P–7: NREL DMU Antenna Hole Seal

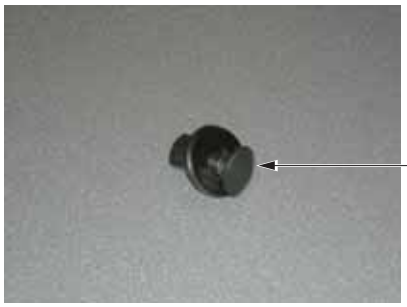


Figure TX 500P–8: NREL DMU Antenna Hole Seal Installation Example

PILOT

Underground Capacitors
Table of Contents

Standard	Title
UC 100	Padmount Capacitors for Solidly Grounded 4-Wire Systems
UC 100.1	Padmount Capacitors (Scott Engineering, Inc.)
UC 100.2	Dead Front Padmount Capacitors (Scott Engineering, Inc.)
UC 110	Current Limiting Fuses for Padmount Capacitors (Solidly Grounded 4-Wire Systems)
UC 110.1	Current Limiting Fuses for Padmount Capacitors (Solidly Grounded 4-Wire Systems)
UC 120	Padmount Capacitors for 3- or 4-Wire Systems
UC 120.1	Padmount Capacitors for 3- or 4-Wire Systems
UC 120.2	Padmount Capacitors for 3- or 4-Wire Systems
UC 125	SMU-20 Fuse for Ungrounded Capacitor Banks — 3-Wire or 4-Wire Systems
UC 125.1	SMU-20 Fuses for Ungrounded Capacitor Banks

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UC 100 Padmount Capacitors for Solidly Grounded 4-Wire Systems

Scope UC 100.1 Padmount Capacitors (Scott Engineering, Inc.)

Figure UC 100–1: Padmount Capacitors (Scott Engineering, Inc.)

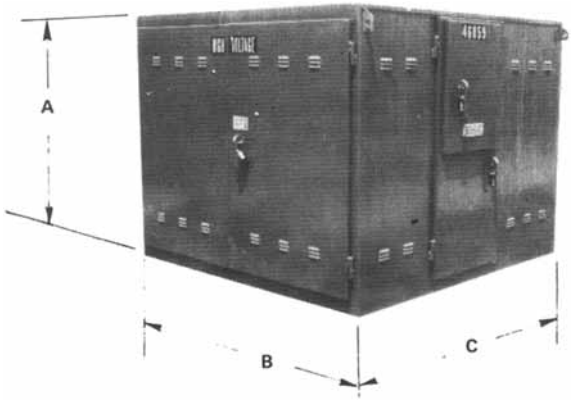


Figure UC 100–1.1: Live Front

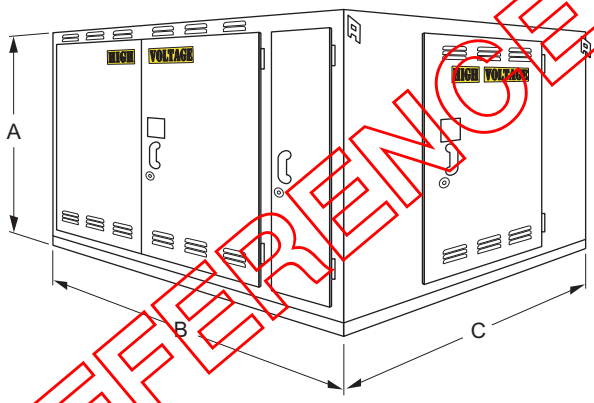


Figure UC 100–1.2: Dead Front

Table UC 100–1: Scott Engineering Pad-Mounted Capacitor Data

kvar Size	Bank Design	12 kV or 16 kV Dimensions			Approx. Weight (lb)
		A (in)	B (in)	C (in)	
900	Live Front	60	72	72	2,300
	Dead Front	60	96	70	2,200
1,200	Live Front	60	72	72	2,400
	Dead Front	60	96	70	2,350
1,800	Live Front	60	72	72	2,800
	Dead Front	60	96	70	2,875

FOR REFERENCE ONLY

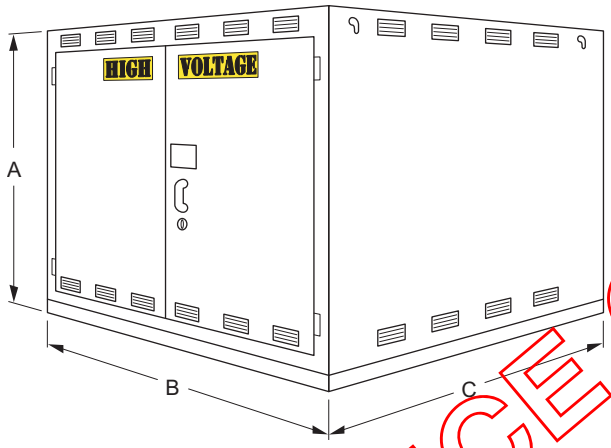


Figure UC 100–1.3

FOR REFERENCE ONLY

Table UC 100–2: Scott Engineering Pad-Mounted Capacitor Material Codes

kvar Size	12 kV or 16 kV Dimensions			Material Codes		Approx. Weight (lb)
	A (in)	B (in)	C (in)	12 kV	16 kV	
900	62	71	60	492-71xxx	492-71208	2,000
1,200	62	71	60	492-71xxx	492-71216	2,200
1,800	62	71	60	492-71xxx	492-71224	2,700

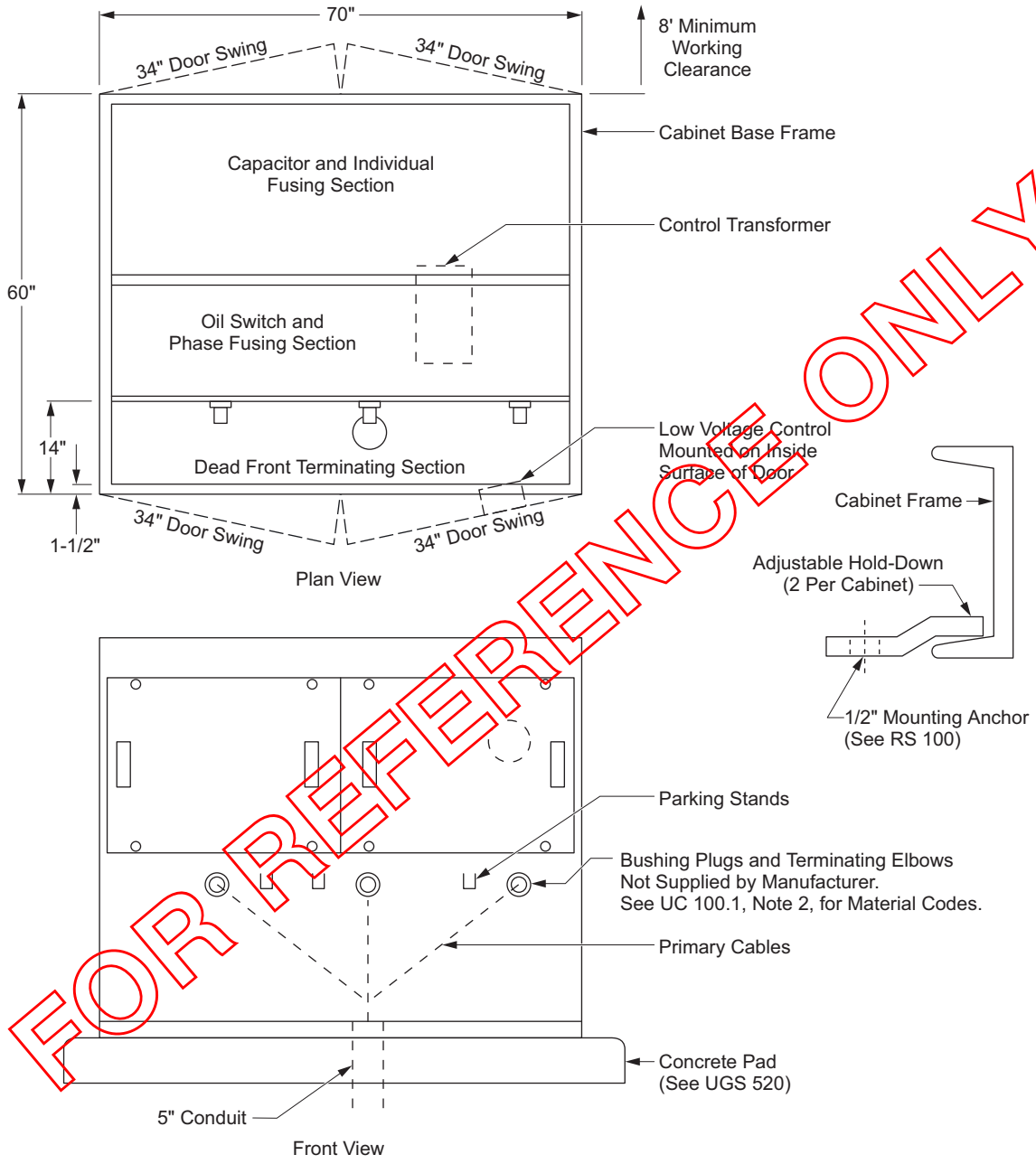
Note(s):
Padmount capacitor banks are supplied complete with capacitors, capacitor oil switches, control transformer, and fusing.
Additional Material Required:

1. Capacitor Cable (M/C 493-02003 thermal) or (493-02508 electronic).
2. Cable Terminals, 3 Primary Elbows (#2-220 mil, 656-33000) or (1/0-220 mil, 056-33307) and 3 Bushing Plugs (M/C 656-14505).
3. See DOM Section 90.1, .2 for operation and refusing information.
4. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon–Fri 7 a.m.–4 p.m. Available after hours/weekends upon request.

See Figure UC 100–2 (Sheet 3) for Layout Data.
See UC 110 for Engineering Data.
See UGS SS 520 for Capacitor Mounting Pad.
See PD 500 for Installation and Testing of Capacitor Ground Fault Relay (CGFR). Installation of the CGFR relay is optional.

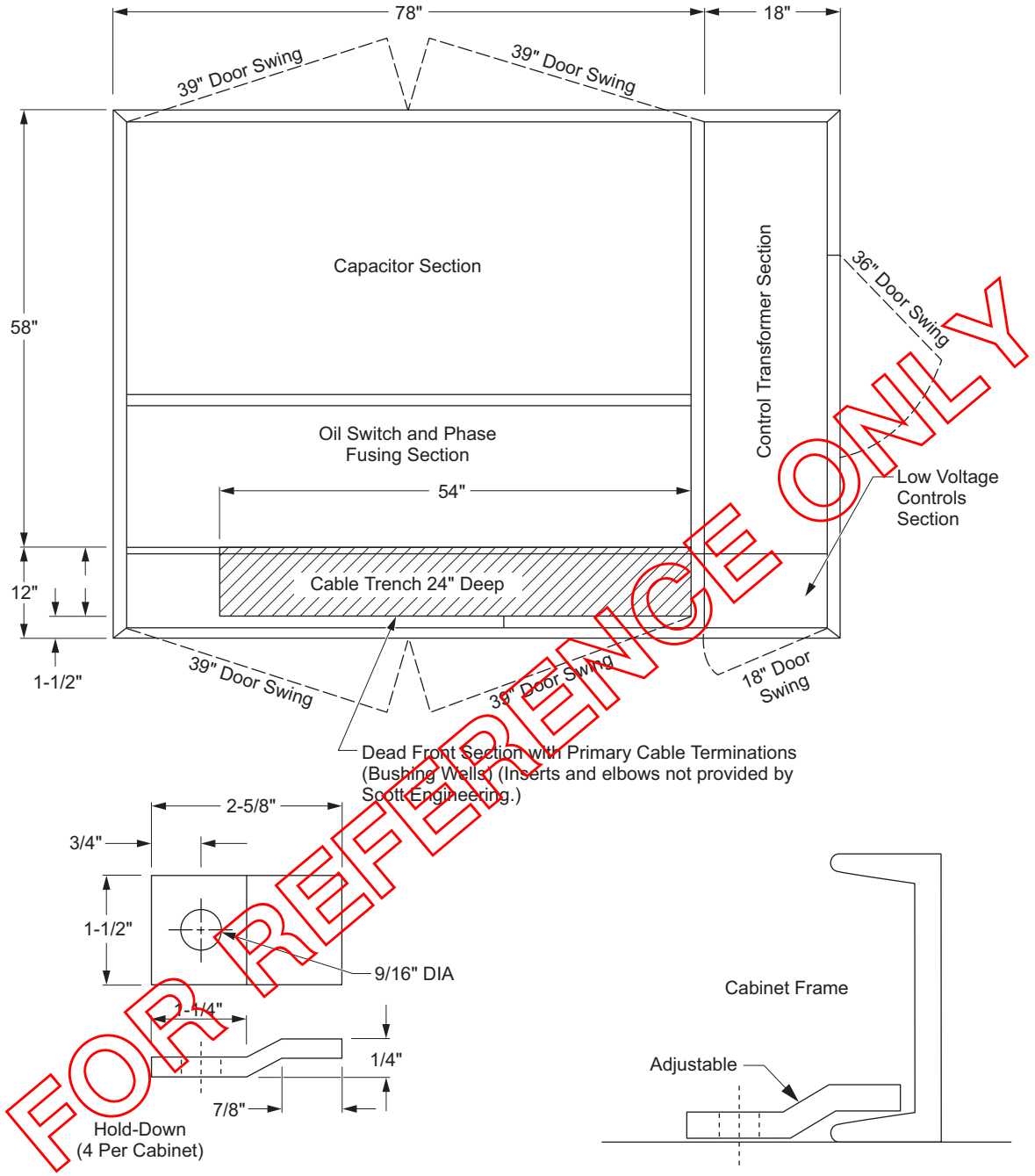
Scope UC 100.2 Dead Front Padmount Capacitors (Scott Engineering, Inc.)

Figure UC 100–2: Dead Front Padmount Capacitors (Scott Engineering, Inc.)



FOR REFERENCE ONLY

Figure UC 100–2.1



FOR REFERENCE ONLY

Figure UC 100–2.2

UC 110 Current Limiting Fuses for Padmount Capacitors (Solidly Grounded 4-Wire Systems)

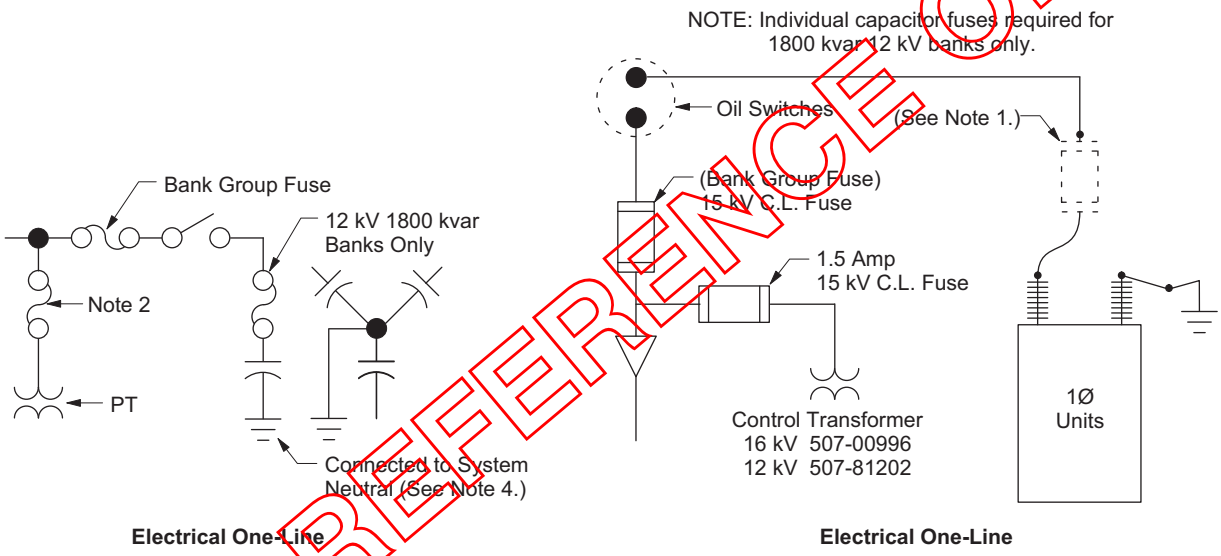
Scope UC 110.1 Current Limiting Fuses for Padmount Capacitors (Solidly Grounded 4-Wire Systems)

Table UC 110–1: Current Limiting Fuses for Padmount Capacitors

Bank Size kvar	12 kV Capacitor Fusing			16 kV Capacitor Fusing		
	900	1,200	1,800	900	1,200	1,800
Bank Group Fuse Size/Ø	2–25	2–40	100	40	2–25	2–40
Individual Fuse Size/Cap. Unit			See Note 1			

Fuse Size	Material Code
1.5A	570-34605
25A	570-33003
40A	570-33300
50A	570-34803
65A*	570-34613

Figure UC 110–1: Current Limiting Fuses for Padmount Capacitors — Solidly Grounded 4-Wire Systems



FOR REFERENCE ONLY

CAUTION

1. These banks are designed for use in solidly grounded 4-wire systems. Consult Field Engineering regarding these applications.
2. See PD 500 for installation and Testing of Capacitor Ground Fault Relay (CGFR).

Note(s):

1. 1,800 kvar 12 kV banks with type “NX” bank fusing require an individual fuse* for each capacitor unit as follows:

Bank Design	Capacitor Unit	Fuse Size/Unit
a. a. Dead Front, 1981-Feb. 1983	300 kvar 1Ø	65*
b. b. Dead Front, 1978. 1981	200 kvar 1Ø	40
c. c. Live Front, Before 1978	300 kvar 3Ø	50

2. Use 1.5A, 15.5 kV fuses with control transformer.
3. 50-, 65-, and 100-A, 15.5 kV fuses are designed for use with 12 kV banks only.
4. Padmount capacitors fed from pole risers should be connected to the system neutral per Std. No. CR 140.
5. Type “NX” fuses with adapters may be used in place of type “Q” fuses. Three adapters are provided with each new bank and extend the “NX” fuse length to fit the “Q” fuse mounting.
6. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon–Fri 7 a.m.–4 p.m. Available after hours/weekends upon request.

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UC 120 Padmount Capacitors for 3- or 4-Wire Systems

Scope UC 120.1 Padmount Capacitors for 3- or 4-Wire Systems

Figure UC 120–1: Padmount Capacitors for 3- or 4-Wire Systems

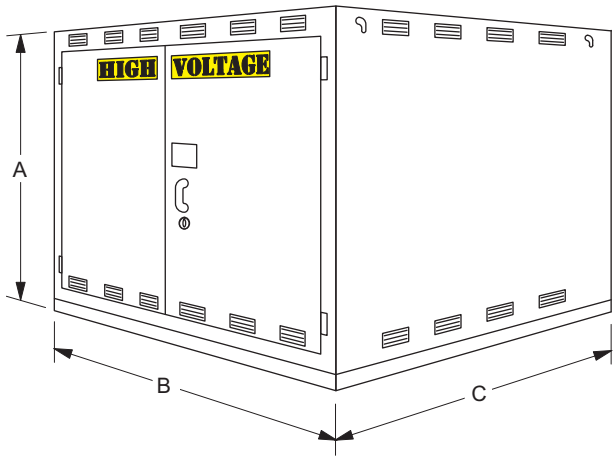


Table UC 120–1: Padmount Capacitors for 3- or 4-Wire Systems

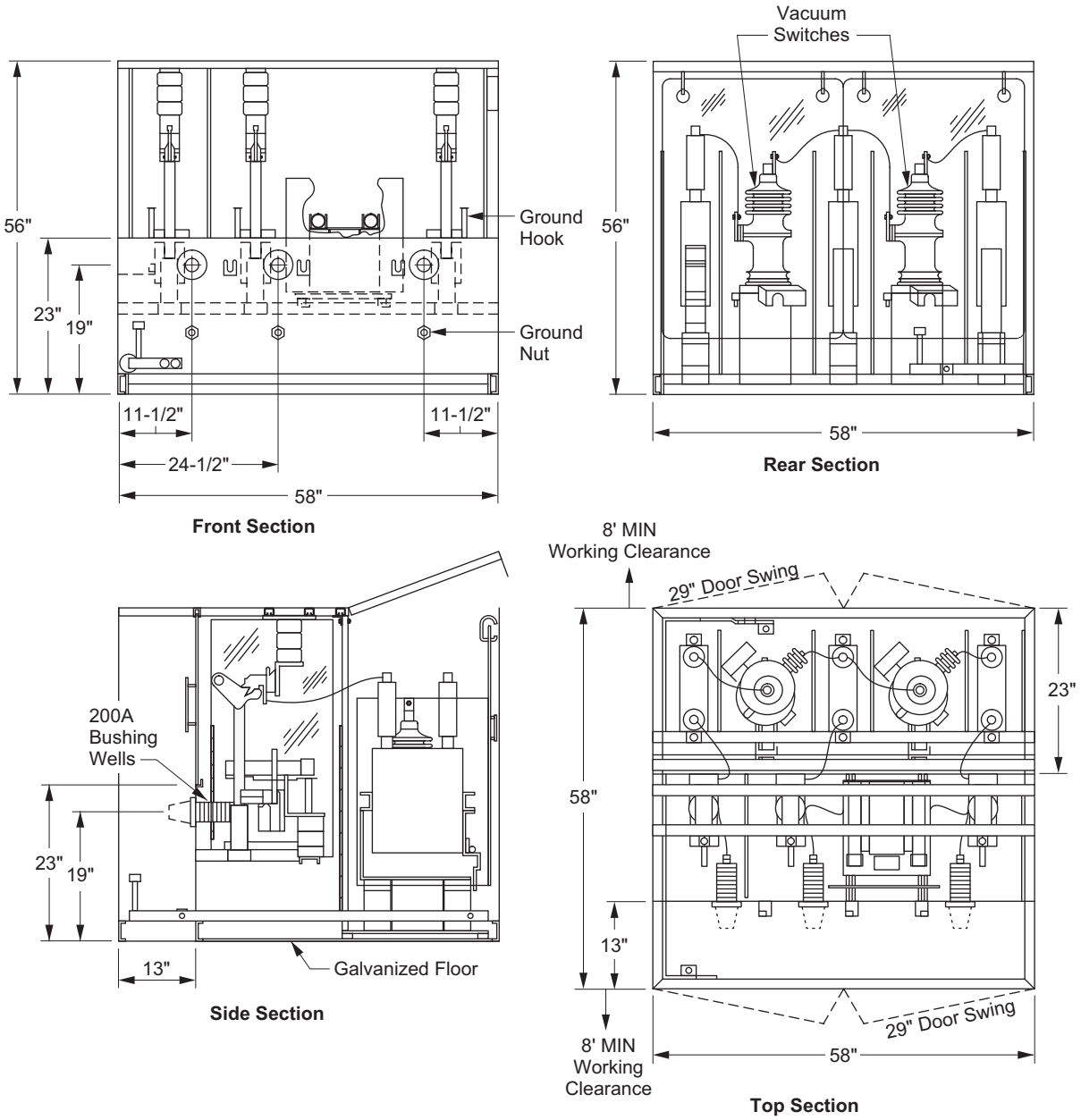
kvar Size	12 or 16 kV Dimensions			SAP Number		Approx. Weight (lb)
	A (in)	B (in)	C (in)	12 kV	16 kV	
900	56	58	58	10104912	10104911	1,500
1,200	56	58	58	10171177	10171179	1,700
1,800	56	58	58	10171173	10171178	1,800

Note(s):

Note(s):

1. Padmount capacitor banks are supplied with capacitors, control transformer, and fuse mountings with end fittings for SMU-20 fuses. Additional material required:
   - Programmable Capacitor Control (SAP 10105100), Radio (SAP 10175268) and Coaxial Cable (SAP 10125495), Two Capacitor Switches (SAP 10106475).
   - Three SMU-20 fuses (see UC 125).
   - Sign red acrylic (SAP 10135320) for attachment to source side switch per DOM Procedure CA-2 (4.1A)
2. See Figure UC 120–2 (Sheet 2) for Layout Data
3. See UGS SS 520 for Capacitor Mounting Pad
4. Capacitor control shall be left energized with 120 VAC, in MANUAL, LOCAL, and OPEN mode by construction crew at time of installation. Apparatus will program control settings and commission the unit.
5. Replacement Control Power Transformers are ordered using SAP 10175750 (12kV) and 10175751 (16kV).
6. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon–Fri 7 a.m.–4 p.m. Available after hours/weekends upon request.

Figure UC 120–2: Dead Front Padmount Capacitor Dimensions



Note(s):

1. Use load-break elbows and bushing plugs. Do not operate load-break elbows to energize or de-energize capacitor banks.
2. See UGS 520 for pad construction details.

Scope UC 120.2 Padmount Capacitors for 3- or 4-Wire Systems

Figure UC 120–3: Padmount Capacitors for 3- or 4-Wire Systems

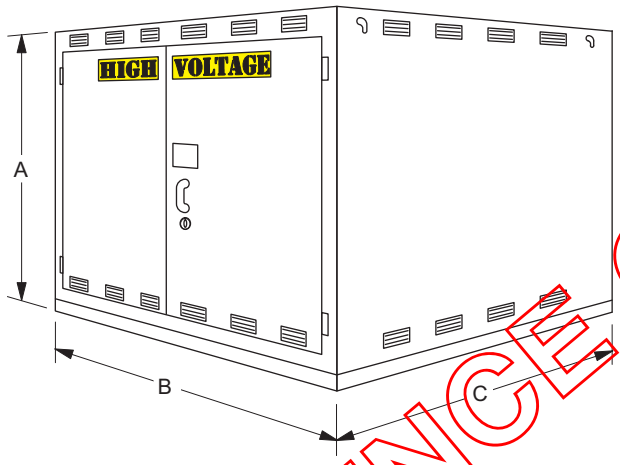


Table UC 120–2: Padmount Capacitors for 3- or 4-Wire Systems

kvar Size	12 or 16 kV Dimensions			Material Code		Approx. Weight (lb)
	A (in)	B (in)	C (in)	12 kV	16 kV	
900	49	58	58	492-00355	492-00348	1,500
1,200	49	58	58	492-00389	492-00405	1,700
1,800	49	58	58	492-00371	492-00397	1,800

FOR REFERENCE ONLY

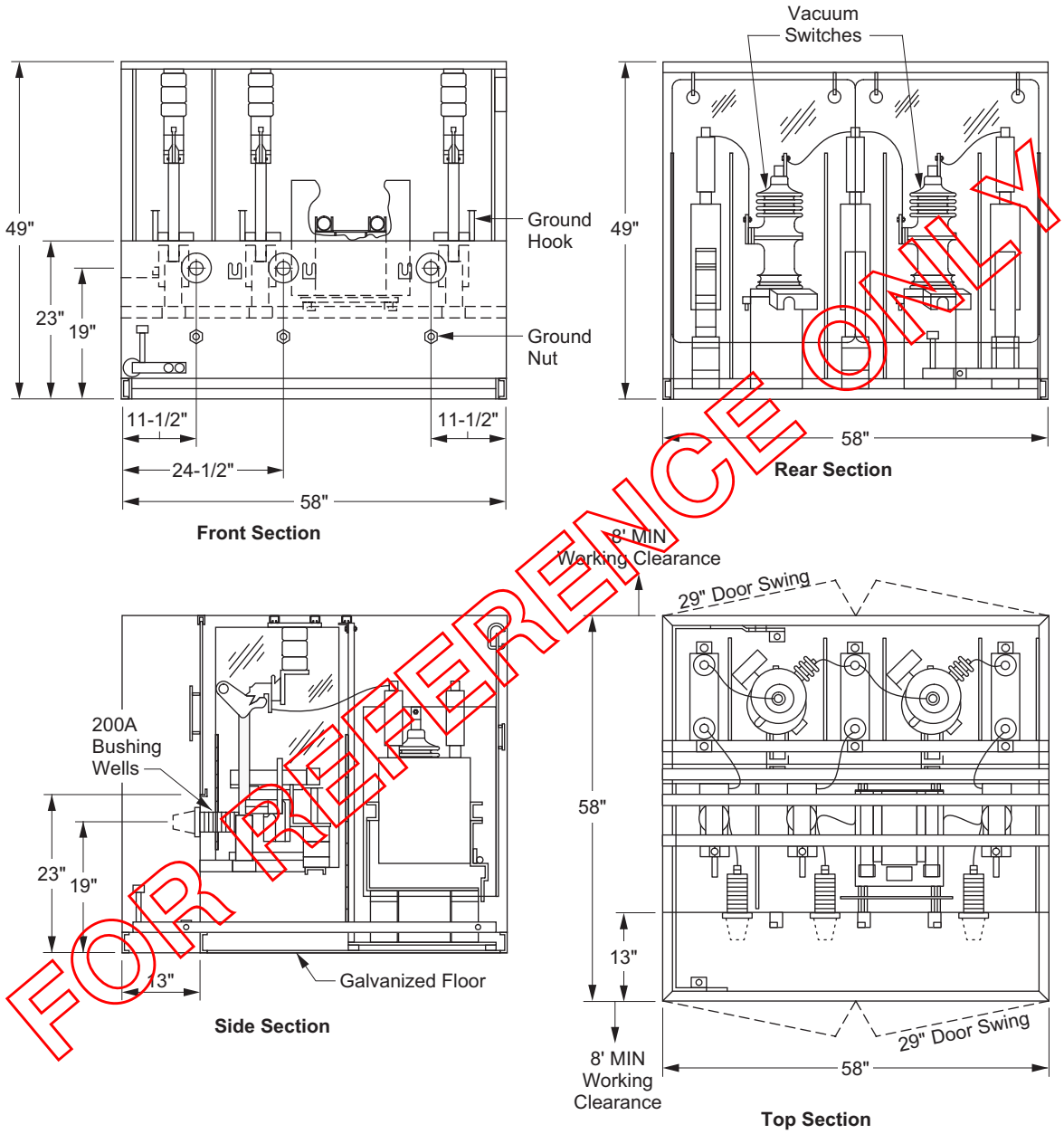
Note(s):

Padmount capacitor banks are supplied with capacitors, capacitor switches, control transformer, and fuse mountings with end fittings for SMU-20 fuses.

Additional material required:

1. Capacitor Control, M/C 493-00635 (PCC with DC-powered radio).
2. Three SMU-20 fuses (see UC 125).
3. Sign red acrylic (M/C 816-00520) for attachment to source side switch per DOM Procedure CA-2 (4.1A)
4. See Figure UC 120–4 (Sheet 4) for Layout Data
5. See UGS SS 520 for Capacitor Mounting Pad

Figure UC 120–4: Dead Front Padmount Capacitors

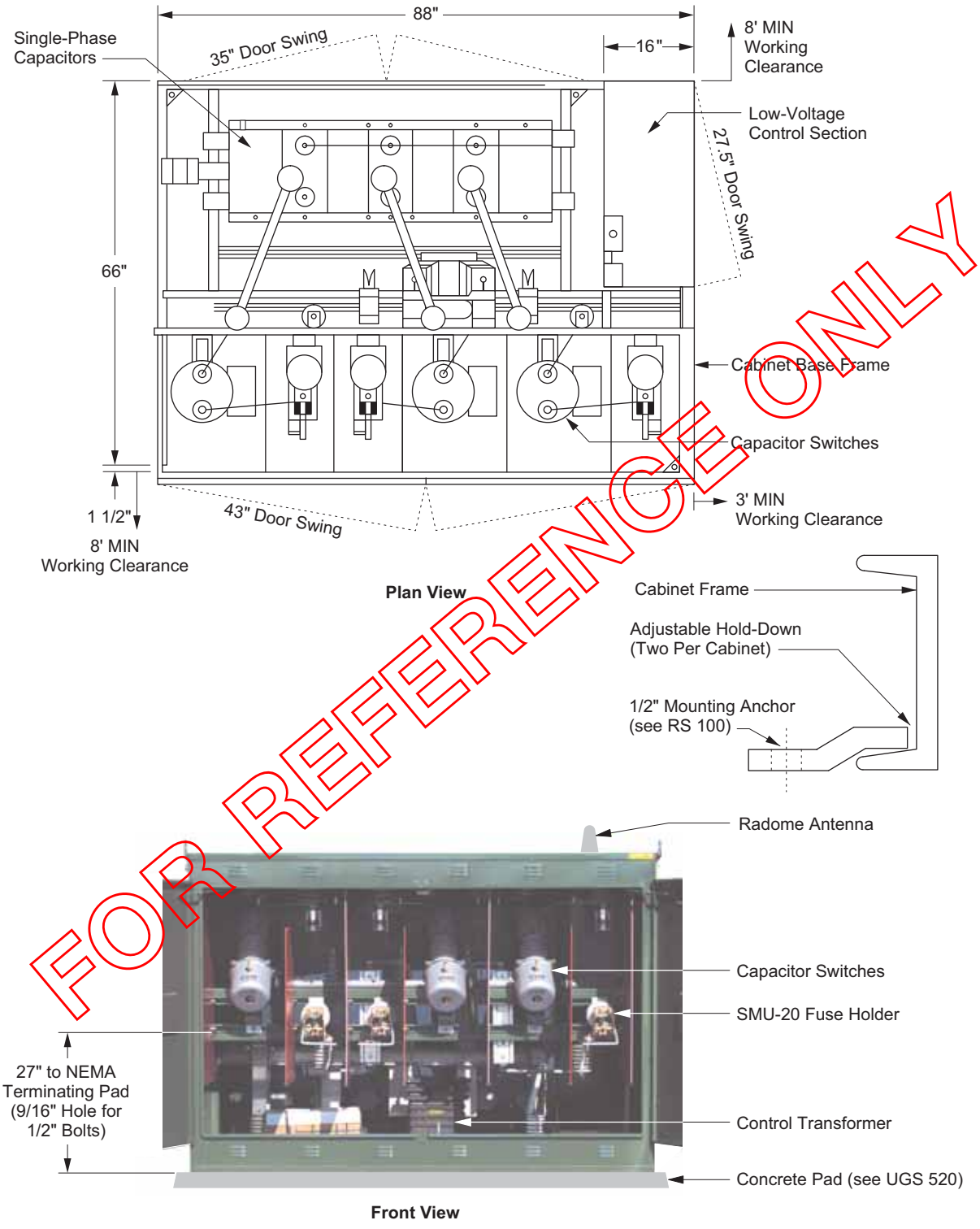


FOR REFERENCE ONLY

Note(s):

1. Use dead-break elbows and bushing plugs.
2. See UGS 520 for pad construction details.

Figure UC 120–5: Underground Padmount Capacitors



FOR REFERENCE ONLY

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UC 125 SMU-20 Fuse for Ungrounded Capacitor Banks — 3-Wire or 4-Wire Systems

Scope UC 125.1 SMU-20 Fuses for Ungrounded Capacitor Banks

Table UC 125–1: Capacitor Fusing

Fuse Rating (SMU-20)		
KVAR	**12 kV**	**16 kV**
900	50E	40E
1,200	65E	50E
1,500[a/]	80 E	65 E
1,800	80E	65E

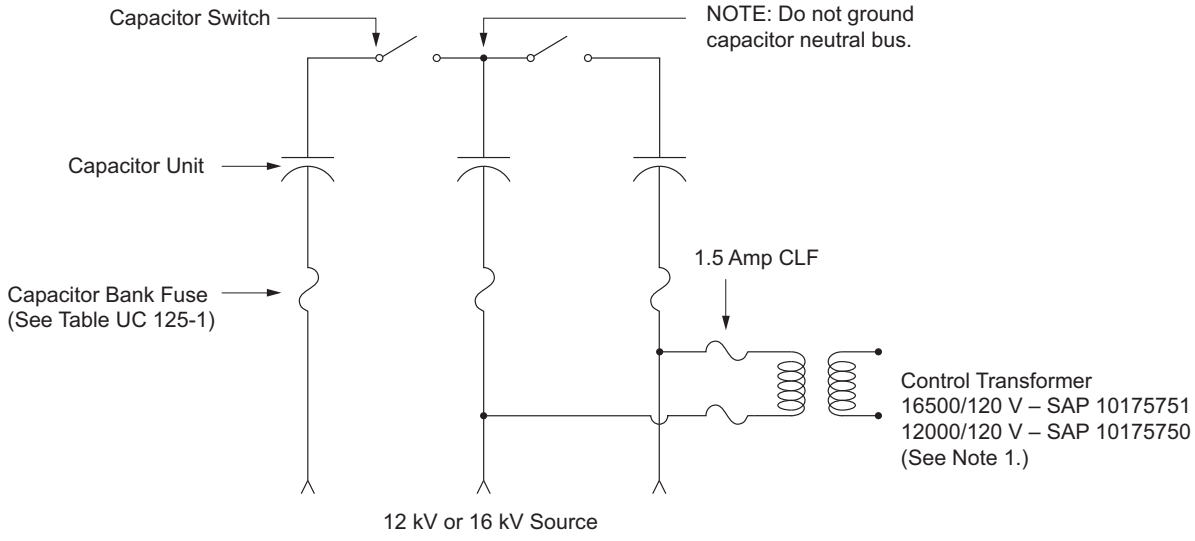
[a/] 1,500 KVAR capacitor banks not approved for new installations. See DOM CA-2, Section 5.4 D for more information.

Note(s):
1. Contact Field Engineering for fuse sizes not listed in the table.
2. Application of capacitor banks in the circuit requires the approval of Field Engineering.
3. SMU-20 fuses are approved for high fire risk area (HFRA) applications.
4. Distribution construction shall contact the Distribution Automation Hotline when installing, relocating, or removing automated equipment at 714-285-4325. Hours: Mon–Fri 7 a.m.–4 p.m. Available after hours/weekends upon request

Table UC 125–2: SMU-20 Fuse

Fuse Size	SAP Number
40E	10108808
50E	10108813
65E	10108814
80 E	10108815

Figure UC 125–1: Electrical Schematic



Note(s):
1. 1.5 Amp, 15.5 kV CL fuses (SAP 10169569) are included in control transformer SAP codes.

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Underground Structures
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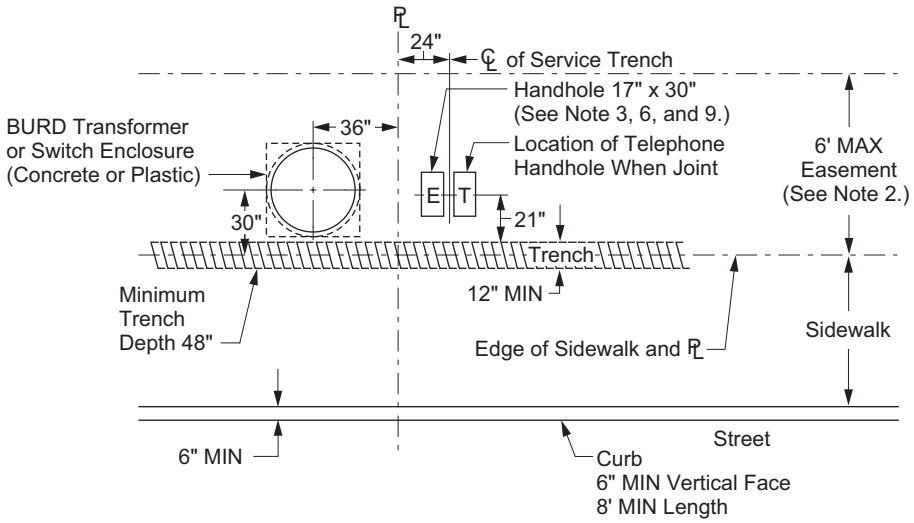
US 210.1	Underground Structure Strengthening using surface applied composite systems - Composites for Infrastructure (CFI)

US 100 Standard Locations — BURD System

Scope US 100.1 Standard Locations of BURD Enclosure, Handhole, and Trench

Figure US 100–1: Standard Locations of BURD Enclosure, Handhole, and Trench without Parkway



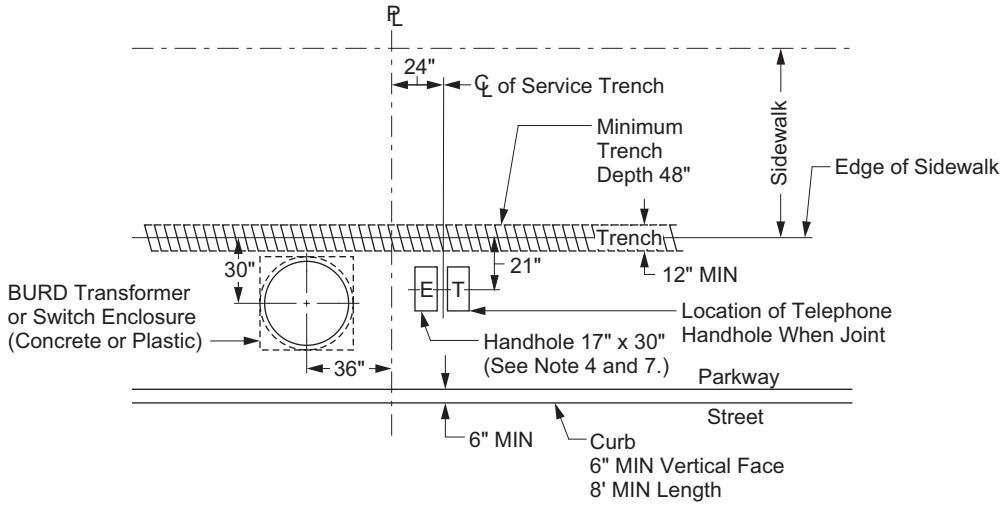
Note(s):

1. BURD systems are no longer standard installation and are allowed only in situations where special conditions exist. They will only be installed with SCE's approval.
2. Location of the property line may vary. Width of easement is 6' maximum and may be less if property line is further from edge of sidewalk.
3. Place handhole on service trench center line when not joint.
4. Set enclosures 2" above grade unless local ordinances require other enclosure levels. When enclosure is against sidewalk, set top flush with sidewalk and add 2" to each depth figure in Note 5.
5. Minimum enclosure excavation below final grade (6" crushed rock included):

Transformer	A. Plastic —	66" DIA x 85" deep
	B. Concrete —	48" DIA x 79" deep
Switch	A. Plastic —	66" DIA x 49" deep
	B. Concrete —	48" DIA x 47" deep

6. Handholes may be placed parallel with sidewalk or in service trench when not joint.
7. Special cases (lot sales) may require other considerations.
8. Refer to UGS MC 830 for use of protective barrier.
9. A 13"x24" handhole will be used for existing construction only.

Figure US 100–2: Standard Locations of BURD Enclosure, Handhole, and Trench with Parkway



Note(s):

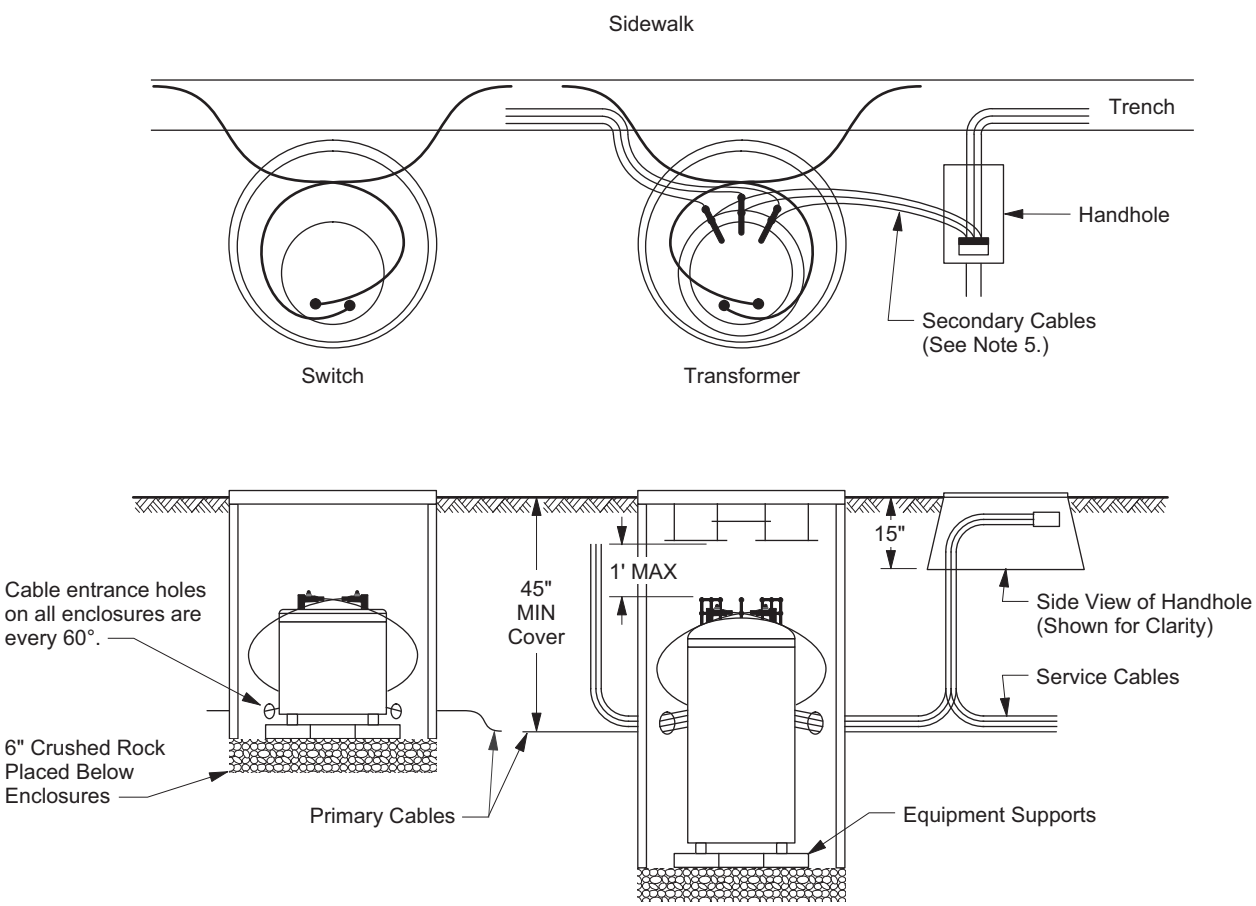
1. BURD systems are no longer standard installation and are allowed only in situations where special conditions exist. They will only be installed with SCE's approval.
2. Set enclosures 2" above grade unless local ordinances require other enclosure levels. When enclosure is against sidewalk, set top flush with sidewalk and add 2" to each depth figure in Note 2.
3. Minimum enclosure excavation below final grade (6" crushed rock included):

Transformer	A. Plastic —	66" DIA x 85" deep
	B. Concrete —	48" DIA x 79" deep
Switch	A. Plastic —	66" DIA x 49" deep
	B. Concrete —	48" DIA x 47" deep

4. Handholes may be placed parallel with sidewalk or in service trench when not joint.
5. Special cases (lot sales) may require other considerations.
6. Refer to UGS MC 830 for use of protective barrier.
7. A 12"x24" handhole will be used for existing construction only.

Scope US 100.2 Typical BURD System Installation

Figure US 100–3: Typical BURD System Installation



Note(s):

1. Cables must never contact the transformer tank or fins.
2. Handholes may be placed parallel or perpendicular to sidewalk.
3. Leave as much duct as practical on the cable. Seal the ducts in corrosive areas.
4. Leave approximately 15 feet of cable inside enclosure.
5. The approximate number of low-voltage cable groups that can be placed directly in BURD enclosures are as follows:
   3-wire BURD systems — 2 cable groups
   4-wire BURD systems — 4 cable groups
   One cable group is either one secondary run or one service (not streetlight cables).
6. Cinder or cement blocks should be used to raise transformer height.

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US 105 Surface Operable Enclosures (SOE) and Vault Cable and Equipment Configurations

Scope US 105.1 SOE and Vault Cable and Equipment Configurations

1.0 General Information

1.1 This standard provides guidelines for installing cable and equipment in SOEs and Vaults.

1.2 Figure US 105-1 through Figure US 105-10 identify the maximum cable and equipment recommended for each SOE/Vault per Table 6-13 of the Distribution Design Standards (DDS) Manual.

1.3 Use gridlines shown in Figure US 105-1 through US 105-10 to determine the appropriate clearances between equipment and/or equipment and structure wall.

1.4 Each SOE/Vault and associated cable/equipment has been sized to support worker and operation safety.

Figure US 105–1: 5’x 8’- 6"x 5’ SOE (Using Cable Only, No Equipment)

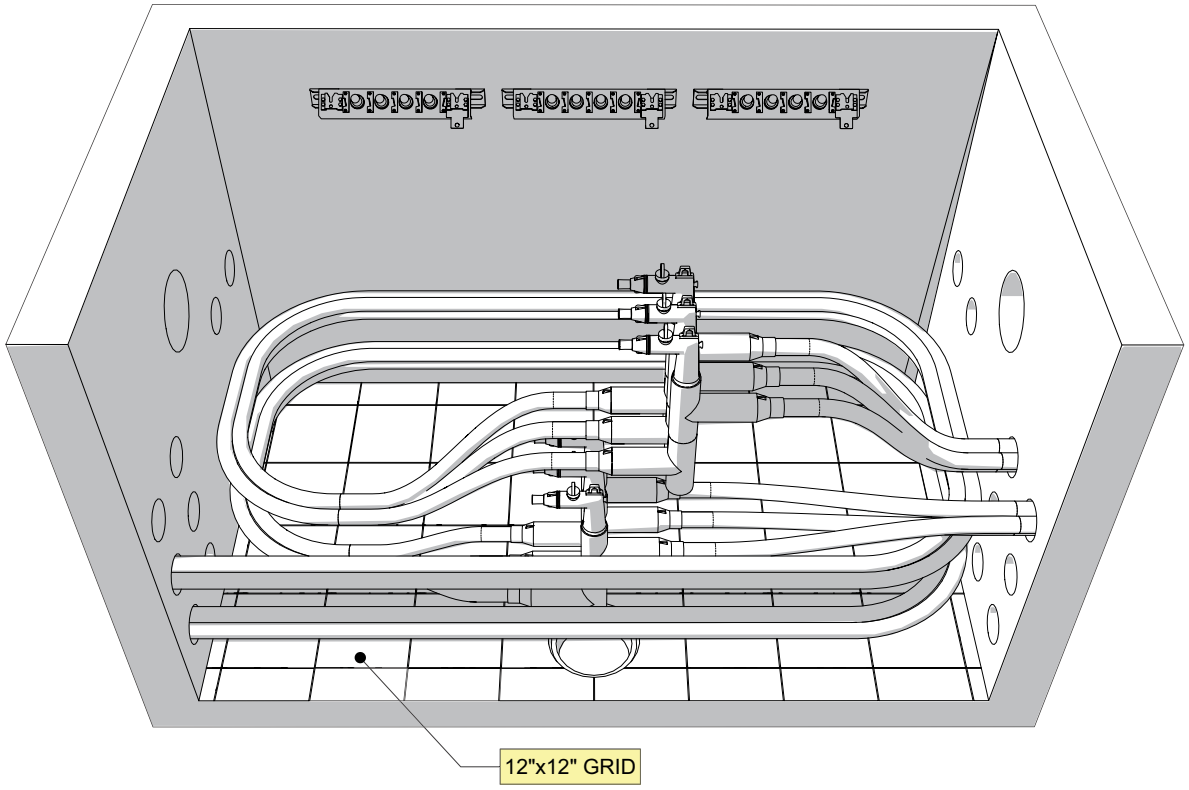


Figure US 105–2: 6'x 12'x 7' Vault (Using 4-Way RAM Switch and 3-Way Junction Bars [J-Bars])

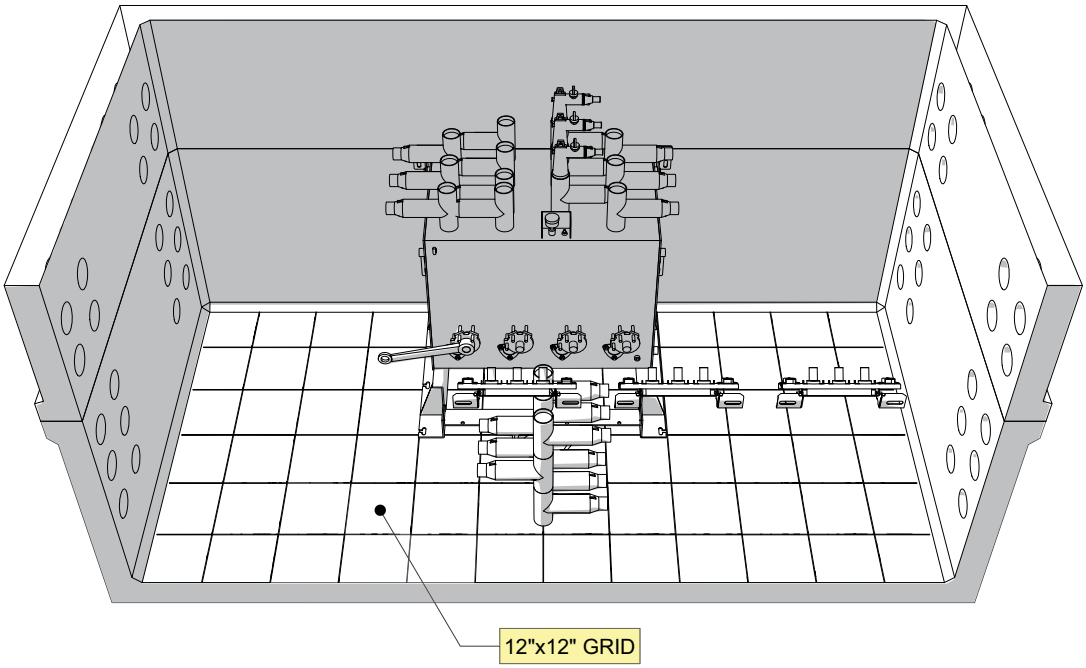


Figure US 105–3: 6'x 12'x 7' Vault (Using 3-Way RAM/RAG Switch, BURD Transformer/Switch and 4-Way J-Bars)

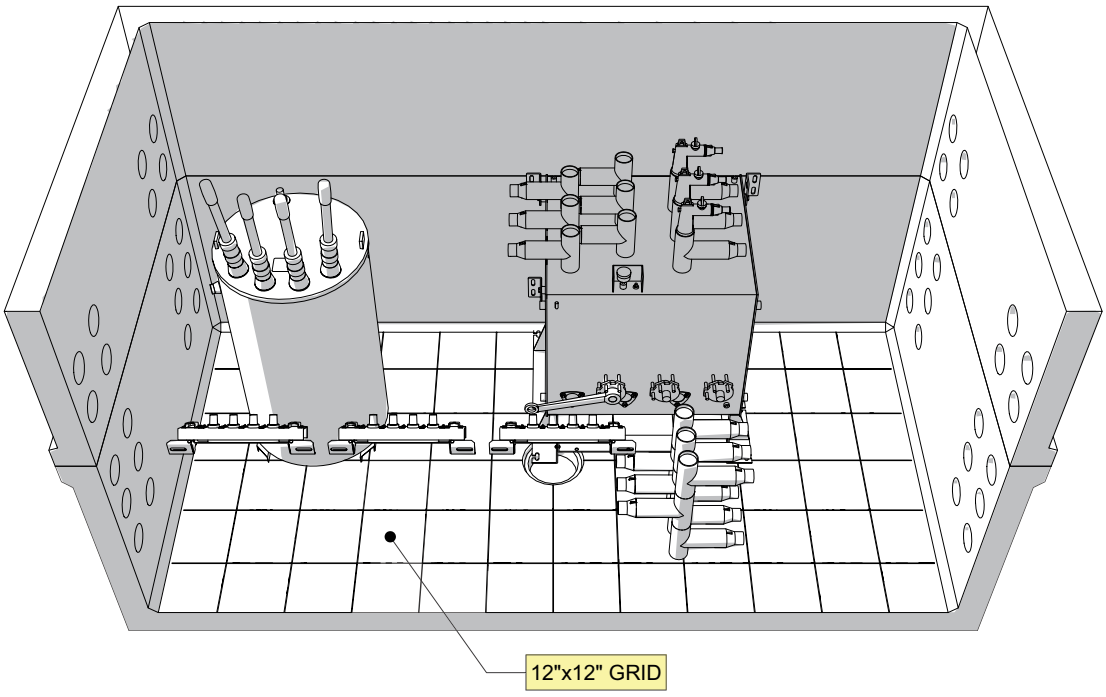


Figure US 105–4: 6'x 12'x 7' Vault (Using BURD Transformers/Switches and 4-Way J-Bars)

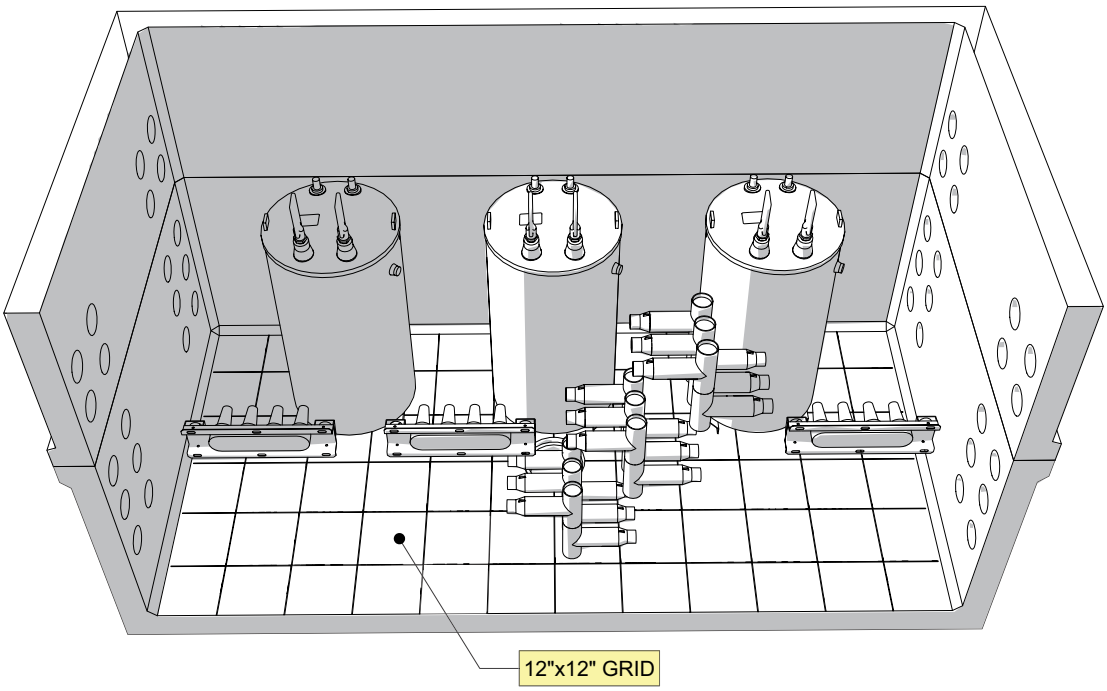


Figure US 105–5: 7'x 14'x 8' Vault (Using 6-Way RAM Switch, Potential Transformer [PT] for Automation, BURD Transformer/Switch and 4-Way J-Bars)

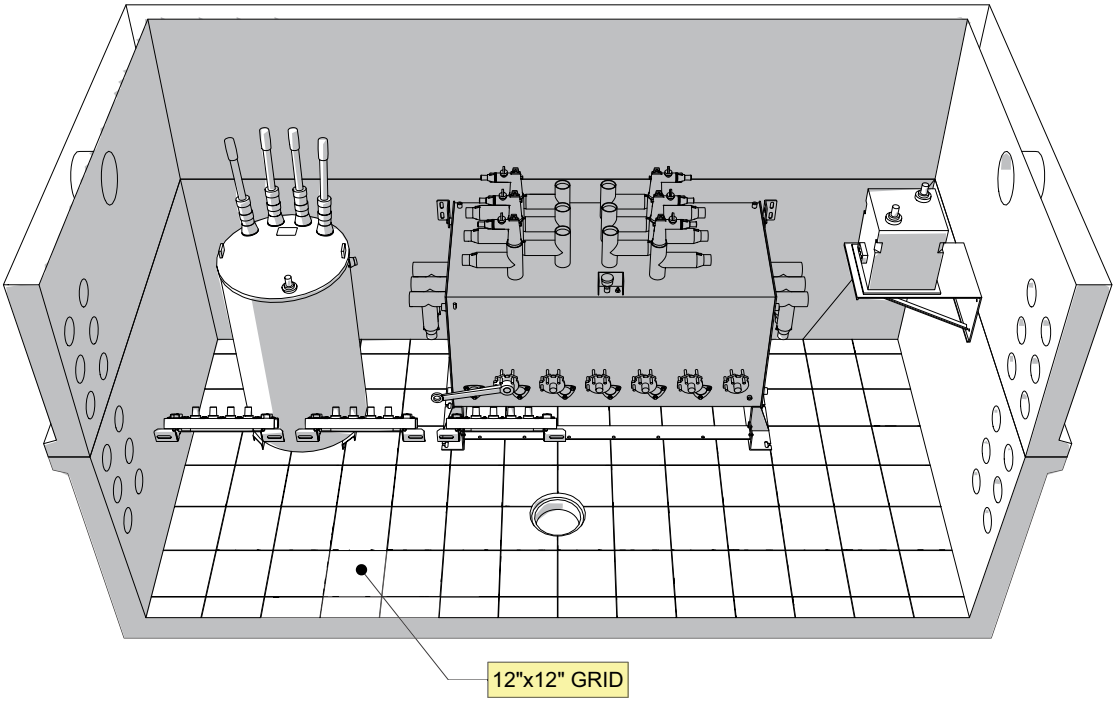


Figure US 105–6: 7"x 14"x 8" Vault (Using 4-Way RAM/RAG Switch, BURD Transformers/Switches and 4-Way Junction Bars)

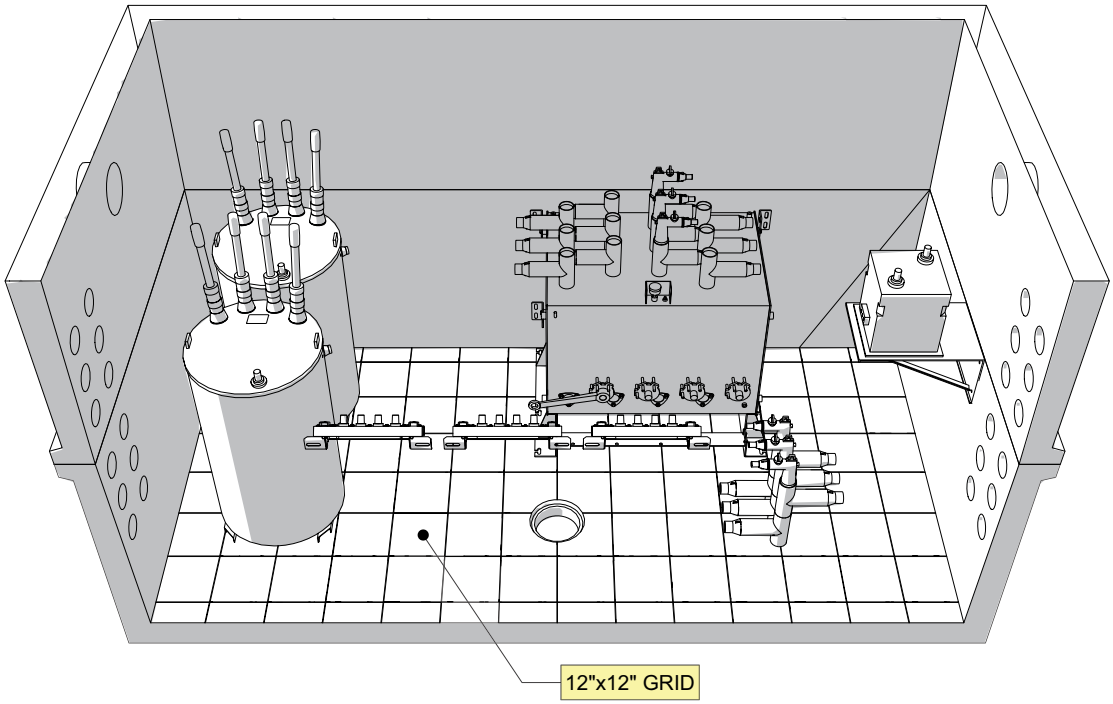


Figure US 105–7: 7'x 14'x 8' Vault (Using BURD Transformers/Switches and 4-Way J-Bars)

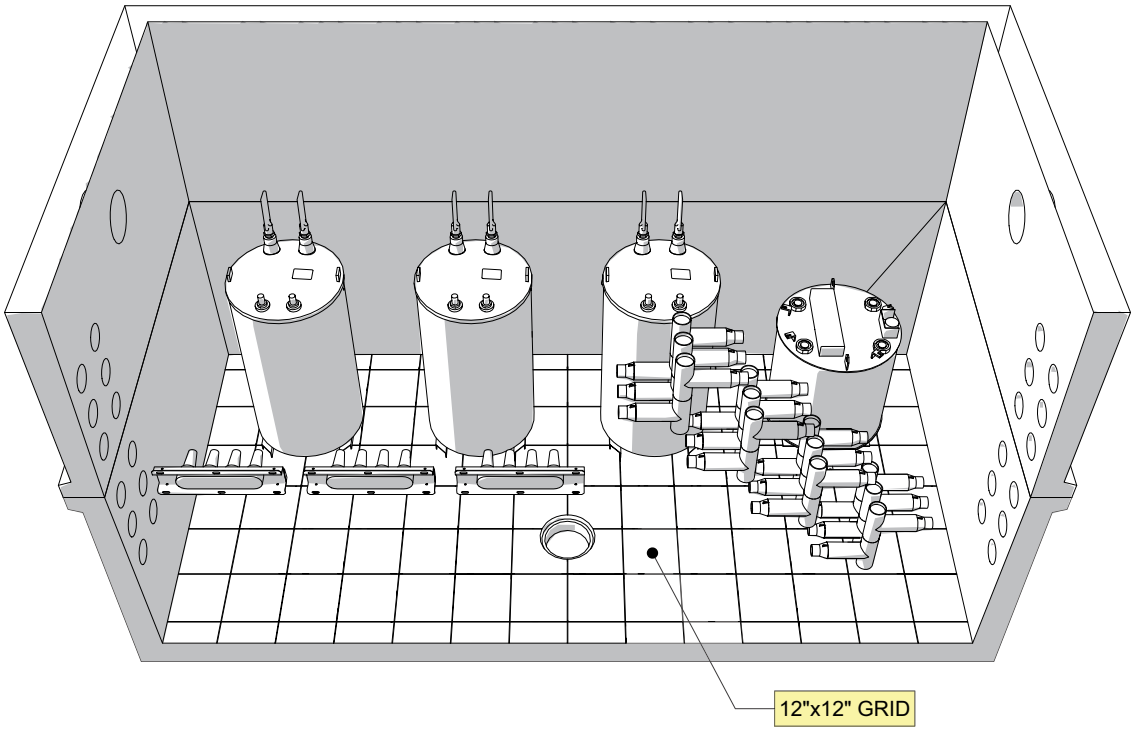


Figure US 105–8: 7'x 18'x 8' Vault (Using RAM Switches, PTs for Automation, BURD Transformer/Switch and 4-Way J-Bars)

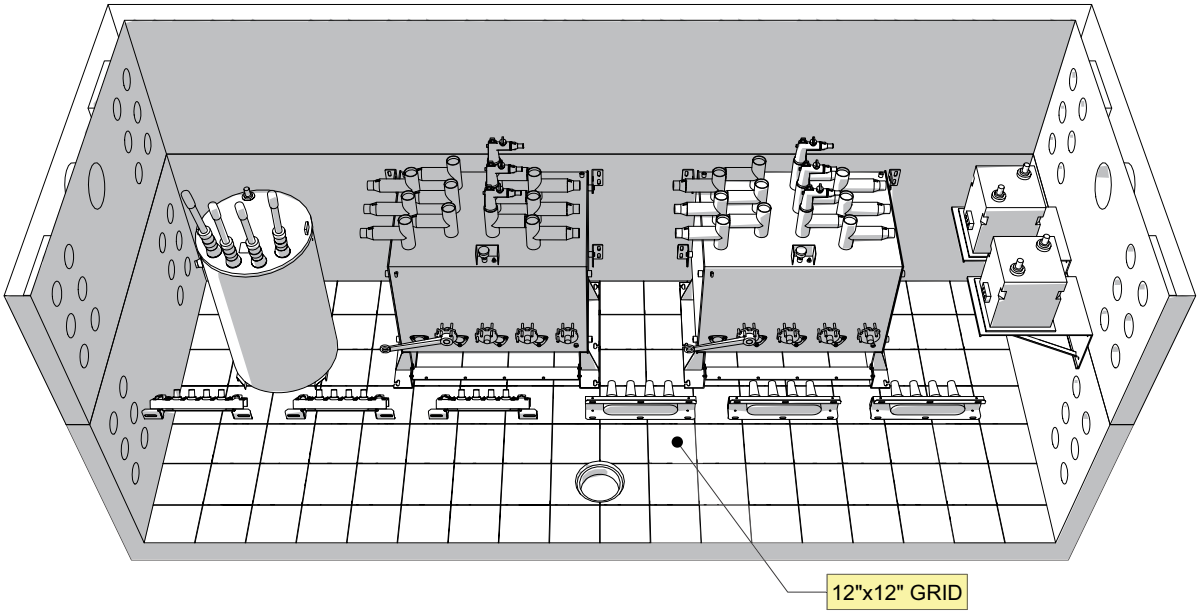


Figure US 105–9: 7'x 18'x 8' Vault (Using 6-Way RAM Switch, PT for Automation, BURD Transformers/Switches and 4-Way J-Bars)

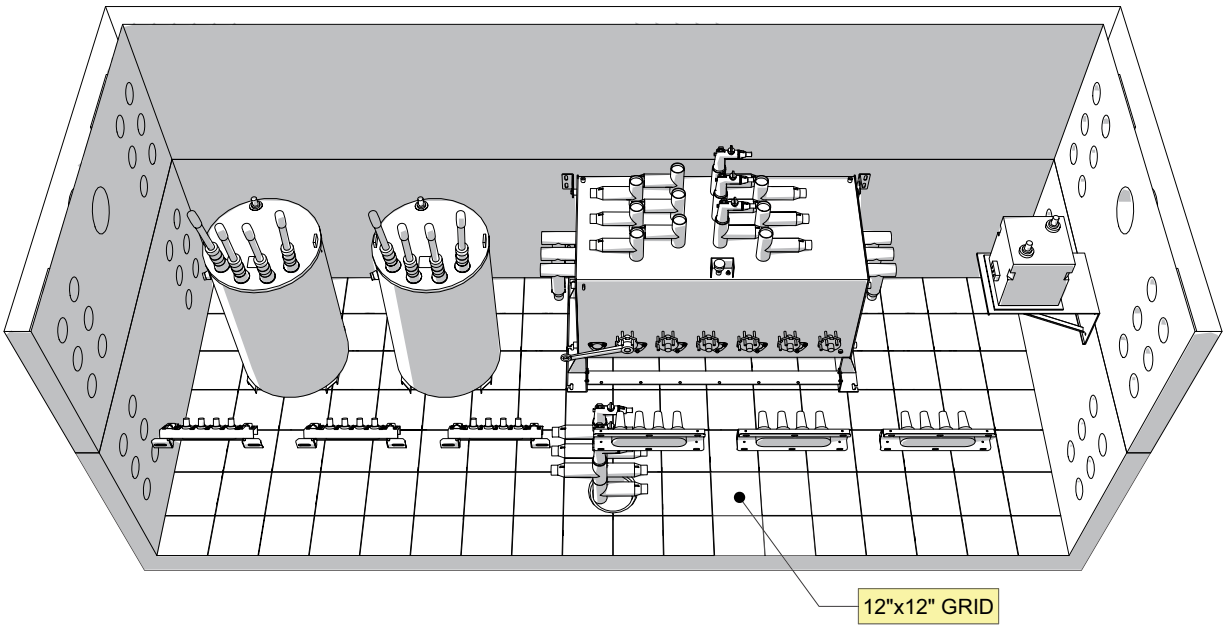
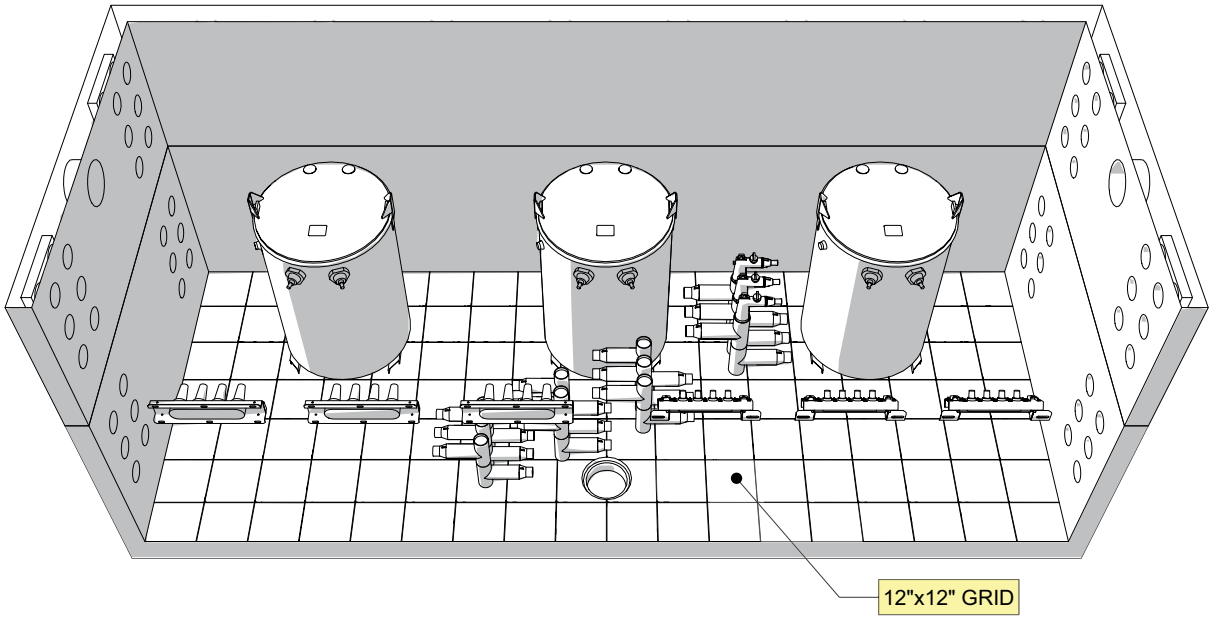


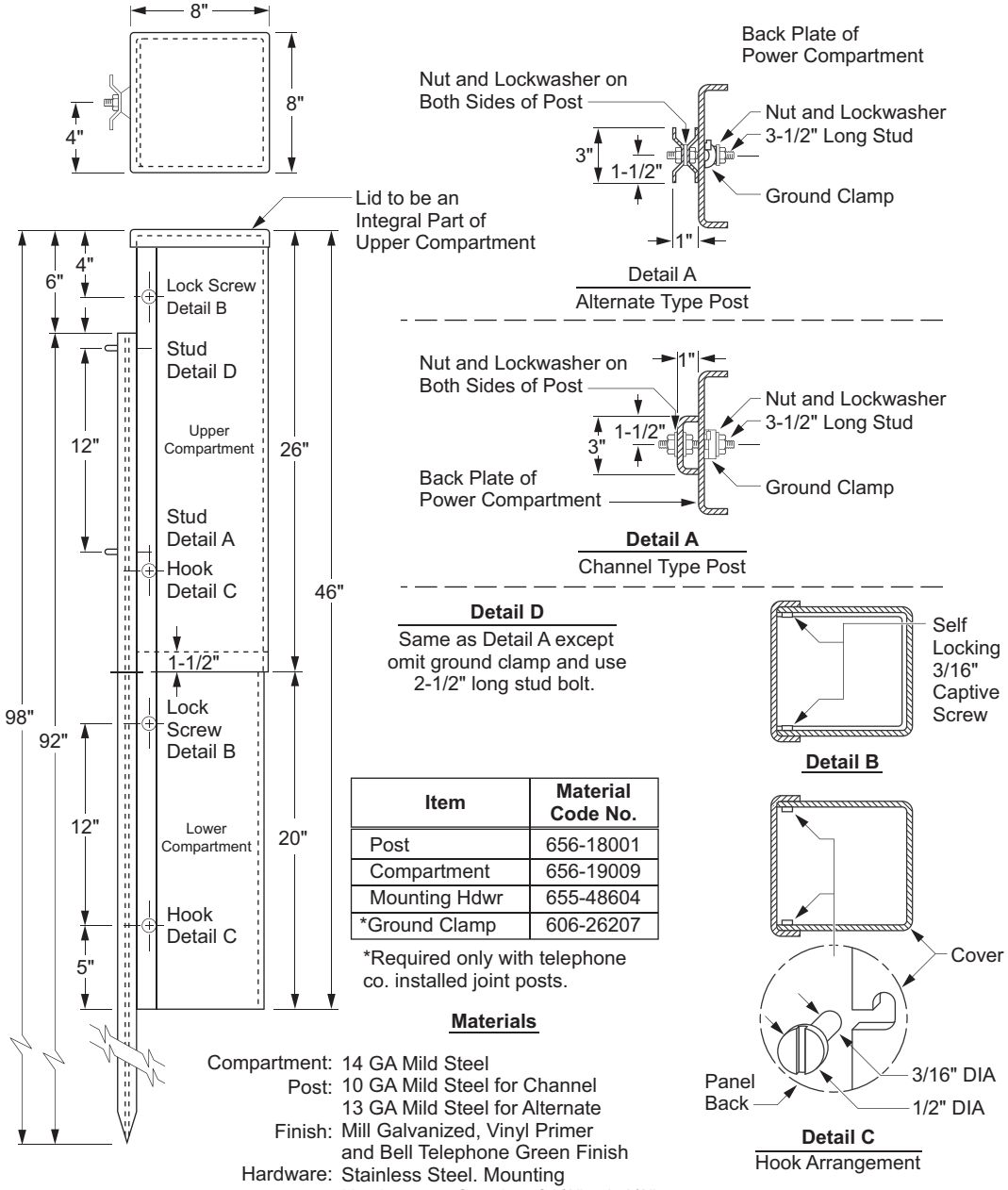
Figure US 105–10: 7'x 18'x 8' Vault (Using BURD Transformers/Switches and 4-Way J-Bars)



US 110 Pedestal

Scope US 110.1 Service Pedestal, 8 Inches

Figure US 110–1: Service Pedestal, 8 Inches



Item	Material Code No.
Post	656-18001
Compartment	656-19009
Mounting Hdwr	655-48604
*Ground Clamp	606-26207

*Required only with telephone co. installed joint posts.

Materials

Compartment: 14 GA Mild Steel
Post: 10 GA Mild Steel for Channel
13 GA Mild Steel for Alternate
Finish: Mill Galvanized, Vinyl Primer and Bell Telephone Green Finish
Hardware: Stainless Steel. Mounting Hardware to Consist of 3/8" x 3-1/2" Stud 3/8" x 2-1/2" Stud 6-3/8" Nuts and Lockwashers and 1-#4-2/0 Ground Clamp
See Note 1.

Note(s):

1. Mounting hardware is not furnished with power compartment. Order this hardware only when needed.
2. See DUG CR 150 for placement of riser conduit warning labels.

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US 115P Above Ground Junction Box

Scope US 115P.1 Above Ground Junction Box with 3-, 4-WayJunction Bars

1.0 General Information

This pilot standard outlines the general requirements and guidelines for the installation of the Cable Junction Pedestal on 3' x 5' Pull Boxes. The pedestal provides an above ground structure to allow installation and operation of three, four-way 200 Amp Load-Break Junctions. Above Ground Junction Boxes containing above ground, load-break junctions may be used to sectionalize energized primary circuits. See DUG TX 160 for sealing and stenciling installations.

At the time of installations all four junction bars shall be installed, insulated caps shall be used on any unused positions.

The pilot installations shall only occur in the following district(s):

Wildomar District

2.0 3' x 5' Pull Box for Above Ground Junction Box with 3-, 4-WayJunction Bars

The above ground 200 Amp Load-Break Junction pedestal is engineered to fit SCE's approved 3' x 5' x 4' pre-cast parkway concrete pull box. Prior to cable pulling and make-up, remove the pedestal from the top of the pull box for maximum working space. All necessary cable pulling, shaping, make-up and terminating should be performed prior to re-installing the pedestal onto the pull box.

PILOT

3.0 Load Break Junction Installation

STEP 1. Assemble and attach universal mounting brackets to junction back plates. The mounting plate can be adjusted to a horizontal or angled position to facilitate operation of elbows. See JJ 680.

STEP 2. One or both of the mounting brackets can be reversed to change the distance required between bolt centers.

STEP 3. Attach to Above Ground Junction Box utilizing unistruts inside of pedestal.

STEP 4. All premolded rubber 200 A components with grounding eyes shall be bonded to ground.

4.0 Equipment and Cable Grounds

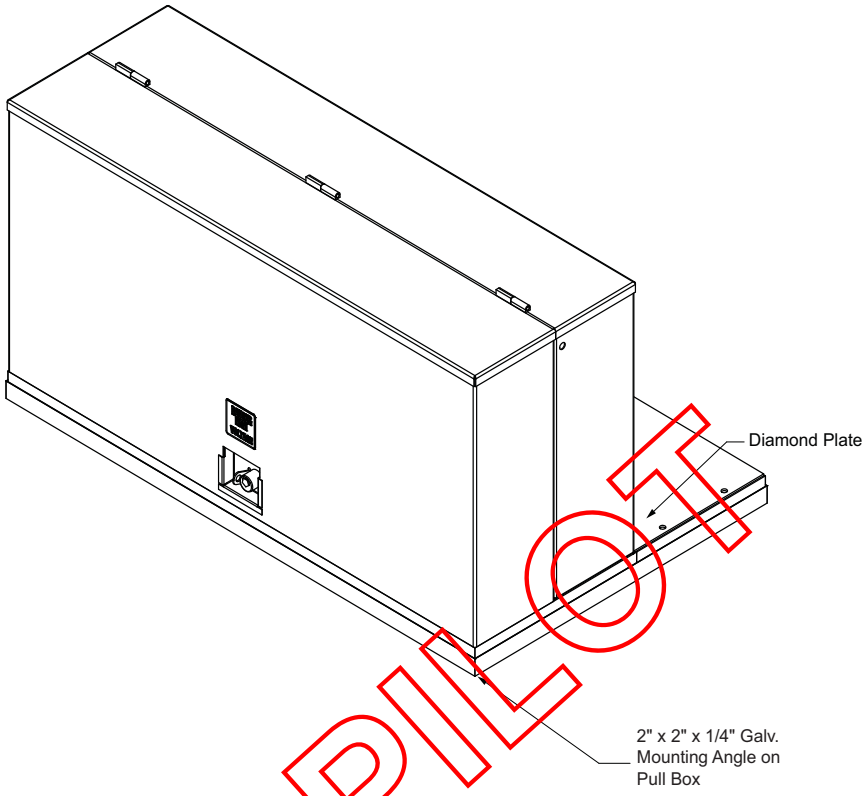
Install grounding lugs in provided locations along the pedestal. Install #2 bare copper routing along the pedestal and down to the pull box wall. Connect the equipment ground to the ground rod.

Attach cable termination concentric wires to the #2 bare copper ground wire. Concentric wires must be long enough to allow elbows to be operated and placed on parking stands.

5.0 Cable Support

Provide cable supports as required to secure the cable to the concrete pull box structure. The cables shall be trained to ensure the elbows may be operated.

Figure US 115P–1: Above Ground Junction Box (Isometric)



PILOT

Figure US 115P–2: Above Ground Junction Box (Top)

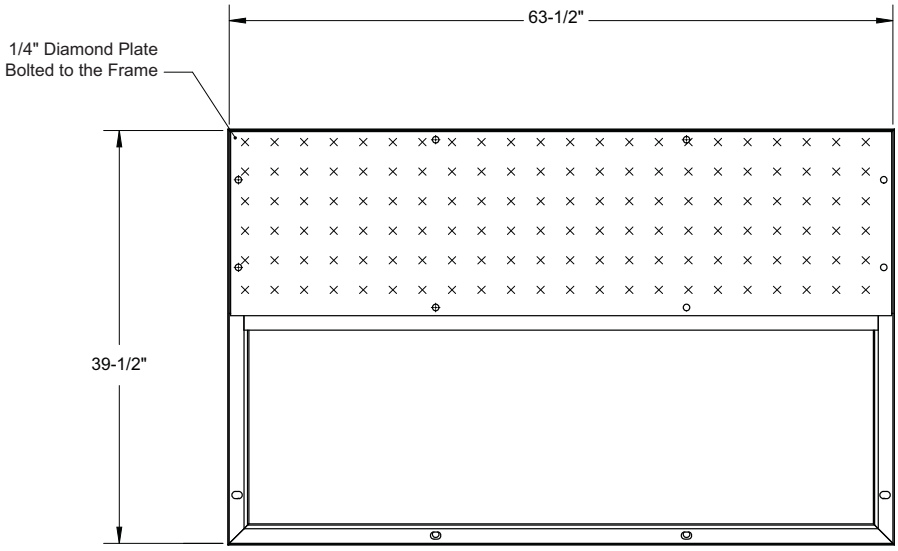


Figure US 115P–3: Above Ground Junction Box (Front)

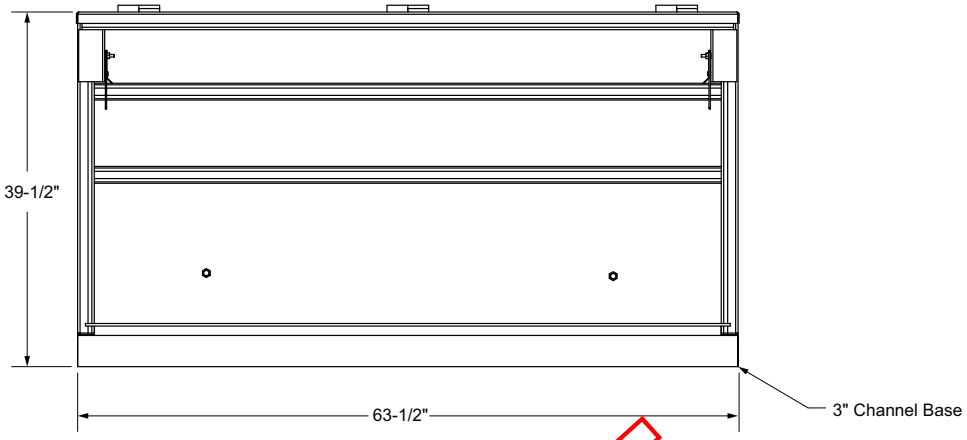
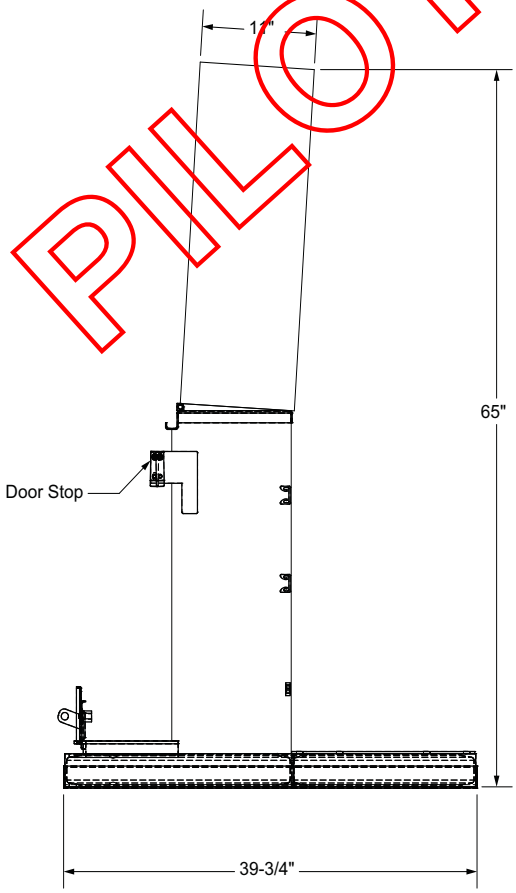


Figure US 115P–4: Above Ground Junction Box (Side)



PILOT

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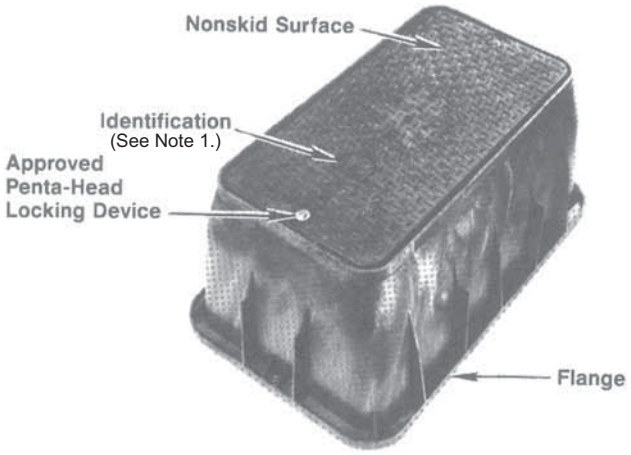
US 120 Handhole Requirements

Scope US 120.1 Rectangular Handhole

Figure US 120–1: Rectangular Handhole



Note(s):
1. Cover shall be identified with “EDISON" in minimum 2-inch letters or labels permanently secured to the lid.

1.0 Dimensions

The minimum clear opening through the top is approximately 11" x 22" and 15" x 28" for each respective box. The body should be tapered (to allow nesting) to an approximate clear opening of 17" x 30" and 23" x 36" at the bottom for each respective box. The minimum clear height from the base to the bottom of the lid is 15 inches.

2.0 Requirements

Plastic lid shall be green in color with a 3-inch block letter E easily visible. The top surface shall be made with a nonskid pattern. All top area of the lid shall be capable of passing a 75 foot-pound impact administered with a 12 pound weight using a TUP C per ASTM D2444. The lid shall be capable of supporting a 300 pound per square foot load (based on overall top surface area of lid), administered with a one square foot plate, with a maximum deflection of 1/4 inch. An approved penta-head locking device is required. The lid material shall be of a self-extinguishing material and ultraviolet stabilized.

Concrete lid shall be natural in color with a 3 inch block letter E easily visible. The top surface shall be made with a nonskid pattern. The lid shall be constructed of 3,000 psi concrete minimum. It shall be capable of supporting a 300 pound per square foot load (based on overall top area of lid), administered with a one square foot plate, without cracking. An approved penta-head locking device is required. This lid must sit inside the top edge on the plastic body to allow placement in sidewalks.

Body shall be of a material with sufficient wall thickness and ribbing to prevent excessive deformation when subjected to the normal pressures of backfill. No bottom is required, but an approximate 1 inch wide flange around the base to prevent setting, is required.

Table US 120–1: Handhole SAP Numbers

Fiberglass Reinforced Plastic, Reinforced Plastic Mortar, Plastic			
Rating	10.5" x 17" x 12"[a/]	13" x 24" x 15"	17" x 30" x 15"
Parkway	10117728	10117725	10117726

[a/] Not approved for new construction.

Table US 120–2: Concrete

Rating	10.5" x 17" x 12"[a/]	10.5" x 17" x 24"[a/]	13" x 24" x 12"	13" x 24" x 24"	17" x 30" x 12"[a/]	17" x 30" x 24"
Parkway	10117723	10117724	10117319	10117315	10117322	10117326

[a/] Not approved for new construction

Table US 120–3: Fiberglass Reinforced Plastic (FRP), Polymer Concrete (RPM)

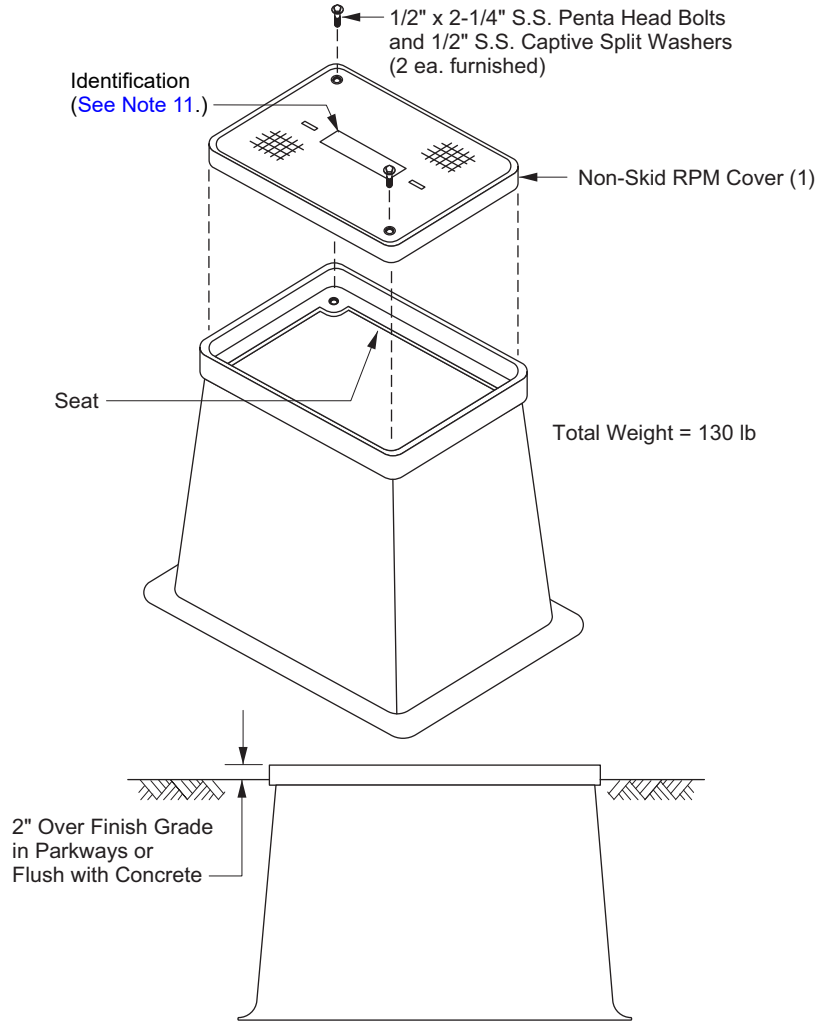
Rating	13" x 24" x 18"	17" x 30" x 18"	17" x 30" x 30"
Parkway	10117408	10117412	10117431
Light Traffic	10117298	10117375	10117333

Note(s):
1. Refer to UGS HP 200 through UGS HP 205 for installation details and a list of approved manufacturers.

US 125 Primary Splice Box for CIC Cable Replacement

Scope US 125.1 17" x 30" x 30" Primary Splice Box for CIC Cables

Figure US 125–1: Splice Box for Primary 17" x 30" x 30" Fiberglass

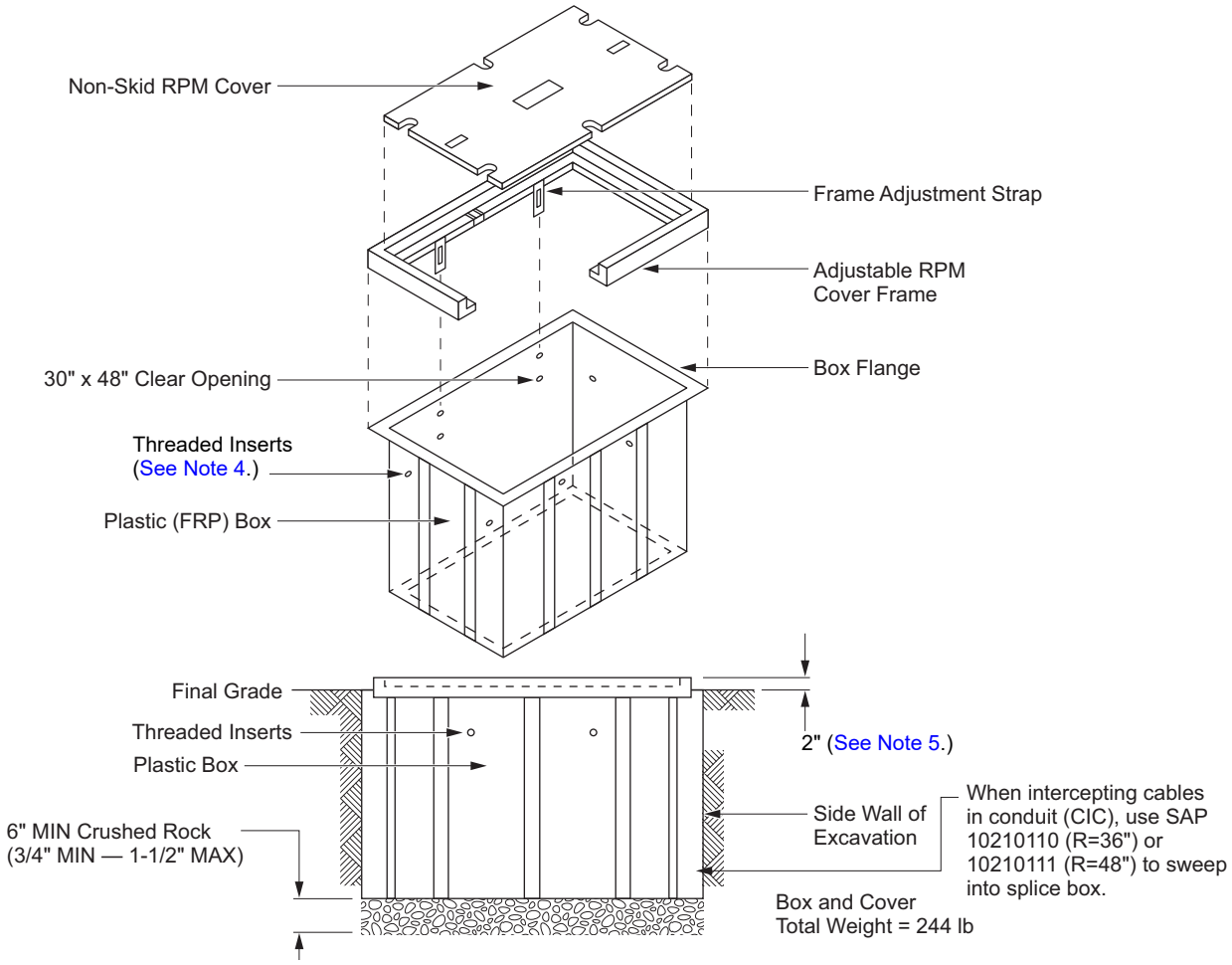


Note(s):

1. The material code for this primary splice box is SAP 10117431 (complete).
2. Body of box is one-piece fiberglass, embedded in a polymer concrete ring and seat for the cover.
3. Cover is made of reinforced polymer material (RPM).
4. The RPM cover and box's ring and seat shall comply with the requirements of Western Underground Committee guide, WUC 3.6.
5. Performance of box shall be in compliance with WUC 3.6.
6. Box is for installation in non-traffic areas only.
7. Backfill should be placed and compacted evenly around box.
8. Mark location of box if it is to be completely covered.
9. This box replaces the 17" x 30" x 30" two-piece high-density polyethylene (HDPE) plastic box.
10. This box is for splicing a maximum of three #2 or 1/0 primary cables, using permanent straight splices. See US 128 for applications.
11. Cover shall be identified with “EDISON" in minimum 2-inch letters or labels permanently secured to the lid.

Scope US 125.2 Splice Box 30" x 48" x 36" Plastic (FRP) SAP 10117318

Figure US 125–2: Splice Box for 30" x 48" x 36" Plastic



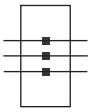
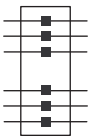
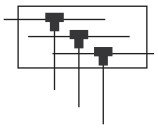
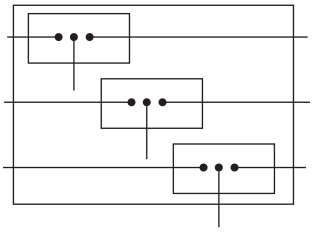
Note(s):

1. Each splice box is furnished complete with an open-bottom one-piece plastic body and RPM cover/frame.
2. Six 1/2" x 1-1/2" stainless steel pentahead bolts with captive free-spinning stainless steel washers are furnished with each splice box.
3. Splice box is used for splicing #2 and 1/0 maximum primary cables. Cables shall enter through clear opening at bottom of box.
4. Splice box is furnished with two 1/2" x 1-1/2" deep threaded plastic inserts, permanently attached flush with inside walls at both ends and sides for attachment of three- and four-way primary junctions.
5. For installation in non-traffic (parkway) areas only.
6. Set top of splice box cover frame flush with grade when adjacent to a sidewalk or curb. It shall be placed 2 inches above grade when in a planted or open area.
7. RPM cover frame can be adjusted upward a maximum of 4 inches above the top flange of the body to conform to grade. When cover frame is moved upward, the perimeter gap between the bottom of the cover frame and top of box flange shall be filled with non-shrink mortar.
8. Excavation to be a minimum of 41" x 59" x 42-1/2" in depth.
9. Maximum of nine cables in this structure.

US 128 Primary Splice Boxes for CIC Cable Replacement

Scope US 128.1 Splice Boxes for CIC Cable

Table US 128–1: Splice Boxes for CIC Cable

Dimensions (W × L × D)	Material	Typical Application	Voltage	Maximum Cable Runs, Maximum Size, and Terminations See Note 1	Splices and Junctions
17" × 30" × 30"	Fiberglass	Residential/ Commercial	4 , 12 , or 16 kV	1 Circuit 3Ø, 1/0 w/Permanent Straight Splices	3-STRAIGHT SPLICES 
30" × 48" × 36"	Plastic (FRP)	Residential/ Commercial	4 , 12 , or 16 kV	2 Circuits 3Ø, 1/0 CIC w/Permanent Straight Splices	6-STRAIGHT SPLICES 
				1 Circuit 3Ø,1/0 CIC w/"T" Splices	3-T-SPLICES 
				1 Circuit 3Ø, 1/0 w/3-3WJunction Bars	3-3W DB JUNCTIONS 

Note(s):
1. Refer to DDS-6 Table 6-2, Note 2 for definition of circuit.
2. Splice boxes are intended to be used for primary CIC cable only. For secondary cable only handholes are preferred and for combinations of primary and secondary cable pull boxes should be used.

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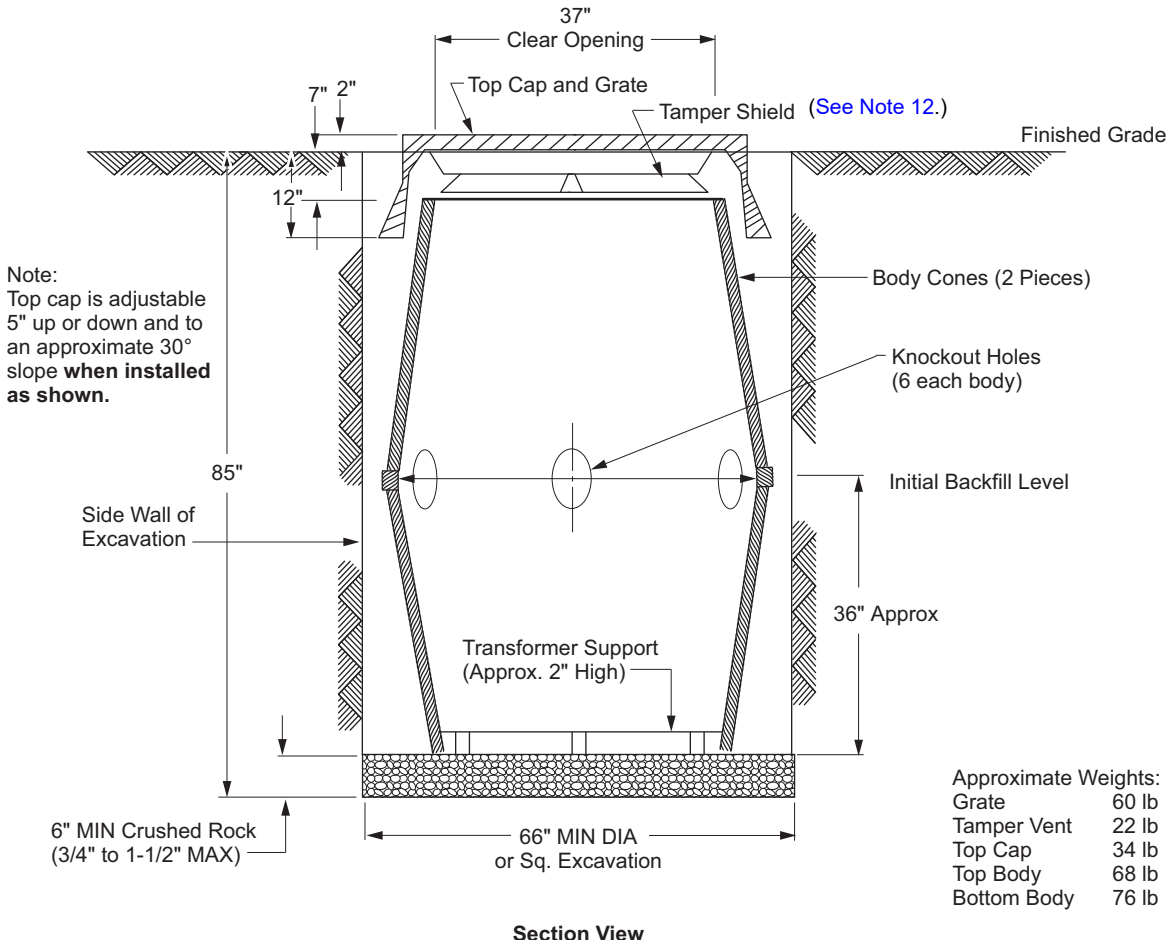
US 150 Transformer Enclosure — Plastic — BURD

Scope US 150.1 Lightweight BURD Plastic Transformer Enclosure for 3-Wire and 4-Wire Transformers

Figure US 150–1: Lightweight BURD Plastic Transformer Enclosure for 3-Wire and 4-Wire Transformers



Section View

Note(s):

1. Lightweight BURD Transformer enclosure per 3-wire and 4-wire transformers (M/C 655-32855, complete).
2. Each enclosure is furnished complete with two-piece body, grate with temporary solid cover, and RPM tamper shield.
3. Set the enclosure top cap **2 inches above grade** wherever possible.
4. Backfill must be placed and compacted **evenly** around the body.
5. Seal cable entry with duct seal or similar sealant.
6. Top cap must be centered over body. (Tamper shield in place aids centering.)
7. When development of surrounding area indicates enclosure will not fill with dirt or debris, or transformer approaches 75 percent of nameplate load, remove temporary solid cover from grate.
8. Replacement parts are available. For material code numbers, see Scope US 150.2 (Sheet 2).
9. Install in nontraffic area only.
10. Use concrete enclosure in rocky soil areas. See US 145.
11. Enclosure will feature interchangeability of grate, tamper shield, and top cap **(regardless of manufacturer)**.
12. Install high voltage sign (M/C 816-00645) on tamper shield. Attach 2-1/2" or 1" Scotchlite decals on high voltage sign for structure identification.

Scope US 150.2 Replacement Part Material Code Numbers

Figure US 150–2: Replacement Part Material Code Numbers

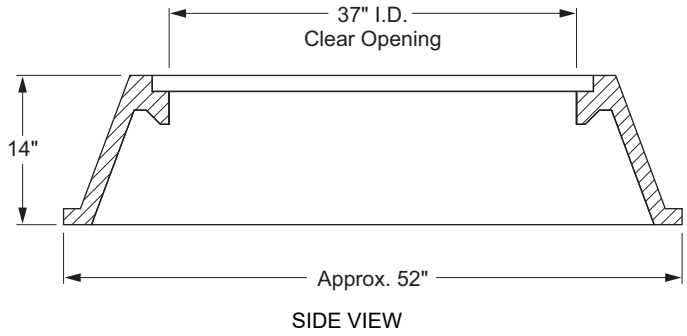


Figure US 150–2.1: Top Caps (M/C 655-24514)

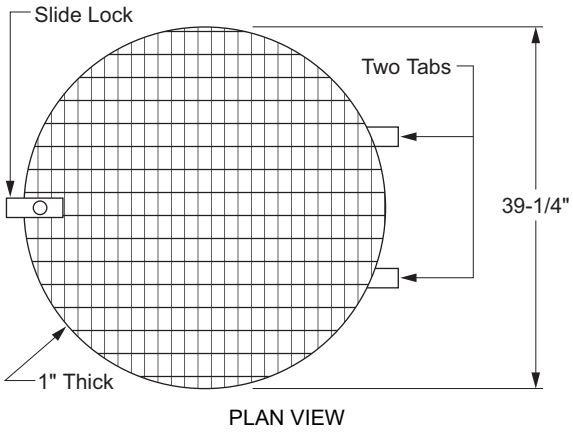


Figure US 150–2.2: Grates (M/C 655-34117)

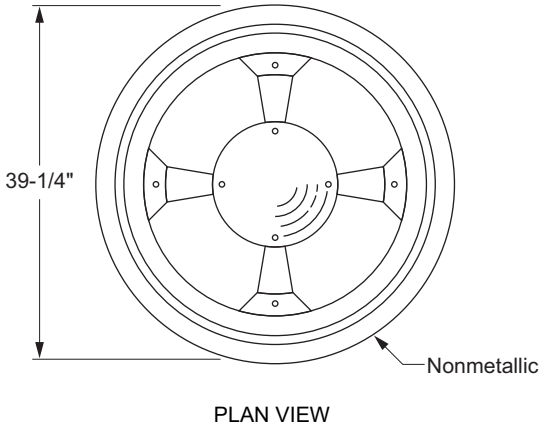


Figure US 150–2.3: Tamper Shields (M/C 656-44601)

US 155 RPM Apparatus Support Extension

Scope US 155.1 RPM Apparatus Support Extension

Figure US 155–1: RPM Apparatus Support Extension

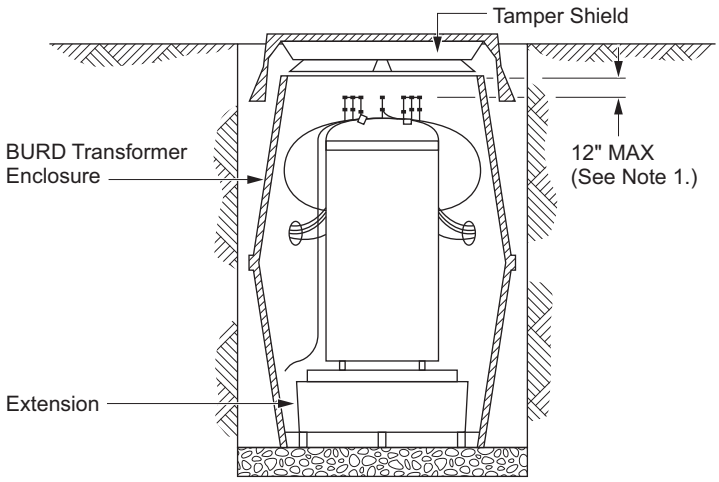


Figure US 155–1.1

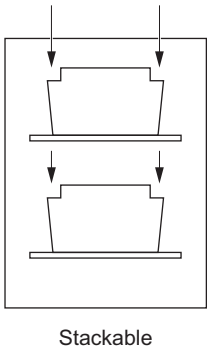
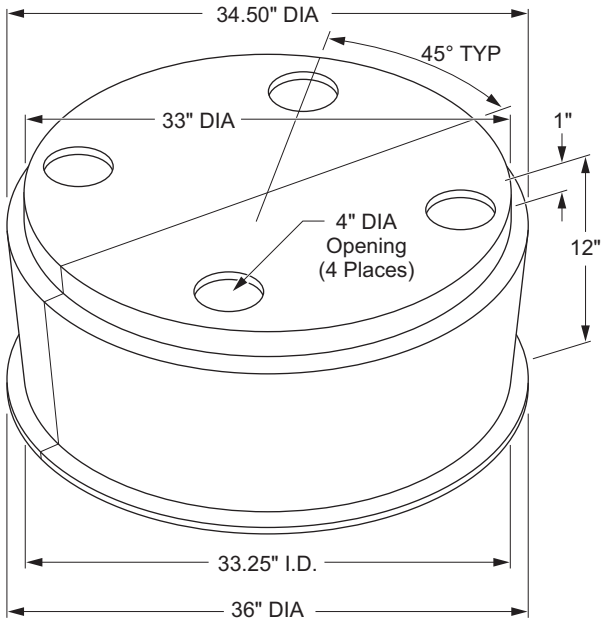


Figure US 155–1.2

Figure US 155–2: Equipment Support Extension (M/C 655-00449)



Note(s):

1. The apparatus support extension should be installed into a BURD transformer enclosure whenever the transformer secondary/primary connections would be more than 12 inches below the bottom of the tamper shield, see Figure US 155–1 (Sheet 1).
2. Apparatus extensions can be stacked (see Figure US 155–1 [Sheet 1]) if additional support height is required.
3. Support extensions can be utilized in underground vaults to elevate apparatus when water exists in the structure.

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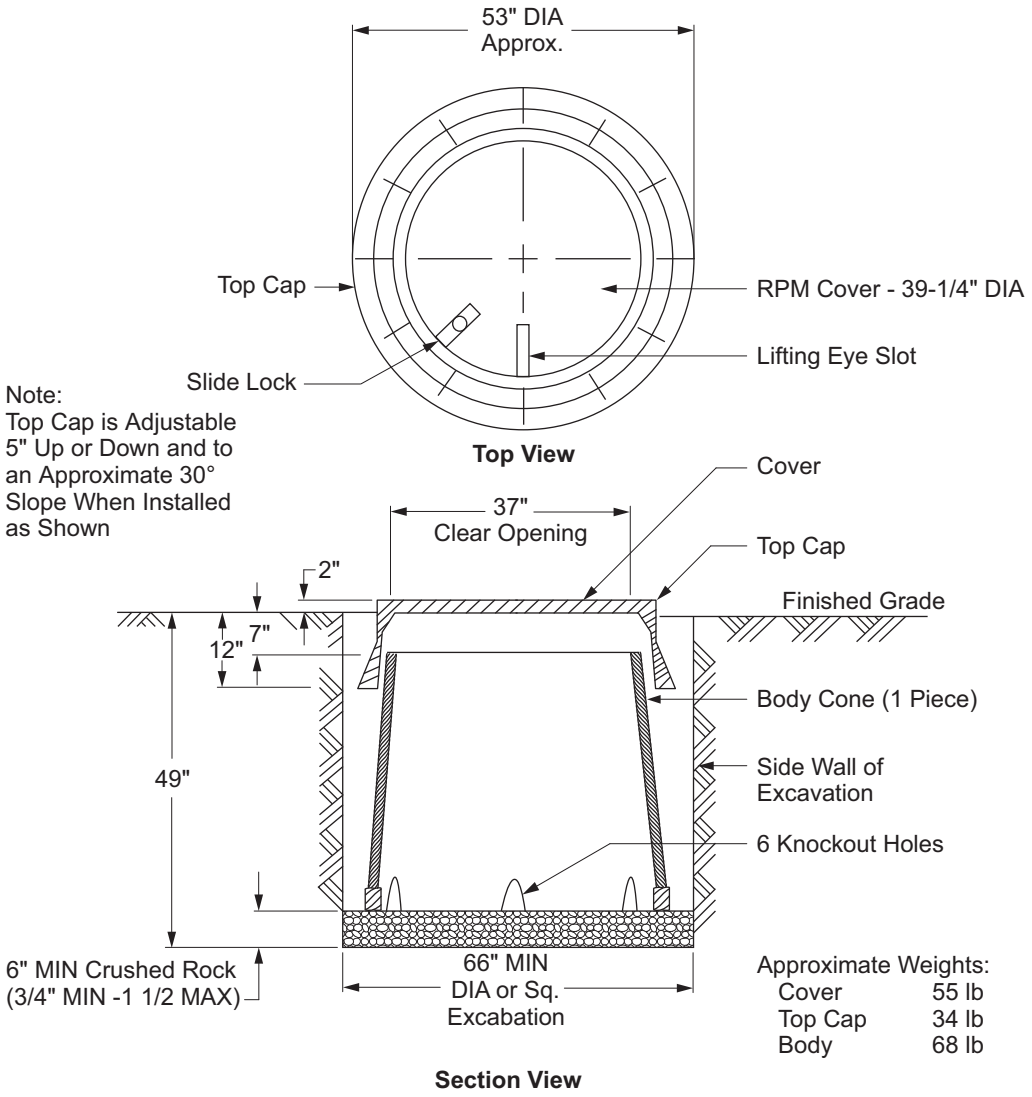
US 165 Switch Enclosure — 36" Plastic — BURD

Scope US 165.1 Lightweight BURD Switch Plastic Enclosure

Figure US 165–1: Lightweight BURD Switch Plastic Enclosure (SAP 10117681) (See Note 9.)



Note(s):

1. Each enclosure is furnished complete with one-piece body and RPM cover.
2. Backfill must be placed and compacted evenly around body.
3. Seal cable entry with duct seal or similar sealant.
4. Replacement covers available with SAP 10117666.
5. Replacement top caps available with SAP 10117636.
6. Use concrete enclosure in rocky soil areas. See US 161.
7. For parkway use only.
8. Enclosures will feature interchangeability of cover, and top cap (regardless of manufacturer).
9. Not approved for use on new construction.

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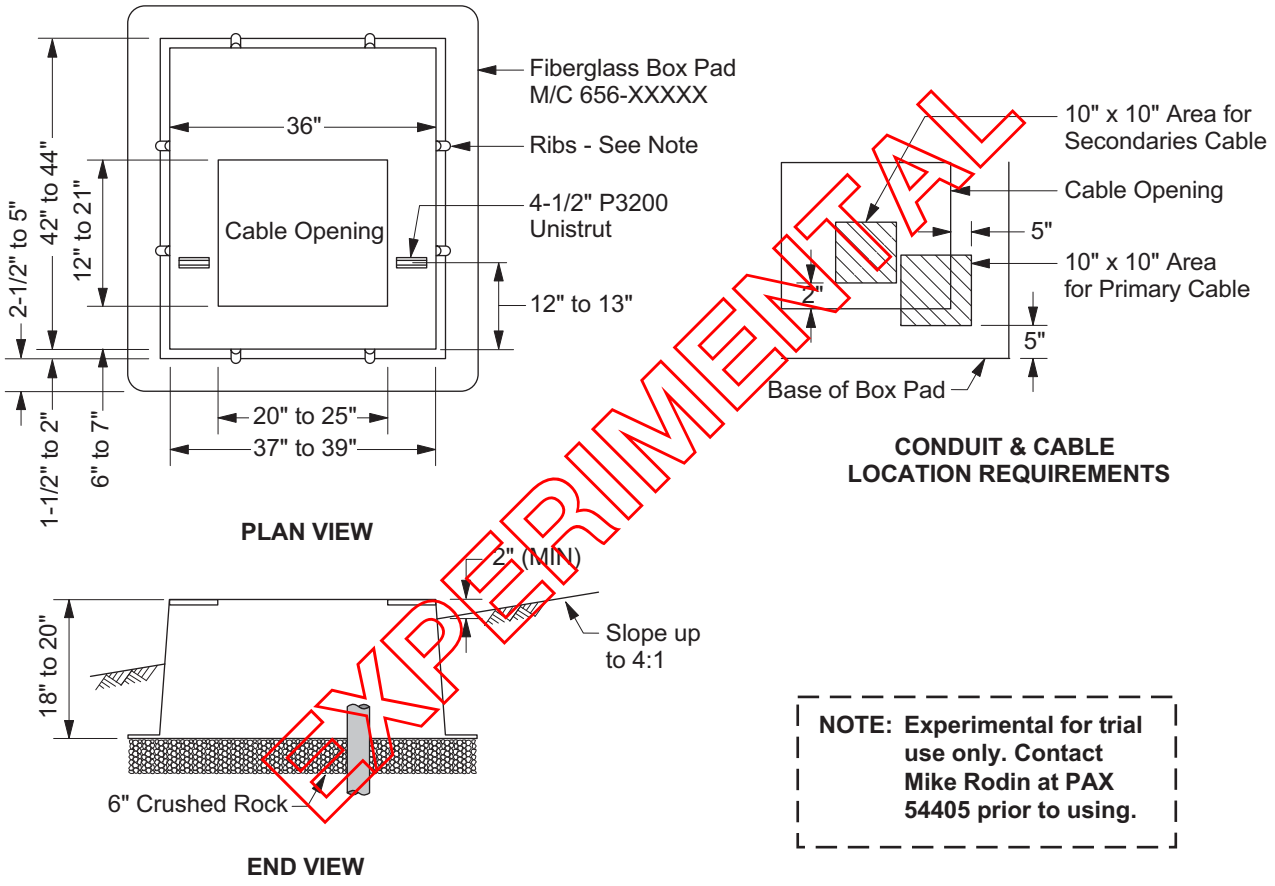
US 170 Pads for Pad-Mounted Transformers

Scope US 170.1 Fiberglass Box Pad for 1Ø, Mini-Pad-Mounted Transformers

Figure US 170–1: Fiberglass Box Pad for 1Ø, Mini-Pad-Mounted Transformers



Note(s):

1. Box pad to be set level on 6 inches of crushed rock base.
2. Box pad can be used in slopes of up to 4:1 without the need for a level finish grade. A minimum of 3 inches cover over the bottom lip is needed. This installation can also be used instead of a polymer concrete pad with an inverted handhole in those cases where additional cabling depth is needed.
3. Contractor shall set the box pad level to within 1/4 inch and to the correct grade relative to the finish curb or other reference elevation.
4. Ground rods shall be per GR 100.
5. Secure pad-mounted transformer to pad unistrut hold-down brackets with 5/8-inch unistrut nuts and bolts. Exposed outside slots of unistrut shall be filled with duct seal to close off opening after transformer installation.
6. Primary and secondary cables for mini-pad-mounted transformers should be placed into the clear opening areas as shown in the detail above to allow proper shaping, terminating, and future operation of the cables. Place the largest cables at back of the secondary cable group area and smallest at front.
7. A minimum of 8 feet of working clearance is required in front of the pad for operation of the equipment.
8. Fill the pad opening around the conduit with a thin layer of Redi-Crete or liquid asphalt emulsion for rodent control. Drive two 1-inch diameter PVC pipes through as drains.

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US 200 Shoring Requirements

Scope US 200.1 Shoring Requirements

1.0 General

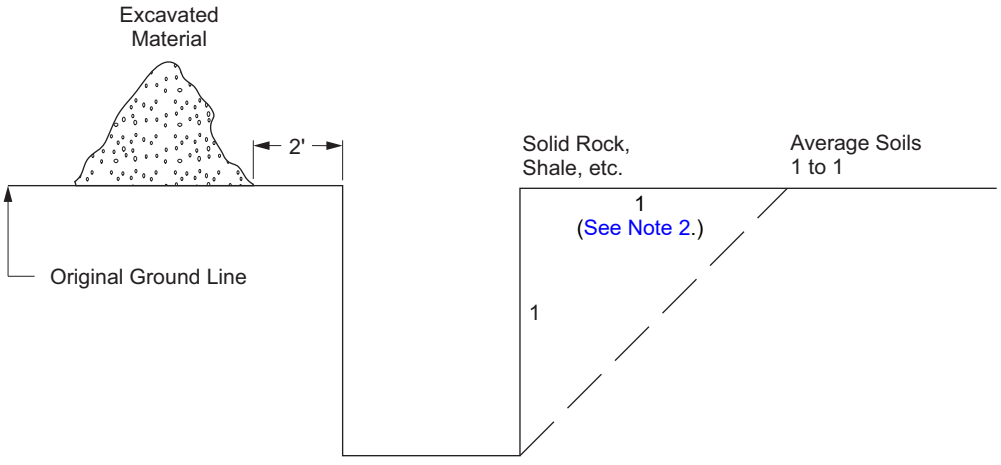
Normally, it will not be necessary to shore trenches or excavations because it is seldom necessary for Edison personnel to enter deep trenches or excavations. Where exceptions exist and workers must enter trenches or excavations, consideration should first be given to performing the work in an alternate method; for example, push or pull cables under obstructions with a hot stick or rope; partially backfill trench or excavations to a point meeting SCE cable depth requirements and when shoring is not required; insist developer provide either proper trench wall slope or shoring, for example, so that trench may be entered in a safe manner. Minimum CAL-OSHA regulations shall be followed when trenching and shoring.

It is permissible to enter **concrete** BURD enclosures without any other type of shoring around the excavation **provided** the top of the enclosure is no lower than one foot below surrounding ground level. Plastic BURD should only be entered if excavation is dug with BURD auger; or backfilled to within 45 inches of the top of trench or excavation. It is not permissible to enter a BURD transformer enclosure (concrete or plastic) when only the bottom half is installed unless there is some other means of protection or shoring in the upper half of the excavation.

2.0 Requirements

Employees shall not work in an excavation or trench five feet deep or more unless it is shored, laid back to a stable slope (see Figure US 200–1 [Sheet 1]), or protected by some other equivalent means (such as plastic or concrete enclosures under conditions stated above). Sloping or shoring for excavations greater than 20 feet deep shall be designed and stamped by a California Registered Professional Engineer.

Figure US 200–1: Shoring and Sloping Requirements



Trenches less than five feet in depth shall also be effectively protected when examination of the ground indicates hazardous ground movement may be expected. The suggested method of supplying protection in trenches less than five feet in depth is the use of 3/4-inch plywood sheeting with 4 x 4 wood cross braces. Metal expanding trench jacks may be used in lieu of 4 x 4 cross bracing.

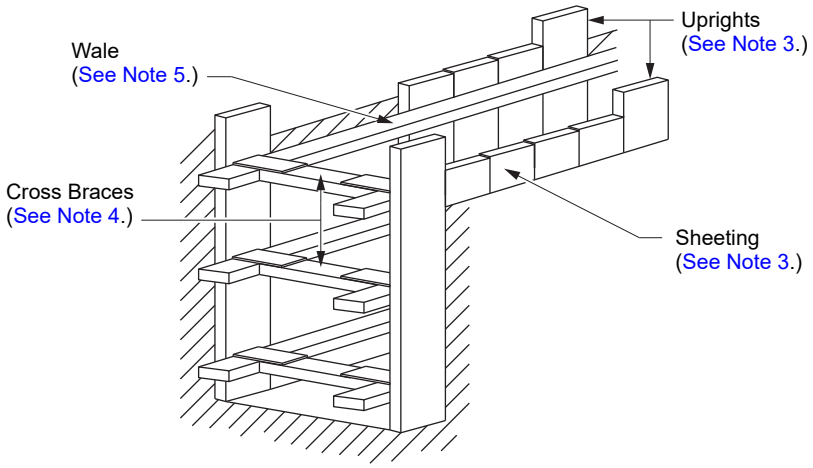
Table US 200–1: Shoring Requirements — Timber Size and Spacing

Soil Type	Depth	Uprights		Cross Braces			Wales	
	Feet	Size (in)	Horizontal Spacing (ft)	Size (in)	Horizontal Spacing (ft)	Vertical Spacing (ft)	Size (in)	Vertical Spacing (ft)
Hard, Compact	5–10	4 x 8	8	4 x 4	8	4	—	—[a/]
Hard, Compact	10–20	4 x 12	4	6 x 6	12	4	8 x 8	4
Unstable	5–10	4 x 8	3	6 x 6	10	5	6 x 8	5
Unstable	5–10	3 x 12	3	6 x 6	10	5	6 x 8	5
Unstable	10–20	4 x 6	Solid	6 x 8	8	5	8 x 10	5
Running	5–10	3 x 6	Solid	6 x 6	10	5	8 x 8	5
Running	10–20	4 x 6	Solid	8 x 8	6	5	10 x 12	5

[a/] Generally not required.

Table US 200–1 (Sheet 2) shows the minimum OSHA requirements for trench shoring for trenches up to 6 feet wide and the specific depth. Timber sizes are stated for Douglas Fir or equivalent. Whether shoring is required or not, all trenches and excavations four feet or more in depth shall be ascended and descended with ladders. There shall be a ladder no more than 25 feet from any employee occupying the trench and it shall extend at least three feet out of the excavation. The most current OSHA regulations should be followed for all trenching and shoring requirements.

Figure US 200–2: Shoring Diagram



Note(s):

1. Both sides of trench and all sides of excavation must be sloped when used in lieu of shoring.
2. Unstable soils such as gravel, sand, submerged soil, or soil which water is freely seeping require a slope ratio greater than or equal to 1.5 (horizontal) to 1 (vertical). Undisturbed clay and cemented soils may have a slope ratio greater than or equal to 3/4 (horizontal) to 1 (vertical).
3. Uprights, also called sheeting, are the vertical members placed in contact with the earth.
4. Cross braces are horizontal members installed perpendicular to the sides of the excavation, the ends of which bear against uprights or wales. The top crossbrace is placed no more than 2 feet below the top of the trench.
5. Wales are horizontal members placed parallel to the excavation face whose sides bear against the vertical members or earth.

US 201 Vault Shoring

Scope US 201.1 Adjustable Vault Reinforcement Systems

1.0 General Information

Adjustable vault reinforcement (AVR) systems are available as prefabricated kits for insertion into deteriorated SCE vaults per SCE Engineering Specification SSD3-2015. These kits are designed for structural reinforcing and associated safety of the vault ceiling, not the walls or floor. Other shoring or measures shall be used where walls are determined to be structurally compromised.

Follow all appropriate policies and procedures per the Accident Prevention Manual (APM) during installation of any AVR system.

AVR system installations shall not interfere with the operation of switches.

Table US 201–1: AVR Systems and Selection Criteria

AVR SYSTEM	DURATION OF USE	VAULT SCHEDULED TO BE REPLACED?	FALLING DEBRIS?	TYPICAL USE / NOTES	COMMENTS
Heavy Decking (HD)	3-15 years	No	Yes	Use when ceiling and vault is in fair condition	See DUGUS 201.2
Light Decking (LD)	1-5 years	Yes	Yes	Use when ceiling and vault is in poor to fair condition	See DUGUS 201.3
Post and Beam (with Netting)	Up to 3 years	Yes	Yes	Emergencies and other short term cases	See DUGUS 201.4
Post and Beam (without netting)	3-15 years	No	No	Primary use is for non-standard vaults when structural stability of ceiling is in doubt	See DUGUS 201.5
Vault Ceiling Netting (without Post and Beam)	1-5 years	No	Yes	Use when ceiling and vault is in fair condition.	See DUG US 201.6
Vault Riser Netting (without Post and Beam)	1-5 years	No	Yes	Use when ceiling and vault is in fair condition and riser is spalling.	See DUG US 201.7

Note(s):
1. This table will be used by the Deteriorated Vault and Manhole Program (DVMP) Project Manager in coordination with Distribution Structural Engineering to determine appropriate action for a deteriorated vault.
2. Spalling is defined as thin layers of concrete that have broken off. Refer to Deteriorated Vault and Manhole Assessment Guide available from Distribution Structural Engineering.

Scope US 201.2 Adjustable Vault Reinforcement – Heavy Decking

1.0 General Information

The AVR heavy decking kit is intended to shore a deteriorated vault ceiling from 3 to 15 years. The kit consists of columns and beams which provide structural support to the ceiling; and decking which prevents spalling concrete from falling.

2.0 Materials

Materials are laminated wood and metal components and are pre-packed in kits as defined in Table US 201–2 shown below.

Table US 201–2: Adjustable Vault Reinforcement System Kits – Heavy Decking

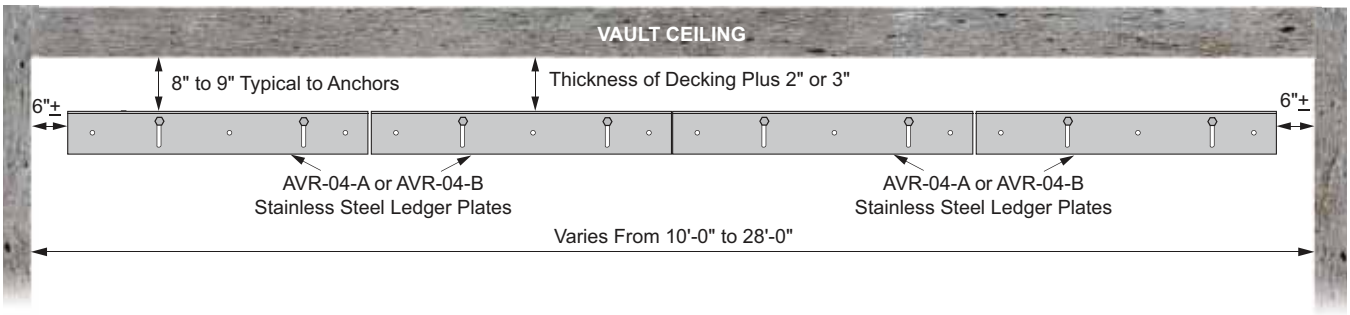
SCE Vault Dimensions		Reinforcement System Kit SAP Number	Post-less Reinforcement System Kit SAP Number
Length (ft)	Width (ft)		
10	8	10203109	10214751
14	8	10203111	10214752
18	8	10203106	10214753
20	8	10203279	10214754
22	8	10203278	10214755
24	8	10203277	10214756
26	8	10203276	10214757
28	8	10203275	10214758

3.0 Installation

Installation shall be in accordance with the manufacturer's written instructions, provided as follows for reference.

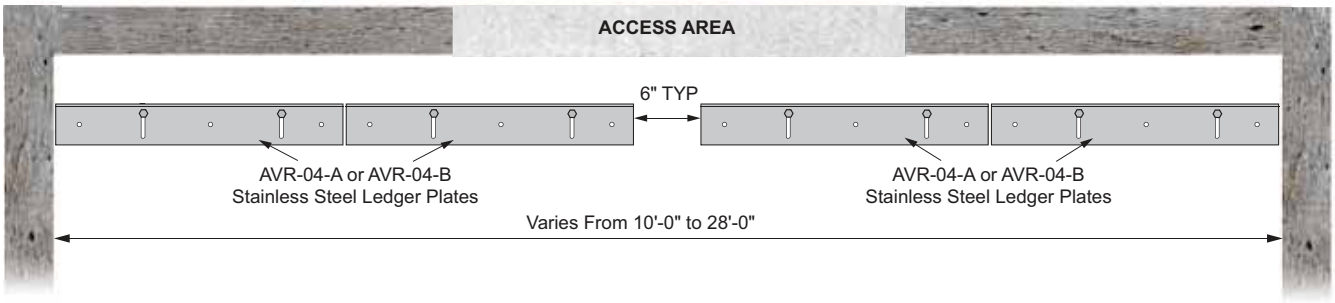
STEP 1. Drill 5/8" x 3-1/2" (minimum depth) holes in the long wall opposite the access area. Temporarily attach ledger plates to vault walls as shown in Figure US 201–1, with the slotted holes of the ledger plates resting on the 5/8" anchor bolts. The distance between the vault ceiling and the top of the ledger plate shall be 2" to 3" plus the thickness of the decking.

Figure US 201–1: Ledger Plate Positioning on Long Wall Opposite Entry Area



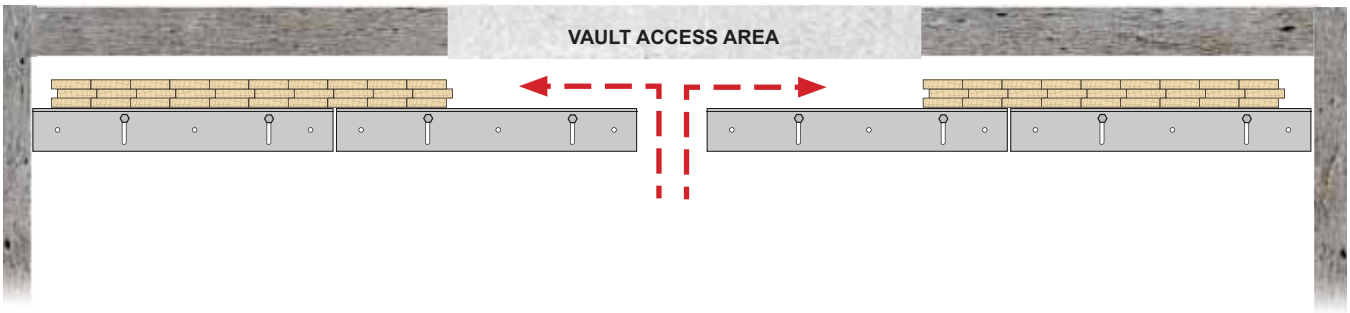
STEP 2. Repeat STEP 1 for the long wall adjacent to the access area, using the ledger placement shown in Figure US 201–2. Rather than leaving 6" gaps on each end, the plates will be located so as to create a 6" to 9" minimum gap in the center of the access area.

Figure US 201–2: Ledger Plate Positioning on Long Wall Adjacent Entry Area



STEP 3. Insert decking members from the center towards the ends of the vault as shown in Figure US 201–3, leaving the access area free of decking.

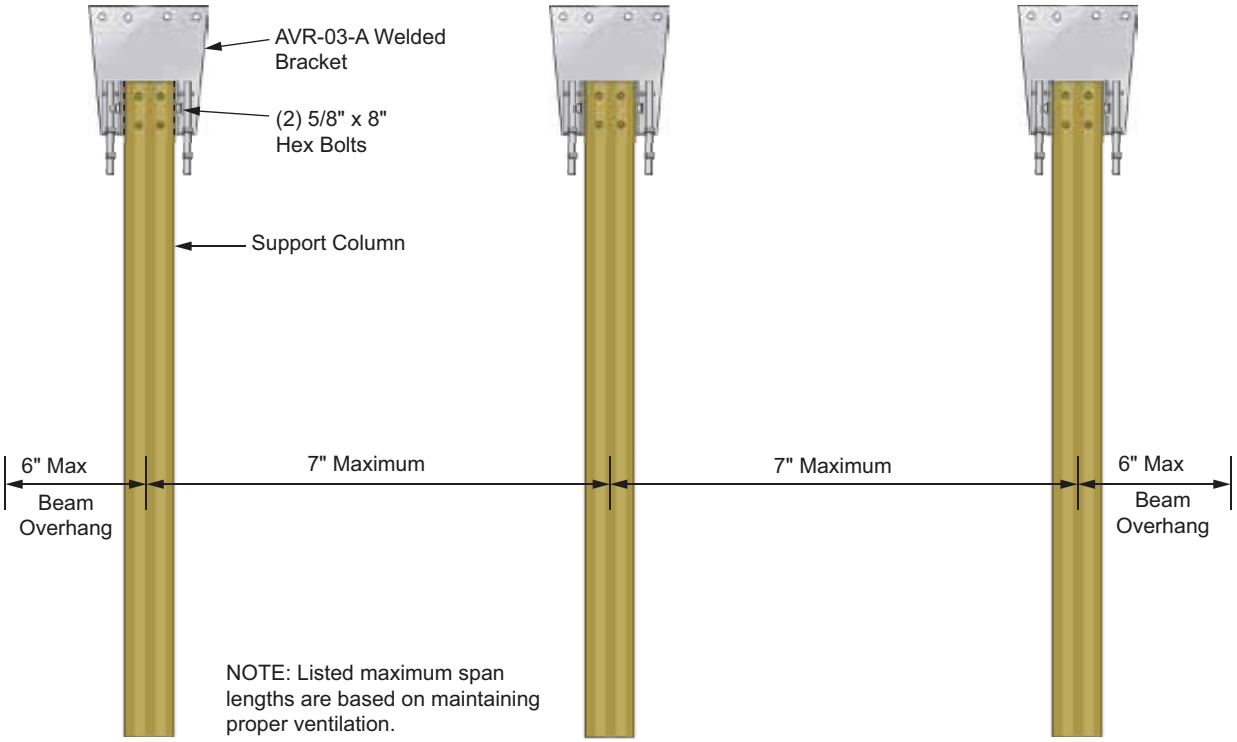
Figure US 201–3: Decking Members



STEP 4. Mount welded brackets to top of the columns using two 5/8" x 8" hex bolts.

STEP 5. Locate, plumb & temporarily support all support columns using temporary shoring per manufacturer's installation instructions. The maximum distance between support columns is 7'. The maximum distance that the beam may overhang past the support columns on the ends is 3'-6" as shown in Figure US 201–4.

Figure US 201–4: Support Column Placement



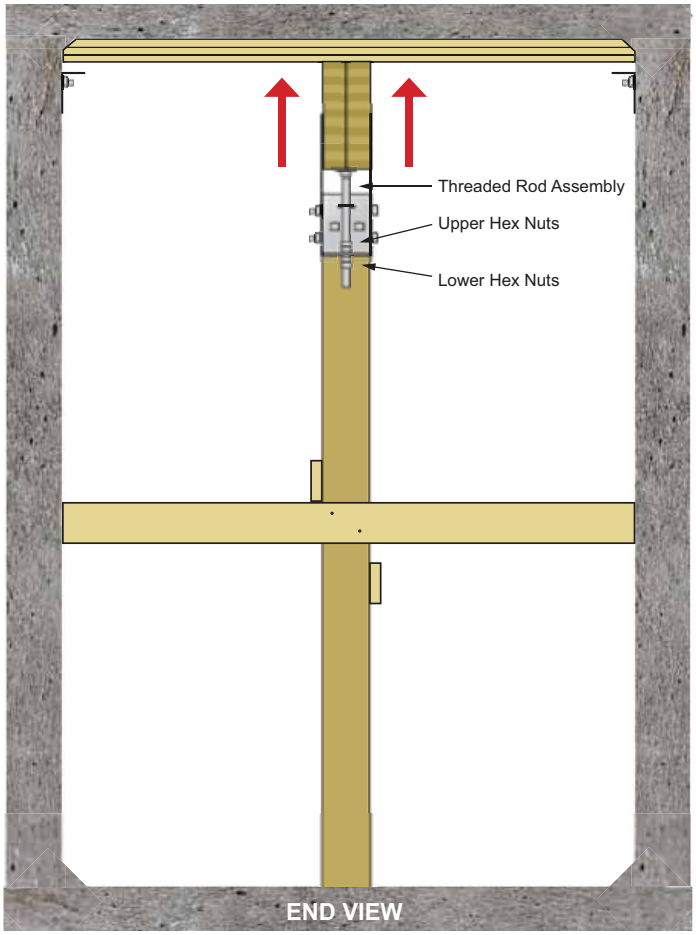
STEP 6. Attach AVR side plates to the columns using one 5/8" x 8" hex bolt. Lift the first support beams into place on top of the columns and temporarily secure with 3" hex screws from the back, using the small holes in the center of the welded brackets. Lift remaining beams into place and rotate side plates into position and secure with 5/8" hex bolts.

STEP 7. Cut decking to fit into the remaining middle area. Decking members can be slid in on top of the AVR support beams so that they rest on the beams and the ledger plates.

STEP 8. After all remaining decking members have been inserted, secure them to each other using 4" screws.

STEP 9. Using a wrench, rotate the upper hex nut (see Figure US 201–5) clockwise to raise the rod assembly against the support beams. Continue rotating both upper hex nuts until the support beam is firmly pressed against the vault ceiling. Hand tighten the remaining hex nuts against bottom of bracket to temporarily secure the rod assemblies.

Figure US 201–5: Rod Assembly



STEP 10. Drill 15/16" holes in the support beams and install 7/8" hex bolts to secure the support beams to the AVR side plates.

STEP 11. Push ledger plates up against ceiling decking and drill 5/16" x 3" pilot holes in ceiling decking, then secure ledger plates to decking with 5/8" x 3" lag bolts. Tighten the 5/8" anchor bolts in the slotted ledger plate holes.

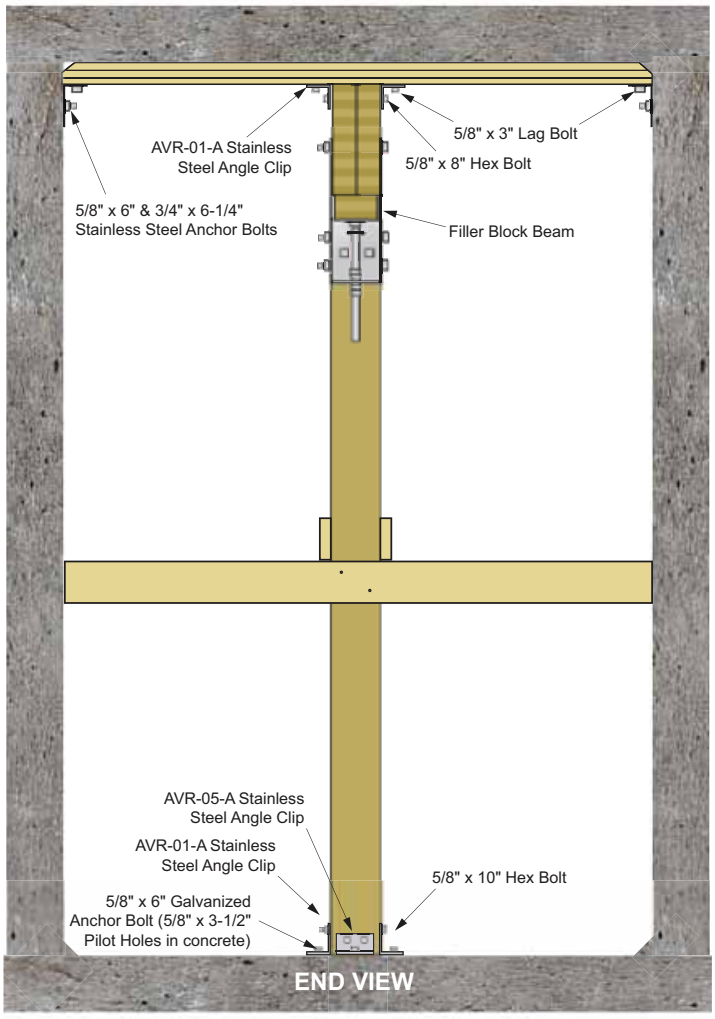
STEP 12. In the remaining ledger plate bolt positions, drill 3/4" x 4-1/4" deep pilot holes for the 3/4" x 6-1/4" anchor bolts. Permanently secure stainless steel ledger plates to vault walls.

STEP 13. Measure the gaps between the support beam and the top of each column. Using the 4-3/8" x 6" x 6' Filler Block beam supplied with the AVR System, trim the 4-3/8" thickness to tightly fit this gap. Cut each section to a minimum of 18" in length and insert filler blocks into each gap.

STEP 14. Using a wrench, raise the rod assemblies tightly against the spacer blocks. Permanently secure the rod in place by tightening remaining hex nuts.

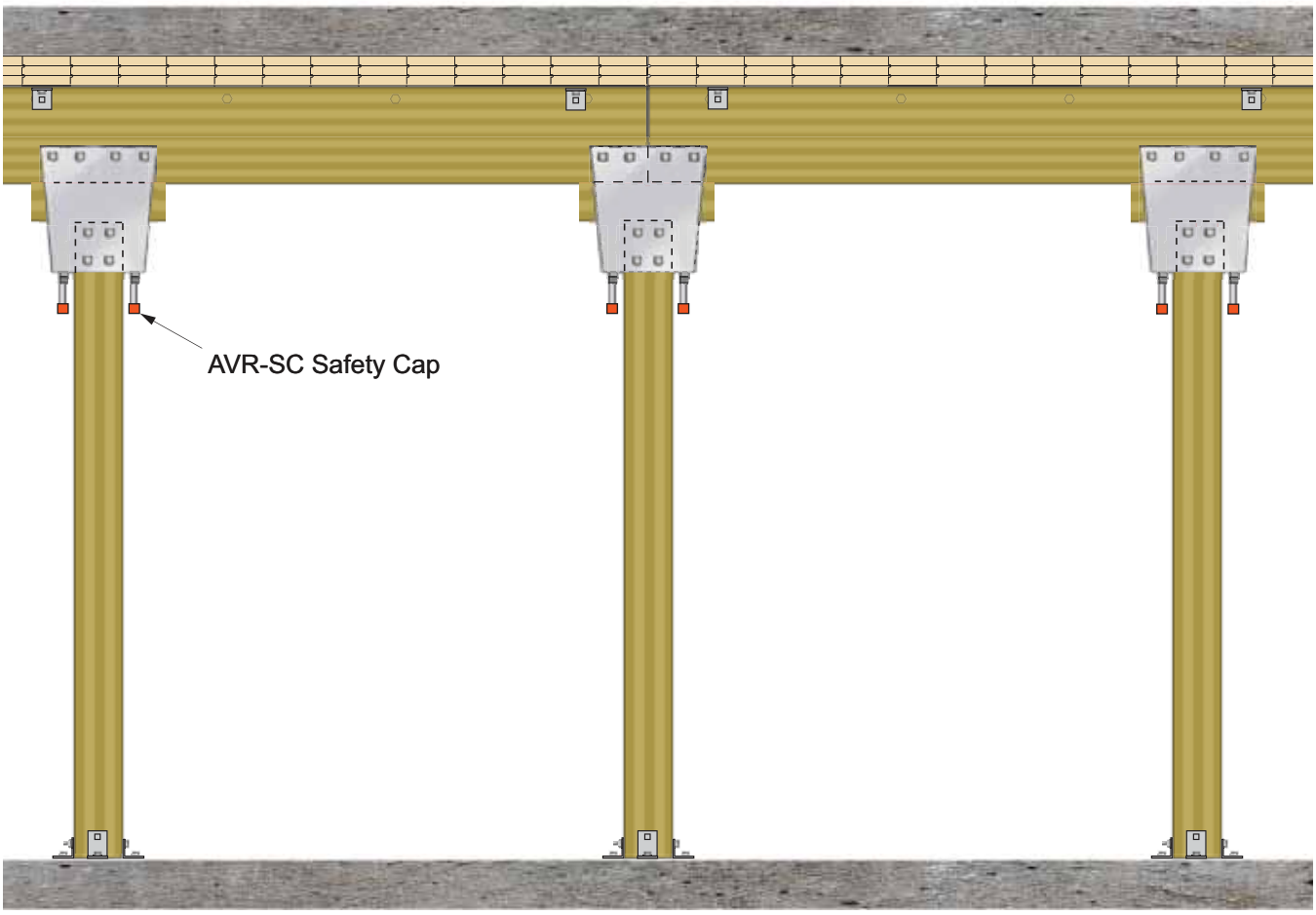
STEP 15. Drill 5/16" x 3" pilot holes for angle clips in the ceiling decking and support beams. Attach angle clips to the support beam at the ceiling and to all four sides of the base of the support columns at the floor as shown in Figure US 201–6 andFigure US 201–7.

Figure US 201–6: Angle Clip Placement



STEP 16. Complete installation by removing temporary shoring, attaching warning labels to support columns, and attaching safety caps to adjustable rods as shown in Figure US 201–7.

Figure US 201–7: AVR Full Assembly



4.0 Restrictions

1. Do not attach rigging or cable pulling apparatus to support columns.
2. The manufacturer supplied rounded hog-eye shall only be installed on ceiling decking and is rated to a maximum of 200 lbs.

5.0 Inspection & Repairs

Adjustable vault reinforcement system components shall be inspected concurrent with the regular DIMP scheduled structural inspections for vaults. The laminated columns and beams shall be inspected for any signs of deterioration (see DIMP CG-3). Areas showing discoloration shall be sounded with a light hammer to test for any internal defects. The metallic portions shall be inspected for any signs of corrosion.

Scope US 201.3 Adjustable Vault Reinforcement – Light Decking

1.0 General Information

The AVR light decking kit is intended to shore a deteriorated vault ceiling from 1 to 5 years. The kit consists of columns and beams which provide structural support to the ceiling; and decking which prevents spalling concrete from falling.

2.0 Materials

Materials are laminated wood and metal components and are pre-packed in kits as defined in Table US 201–3 shown below.

Table US 201–3: Adjustable Vault Reinforcement System Kits – Light Decking

SCE Vault Dimensions		Reinforcement System AVR Drawing Number
Length (ft)	Width (ft)	
10	8	AVR-A10-LD
14	8	AVR-A14-LD1
18	8	AVR-A18-LD

3.0 Installation

Installation shall be in accordance with the manufacturer's written instructions, similar to heavy decking shown previously for reference.

Scope US 201.4 Adjustable Vault Reinforcement - Post and Beam with Netting

1.0 General Information

The AVR post and beam with netting kit is intended to shore a deteriorated vault ceiling and prevent falling debris for up to 3 years. This kit is intended to be used as a temporary safety measure until the vault will be replaced.

2.0 Materials

Materials are laminated wood, metal components, and netting which are pre-packed in kits as defined in Table US 201–4 shown below.

Table US 201–4: Adjustable Vault Reinforcement System Kits -- Post and Beam with Netting

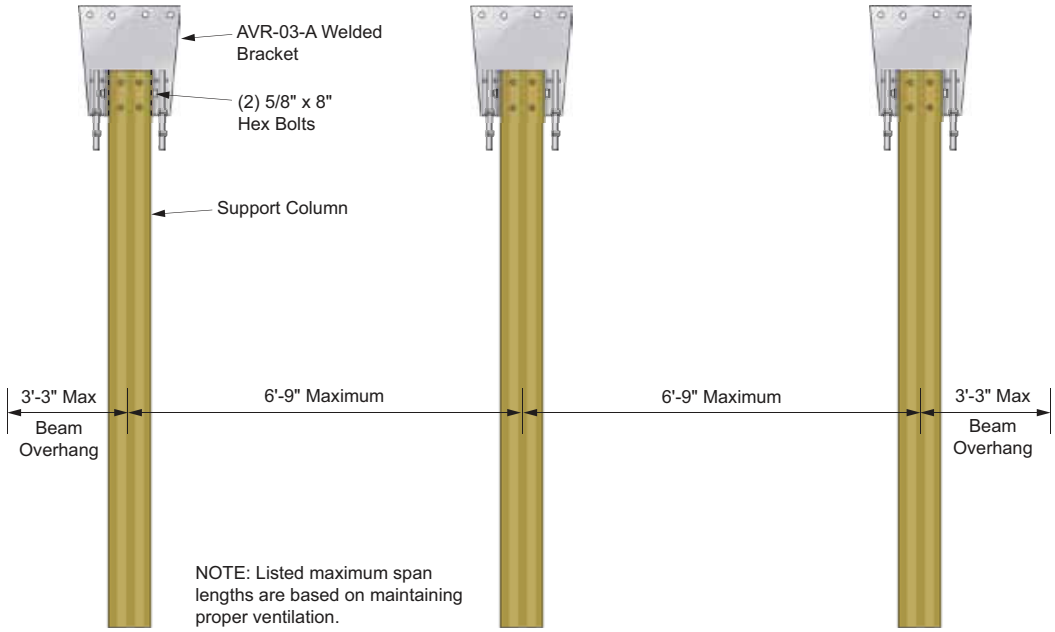
SCE Vault Dimensions		Reinforcement System AVR Drawing Number
Length (ft)	Width (ft)	
10	8	AVR-A10-NET
14	8	AVR-A14-NET
18	8	AVR-A18-NET
20	8	AVR-A20-NET
22	8	AVR-A22-NET
24	8	AVR-A24-NET
26	8	AVR-A26-NET
28	8	AVR-A28-NET

3.0 Installation

Installation shall be in accordance with the manufacturer's written instructions shown below for reference.

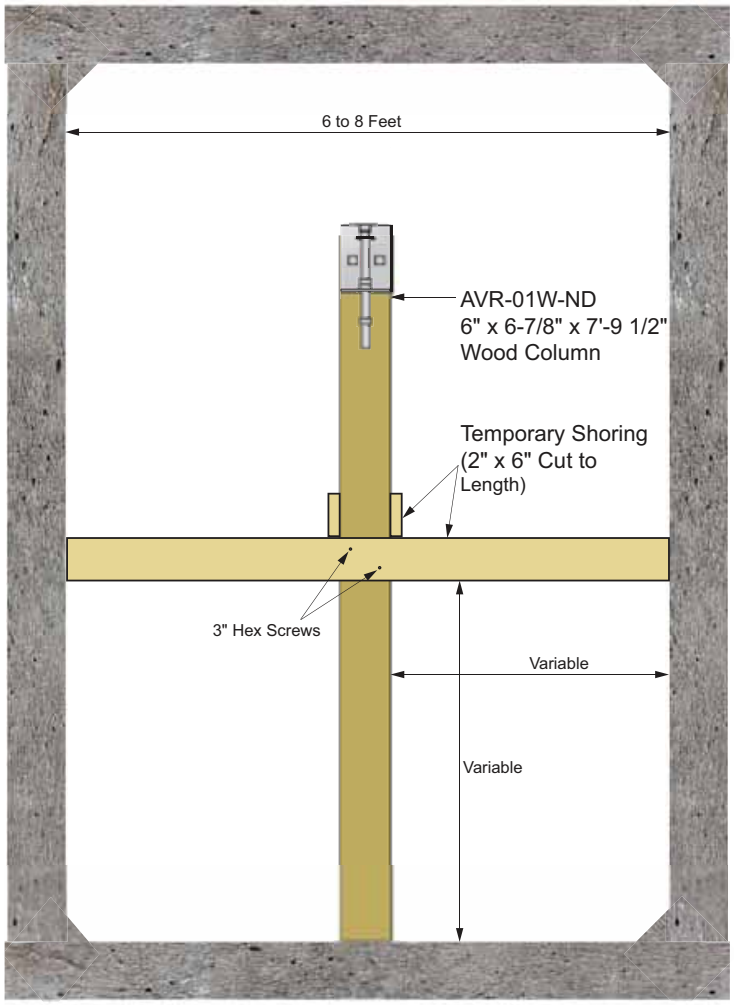
STEP 1. Mount AVR-03-A welded brackets to top of the columns using two 5/8" x 8" hex bolts.

Figure US 201–8: Column and Bracket Placement



STEP 2. Locate, plumb & temporarily support all support columns using temporary shoring. Support columns should be located as close to the center of the vault as possible.

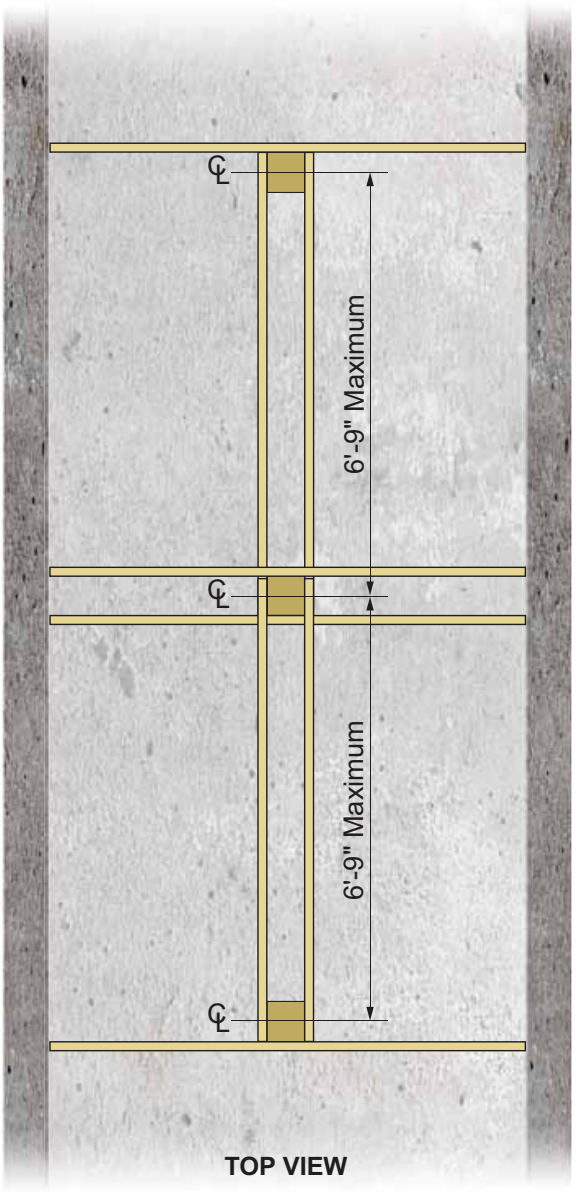
Figure US 201–9: Temporary Shoring Construction



END VIEW

STEP 3. Plumb & tie together support columns with temporary shoring.

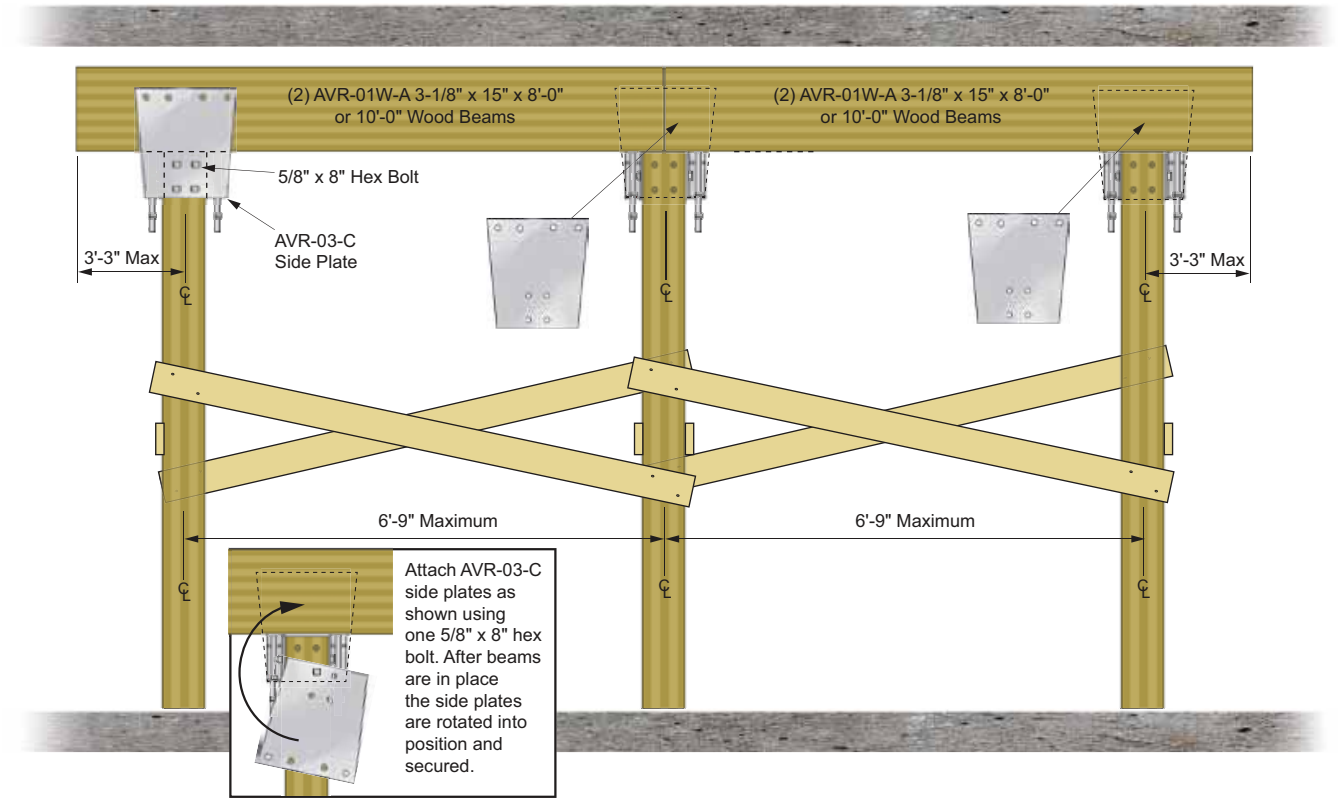
Figure US 201–10: Temporary Shoring



TOP VIEW

STEP 4. Attach plate “AVR-03-C" to the columns using one 5/8" x 8" hex bolt as shown in the illustration below. Lift first support beams into place on top of columns and temporarily secure with 3" hex screws from the back through small holes in the center of the welded brackets AVR-03-A. Lift remaining beams into place as shown and rotate side plates into position and secure with 5/8" hex bolts.

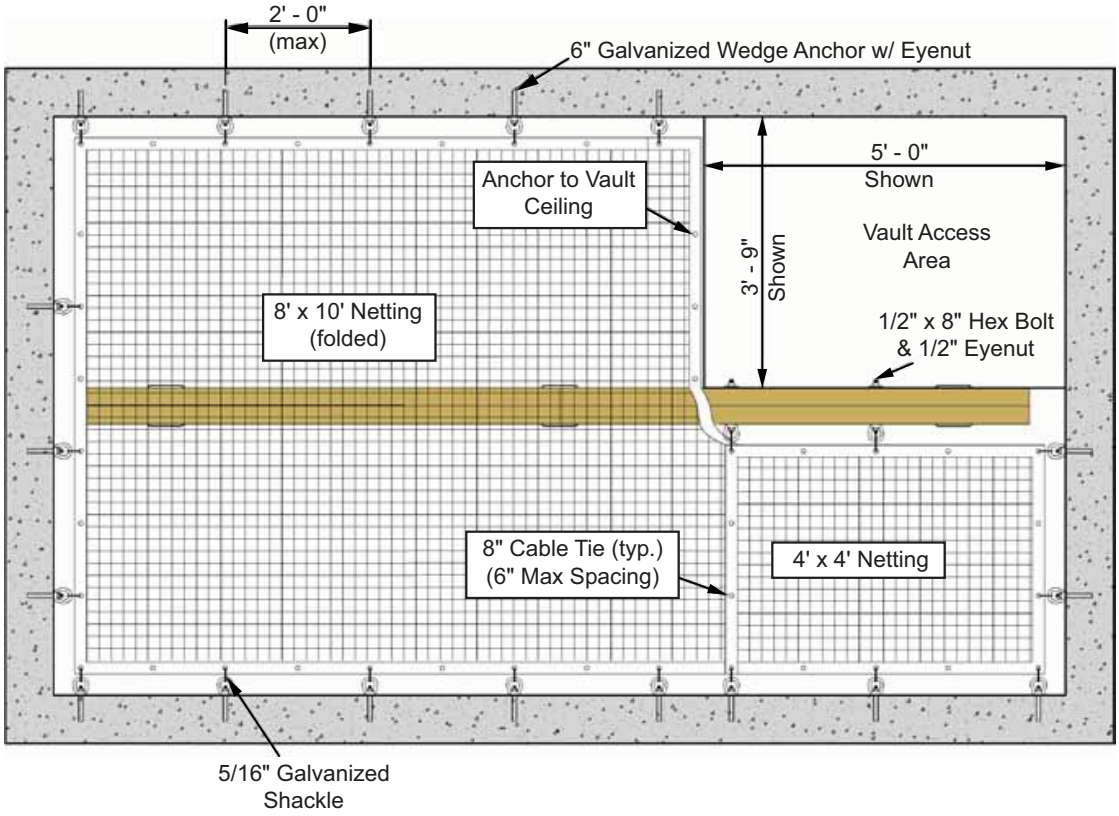
Figure US 201–11: Side Plate Installation:



SIDE VIEW

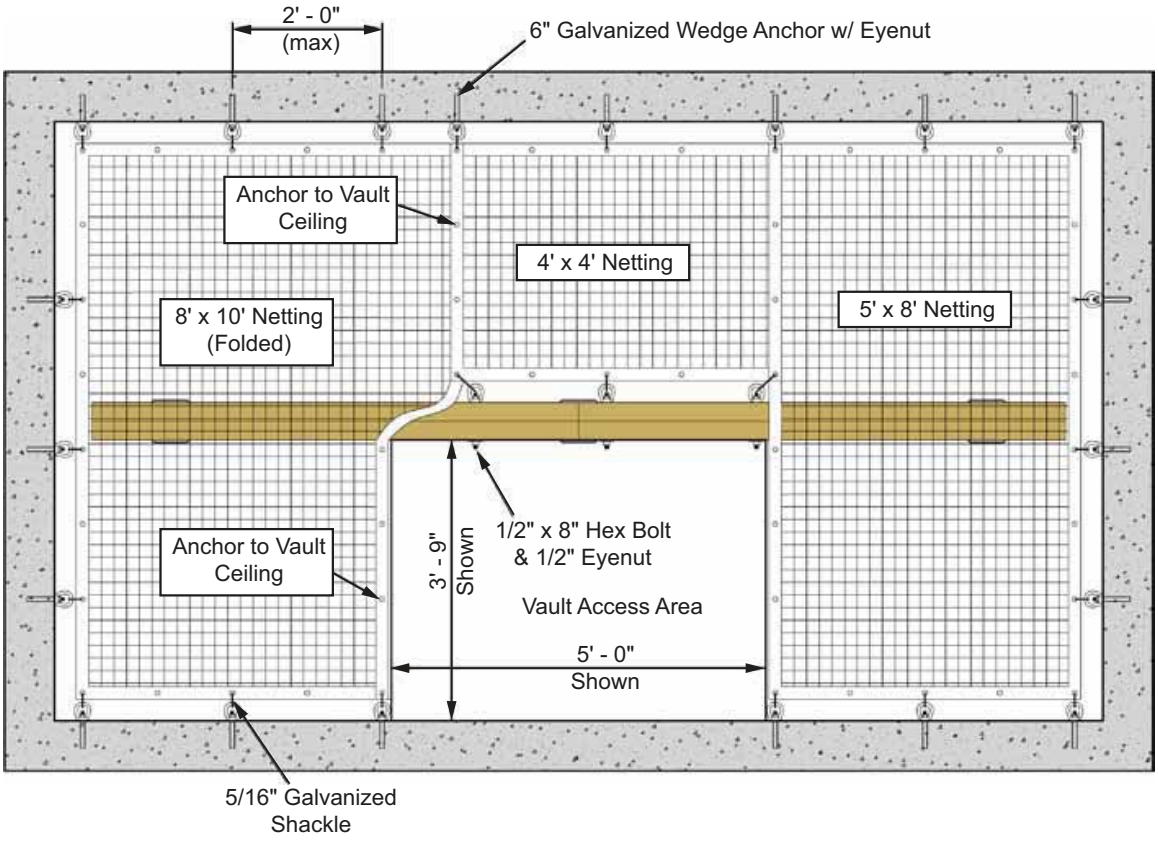
STEP 5.1 Install galvanized anchors and eyenuts for 4' x 4' netting section. Install 4' x 4' netting section securing it to the eyenuts with galvanized shackles. Install galvanized anchors and eyenuts for 8' x 10' netting section. Install 8' x 10' netting section, draping it over beam, securing it to the eyenuts with galvanized shackles.

Figure US 201–12: Netting Installation



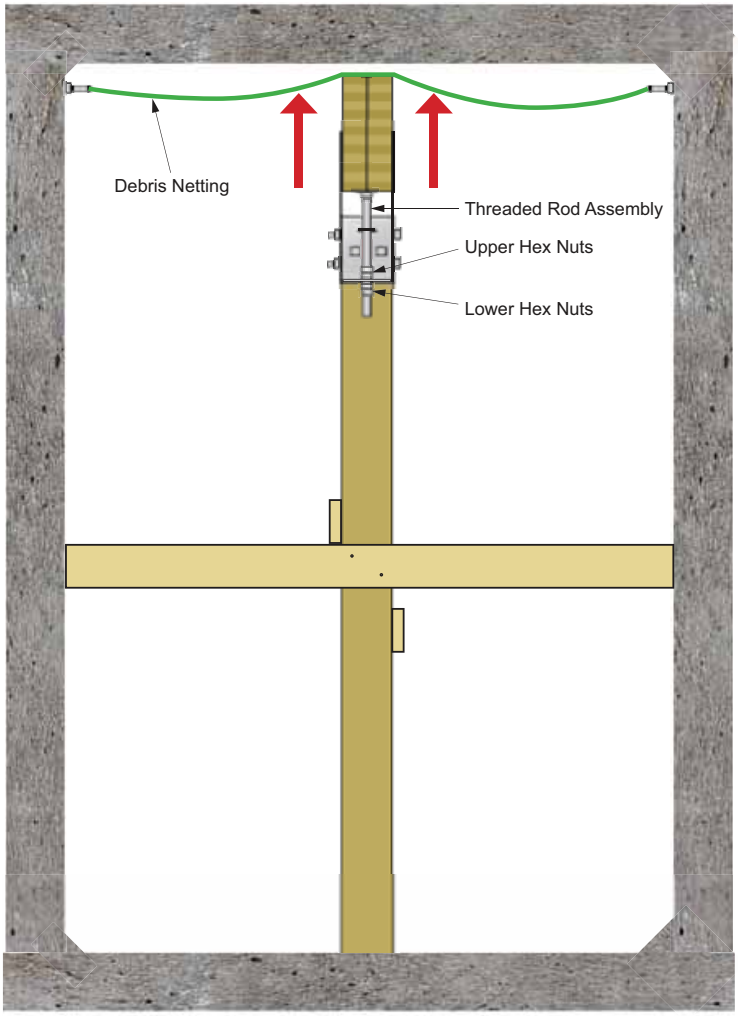
STEP 5.2 Install galvanized anchors and eyenuts for 4' x 4' netting section. Install 4' x 4' netting section securing it to the eyenuts with galvanized shackles. Install galvanized anchors and eyenuts for 4' x 8' netting section. Install 8' x 8' netting section (folding it in half to make a 4' x 8' section), draping it over beam, securing it with cable clips. Install galvanized anchors and eyenuts for 5' x 8' netting section. Install 8' x 10' netting section (folding it to make a 4' x 8' section), draping it over beam, securing it to the eyenuts with galvanized shackles.

Figure US 201–13: Netting Installation



STEP 6. Using a wrench, rotate the upper hex nut (see diagram below) clockwise to raise the rod assembly against the support beams. Continue rotating both upper hex nuts until the support beam is firmly pressed against the vault ceiling. Hand tighten the remaining hex nuts against bottom of bracket to temporarily secure the rod assemblies.

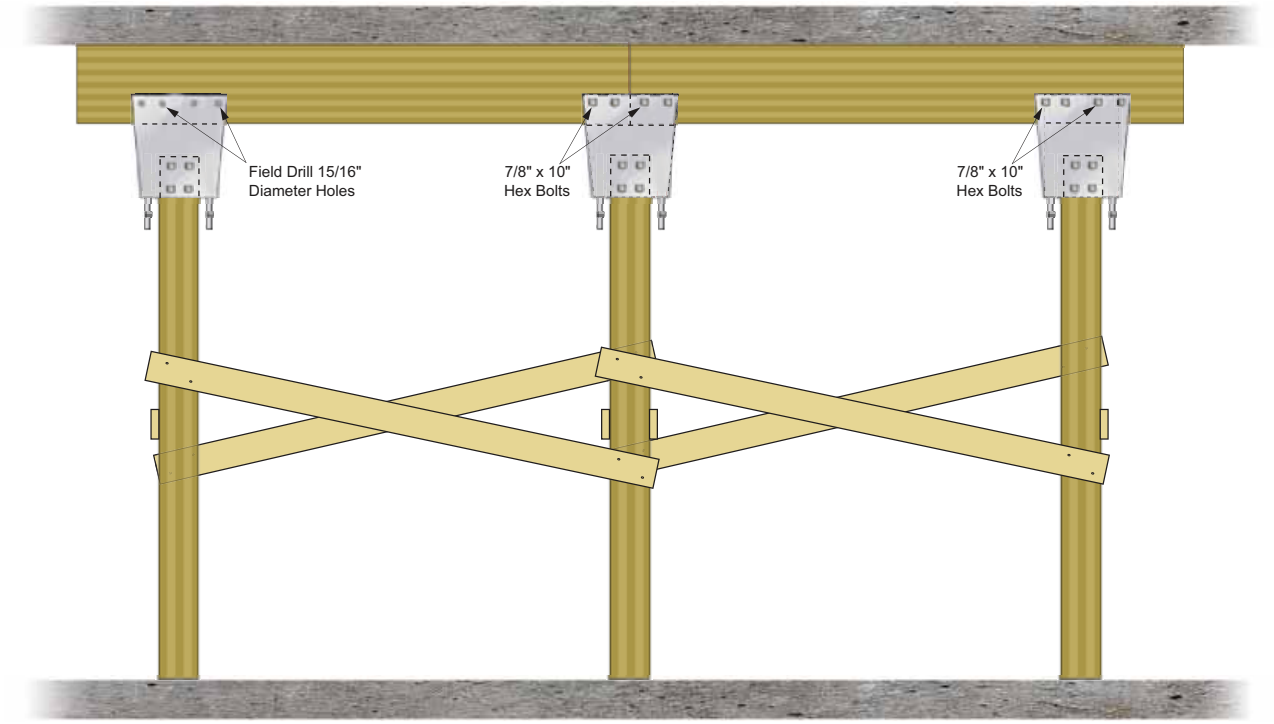
Figure US 201–14: Raising Rod Assembly



END VIEW

STEP 7. Field drill holes in the support beams and install 7/8" hex bolts to secure the support beams to the plates as shown inFigure US 201–15.

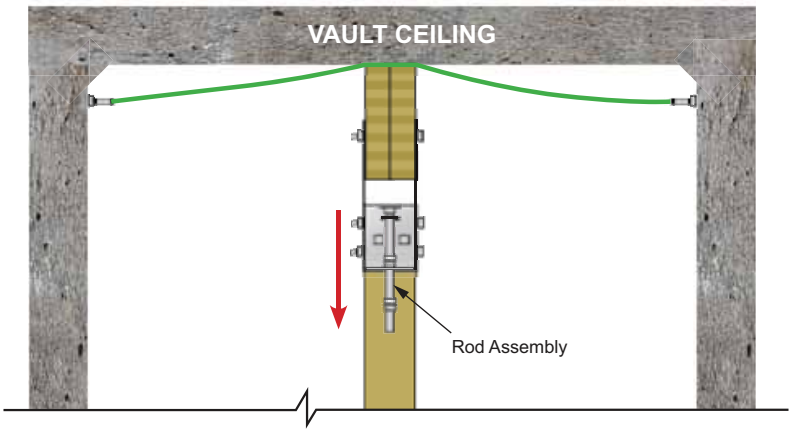
Figure US 201–15: Drilling Locations



SIDE VIEW

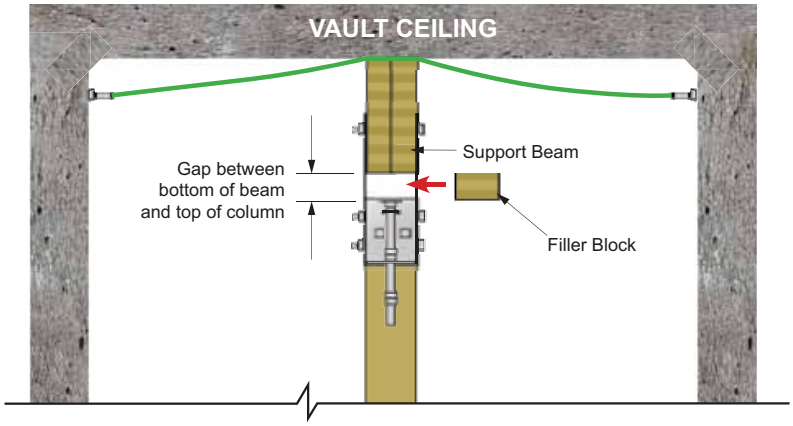
STEP 8. Using a wrench, loosen nuts and lower Rod Assemblies as shown in Figure US 201–16

Figure US 201–16: Lowering Rod Assembly



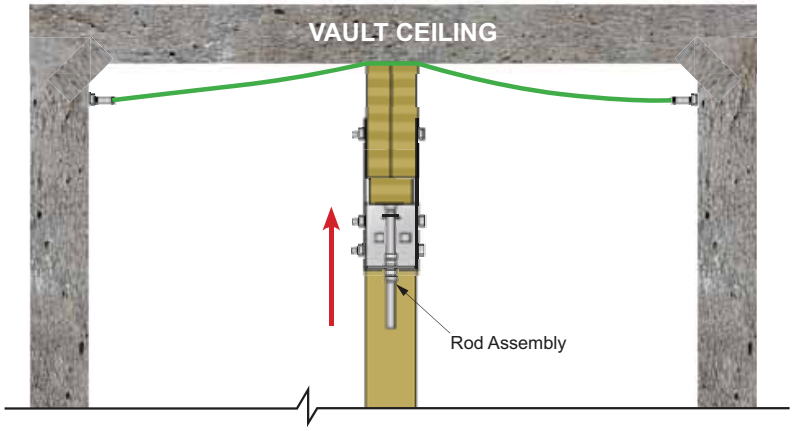
STEP 9. Measure each gap between the beams and top of columns. Using the AVR-01W-B 4-3/8" x 6" x 6'-0" Filler Block beam supplied with the AVR System, trim the 4-3/8" thickness to tightly fit this gap. Cut each section to a minimum of 18" in length. Insert filler blocks into each gap.

Figure US 201–17: Filler Block Installation



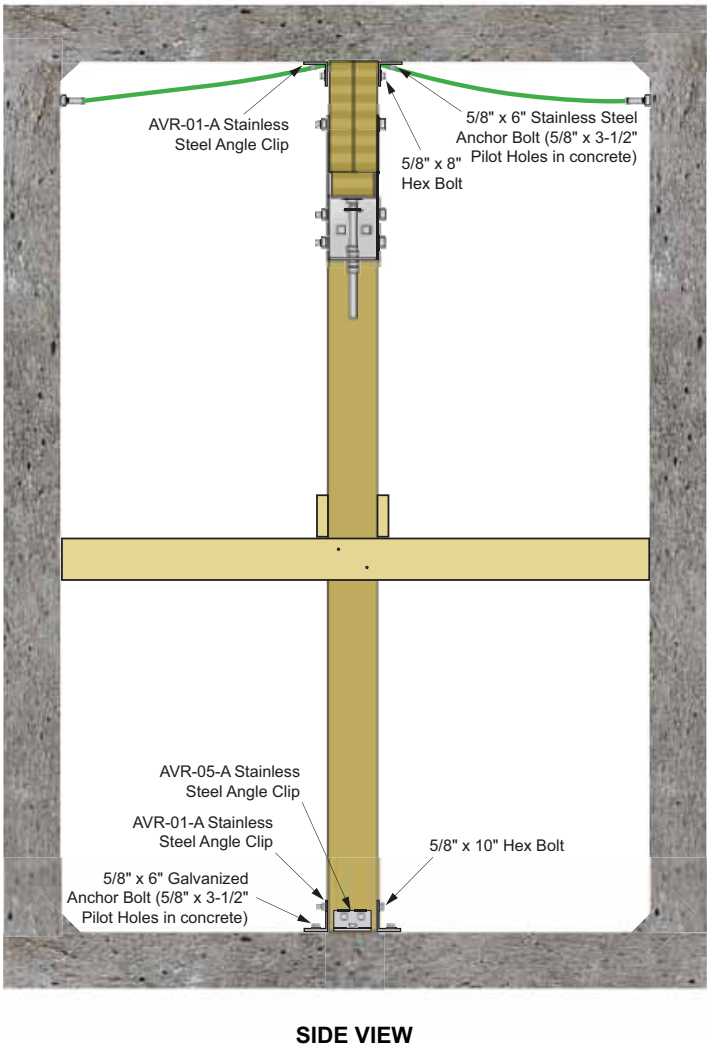
STEP 10. Using a wrench, raise the rod assemblies tightly against the spacer blocks. Permanently secure the rod in place by tightening remaining hex nuts.

Figure US 201–18: Rod Assembly Installation



STEP 11. Drill 5/16" x 3" pilot holes in support beams. Attach angle clips to the support beam at the ceiling (see step 12 for placement). Attach angle clips to the base of the support columns at the floor.

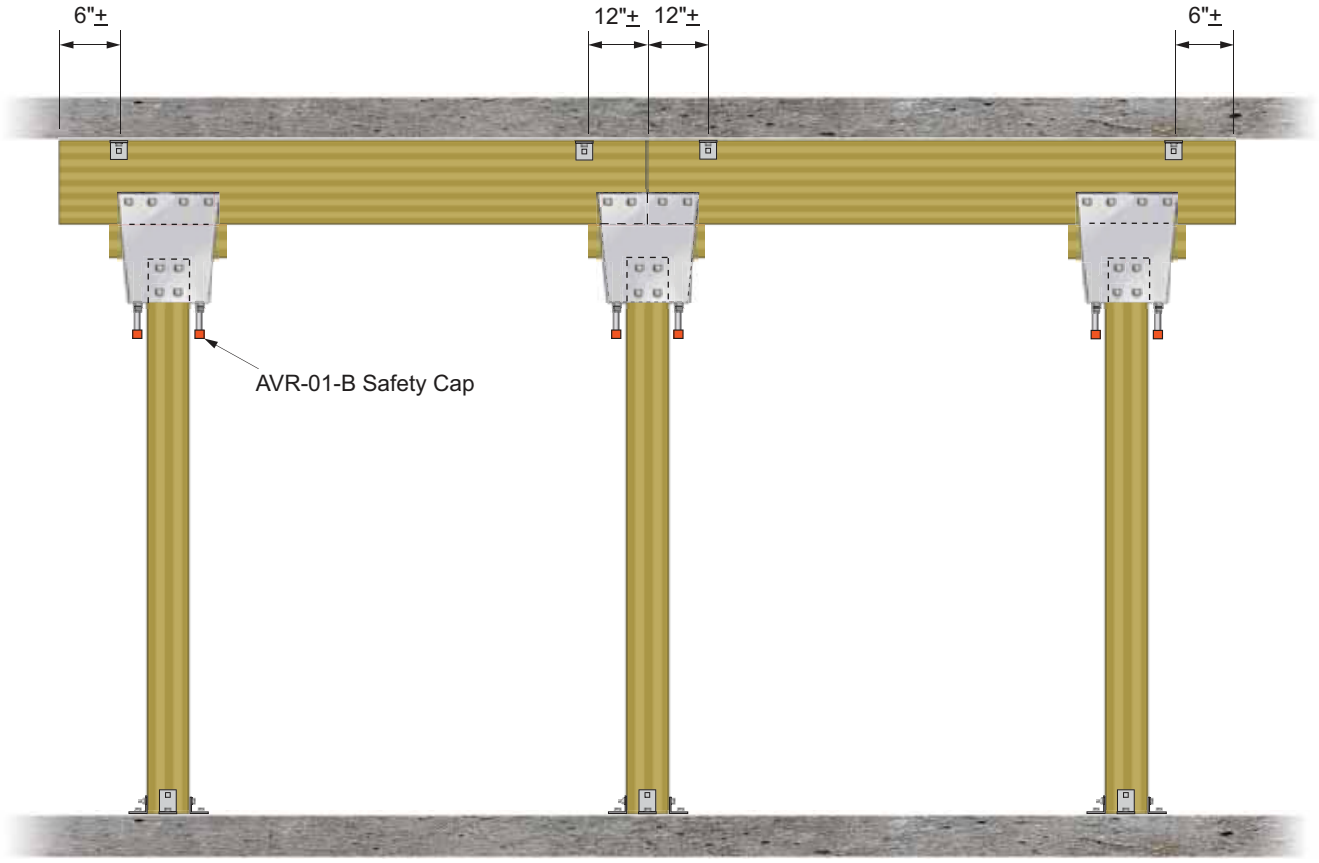
Figure US 201–19: Angle Clip Installation



SIDE VIEW

STEP 12. Complete installation by removing temporary shoring and attaching safety caps to adjustable rods as shown below.

Figure US 201–20: Safety Cap Installation



SIDE VIEW

Scope US 201.5 Adjustable Vault Reinforcement – Post and Beam

1.0 General Information

The AVR post and beam (only) kit is intended to shore non-standard vault ceilings or those whose structural stability is in doubt. The ceiling does not have spalling or risk of falling debris. The option is for use from 3 to 15 years. The kit consists of columns and beams which provide structural support to the ceiling.

2.0 Materials

Materials are laminated wood, metal components, and netting which are pre-packed in kits as defined in Table US 201–5 shown below.

Table US 201–5: Adjustable Vault Reinforcement System Kits -- Post and Beam with Netting

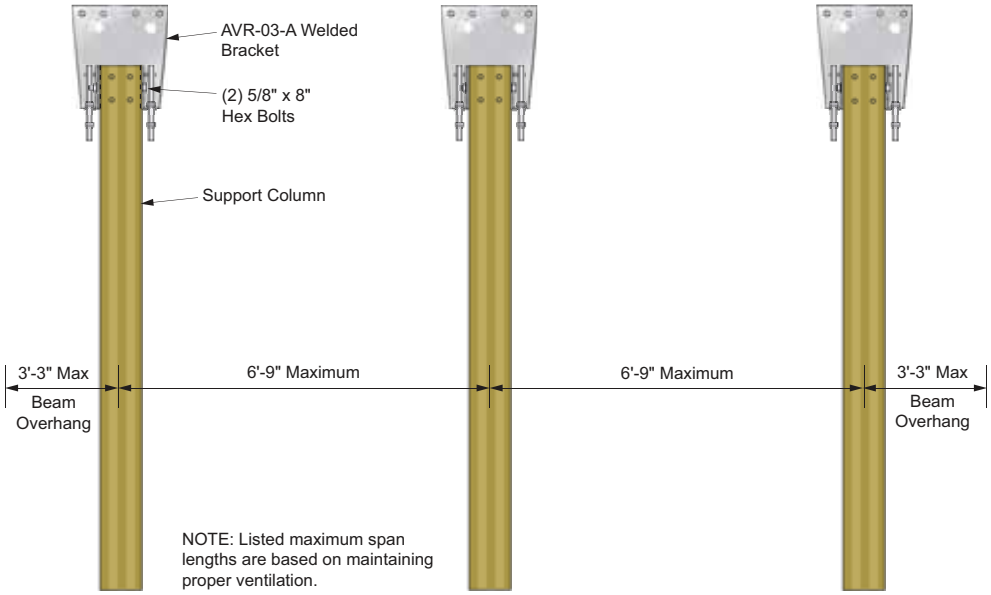
SCE Vault Dimensions		Reinforcement System Kit SAP Number
Length (ft)	Width (ft)	
10	8	10203108
14	8	10203110
18	8	10203112
20	8	10203274
22	8	10203273
24	8	10203272
26	8	10203271
28	8	10203270

3.0 Installation

Installation shall be in accordance with the manufacturer's written instructions, provided as follows for reference.

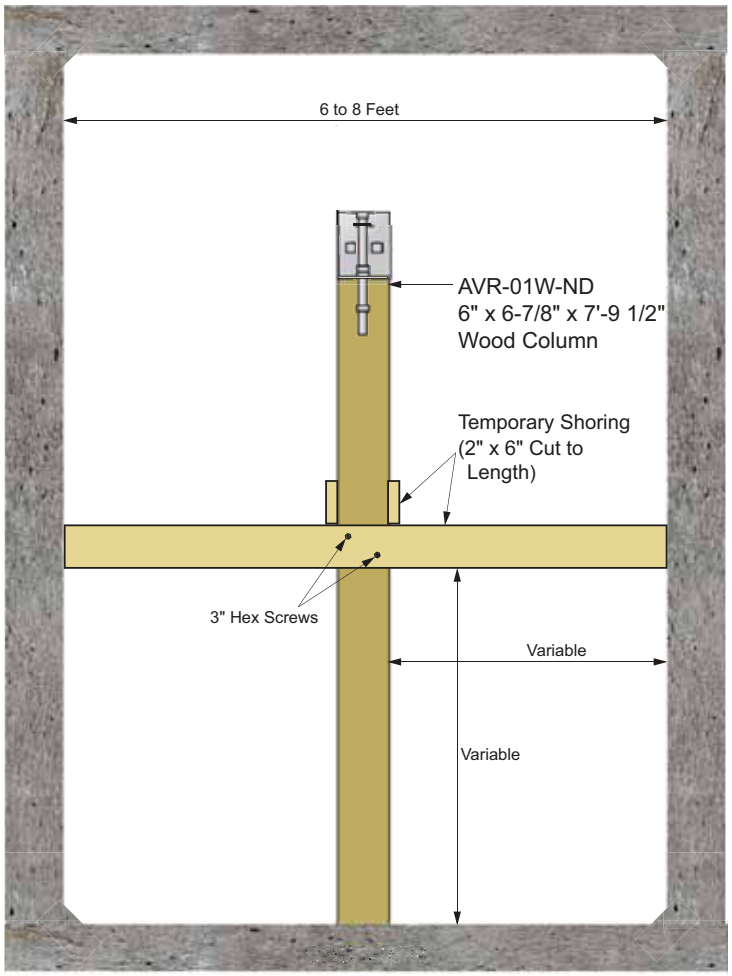
STEP 1. Mount AVR-03-A welded brackets to top of the columns using two 5/8" x 8" hex bolts.

Figure US 201–21: Ledger Plate Positioning on Long Wall Opposite Entry Area



STEP 2. Locate, plumb & temporarily support all support columns using temporary shoring. Support columns should be located as close to the center of the vault as possible.

Figure US 201–22: Temporary Column Support

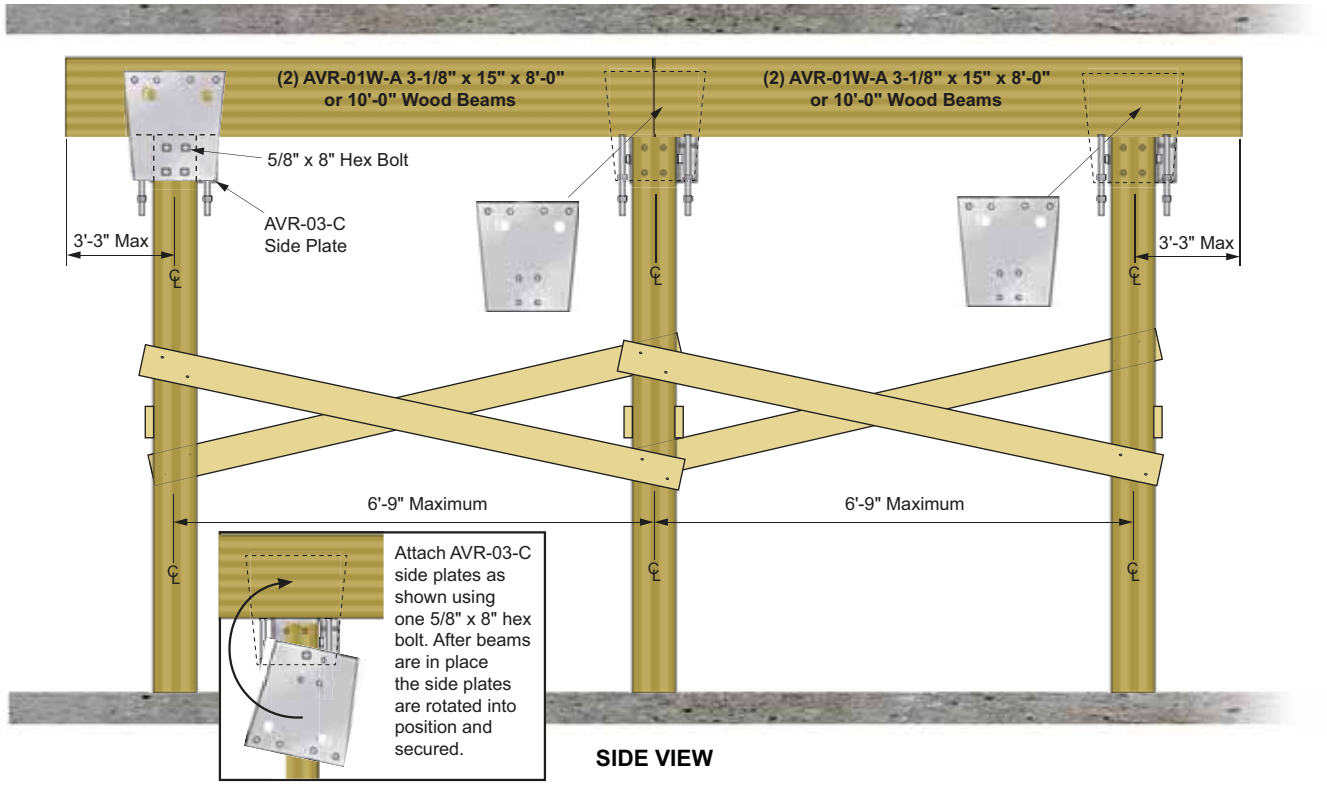


END VIEW

STEP 3. Plumb & tie together support columns with temporary shoring.

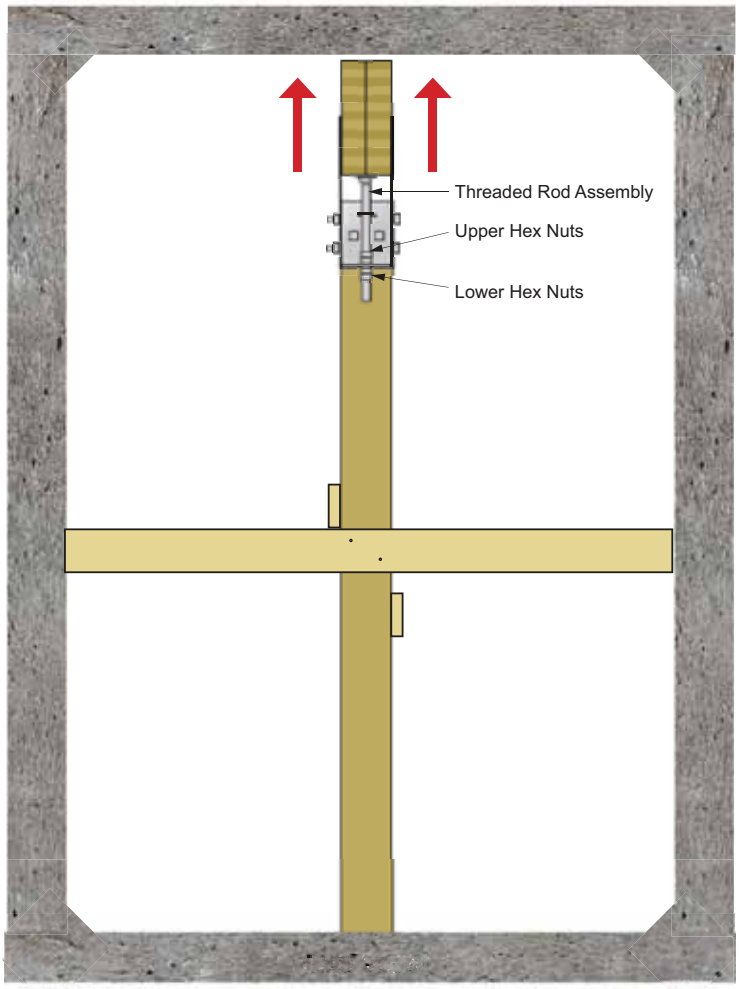
STEP 4. STEP 4 Attach plate "AVR-03-C" to the columns using one 5/8" x 8" hex bolt as shown in the illustration below. Lift first support beams into place on top of columns and temporarily secure with 3" hex screws from the back through small holes in the center of the welded brackets AVR-03-A. Lift remaining beams into place as shown and rotate side plates into position and secure with 5/8" hex bolts.

Figure US 201–23: Support Column Placement



STEP 5. Using a wrench, rotate the upper hex nut (see diagram below) clockwise to raise the rod assembly against the support beams .Continue rotating both upper hex nuts until the support beam is firmly pressed against the vault ceiling. Hand tighten the remaining hex nuts against bottom of bracket to temporarily secure the rod assemblies.

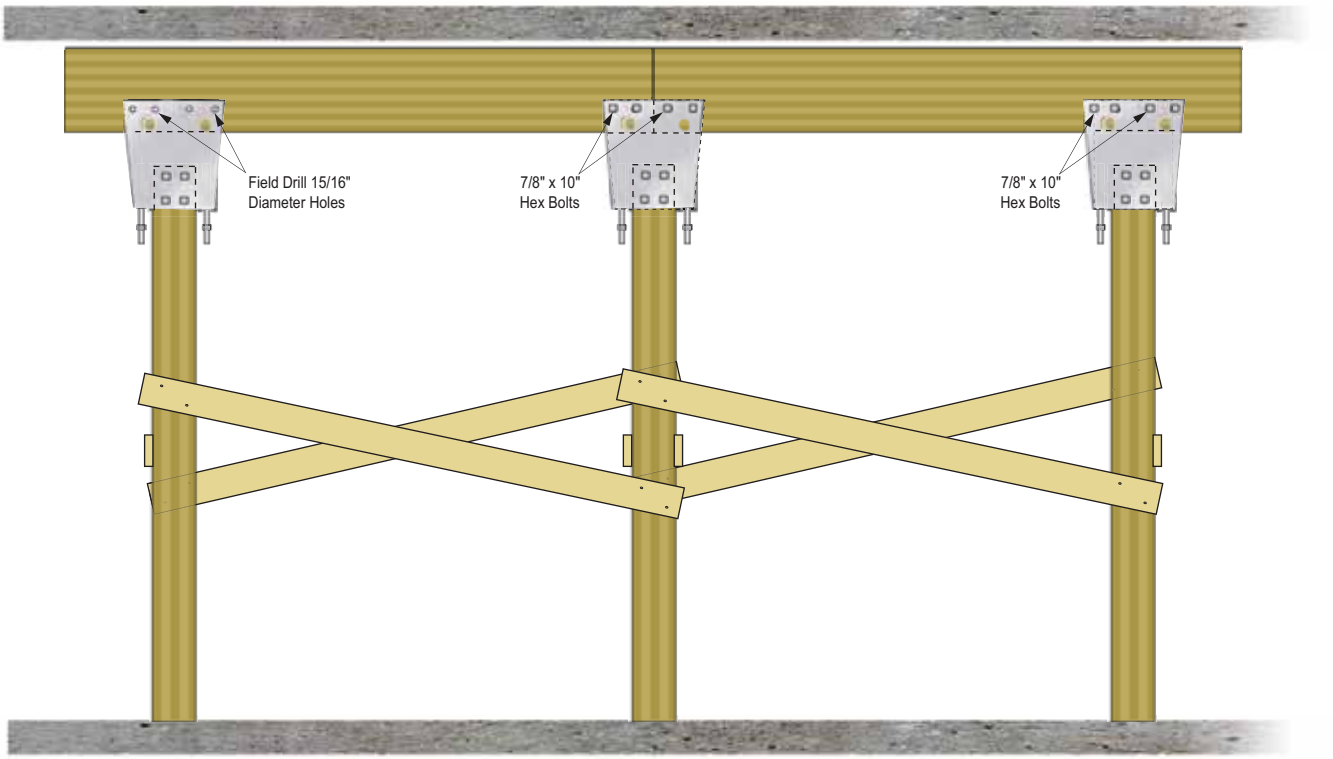
Figure US 201–24: Support Beam Assembly



END VIEW

STEP 6. Field drill holes in the support beams and install 7/8" hex bolts to secure the support beams to the plates as shown.

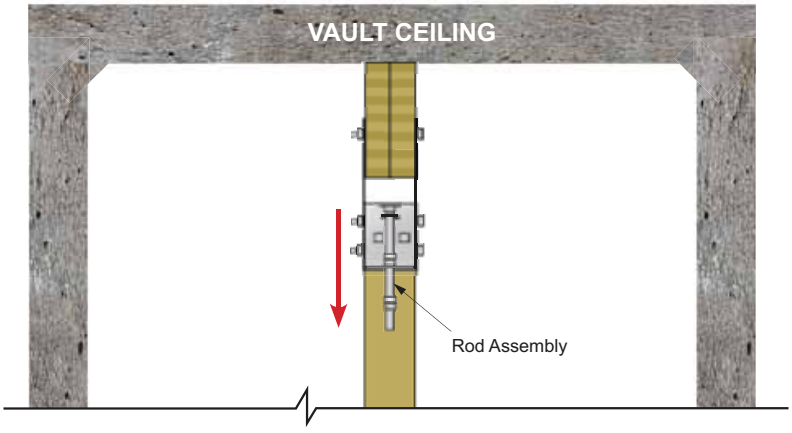
Figure US 201–25: Support Beam Assembly



SIDE VIEW

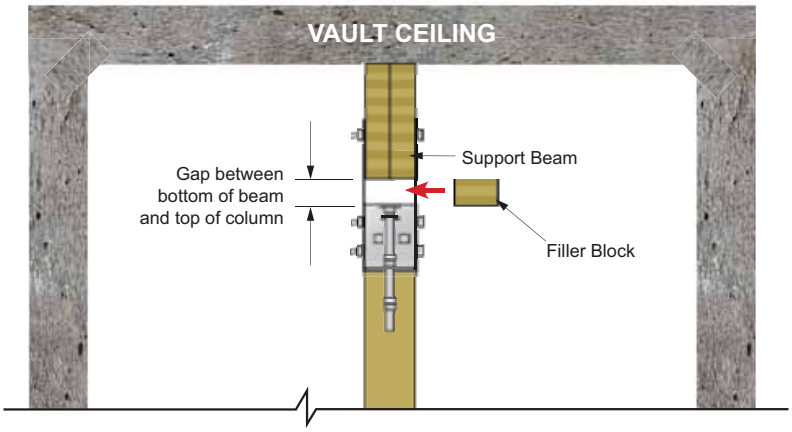
STEP 7. Using a wrench, loosen nuts and lower Rod Assemblies as shown below.

Figure US 201–26: Rod Assembly



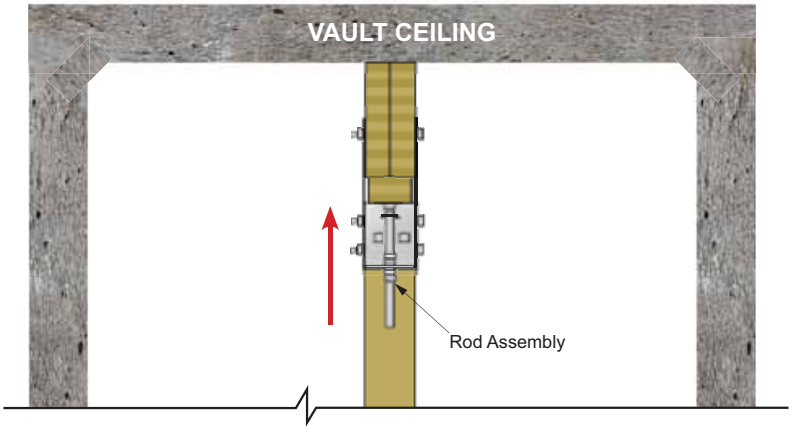
STEP 8. Measure each gap between the beams and top of columns. Using the AVR-01W-B 4-3/8" x 6" x 6'-0" Filler Block beam supplied with the AVR System, trim the 4- 3/8" thickness to tightly fit this gap. Cut each section to a minimum of 18" in length. Insert filler blocks into each gap.

Figure US 201–27: Filler Block Installation



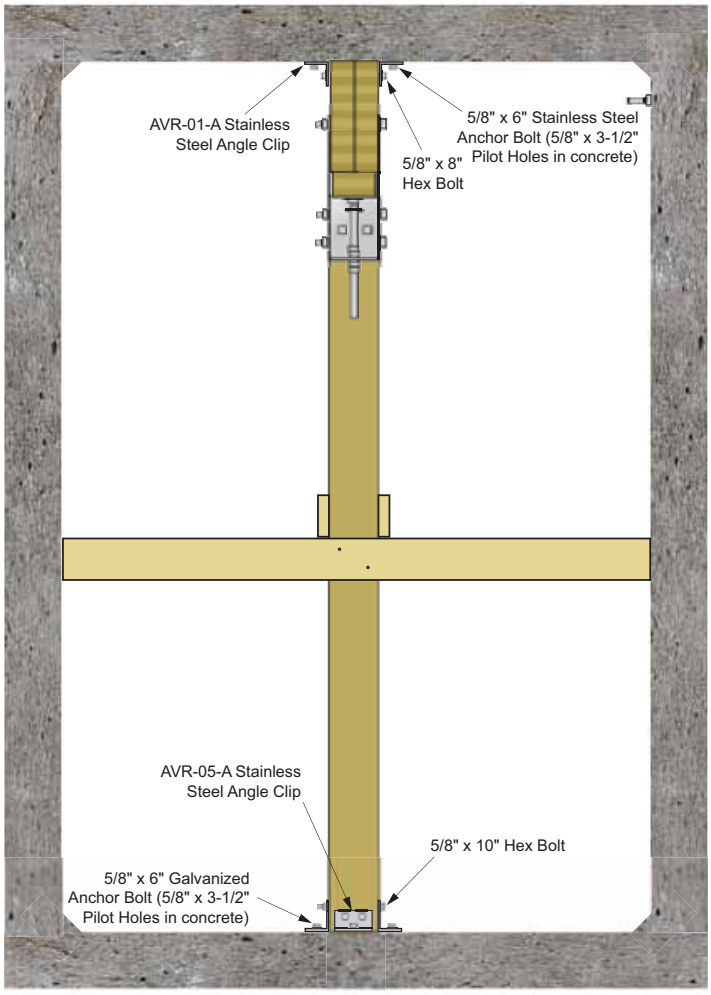
STEP 9. Using a wrench, raise the rod assemblies tightly against the spacer blocks. Permanently secure the rod in place by tightening remaining hex nuts.

Figure US 201–28: Rod Assembly Installation



STEP 10. Drill 5/16" x 3" pilot holes in support beams. Attach angle clips to the support beam at the ceiling (see step 11 for placement). Attach angle clips to the base of the support columns at the floor.

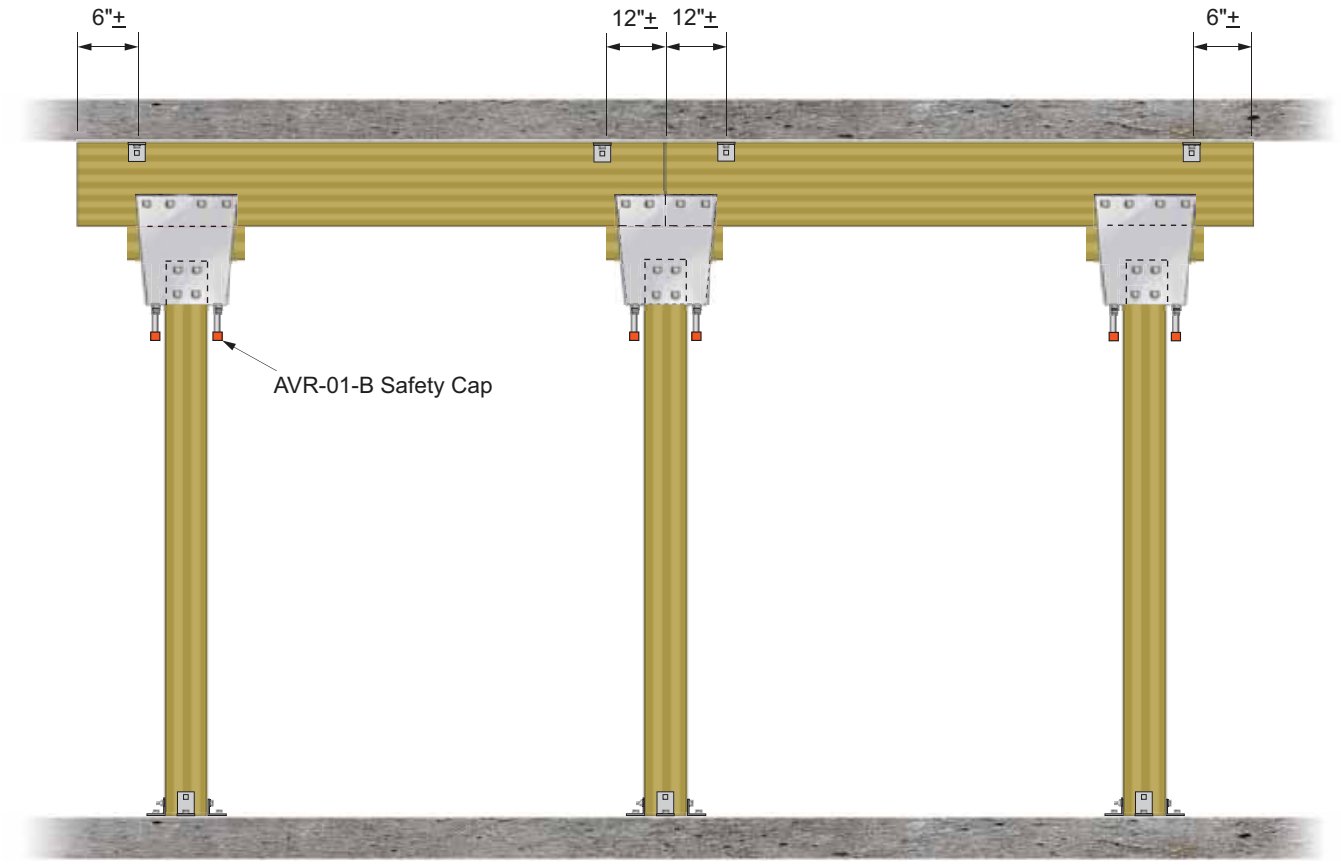
Figure US 201–29: Column Angle Clip Installation



SIDE VIEW

STEP 11. Complete installation by removing temporary shoring and attaching safety caps to adjustable rods as shown below.

Figure US 201–30: Final Installation



SIDE VIEW

Scope US 201.6 Vault Ceiling Netting (without Post & Beam)

1.0 General Information

The vault ceiling netting kit is intended to keep personnel safe and protect equipment from falling debris (spalling concrete) and contain the debris for 1 to 5 years.

2.0 Materials

Materials include netting and anchor bolt components and are pre-packaged in kits as defined in Table US 201–6 shown below.

Table US 201–6: Laminated Wood System Kits – Vault Ceiling Netting

	Vault Ceiling Netting Dimensions			SAP
Vault Type	Qty.	Width (ft)	Length (ft)	
Tub	1	3	4	10208082
	1	4	4	
Tunnel	2	4	4	10208083

3.0 Installation

Installation shall be in accordance with the manufacturer's written instructions.

Scope US 201.7 Vault Riser Netting (without Post & Beam)

1.0 General Information

The vault riser netting kit is intended to keep personnel safe and protect equipment from falling debris (spalling concrete) and contain the debris for 1 to 5 years.

2.0 Materials

Materials include netting and anchor bolt components and are pre-packaged in kits as defined in Table US 201–7 shown below.

Table US 201–7: Laminated Wood System Kits – Vault Neck Netting

Vault Ceiling Netting Dimensions			SAP
Qty.	Width (ft)	Length (ft)	
2	4	4	10208082
2	4	5	

3.0 Installation

Installation shall be in accordance with the manufacturer's written instructions.

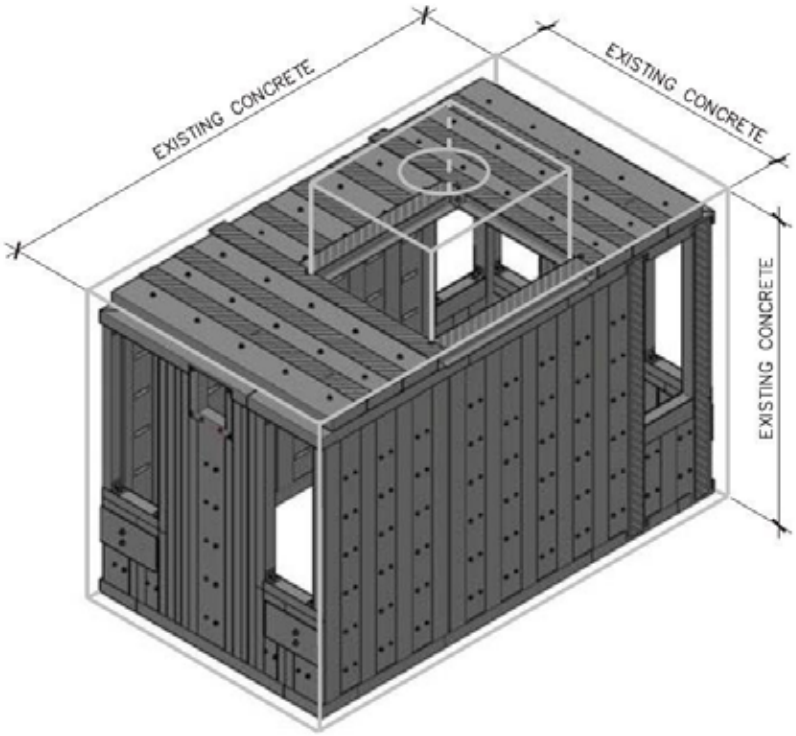
US 205 Voltek Vault Replacement System

Scope US 205.1 Voltek Vault Replacement System

1.0 General Information

The Voltek system consists of a series of composite panels and beams, and stainless-steel structural ceiling beams. Installation process is performed by passing panels and beams through the vault access opening. Materials are then assembled inside the existing vault to form a new stand-alone structure. This significantly minimizes excavation from the process. Also, this enables vault replacement in locations where there are permit prohibitions agency moratoriums, and other urban constraints.

Figure US 205–1: Voltek Vault Replacement System



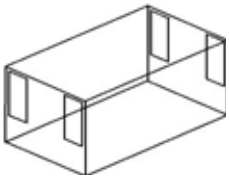
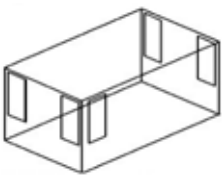
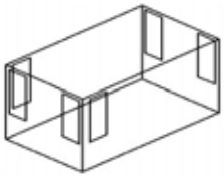
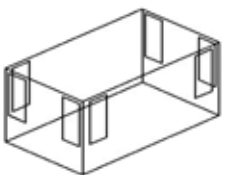
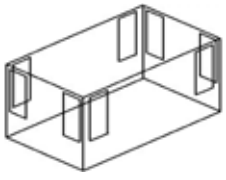
2.0 Vault Selection Criteria

The following criteria shall be evaluated:

- Post dimensions shall not be less than 4 ft. in width or length and 5 ft. in height per G.O. 128 - Appendix D, Article 3 - 8051
- Adherence to Distribution Field Engineering scoping process review
- Distribution Design Standards DDS-6, Table 6-14 "Maximum Cable and Equipment for Voltek Structures
- Cost per Distribution Design Standards DDS-13 Rebuild Strategy, Section 5.8
- Condition of existing grade rings and floor. If either are not in good condition, they shall be repaired or replaced as part of the work.

3.0 Manufacturer Part Numbers and SAP Numbers

Table US 205–1: Voltek Manufacturer Part Numbers and SAP Numbers

	4 Windows (Duct Banks)		5 Windows (Duct Banks)		6 Windows (Duct Banks)		7 Windows (Duct Banks)		8 Windows (Duct Banks)	
Existing Vault Size										
	Part Number	SAP	Part Number	SAP	Part Number	SAP	Part Number	SAP	Part Number	SAP
6’ x 10’ x 7’	A6006107VO LTEK-SCE4	10209526	A6006107VO LTEK-SCE5	10209535	A6006107VO LTEK-SCE6	10209544	A6006107VO LTEK-SCE7	10209553	A6006107VOL TEK-SCE8	10209562
6’ x 10’ x 9’-4”’	A6006109VO LTEK-SCE4	10209527	A6006109VO LTEK-SCE5	10209536	A6006109VO LTEK-SCE6	10209545	A6006109VO LTEK-SCE7	10209554	A6006109VOL TEK-SCE8	10209563
8’ x 10’ x 9’-4”	A6008109VO LTEK-SCE4	10209528	A6008109VO LTEK-SCE5	10209537	A6008109VO LTEK-SCE6	10209546	A6008109VO LTEK-SCE7	10209555	A6008109VOL TEK-SCE8	10209564
8’ x 14’ x 9’-4”	A6008149VO LTEK-SCE4	10209529	A6008149VO LTEK-SCE5	10209538	A6008149VO LTEK-SCE6	10209547	A6008149VO LTEK-SCE7	10209556	A6008149VOL TEK-SCE8	10209565
8’ x 18’ x 9’-4”	A6008189VO LTEK-SCE4	10209530	A6008189VO LTEK-SCE5	10209539	A6008189VO LTEK-SCE6	10209548	A6008189VO LTEK-SCE7	10209557	A6008189VOL TEK-SCE8	10209566
8’ x 22’ x 9’-4”	A6008229VO LTEK-SCE4	10209531	A6008229VO LTEK-SCE5	10209540	A6008229VO LTEK-SCE6	10209549	A6008229VO LTEK-SCE7	10209558	A6008229VOL TEK-SCE8	10209567
8’ x 24’ x 9’-4”	A6008249VO LTEK-SCE4	10209532	A6008249VO LTEK-SCE5	10209541	A6008249VO LTEK-SCE6	10209550	A6008249VO LTEK-SCE7	10209559	A6008249VOL TEK-SCE8	10209568
8’ x 26’ x 9’-4”	A6008269VO LTEK-SCE4	10209533	A6008269VO LTEK-SCE5	10209542	A6008269VO LTEK-SCE6	10209551	A6008269VO LTEK-SCE7	10209560	A6008269VOL TEK-SCE8	10209569
8’ x 27’ x 9’-4”	A6008279VO LTEK-SCE4	10209534	A6008279VO LTEK-SCE5	10209543	A6008279VO LTEK-SCE6	10209552	A6008279VO LTEK-SCE7	10209561	A6008279VOL TEK-SCE8	10209570

Note(s):

1. Sizes not listed on table shall be submitted to Underground Structural Engineering group for review and approval.
2. Deviations from these sizes and features shall require calculations and drawings both stamped and signed by a licensed State of California professional civil or structural engineer.

4.0 Frame and Cover Replacement for New Voltek Installations

Figure US 205–2: Voltek Restaint Connections

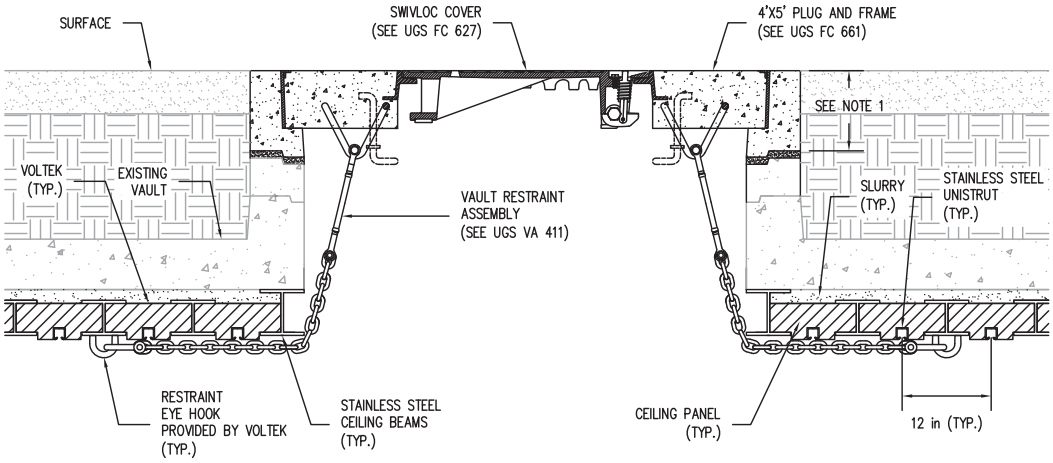
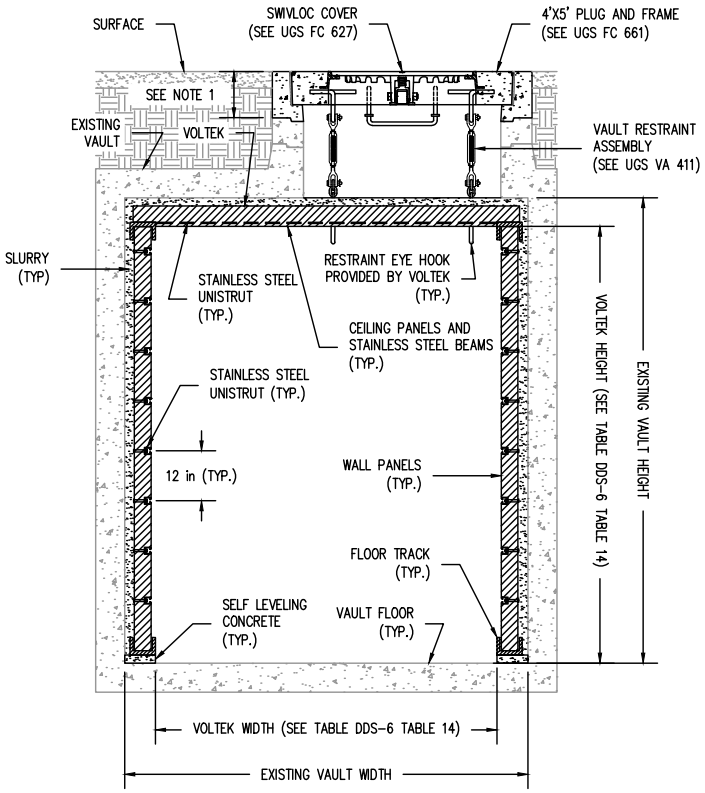


Figure US 205–3: Typical Voltek Section



Note(s):

1. The existing frame and cover shall be removed and replaced with a new 4'x5' frame and cover per UGS FC 661

5.0 Structural Design

5.1 Structural design will conform to the latest edition of the Standard Specifications for Highway Bridges as adopted by the American Association of State Highway and Transportation Officials (AASHTO) HS20-44 loading requirements as a stand-alone structure and ASTM C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.

5.2 Structural design calculations shall be based on AASHTO specification LRFD

A. Vertical loads due to soil weight, ceiling panel and beam weight, existing concrete weight, and traffic shall be considered.

B. Horizontal loads due to active soil pressure and live-load surcharges pressure shall be considered.

5.3 Loads due to cable pulling shall be considered in the design of the Voltek system. These loads shall be assumed to be independent of normal soil pressures.

5.4 For all design calculations, soil density shall be assumed to be 110 lbs per cubic feet. Saturated soil conditions shall be assumed at 2-ft, 0-inch depth. Lateral soil pressure includes a 2-ft, 0-inch love-load surcharge.

5.5 Nominal material strengths used in the structural design calculations shall be based on material testing completed by a third-party laboratory. The manufacturer shall furnish the results of these tests to the designer.

6.0 Specifications

6.1 The Voltek system shall be custom fitted to meet required conduit, vent, and access section in each individual structure.

6.2 Accommodations for grounding shall be as follows:

A. Installation vault ground provisions shall be SCE's responsibility.

B. Grounding accommodations shall be in accordance with UGS AC 700

6.3 Wall and ceiling panels shall include embedded 1-5/8 inch x 1-5/8 inch stainless-steel unistrut channels to allow for hanging cables and electrical equipment. The unistrut channels shall be rated for a pull-out strength of 2,000 pounds (lbs).

6.4 A stainless-steel pulling eye shall be located at each of the four corners of the wall just above the floor. The pulling eye shall be rated for a pull-out strength of 20,000 lbs. The final locations of the pulling eyes shall be determined during field measurements of the existing structure.

6.5 The Voltek system interior shall be permanently marked using stencil with the following information:

- “Edison" and logo
- Unistrut channel "Pulling Out Rating 2,000 lbs"
- Pulling eye "Pull Out Rating 20,000 lbs"
- "Voltek"
- Other pertinent information including but not limited to "Do Not Drill"

7.0 Material Requirements

All components shall comply with the following:

7.1 Operating Temperature

A. Shall be capable of withstanding ambient temperature ranging between -58°F below zero and 200°F without splitting, cracking, deforming, or delaminating.

7.2 Fire Resistance

A. All Voltek componenets are classified as Class A material, per National Fire Protection Association (NFPA) 101, "Life Safety Code," and are tested in accordance with American Society for Testing and Materials (ASTM) Standard E84.

7.3 Electrical Resistivity

A. All non-metallic Voltek components are rated as electrical insulating materials, as determined in accordance with ASTM Standard D257.

B. All non-metallic Voltek components attached a minimum electrical tracking resistance time for 1,200 minutes, as determined in accordance with ASTM Standard D2303.

7.4 Water and Corrosion Resistance

A. Water absorption in all Voltek components shall not exceed 0.5%, as measured in accordance with ASTM Standard D570.

B. All Voltek components shall be corrosion resistant, as determined in accordance with ASTM Standard C581.

7.5 Wall and Ceiling Panels

A. All Voltek wall and ceiling panels consist of a fiberglass-reinforced, fire-retardant composite vinyl ester resin shell with a balsa wood structural inner core.

B. Fiberglass reinforcement is a combination of continuous fiberglass roving and continuous strand mat and surfacing veil.

C. All glass fibers are infused with vinyl ester resin to maintain structural integrity of the composite material.

7.6 Beams and Columns

A. Vertical wall connector columns are manufactured using fiberglass-reinforced vinyl ester resin or stainless steel Type 304, as determined by structural engineering design calculations.

B. Horizontal load-bearing ceiling beams consist of stainless steel Type 304, as determined by structural engineering design calculations, unless otherwise apprived by SCE and Voltek.

7.7 Voltek wall and ceiling panels and "H" connector beams shall be lightweight composite materials.

7.8 All steel used within the Voltek system shall be ANSI 304 stainless steel, including structural beams.

8.0 Installation

8.1 General Requirements

A. A certified utility crew of an approved utility contractor installs the Voltek Vault Replacement System.

B. All installation operations must be conducted in accordance with Voltek's instructions and recommendations.

C. A Voltek representative must be available to provide training to installation crews, as required.

D. A Voltek representative must be present at all times throughout the installation to ensure compliance with Voltek's installation instructions.

8.2 Training

For installation details and procedures see Training Integration Job Aid.

8.3 Pre-Installation Requirements

A. Conduct job walk with stakeholders confirming schedule and work variables.

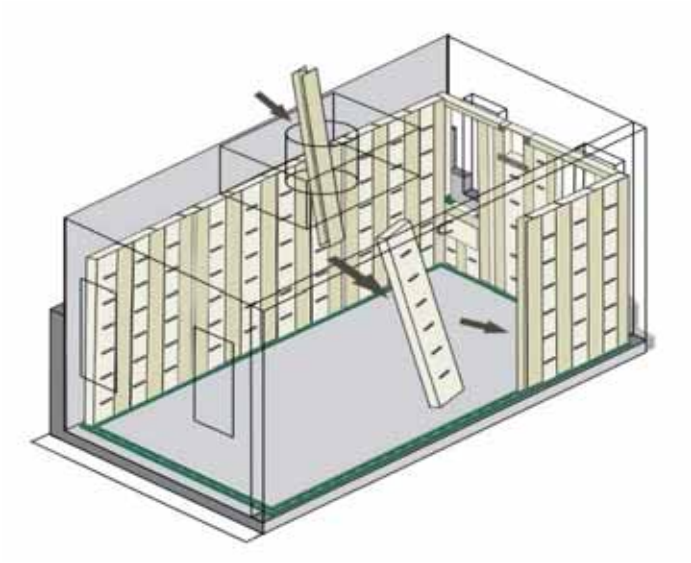
B. An outage shall be obtained to move cables and equipment to center of the structure.

C. Construct temporary system to protect cables and equipment. System shall be approved by a QEW.

8.4 Typical Installation

STEP 1. Install floor track.
STEP 2. Repair floor as necessary.
STEP 3. Install wall panels and beams. See Figure 4 below

Figure US 205–4: Typical Installation of Voltek Wall Panels and Beams



STEP 4. Install ceiling track, ceiling panel, and beam.
STEP 5. Install wood forming around conduit and vent entrances
STEP 6. Install temporary bracing to shore walls while slurry backfill is being poured and cured.
STEP 7. Pour slurry to fill voids behind Voltek walls and above ceiling. Refer to manufacturer's specifications (Voltek Assembly Guidelines).
STEP 8. Remove forming materials and fill in any slurry voids.
STEP 9. Obtain an outage to re-rack rables and equipment to finalize installation.

9.0 Repairs

Underground Structural Engineering shall be notified if any damage to the Voltek structure is observed.

10.0 Manufacturing

10.1 General

A. The Voltek Vault Replacement System is manufactured by Armorcast Products Company, Voltek Divisons, 13230 Saticoy Street, North Hollywood, CA 91605. Telephone: (818) 982-3600; Website: www.armorcastpod.com

B. Wall panels, ceiling panels, and beams shall be fitted with lifting and handling capability to facilitate handling and ease of installation.

C. Manufacturer shall mock assemble Voltek system prior to shipment to work location. Mock assembly shall include interlocking connections and confirming measurements before packaging. Shipment shall include documentation verifying mock assembly has been completed.

10.2 Packaging and Shipping

A. Engineering drawings and installation instructions shall be included within each individual shipment

B. Components shall be packaged based on equence of installation, with floor track on separate pallet, wall panels on separate pallet, ceiling on separate pallet, etc.

C. Voltek vault shall be shipped to SCE job site

US 210 Underground Structure Strengthening using surface applied composite systems - Composites for Infrastructure (CFI)

Scope US 210.1 Underground Structure Strengthening using surface applied composite systems - Composites for Infrastructure (CFI)

1.0 General Information

The CFI underground structure remediation system is a family of advanced composite materials which are applied to the inside walls, ceiling, and neck of the underground structure. The system repairs cracks and spalls in the structure walls and ceiling and provides a structural layer which arrests and redirects crack propagation. The finished system is 3/8" thick and brings back the underground structure to original structural ratings. All work is performed through the structure maintenance hole and requires no excavation or repaving.

2.0 UG Structure Replacement Alternatives

See CFI Design Support Update: DSU 12A-21 - CFI Underground Structures Strengthening Using Surface-applied Composite Systems

3.0 Manufacturer Part Numbers and SAP

3.1 CFI Manufacturer Part Numbers and SAP numbers are listed in Table US 210–1 .

Table US 210–1: CFI Manufacturer Part Numbers and SAP Numbers

Manufacturer ID	Structure Dimensions	SAP Number
CFI487M5	Manhole 4'- 5" x 8'- 5" x 7'	10213964
CFI465M1	Manhole 4' x 6'- 5" x 5'- 5"	10213965
CFI467M2	Manhole 4' x 6' x 7'	10213966
CFI487M4	Manhole 4' x 8' x 7'	10213967
CFI6107	Manhole 6' x 10' x 7'	10213968
CFI6109	Manhole 6' x 10' x 9'- 4"	10213969
CFI687M6	Manhole 6' x 8' x 7'	10213970
CFI7107	Vault 7' x 10' x 7'	10213971
CFI7108	Vault 7' x 10' x 8'	10213972
CFI7148	Vault 7' x 14' x 8'	10213973
CFI7188	Vault 7' x 18' x 8'	10213974
CFI7228	Vault 7' x 22' x 8'	10213975
CFI7248	Vault 7' x 24' x 8'	10213976
CFI7268	Vault 7' x 26' x 8'	10213977
CFI7278	Vault 7' x 27' x 8'	10213978
CFI777M9	Vault 7' x 7' x 7'	10213979
CFI8109	Vault 8' x 10' x 9'- 4"	10213980
CFI8149	Vault 8' x 14' x 9'- 4"	10213981
CFI8189	Vault 8' x 18' x 9'- 4"	10213982
CFI8229	Vault 8' x 22' x 9'- 4"	10213983
CFI8249	Vault 8' x 24' x 9'- 4"	10213984
CFI8269	Vault 8' x 26' x 9'- 4"	10213985
CFI8279	Vault 8' x 27' x 9'- 4"	10213986

Note(s):
1. Sizes not listed on table shall be shall be designed with the next size up..
2. Price includes civil contractor to protect cable and equipment, CFI materials, and installation labor. Contractor is responsible for QEW and traffic control.

3.2 CFI underground structure remediation system is formed around underground structure features during installation and can accommodate all standard vault features.

3.3 Scope of Work

A. Mobilization/Demobilization from the work site

B. Procure materials from CFI Composites

C. Provide PPE and safety measures for our workers

D. Provide Qualified Electrical Worker (QEW)

E. Install civil improvements

F. Install restraint system per Edison standards

G. Install CFI System on walls, ceiling, and access

H. Install inserts per Edison standards

I. Provide traffic control during the subcontractor work and CFI install only per the permit requirements

4.0 Materials

The CFI Underground Structure Remediation system includes different filled resins and reinforcement which impart specific strengths and stiffnesses for the various loading conditions throughout the structure. When these materials are applied to CFI standards by certified installing contractors the underground structure is restored to its original load rating and structural performance. CFI continues to work with SCE, ICC-ES and the University of Southern California to develop ICC certifications for the CFI system.

The five components are:

4.1 **Wall Crack Fill** is used to fill cracks and voids in the wall back to the original plane of the wall. Black in color, the no-sag adhesive has a compressive strength exceeding that of the concrete it replaces and has a high modulus.

4.2 **Ceiling Crack Fill/Ceiling Base** is used to fill cracks and voids in the ceiling back to the original plane of the ceiling. Light gray in color, the low density and no-sag adhesive has a high tensile and shear strength to transfer load from the structure into the reinforcing top compound. This material is also applied about 1/4" thick to the ceiling after cracks and voids are filled.

4.3 **Wall Base Compound** serves as a tie layer between the brittle concrete and ductile, high tensile strength reinforcing top compound and adds flexural stiffness. The off-white, no-sag adhesive is applied in a nominal 1/4" layer to all vertical walls.

4.4 **Reinforcing Material** is a proprietary woven glass with sizing specified by CFI.

4.5 **Top Compound** is a filled epoxy which impregnates the reinforcing material. The "wetted out" reinforcing material is applied to the walls and ceiling of the vault in 3 staggered layers. These layers

contribute high tensile strength and stiffness to restore strength lacking from failed and missing rebar in the reinforced concrete structure. Light grey in color, this material performs to a UL 94 V0 non-flammable material standard and is not electrically conductive.

5.0 Structural Design

5.1 Application of analytical model to certify that underground structures with the CFI remediation system comply with AASHTO HS20-44, ASTM A-16 loading requirements.

5.2 Structural design shall conform to the latest edition of the Standard Specifications for Highway Bridges as adopted by the American Association of State Highway and Transportation Officials (AASHTO) HS20-44 loading requirements as a stand-alone structure.

6.0 Specifications

6.1 The CFI vault remediation system can be applied to all underground structure designs, including poured-in-place, concrete, and brick underground structures.

6.2 The CFI vault remediation system can be formed around conduit, vents, access, and other underground structure features during installation.

6.3 Threaded inserts (>1000 lbf pull out strength) and pulling eyes (>10,000 lbf pull out strength) shall be installed into the CFI material during application in accordance with SCE requirements.

6.4 The finished CFI system material can also be drilled to install anchors using standard masonry bits, the same as a concrete vault.

6.5 Accommodations for grounding shall be as follows:

A. Installation of vault ground provisions shall be SCE's responsibility.

B. Grounding accommodations shall be in accordance with UGS AC 700.

7.0 Material Requirements

7.1 Operating Temperature – The material can be applied from 30°F to 110°F. Once installed the system performs from -40°F to 225°F

7.2 Fire Resistance –The CFI remediation system has fire and flame resistance to UL94. The system is self-extinguishing and does not drip.

7.3 Electrical Resistance – All CFI materials are non-metallic and non-conductive.

7.4 Heat Dissipation – The CFI system conducts heat more readily than concrete, therefore does not act as an insulator and will not change the thermal properties of the vault. In addition, since the system is only about 3/8" thick it does not materially decrease the volume of air in the vault, allowing for the same heat dissipation as before the remediation system was installed.

7.5 Water and Corrosion Resistance

	Average Values			Strength	Wt. and Dimension Δ
	Failure Load (lb./f)	Flexural Strength (psi)	Control / Conditioned Strength (%)	Conditions 1, 2 Pass / Fail	Condition 3, 4 Pass / Fail
Control Specimens	11.0	6,690	100%	N/A	N/A
Na Cl 5%	10.5	6,395	96%	Pass	Pass
Sulfuric Acid -0.1N	10.3	6,081	91%	Pass	Pass
Sodium Carbonate -0.1N	12.5	7,454	111%	Pass	Pass
Sodium Sulfate -0.1N	11.5	7,169	107%	Pass	Pass
Hydrochloric Acid -0.2N	10.1	6,317	94%	Pass	Pass
Sodium Hydroxide -0.1N	11.4	6,703	100%	Pass	Pass
Kerosene	12.3	7,362	110%	Pass	Pass
Transformer Oil	12.3	7,362	110%	Pass	Pass
Water Absorption -24 hr	12.3	6,541	98%	Pass	Pass

Condition 1: Average flexural strength must exceed 75% of the control specimens.

Condition 2: No more than 1 sample in a set has a strength below 75% of the control specimens.

Condition 3: Average % weight and dimension change is within 2% of the unconditioned value.

Condition 4: No more than 1 sample in a set has a % weight and dimension change that is above 2% of the unconditioned value.

8.0 Installation

8.1 General Requirements

A. A certified contracting crew of an approved contractor installs the CFI Underground Structures Remediation System

B. All installation operations must be conducted in accordance with CFI instructions, training, and recommendations.

C. Crew must be trained by CFI personnel in operation of CFI equipment and CFI material application

8.2 Pre-Installation Requirements

A. Conduct job walk with stakeholders confirming schedule and work variables.

1. Confirm specific locations for threaded inserts, pulling eyes, or other underground structure-specific requirements with vault owner during job walk

B. An outage shall be obtained to move cables and equipment to center of the structure.

C. Construct temporary system to protect cables and equipment. System shall be approved by a QEW.

8.3 Typical Installation

A. Vault preparation work shall be completed by SCE or contract electrical crews.

The Electrical crew shall be responsible for moving equipment and cables off of the walls.The Civil crew shall be responsible for constructing the equipment protection system “doghouse” and clearing walls of dirt and loose debris.

B. Apply Crack Fill Material to fill voids, cracks, and spalls back to original plane.

C. Apply ¼" layer of Wall Base Material on walls, and Ceiling Base Material on ceiling (material can be applied over cured or uncured Crack Fill, work can proceed simultaneously depending on worker access)

D. Impregnate woven glass reinforcement with Top Coat material and apply to walls and ceiling, forming glass around vault features. (material can be applied over cured or uncured Base material, work can proceed simultaneously depending on worker access)

E. After Top Coat Material is cured, perform light grinding and cleanup.

F. The Electrical crew shall return vault equipment and cables to original conditions. It is possible that an outage may be required to reinstall cables and equipment.

9.0 Cover Pressure Relief and Restraint System (CPRR)

All vaults and manholes remediated with CFI shall be installed with new cover pressure, relief and restraint system (CPRR).

10.0 Repairs

Underground Structural Engineering shall be notified if any damage to the CFI remediation materials is observed.

11.0 Manufacturing

CFI materials are manufactured by:

Composites for Infrastructure (CFI)
228 Chilsom Trail, Pipe Creek, TX 78063
(530) 305-1600
http://www.cficomposites.com/
info@cficomposites.com

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Ventilating Equipment
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VE 245.3	Vault Blower Offset Bracket for Existing One (1) Horsepower Blower Installations

VE 100 Ventilating Systems — General

Scope VE 100.1 Ventilation System — General

1.0 General Information

Transformers installed in a vault produce heat when energized. The heat loss produced by a transformer when loaded to capacity is generally considered to be 1-3/4 percent of nameplate. For example, heat loss of a 100 kVA transformer loaded to capacity is about equivalent to that of a 1.5 kW heater. This heat must be removed from the vault cavity by a combination of two methods. The heat is dissipated through the walls and floor of the vault and removed by either natural or forced ventilation.

About 15-20 percent of the heat generated in a vault at peak conditions leaves the vault through heat dissipation. The remainder must be removed by ventilation. For small loads 225 kVA and below, heat dissipation and natural ventilation accomplish the necessary heat removal. For loads above 225 kVA, forced ventilation provided by a vault blower is required.

2.0 Installation of Blowers

Vault blowers shall be installed with the proper size vents. Intake and exhaust vents should be equal in area. The blower should be installed so that it blows air into the vault, forcing air over the transformer(s) and out the exhaust vent. The vault cavity will thus be under pressure, providing a positive pressure within the vault. Ventilation is more efficient within the pressurized vault, and the positive pressures inside the vault minimize the entry of volatile gases.

3.0 Installation of Vent Pipes

Provide one intake and one exhaust vent equal in size at opposite ends of the vault, refer to Underground Structures Standards (UGS), AC 751.

Blower	Vent Size
1 hp	10" Diameter
3 hp	18" Diameter

Install a straight 10-foot section of intake duct immediately adjacent to the blower. Vent ducts should be installed with minimum overall lengths and with not more than two 90-degree elbows whenever possible.

Place standpipe vents away from windows and other locations where noise may be objectionable. Whenever possible, place standpipe vents at lot corners to avoid noise problems. If space permits or can be provided at no additional cost or low cost minor work, maintain a minimum clearance of 36 inches for pedestrian and Americans with Disabilities Act of 1990 (ADA) accommodations. Avoid standpipe vent placement in wheelchair ramp locations. In critical noise areas, a low noise level blower of reduced horsepower may be used within the vault. Vent openings should be placed at least ten feet apart.

For new installations approved PVC, steel, or polyethylene standpipe vents may be used. PVC should be used for most field installations. To help blend with new construction designs, decorative polyethylene standpipes are available for 8-inch and 10-inch structure ventilation duct. When replacing broken standpipe vents, keep the same style of standpipe for both the intake and exhaust vents, see TP 100 for more details. HDG and steel may be used only in areas where vents are exposed to vehicular damage, such as alleys and driveways. Do not paint standpipe vents.

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VE 110 Ventilating Application

Scope VE 110.1 Ventilation Application

Table VE 110–1 shown below assumes a transformer loading of 75 percent or more during peak load time and an ambient vault temperature over 120 °F. It should be noted that exceptions will exist. Contact Distribution Engineering Office if exception is requested.

Table VE 110–1: Ventilating Application

Installed Transformer kVA[1/]	Recommendations
0–225-kVA	Building Vaults: With a minimum of two 24" x 24" openings, no blower is required and natural ventilation is acceptable. Underground Vaults: With two 10-inch diameter vents, no blower is required.
226–1,000-kVA	Building Vaults: Use low noise level building vault blower, 1/4 hp, with two 24" x 24" openings. See VE 205. Underground Vaults: Use 3Ø, 230/460 V, 1 hp, when possible. See VE 205. For low noise applications use 3Ø, 230 V, 3/4 hp, (good to 750 kVA only). Use thermostat controls in dry vaults.[2/]
Above 1,000 kVA	Building Vaults: Use low noise level building vault blower, 1/4 hp, with two 24" x 24" openings (good to 1,500 kVA only). For loads above 1,500 kVA, call Division Engineering. Underground Vaults: Use 3Ø, 230/460 V, 3 hp, blower continuously.

[1/] The heat losses of R.O. transformers are twice the heat losses of distribution transformers. To calculate total kVA in the vault, add the kVA rating of the distribution transformers to two times the kW ratings of the R.O. transformers.

[2/] Do not install thermostats in vaults which frequently or continuously contain large quantities of water. It is necessary that all vaults which contain water be continuously ventilated to minimize corrosion effects caused by the moist atmosphere.

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VE 120 Temperature Control Kits

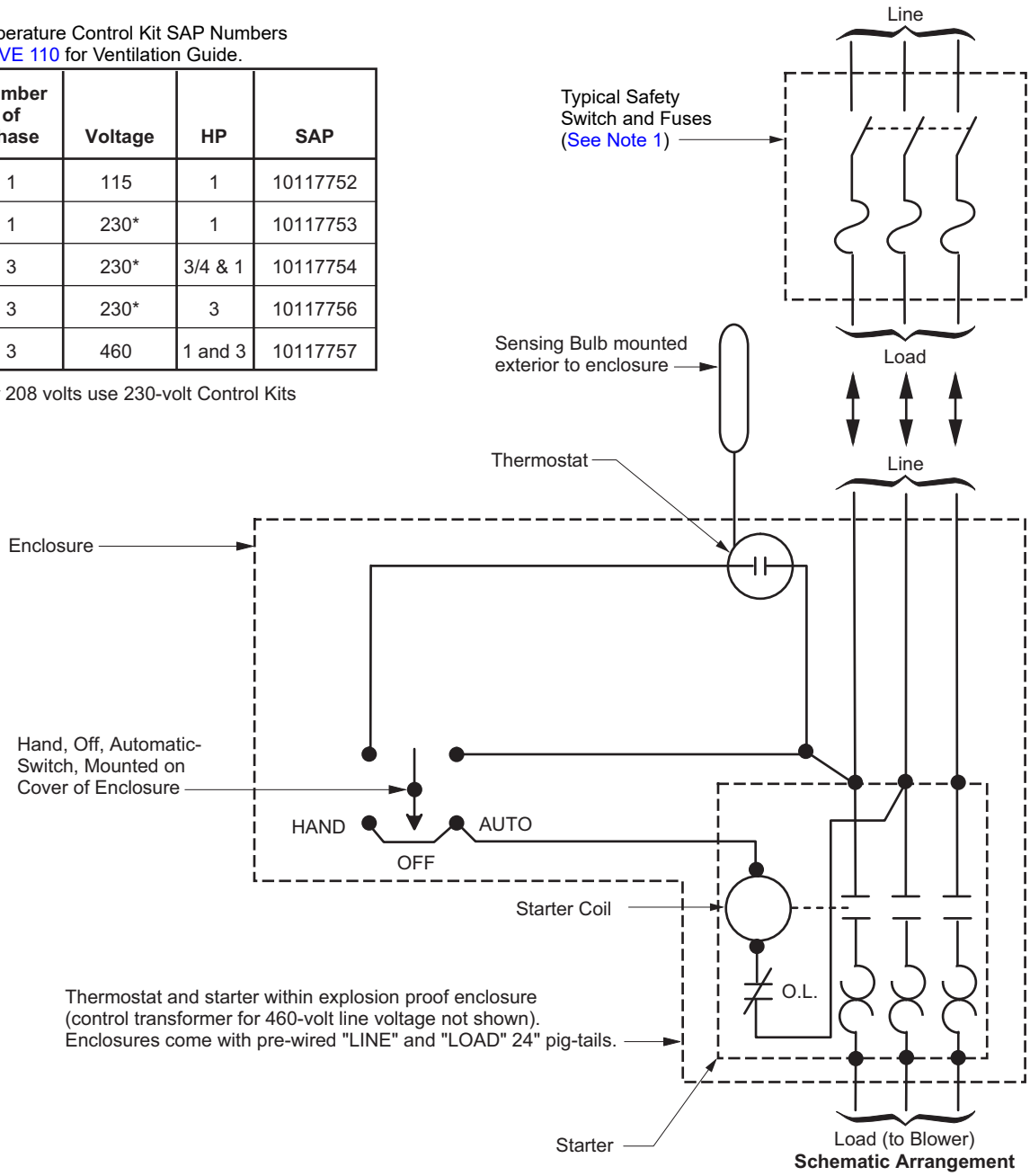
Scope VE 120.1 Installation of Ventilation System Explosion-Proof Temperature Control Kits

Figure VE 120–1: Installation of Ventilation System Explosion-Proof Temperature Control Kits

Temperature Control Kit SAP Numbers
See VE 110 for Ventilation Guide.

Number of Phase	Voltage	HP	SAP
1	115	1	10117752
1	230*	1	10117753
3	230*	3/4 & 1	10117754
3	230*	3	10117756
3	460	1 and 3	10117757

* For 208 volts use 230-volt Control Kits



Schematic Arrangement

Note(s):

1. A safety switch with current limiting fuses shall be utilized in conjunction with any existing or new temperature control kit installation. Connect “LINE” conductors of temperature kit to “LOAD” side of safety switch and “LOAD” conductors directly to blower. See VE 130 for safety switch and fuse information.
2. All control boxes are explosion proof.

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VE 125 Blower Starter Switches and Fusing

Scope VE 125.1 Ventilating System — Engineering and Technical Data — for Starters without Temperature Control Kits

1.0 Starter Switches

The standard starter switch is a manual Square D nonreversing type switch. It is not necessary to install a safety switch in conjunction with this starter. The same starter is used for both three-phase and single-phase installations. Refer to the table for the proper thermal overload units to use with this starter. Material Code number for the starter is 434-68008. Be sure to state size and material code number of thermal overload unit desired when ordering starter switch. Three overload units are required for each starter.

2.0 Protection and Fusing of Blower Motors

Install three of the proper size thermal overload units into the starter switch. The following table should be followed when ordering the thermal units for use with blower motors. These thermal overload units are Square D melting alloy relay units, for use with the Square D manual starter. The heavy duty units are for use in very high temperature areas and should not be used except when the standard overload units have proven inadequate.

Table VE 125–1: Thermal Overload Unit Table

HP	Phase	Voltage	Full Load Amps	Standard Size	Material Code	Heavy Duty Size	Material Code
3/4[1/]	3	230	3.1	B 4.15	629-98729	B 4.85	629-98802
3/4[1/]	3	460	1.5	B 2.10	629-98711	B 2.40	629-98604
1	1	115	16.1	B 22.00	629-98919	B 25.00	629-98927
1	1	230	8.3	B 12.80	629-99107	B 14.00	629-99206
1	3	230	3.6	B 4.85	629-98802	B 5.50	629-98901
1	3	460	1.8	B 2.40	629-98604	B 2.65	629-98703
3	3	230	8.8	B 12.80	629-99107	B 14.00	629-99206
3	3	460	4.4	B 5.50	629-98901	B 2.80	629-99107

[1/] For noise reduction only

FOR REFERENCE ONLY

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VE 130 Blower Safety Switches and Fusing

Scope VE 130.1 Safety Switches and Current Limiting Fuses for Underground Vault Blowers

1.0 Safety Switches

Three types of fused, 30A, gang-operated safety switches are available: 2 pole, 250V (Figure VE 130–1.1 [Sheet 1]); 3 pole, 250V; and 3 pole, 600V (Figure VE 130–1.2 [Sheet 1]). All switches are supplied with Class R rejection type fuse holders for Class RK5 Current Limiting fuses. This type fuse clips will prevent insertion of any nonapproved fuses.

NOTE A starter switch is not required in conjunction with the safety switch.

Figure VE 130–1: Fused, 30 A, Gang-Operated Safety Switches

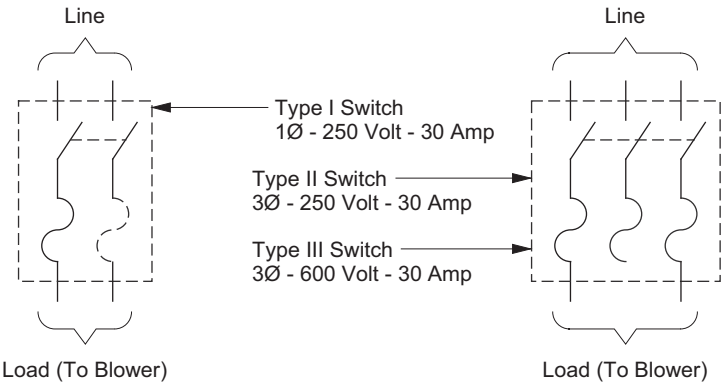


Figure VE 130–1.1 **Figure VE 130–1.2**

2.0 Protection and Fusing of Blower Motors

Current limiting fuses provide both overload and short circuit protection. Install the appropriate number and size of fuses into the safety switch (see Table VE 130–1 [Sheet 2]). The grooved ferrule of the fuse can only be inserted into the rejection clip of the fuse holder. Rejection clips can be either at the top or bottom of the fuse clips, depending on switch manufacture.

Table VE 130–1: Safety Switch and Fuse Tables

HP	Phase	Voltage	Full Load Amps	Switch Type	Safety Switch SAP	Number of Fuses	Fuse Size	SAP
1	1	115	16.1	I	10115042	1	20	10108166
1	1	230	8.3	I		2	10	10108172
3/4[1/]	3	230	3.1	II	10115241	3	3-1/2	10108171
1	3	230	3.6	II		3	5	10108173
3	3	230	8.8	II		3	12	10108170
3/4[1/]	3	460	1.5	III	10115240	3	1-4/5	10108169
1	3	460	1.8	III		3	2-1/2	10108168
3	3	460	4.4	III		3	6-1/4	10108167
1	3	208	4.0	II	10115241	3	6-1/4	10108091
3	3	208	10.6	II		3	15	10108144

[1/] For noise reduction only

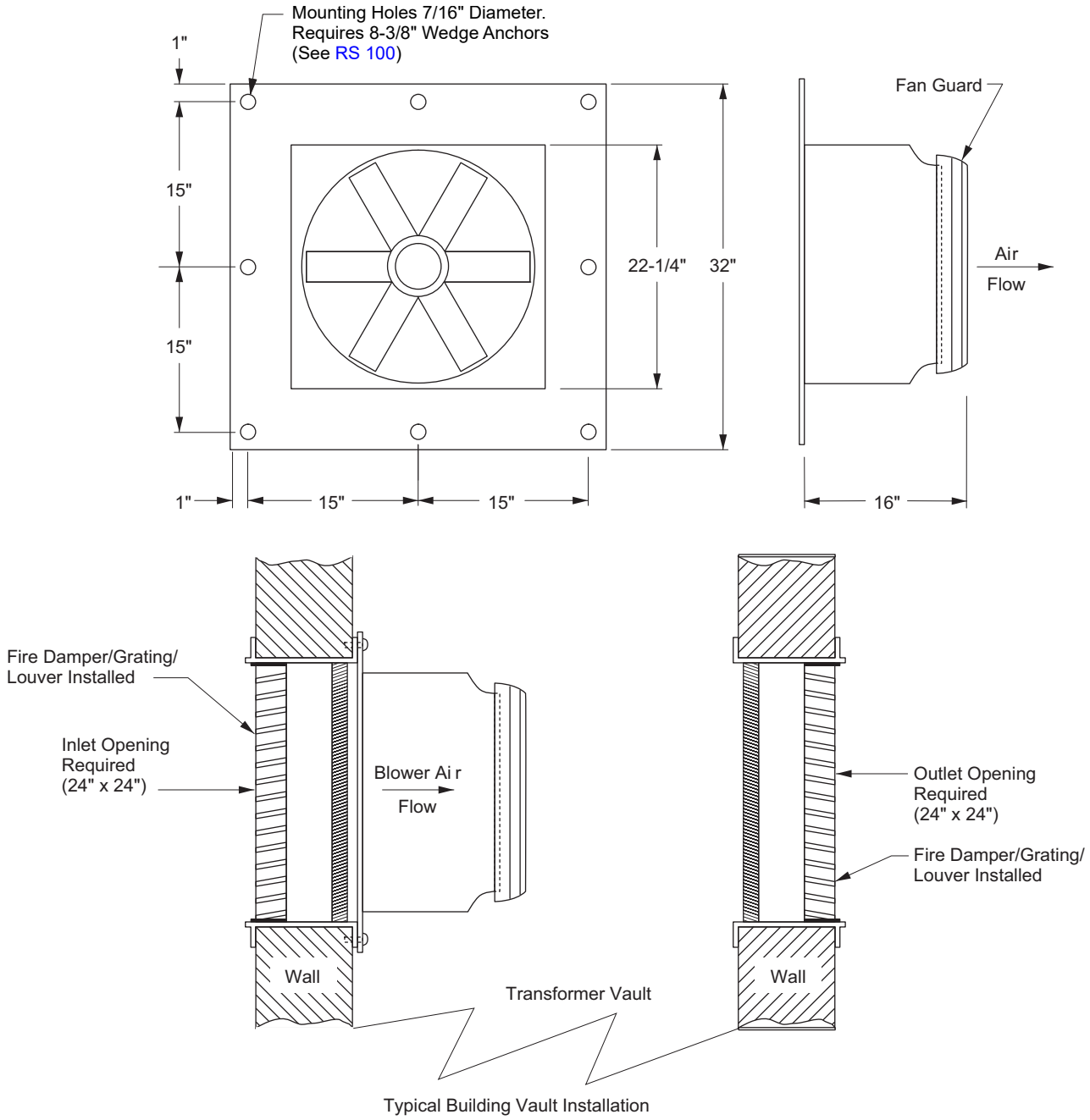
VE 200 Blower — Low Noise Level

Scope VE 200.1 Low Noise Level Blower for Building Vaults

1.0 Applications

Building vaults and noise-sensitive areas where low noise levels are or will be required. **Do not use with air ducts.**

Figure VE 200–1: Low Noise Level Blower for Building Vaults



Typical Building Vault Installation

2.0 Installation

2.1 Wall louvers, fire dampers, and grating shall be installed on interior and exterior walls as required by local codes or ordinances. Inlets shall open to cool air, either inside or outside. Outlets shall open to free air, so that no back pressure will be impressed against the blower. **Air ducts shall not be used for these blowers.**

2.2 Customer shall provide and install all vent covers, louvers, and fire dampers as part of the vault. The Edison Company will install the blower, blower switch, and wiring.

2.3 Two 24" x 24" wall openings are required. Wall louvers, fire dampers, and grating must be designed and installed to allow the blower to be properly mounted in place.

2.4 115V model blower is furnished with a two-speed motor switch and a thermostat.

2.5 460V model blower is a single-speed blower furnished with a three pole on/off switch only (thermostat is not included).

Table VE 200–1: Low Noise Level Blower for Building Vaults

SAP Number	Motor (2-Speed) HP (Voltage)	RPM1/4	Maximum Installed Trans. Cap kVA	Noise dB "A" Scale	Weight (lb)	Wall Openings (2 Req'd.)
10117630	1/4 (115V-1Ø)	1,140 850	See VE 110	66 57	95	24" x 24"

VE 205 Blower — One (1) Horsepower

Scope VE 205.1 One (1) Horsepower Blower for Underground Vaults (226–1,000 kVA)

This blower may be ordered completely assembled and ready for installation. The unit weighs 85 pounds. Material codes for the available voltages are shown in Table VE 205–1 (Sheet 1). Replacement parts of the blower assembly may be ordered as shown on Table VE 205–1 (Sheet 2).

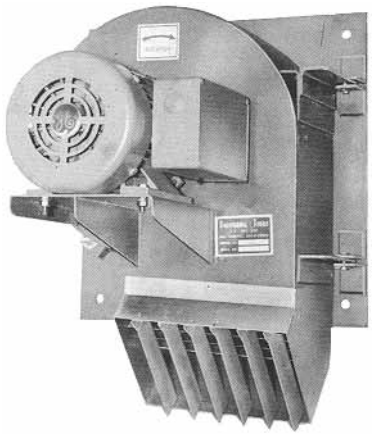


Figure VE 205–0.1Installed Unit

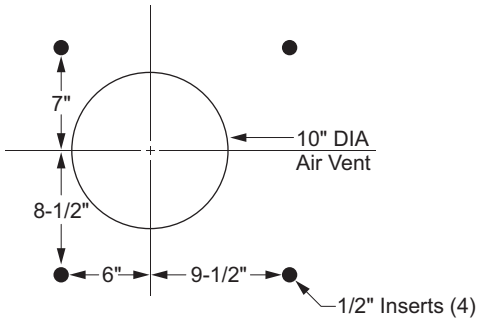


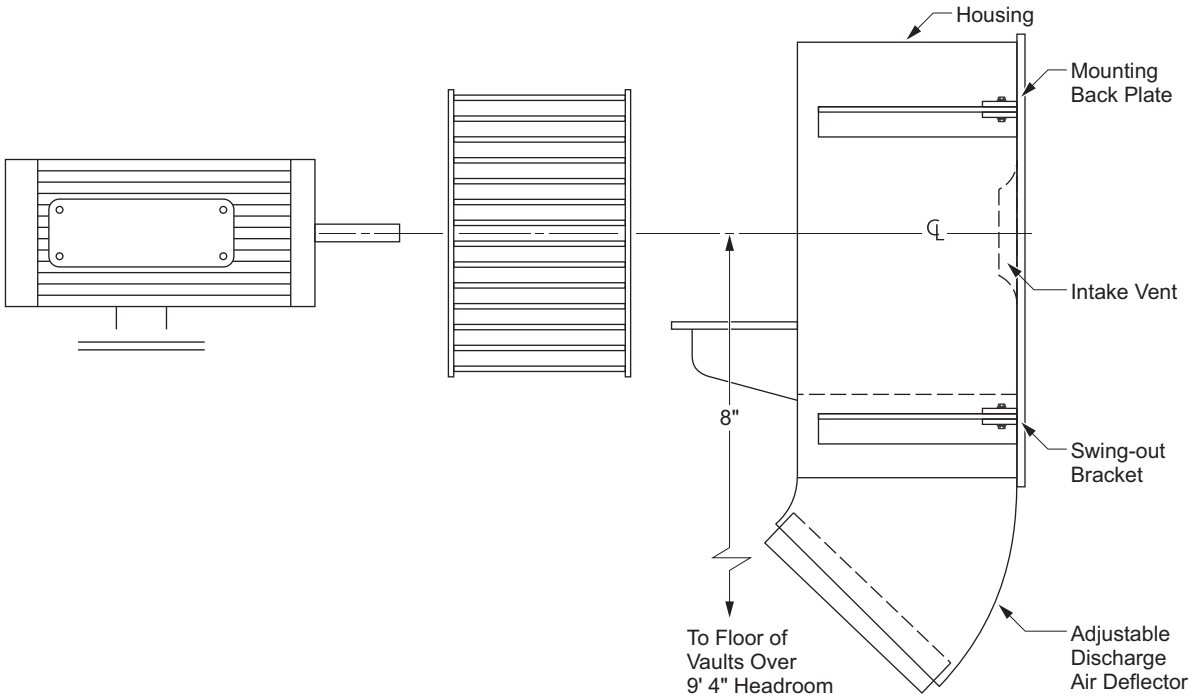
Figure VE 205–0.2Bolt Pattern (Use 1/2" Bolts)

Table VE 205–1: Material Codes for 1 HP Blower for Underground Vaults

Available Voltage In Vault	Phase	Low Noise (Up to 750 kVA of Load)	Regular Noise Level 1 HP
115 or 230 High Efficiency	—	—	10117625
208 or 230 or 460	3	10117627	10117628

Note(s):
1. If vault exhaust is a steel street grate and contains a CM-V (Pilot) or Network Protector, refer to DUG VE 245.

Figure VE 205–1: One Horsepower Underground Vault Blower Assembly (226–1,000 kVA)



VE 210 Blower — Three (3) Horsepower

Scope VE 210.1 Three (3) Horsepower Blower for Large Vaults (1,000 kVA and Above — M/C 655-19506)

The blower comes completely assembled and ready to install with M/C 655-19506. The unit weighs 250 pounds. The motor is a 3 phase 230/460 volt unit. Replacement motors are available with M/C 433-07008. Single phase motors are available by special request only.

An exhaust vent, equal in size to the intake vent, is required for all blower installations. If rectangular duct is used it must have an area equivalent to that of an 18-inch diameter opening.

The blowers move a large amount of air and may cause considerable noise if not installed with a duct system. A straight 10 foot length of duct leading into the blower will afford the most efficient use of the unit and will also eliminate most of the air noise. If a blower must be installed without a duct system (for example, building vault), and noise is undesirable, other noise reduction methods are available. Contact Division Engineers for details.

The lubrication and maintenance for the three horsepower blower is identical to the one horsepower units.

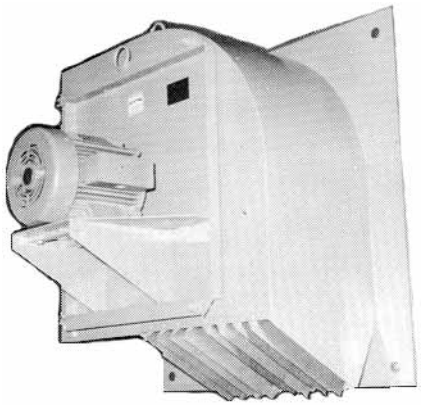


Figure VE 210–0.1Installed Blower

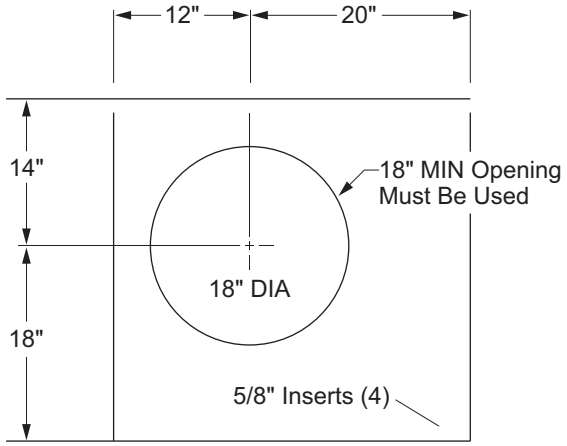


Figure VE 210–0.2Bolt Pattern (Use 5/8" Bolts)

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VE 220 Standpipe Vents — BURD Enclosure

Scope VE 220.1 Vents for BURD Transformer Enclosures (for Special Applications)

BURD transformer enclosures should not be allowed to fill with sand, mud or other debris. Where a filling problem is encountered several remedies are, available.

If the enclosure is in an area where the earth slopes, refer to Underground Structures Section for a possible solution. This is a permanent installation.

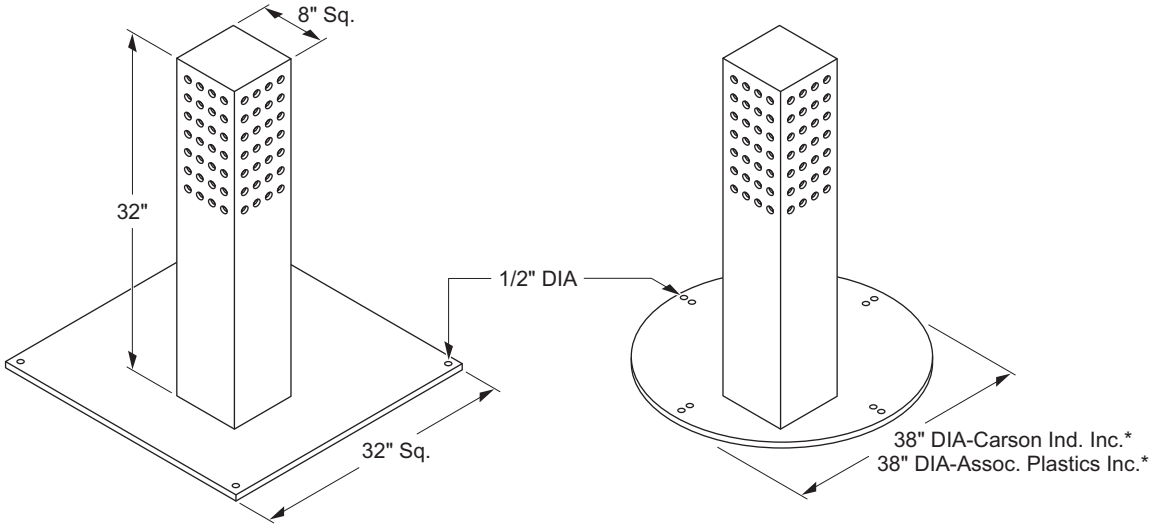
A temporary plastic cover is supplied with each grate. This cover should be removed when debris problem is eliminated or when the transformer peak load exceeds 75 percent of nameplate rating.

The covers shown above should be used only when these other remedies are unacceptable. Order the vented cover by type of enclosure it is to be used on (concrete or plastic) and manufacturer. Always remove the grate and tamper shield when installing a vented cover. If possible, install the vented cover so the side of the standpipe that has the extension below the cover is facing the prevailing wind. Fasten the cover in place using the existing or replaced penta head cap screws.

The removed grate and tamper shield should be saved and replaced on the enclosure when the debris problem is gone. The standpipe vented covers are reusable and only a minimum number should be ordered.

There are several sizes of plastic enclosures which have been provided by the manufacturers. When ordering vents, include manufacturer's name and O.D. of enclosure grating with the requisition.

Figure VE 220–1: Vents for BURD Transformer Enclosures (for Special Applications)



For 36" DIA Concrete Enclosure
Only MC 655.32228

For Plastic Enclosures
M/C 65532236
Order by Manufacturer Name*

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VE 225 Replacement of Standpipe Vents

Scope VE 225.1 Preferred Replacement for Standpipe Vent

1.0 General Information

For most field installations standpipe vents should be replaced with the same type of standpipe that was initially damaged. Exceptions to this may be when changing from a PVC standpipe to either a Steel or Polyethylene standpipe.

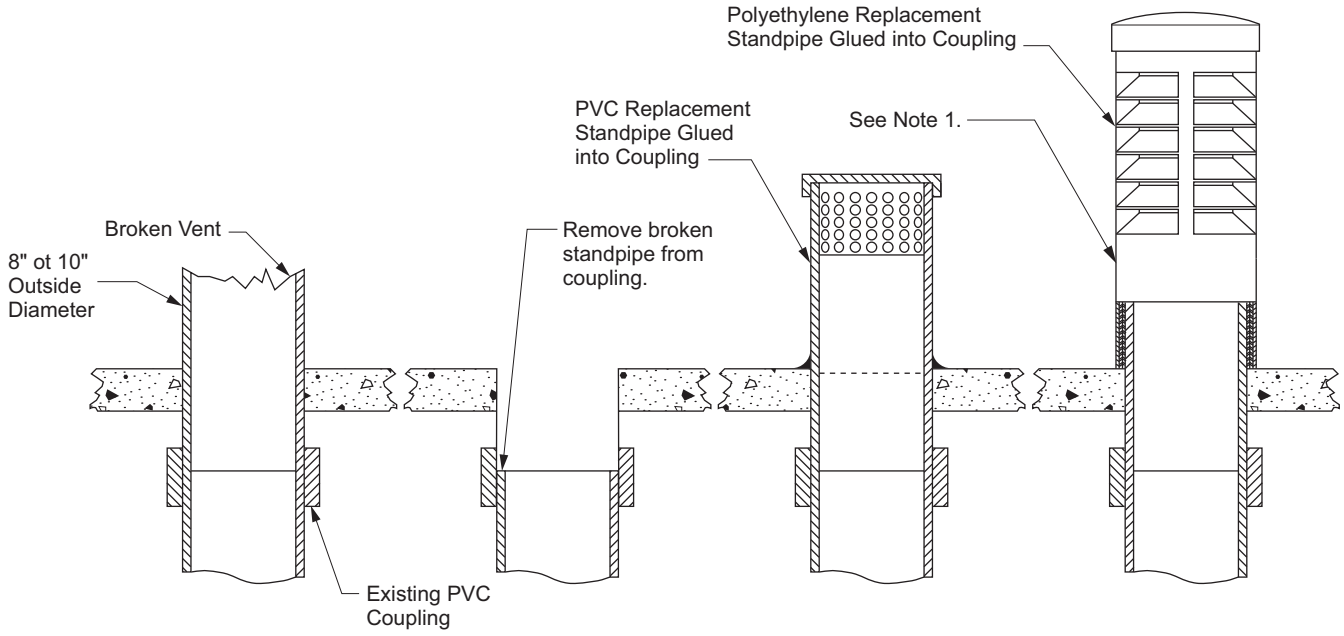
Steel may be used to replace PVC at locations were PVC has a history of being damaged, and in areas where they are exposed to vehicular damage, such as alleys and driveways.

Polyethylene may be used to replace PVC if the following conditions regarding the repair and landscape at the location can be met.

- All of the standpipe vents for the structure need to be replaced.
- The grade at the installation location for the standpipe vent must be level or horizontal. The vent cannot be installed on a slope.

Steel and PVC standpipe vents must be replaced with polyethylene standpipe vents to accommodate SCE NETCOMM antenna installations. See DUG VE 240 for antenna installation details.

Figure VE 225–1: Replacement for PVC and Polyethylene Replacement Standpipe Vents



Note(s):
1. Reinstall strucuture idenditifticaion stickers facing toward the street, see GR 232 for grounding conneciton.

2.0 Specifics when Installing PVC Replacement Standpipe Vents

2.1 Cut and chisel out the entire existing broken standpipe vent from the existing PVC coupling.

2.2 Glue replacement 42" PVC standpipe vent into the original PVC coupling.

2.3 Caulk the replacement standpipe where it meets the concrete, if necessary to ensure a water tight joint.

3.0 Specifics when Installing Polyethylene Replacement Standpipe Vents

3.1 Cut and chisel out the entire existing broken standpipe vent from the existing PVC coupling.

3.2 Cut the lower PVC portion of the standpipe so it will fit into the coupling and have the upper polyethylene portion sit flush on the concrete.

3.3 Glue the lower PVC portion of the standpipe into the existing PVC coupling.

3.4 Caulk the replacement standpipe where it meets the concrete, if necessary to ensure a water tight joint.

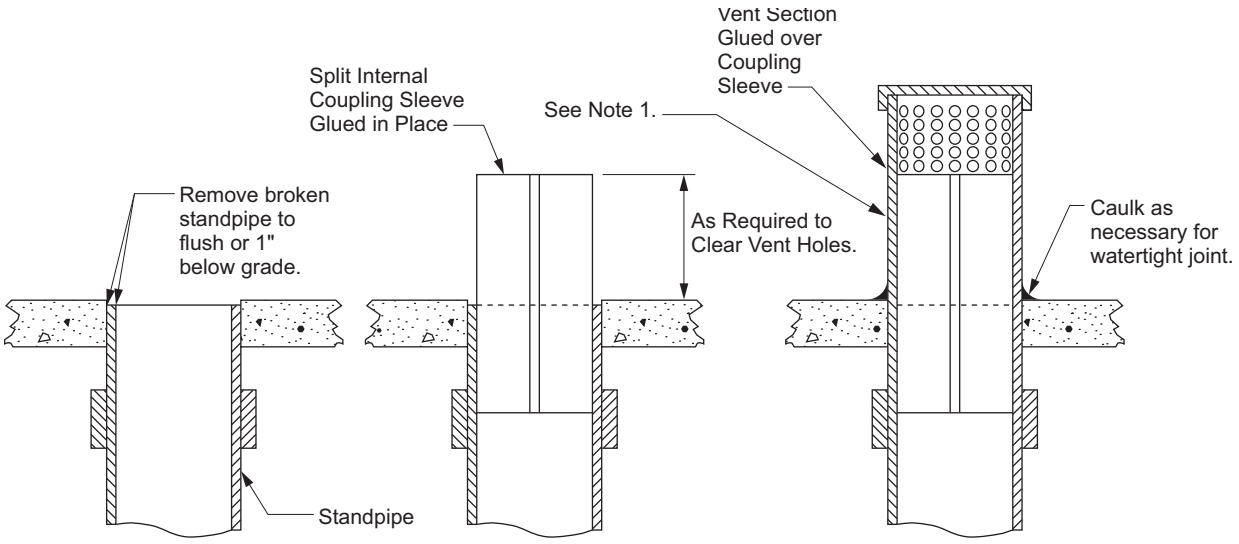
Table VE 225–1: Replacement Polyethylene Standpipe Vent (See Note 1)

Application	Lower PVC Length	Standpipe Exterior Finish	SAP Number
8" Diameter Vent Duct	8"	Granite (Gray)	10117598
10" Diameter Vent Duct	8"	Sand Stone (Brown)	10117599
8" Diameter Vent Duct	16"	Granite (Gray)	10117525
10" Diameter Vent Duct	16"	Sand Stone (Brown)	10117524

Note(s):
1. Polyethylene standpipe vents are supplied with an 8-inch lower PVC portion, which should suffice for most field installations. The PVC section can be cut to fit individual locations. For locations that require a longer PVC section, vents have been coded with a 16-inch lower section that may be used.
2. When replacing broken standpipes, care should be taken to match the replacement pipes with the existing surrounding vents style for the location.

Scope VE 225.2 Alternate Repair for Standpipe Vent

Figure VE 225–2: Alternate Repair of PVC Standpipe Vents



Note(s):
1. Reinstall strucuture idenditifticaion stickers facing toward the street, see GR 232 for grounding conneciton.

1.0 Specifics for PVC Standpipe Repair

1.1 The broken standpipe is cut off flush with grade (or chiseled to one inch below grade if required) and the replacement standpipe is cut to stand 32-34 inches above grade.

1.2 Glue the supplied internal coupling sleeve far enough into the cut off standpipe so that the replacement standpipe vent holes are not blocked when it is in place.

1.3 Glue the replacement standpipe over the coupling sleeve, which was previously glued in place.

1.4 Caulk the replaced standpipe can be caulked where it meets concrete, if necessary to ensure a watertight joint.

2.0 PVC Ventpipe Repair Kits

Replacement PVC kits include the standpipe and the split internal coupling sleeve. Broken PVC standpipe vents can be replaced, using the following repair kits:

Table VE 225–2: PVC Ventpipe Repair Kits

PVC Vent Size	PVC Repair Kit Material Code
8" Diameter	620-20284
10" Diameter	620-20292

Note(s):
1. When replacing broken standpipes, care should be taken to match the replacement pipes with the existing surrounding vents style for the location.

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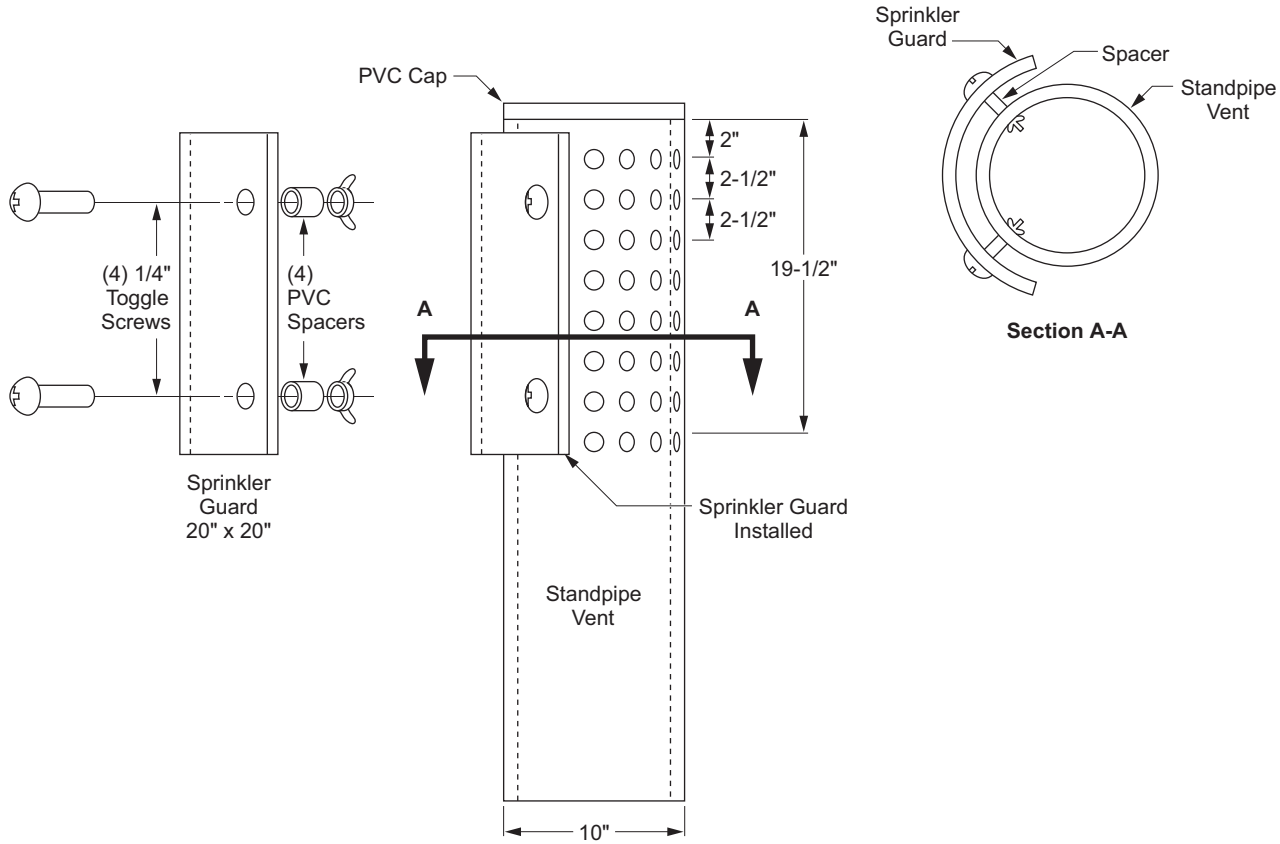
VE 230 Sprinkler Guard for 10 Inch Standpipe Vent

Scope VE 230.1 Installation of Standpipe Vent Sprinkler Guards

Figure VE 230–1: Installation of Standpipe Vent Sprinkler Guards



Note(s):

1. Where standpipe vents are subject to spray from watering systems, vent guards should be installed on the side of the perforated portion of the standpipe most directly facing the source of spray. The PVC vent guards are attached by four 1/4 inch toggle screws passed through the vent perforations. Toggle screws and PVC spacers are included with vent guard.
2. M/C 65500571 — Sprinkler guard, spacers and toggle screws

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VE 240 SCE NETCOMM Retrofit Antenna Installation for 8-inch and 10-inch Steel or PVC Standpipe Vent

Scope VE 240.1 SCE NETCOMM Retrofit Antenna Installation for Existing 8-inch and 10-inch Steel or PVC Standpipe Vent

1.0 Application:

These instructions are for installing a polyethylene standpipe vent for use in conjunction with SCE NETCOMM antennas in lieu of the existing 8-inch and 10-inch steel or PVC standpipe vents that cannot be retrofitted to accept a ground plane and antenna. PVC standpipe vents of other diameters must be replaced per DUG VE 240 to allow for NETCOMM antenna installation.

If the vault contains a 1 HP blower and the exhaust is a steel grate, see DUG VE 245.

Wear proper safety equipment such as gloves and eye protection during installation as vault blower may spread metal shavings during cutting and drilling of the steel standpipe vent.

2.0 Instructions:

1. Cut steel or PVC standpipe vent 12" - 15" above grade. See Figure VE 240–1 (Sheet 1).

Figure VE 240–1: Steel Standpipe Vent Cut to 12" - 15" from Face of Concrete

2. Remove burrs and sharp edges.
3. Spray corrosion inhibitor (SAP 10062945) on the newly cut surface of the steel standpipe vent to reduce corrosion. Be sure inhibitor coats both inside and outside surfaces about 1" – 2" from the top of steel stub out.
4. Slide polyethylene vent over steel or PVC standpipe vent stub out.

Table VE 240–1: Polyethylene Standpipe Vent Retrofit Material Codes

Polyethylene Vent Pipe Retrofit		
Diameter	**SAP Number**	**Exterior Finish**
8 inch	10167695	Granite (Grey)
10 inch	10167697	Sandstone (Brown)

5. Mark the 4 mounting bolt locations using the polyethylene standpipe vent as a template.

6. Remove the polyethylene standpipe vent and drill 7/16-inch holes at the marked locations.
7. Clean metal shavings from drilled holes and spray with corrosion inhibitor.
8. Mark original orientation of top cap to standpipe vent prior to removal. This is important for the alignment of the bolts when replacing the top cap.
9. Remove top cap of the polyethylene standpipe vent. Position polyethylene standpipe vent over steel or PVC stub out and bolt in place using provided stainless steel hardware. See Figure VE 240–2 (Sheet 2).

Figure VE 240–2: Standpipe Vent Mounting Bolt Locations

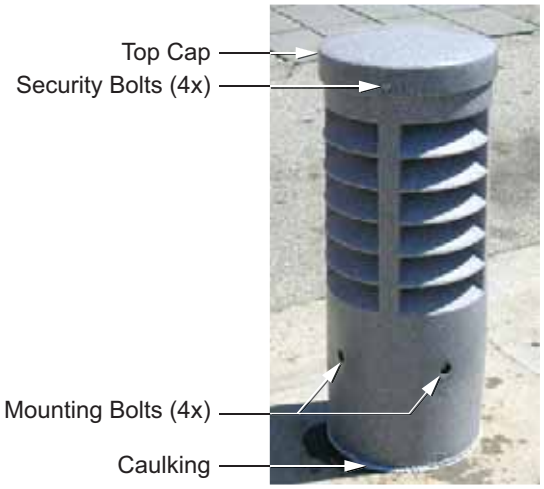
10. Caulk around base of vent as necessary for a watertight joint.
11. Mount radio antenna(s) onto stainless steel mounting plate and set assembly into vent seen in Figure VE 240–4 (Sheet 3). For antenna assembly details see Figure VE 240–8 (Sheet 6).

Figure VE 240–3: Polyethylene Standpipe Vent Pipe (inside view)

Figure VE 240–4: Radio Antenna in Polyethylene Vent Pipe

12. Replace top cap with the security bolts. Figure VE 240–5 (Sheet 3).

Figure VE 240–5: Completed Installation



13. Re-apply structure number to smooth surface of standpipe vent.

Figure VE 240–6: Polyethylene Standpipe Vent for use with 8-inch Steel Vent Pipe (Granite Finish)

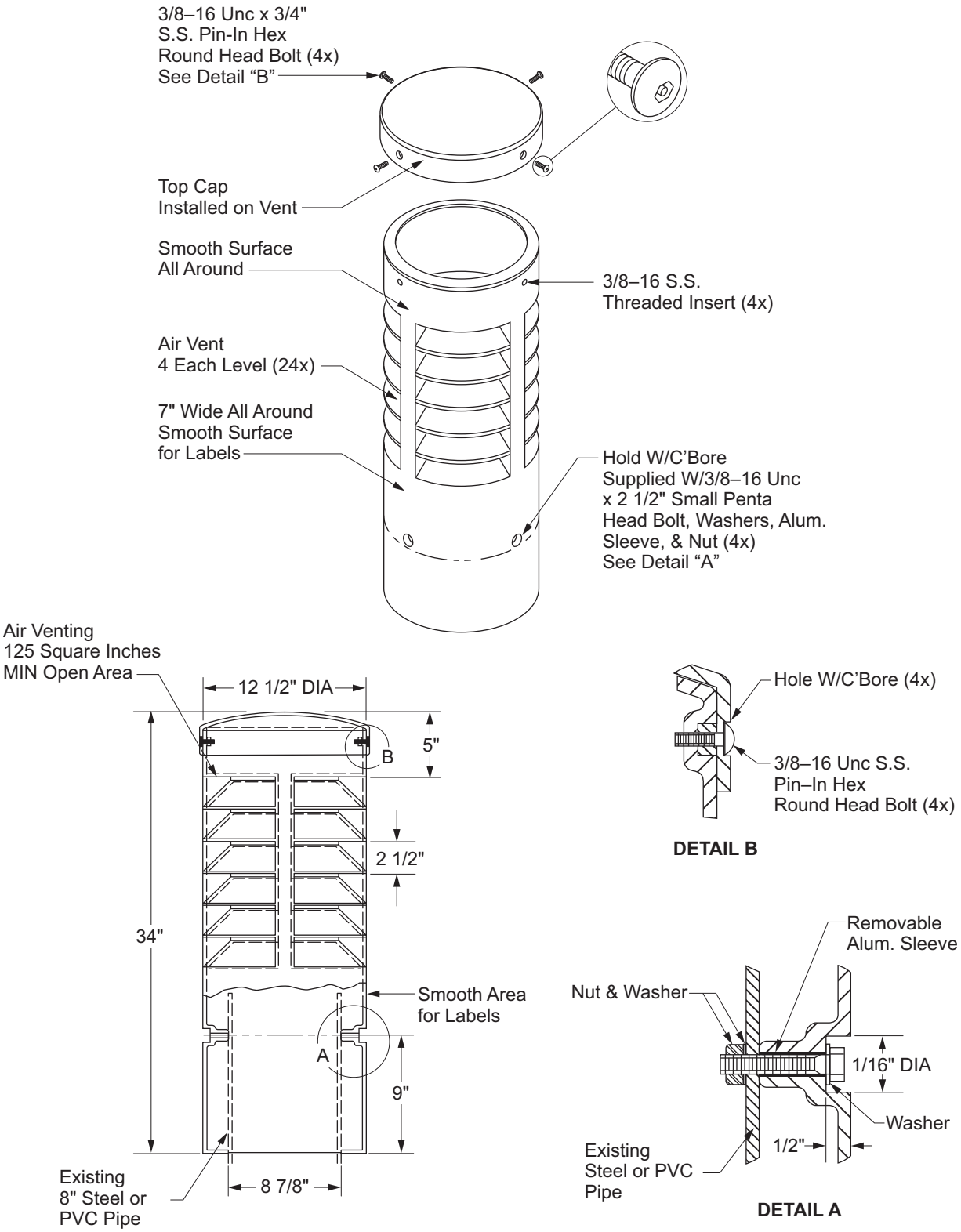


Figure VE 240–7: Polyethylene Standpipe Vent for use with 10-inch Steel Vent Pipe (Sandstone Finish)

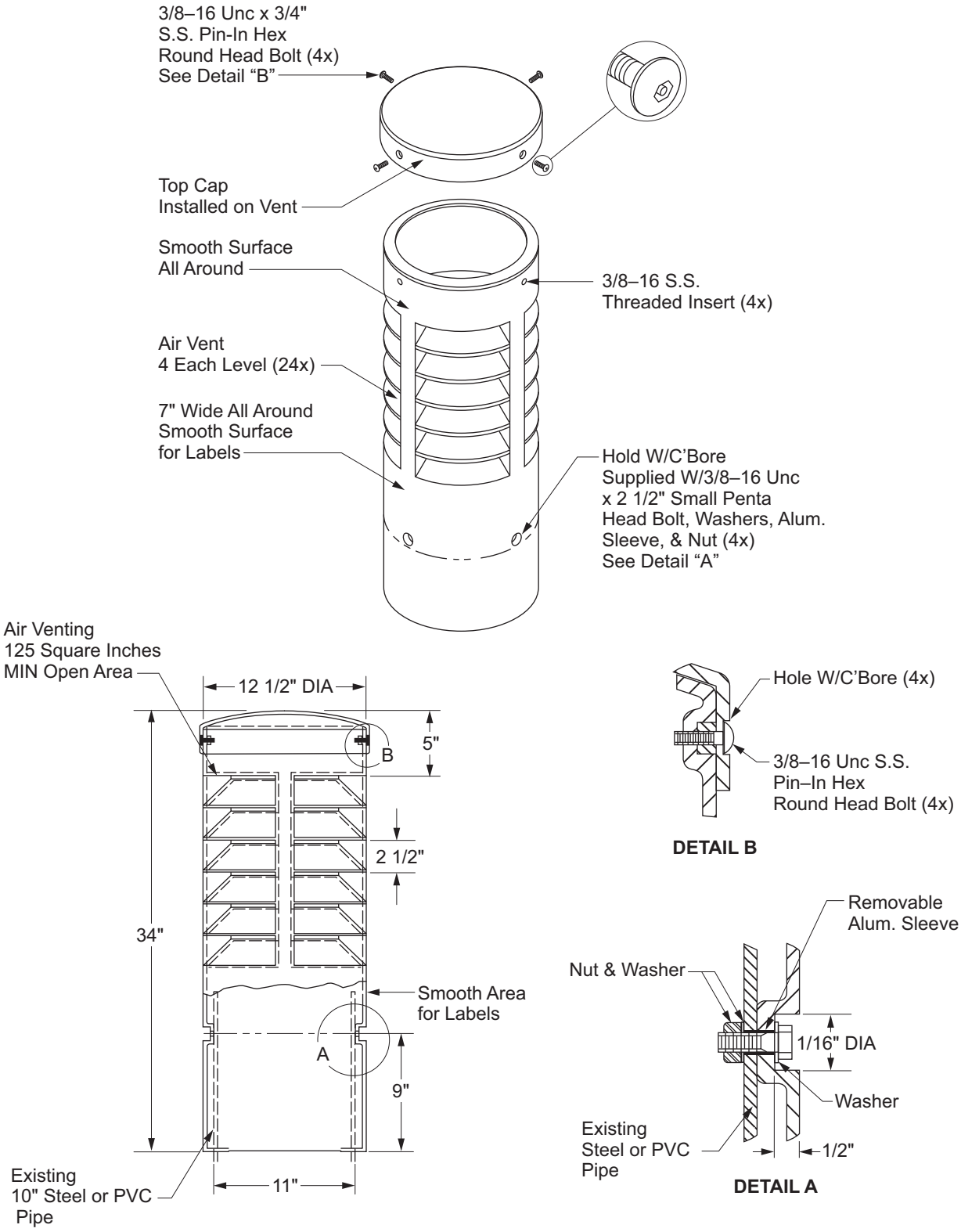
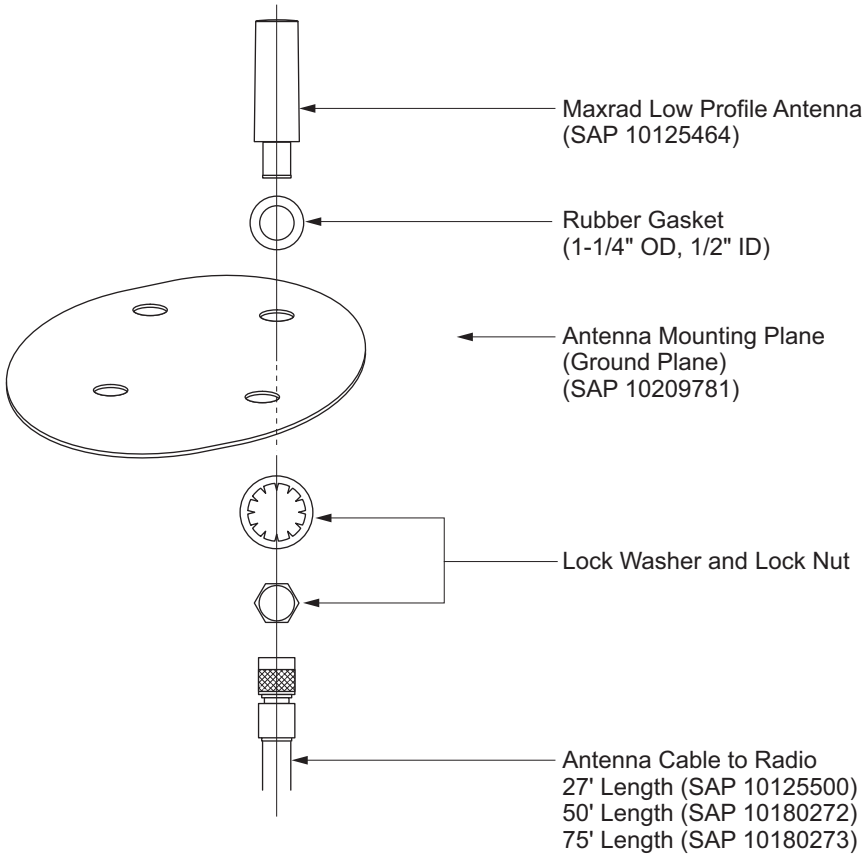


Figure VE 240–8: Low Profile Antenna Detail



Note(s):
1. All connections shall be hand tightened.
2. Knockout holes to be used as needed.

VE 245 Vault Blower Offset Brackets for SCE NETCOMM Installation

Scope VE 245.1 Vault Blower Offset Brackets for SCE NETCOMM Installation

1.0 General Information

Blower offset brackets are used to allow for the routing of antenna coaxial cables through underground structure vent ducts per DUG VE 240. They shall be installed in structures where all of the following conditions are met:

- An existing 1 horsepower (HP) vault blower is installed, or is to be installed, on the structure intake vent tube opening that is equipped with an above-grade standpipe vent.
- The structure exhaust opening is either a street grate or a vent tube that goes to a street grate.
- There is a need to route a coaxial antenna cable or cables past the 1 HP blower due to a CM-V (Pilot), Network Protector, or any combination thereof, installed in the vault.

See Table VE-245-1 for SAP number options.

Table VE 245–1: Offset Bracket SAP Numbers and Descriptions

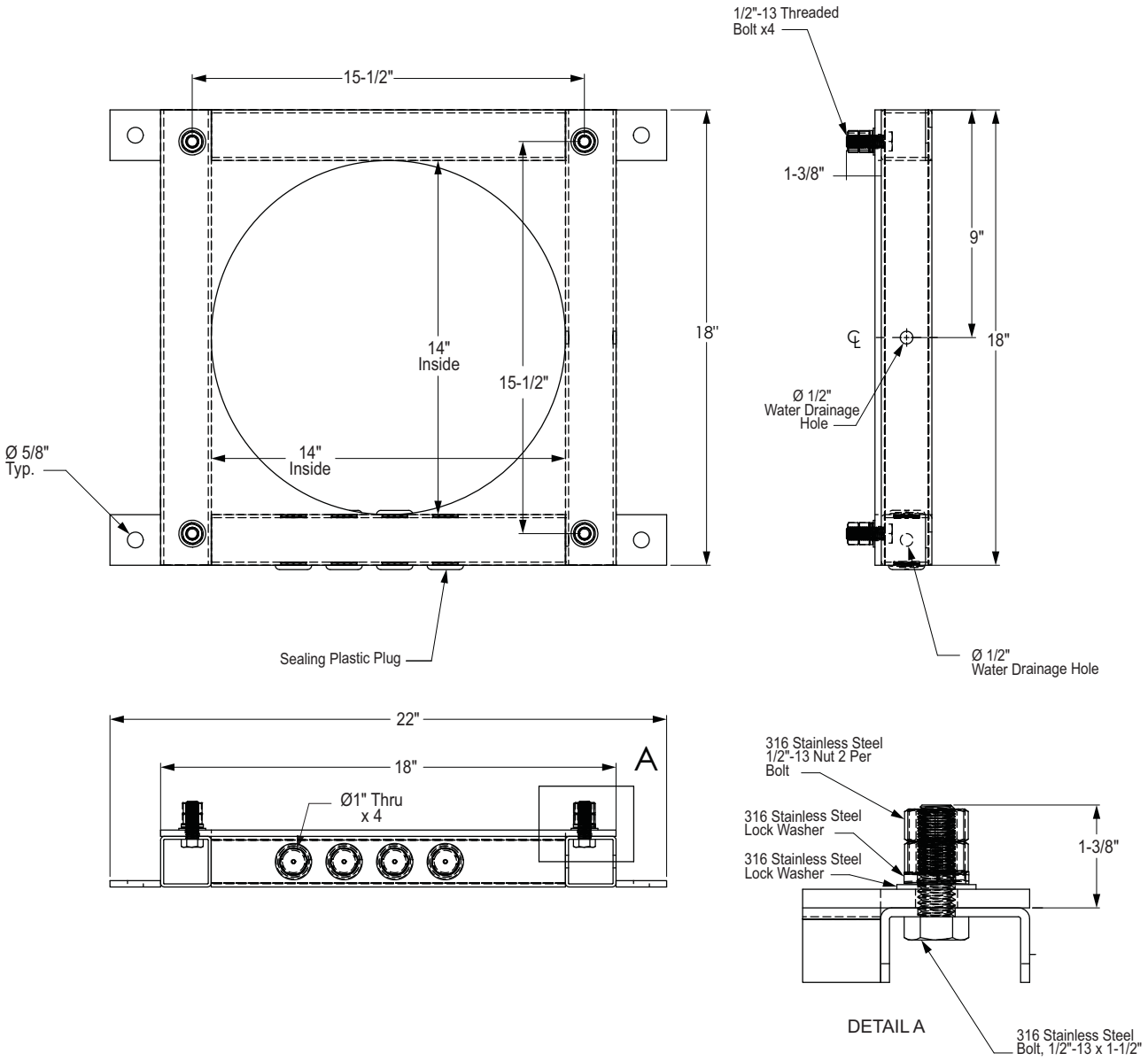
SAP	Description
10211461	Blower offset bracket for vault where new 1 HP blower to be added
10211460	Blower offset bracket for vault with existing 1 HP blower

Scope VE 245.2 Vault Blower Offset Bracket for New One (1) Horsepower Blower Installations

1.0 Application

This vault blower offset bracket shall be used for installations where a vault blower is being added as a new installation. The offset bracket is made from galvanized steel.

Figure VE 245–1: Vault Blower Offset Bracket for New Installations



Note(s):

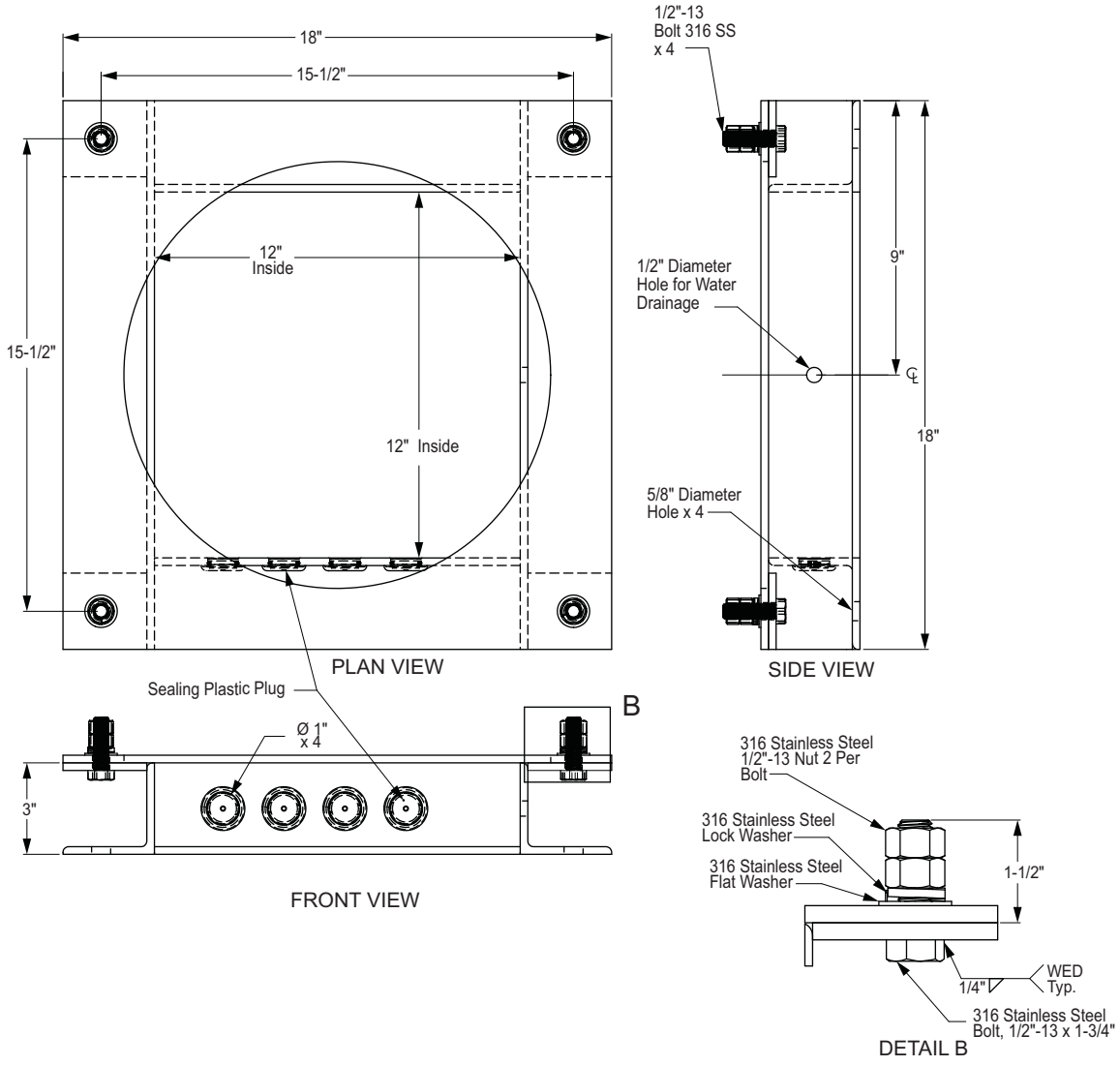
1. Bracket shall be mounted to structure wall using stainless steel 1/2” redhead anchors. Secure to anchors using stainless steel 1/2” lock washers and stainless steel 1/2” lock nuts.
2. Offset bracket shall be installed so that the four holes on the bracket are oriented on the left side of the vent duct.
3. See DUG VE 205 for 1HP blower details.
4. Exercise caution when reaching into structure vent ducts.

Scope VE 245.3 Vault Blower Offset Bracket for Existing One (1) Horsepower Blower Installations

1.0 Application

This vault blower offset bracket shall be used for existing vault blower installations. The offset bracket is made from galvanized steel.

Figure VE 245–2: Vault Blower Offset Bracket for Existing One (1) Horsepower Blower Installations



Note(s):

1. Secure to wall anchors using stainless steel 1/2” lock washers and stainless steel 1/2” lock nuts.
2. Offset bracket shall be installed so that the four holes on the bracket are oriented on the left side of the vent duct.
3. See DUG VE 205 for 1HP blower details.
4. Exercise caution when reaching into structure vent ducts.

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Irvine Smart Grid Demonstration
Table of Contents

Standard	Title
ISGD CES100P	Community Energy Storage Unit (CES)
ISGD CES100P.1	Community Energy Storage Unit
ISGD CES200P	Pad-Mounted Low Voltage Bypass Switch — 600 V
ISGD CES200P.1	Pad-Mounted Low Voltage Bypass Switch — 600 V
ISGD URCI 100P	Pad-Mounted Universal Remote-Controlled Interrupter
ISGD URCI 100P.1	Pad-Mounted Universal Remote-Controlled Interrupter Installation Instructions and General Information
ISGD URCI 200P	S&C IntelliComm WAN Radio General Information
ISGD URCI 200P.1	S&C IntelliComm WAN Radio General Information

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ISGD CES100P Community Energy Storage Unit (CES)

Scope ISGD CES100P.1 Community Energy Storage Unit

1.0 General Information

1.1 These instructions cover the Community Energy Storage Unit that is part of demonstrations for the Irvine Smart Grid Demonstration (ISGD) Project. The system is to be connected to the secondary side of the residential pad mounted transformer (P5478140) on Handel Court in Irvine. The CES Unit is rated at 25 kVA & 50 kWh, providing the ability to support customer loads for up to 2 hours at 25 kW of total demand upon loss of power at the primary side of the residential transformer.

1.2 The CES system is used to support ISGD in conducting an end-to-end demonstration of Smart Grid Technologies. The CES system will be used to reduce peak demand by load shifting, regulate local voltage through VAR injection/absorption, provide load leveling at the residential transformer, and PV power smoothing. External antennas are attached to the CES Unit to stream the project data. Contact Advanced Technology for more information/questions.

Contact: Gabriel Andaya at 909-469-3054 cell: 909-471-1210 email: Gabriel.Andaya@sce.com

2.0 Major Components

- 25 kVA/50 kWh CES Unit
- 600 V bypass switch
- Battery Enclosure

2.1 The 25 kVA/50 kWh CES Unit consists of the power conversion system and one battery enclosure. The battery enclosure will be installed underground. Figure ISGD CES100P–1: shows the power conversion system portion of the CES Unit which is situated above ground, on top of the battery enclosure. The CES Unit measures 4’ -3” x 3’ -2” x 2’ -7” (LxWxH) along with clearances as depicted on Figure ISGD CES100P–3:.

Figure ISGD CES100P-1: Power Conversion System of the CES Unit

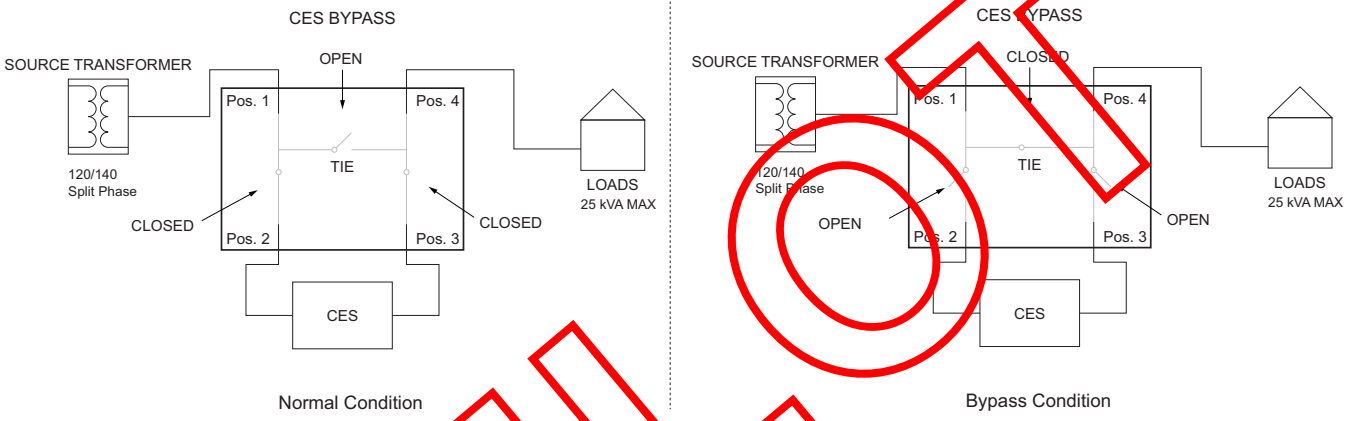
PILOT

2.2 The bypass switch co-located with the CES Unit is capable of completely isolating the CES Unit and enabling the residential transformer (P5478140) to power the connected loads directly. Figure CES 100P-2 depicts the operation of the bypass switch under normal conditions and under bypass conditions.

2.3 2.3 The battery enclosure is made of a fiberglass material and designed to hold the lithium-ion batteries for the CES Unit. The structure is not designed for permanent installation and cannot handle load bearing. The load bearing for the installation will be maintained by stabilizing the nearby soil, and mitigating vehicular traffic.

Contact Distribution Structural Engineering for battery enclosure installation details.

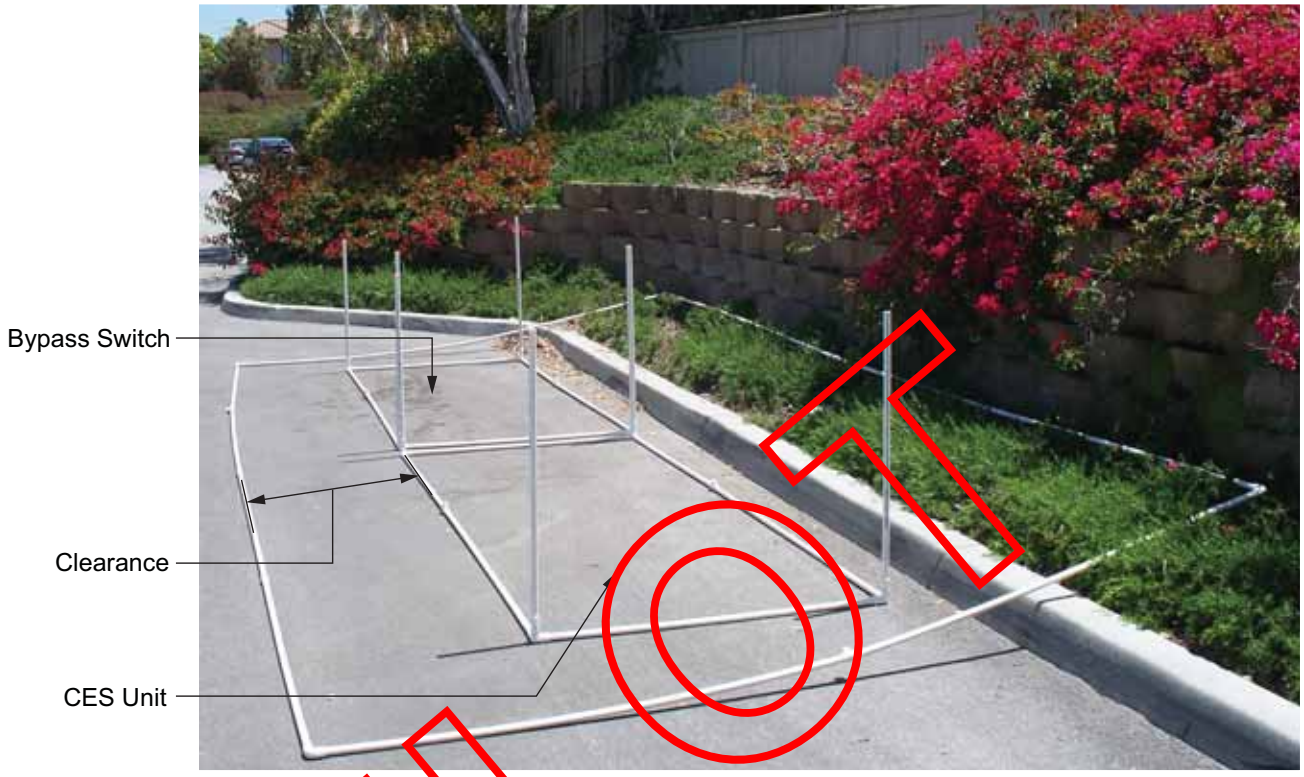
Figure ISGD CES100P–2: Bypass Switch Under Normal and Bypass Conditions



PILOT

3.0 CES Bypass Switch Locations and Street View

Figure ISGD CES100P–3: CES Unit Actual Location and Dimensional Depiction



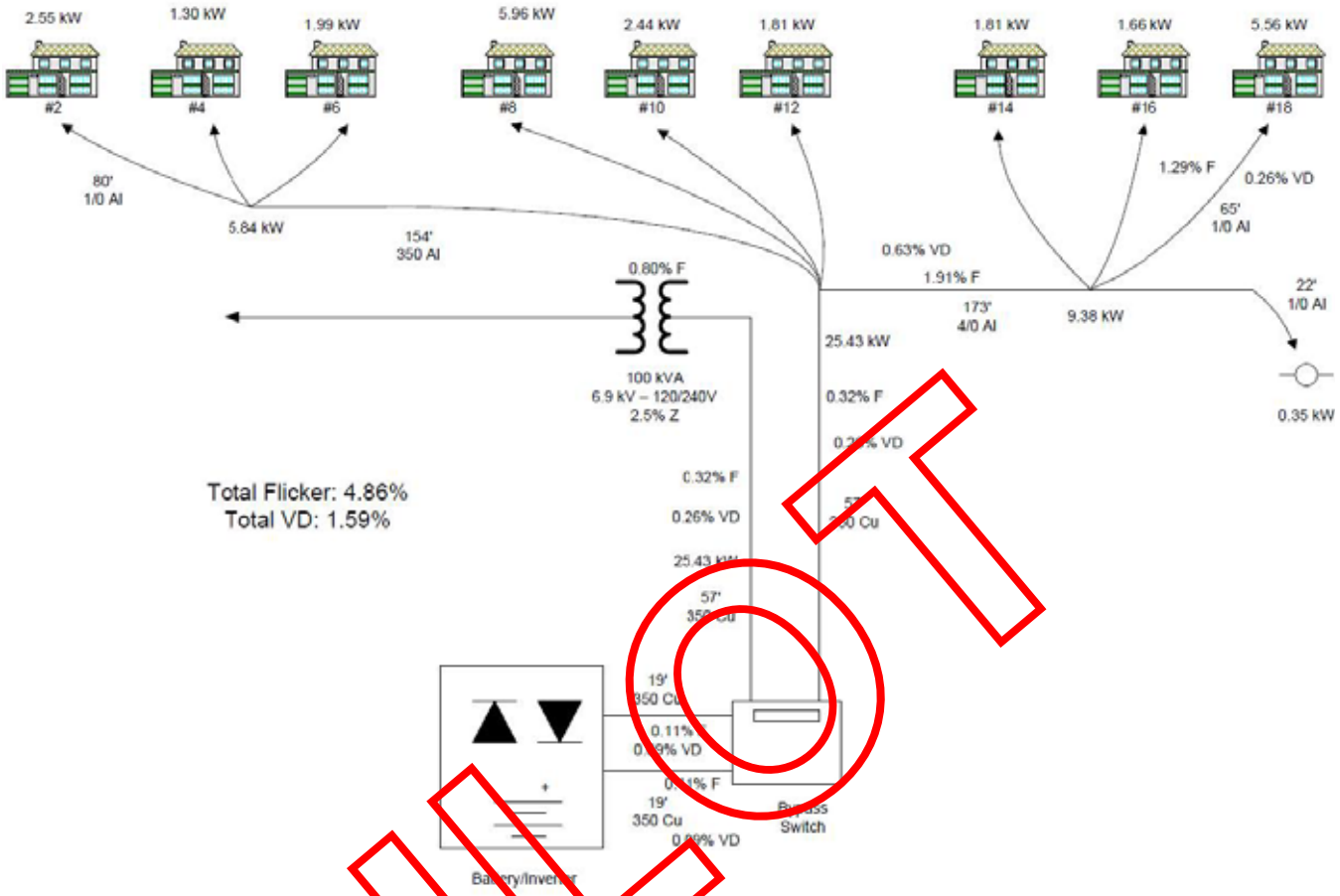
PILOT

Note(s):

1. The CES Unit and the bypass switch location may be interchanged at time of installation based on the most conducive placement for cabling and civil works.

Figure ISGD CES100P–4: Street View & Unit Location

Figure ISGD CES100P–5: CES Unit Flicker & Voltage Drop



PILOT

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ISGD CES200P Pad-Mounted Low Voltage Bypass Switch — 600 V

Scope ISGD CES200P.1 Pad-Mounted Low Voltage Bypass Switch — 600 V

1.0 General Information

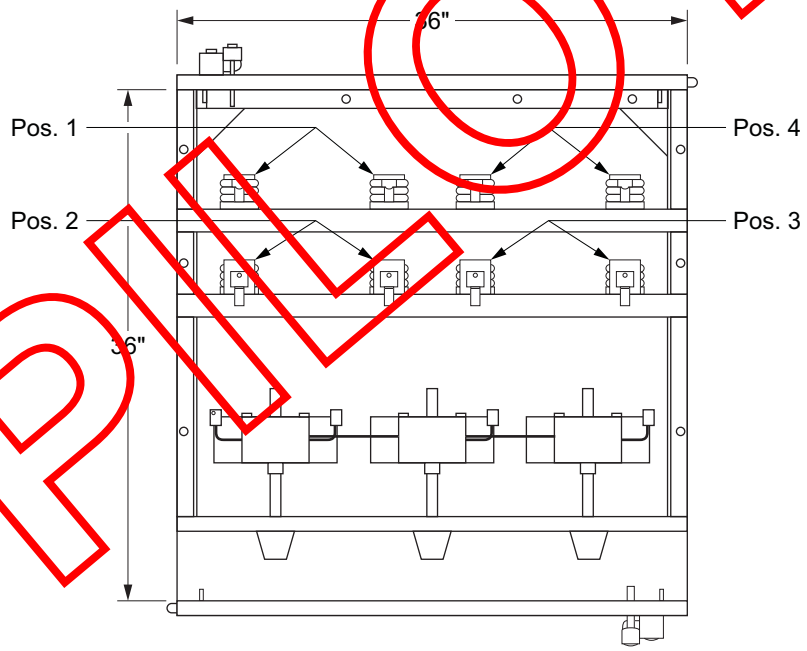
1.1 The Community Energy Storage (CES) low-voltage bypass switch may be applied to disconnect and bypass the CES unit for malfunctions, testing, and maintenance. The CES bypass switch is rated for 600 V maximum, 400 A continuous and load-break. Each switch position is equipped with modular snap-on auxiliary contacts to provide remote indication of position status (open or closed).

1.2 The CES bypass unit for ISGD is configured for 120/240 V systems. The recommended structure for the CES Bypass switch is the 48” x 54” transformer pad (refer to UGS SS 500 Table SS 500-3 and UGS Figure SS 506-1 for construction details). The cable terminations for the CES bypass switch shall be made using 2-hole NEMA lugs.

1.3 See TX 160 for general requirement for anchoring, sealing, stenciling of pad-mounted equipment.

1.4 Refer to documentation to be provided by Advanced Technology for installation instructions.

Figure ISGD CES200P–1: Pad-Mounted Low Voltage CES Bypass Switch, 600 V, 400 A (Top View)



Top View

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Figure ISGD CES200P–2: Pad-Mounted Low Voltage CES Bypass Switch, 600 V, 400 A (Front and Side View)

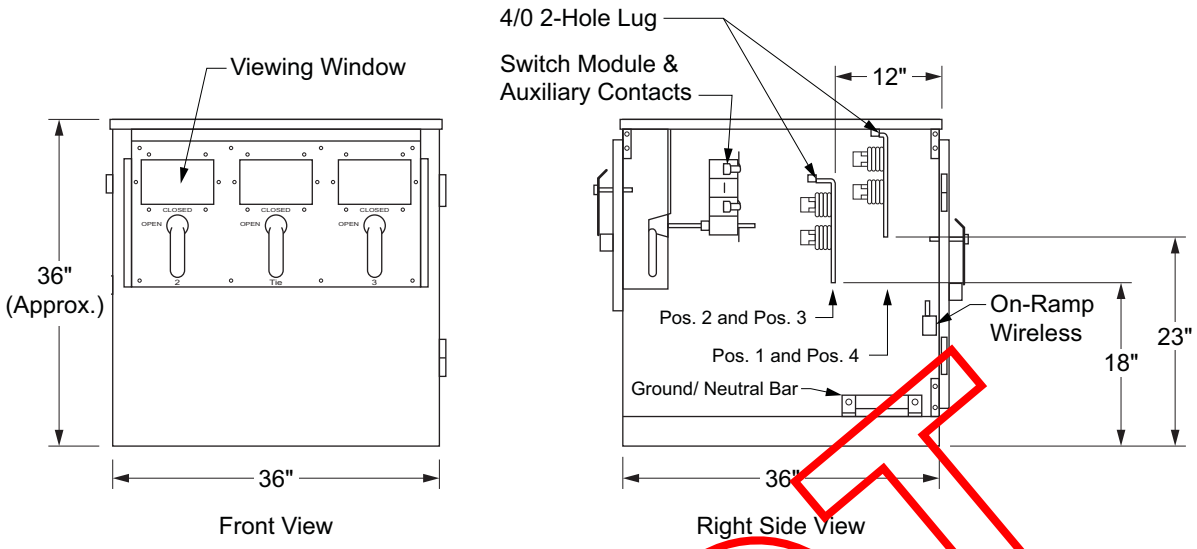

Figure ISGD CES200P–3: CES Bypass Switch Electrical One Line Diagram

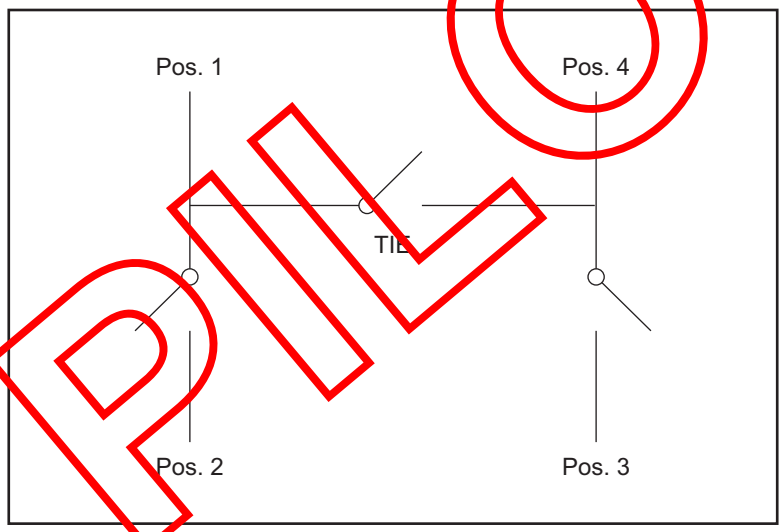

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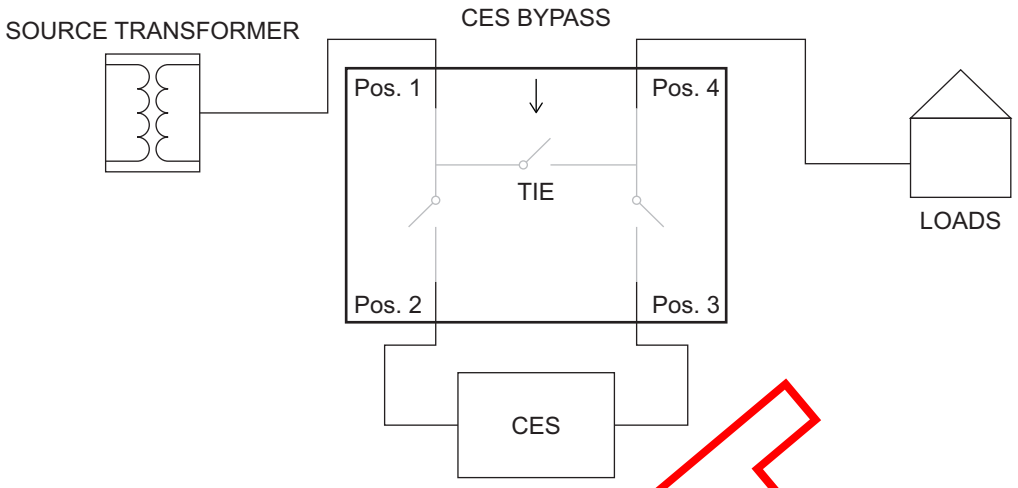
Figure ISGD CES200P–4: Bypass Switch Application Outline



Note: Wiring diagrams and grounding procedure shall be provided by Advanced Technology.

2.0 Specifications and Ordering

- Voltage – 600 V
- Continuous Current – 400 A
- Load Switching – 400 A
- Rated Short 1-Second Circuit Withstand Current – 15 kA
- Rated impulse withstand – 12 kV
- Approximate Weight – 500 lb
- Dimensions (Approx.) – 36” x 36 “x 36”

3.0 Ordering

SAP 10183624 Bypass Switch, pad-mounted, 400 A continuous/load break capability, 600 V, CES bypass switch, for use on 120/240 V systems. Includes 36” x 36” x 36” cabinet enclosure.

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ISGD URCI 100P Pad-Mounted Universal Remote-Controlled Interrupter

Scope ISGD URCI 100P.1 Pad-Mounted Universal Remote-Controlled Interrupter Installation Instructions and General Information

1.0 General Information

1.1 The Universal Remote-Controlled Interrupter (URCI) is being tested as a part of the Irvine Smart Grid Demonstration (ISGD) project. This device is intended to be used as a pilot and will be removed at the end of the project.

1.2 The URCI is installed and operated similar to a Remote-Controlled Automatic Recloser with the below exceptions.

A. The URCI has integral Voltage Sensors on the “Upper” bushings. Specific details on cable terminations should be provided in the work order.

NOTE

The manufacturer labels the Upper Bushings as “Load” however for SCE applications these bushings should be connected to MacArthur substation source and be considered as "Line" side bushings.

B. The URCI devices use a high speed radio system for their sectionalizing scheme which differs from Automatic Reclosers that are stand-alone devices.

C. The URCI installations may include 2 transformers for control power.

1.3 The URCI will be used to isolate and sectionalize sections of the Arnold 12 kV and Rommel 12 kV circuits out of MacArthur Substation. The devices will coordinate with each other and with the substation breaker using a high-speed radio network.

1.4 The Universal Remote-Controlled Interrupter Consists of 3 main parts:

A. G&W Viper Pad-Mounted Recloser

B. SEL 651R Remote Automatic Recloser Controller (Refer to DOM SW-13 for operation details)

C. S&C Intellicom High Speed Radio (Refer to ISGD URCI 200P for radio details)

1.5 Pad-mounted URCIs have dead-front designs with 600 A apparatus bushings, and are rated for 600 A continuous current.

1.6 The bypass switch shall be used in conjunction with the URCI in order to provide isolation and allow for testing and maintenance. See AP 200 for installation details of the bypass switch.

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2.0 Protection Information

Pad-mounted URCI apparatus are supplied with an electronic control. The control shall be programmed with the settings stated on an OD-43, and with the automation settings for DMS monitoring. The controller may be used to electrically operate the recloser. OD-43 settings shall be programmed and changed by qualified Distribution Apparatus Technicians or Foreman.

3.0 Equipment Installations Details

3.1 Pad-mounted URCI shall have dedicated control power transformer(s) for field installations.

3.2 Where two (2) control power transformers are applied with the URCI, one will be installed on the line and the other on the load side of the interrupter. Where only one (1) control power transformer is applied with the URCI it shall be installed on the source side of the recloser. Refer to TX 301P for details on the installation of the control power transformers.

3.3 The control power transformer(s) shall be connected to the disconnect positions 2 and position 3 of the Bypass Switch, for this pilot installation only. See Figure URCI 100P-2 for a single line diagram of the PT connections.

3.4 Refer to Section JJ for 600 A elbow terminations, as well as Section GR for grounding requirements.

3.5 The PT secondary neutral shall be bonded to the structure ground. The 120 VAC power connection shall be terminated in the control cabinet. When two control power transformers are used the 120 VAC connection shall be separate. A connection detail is provided below for the control power connections.

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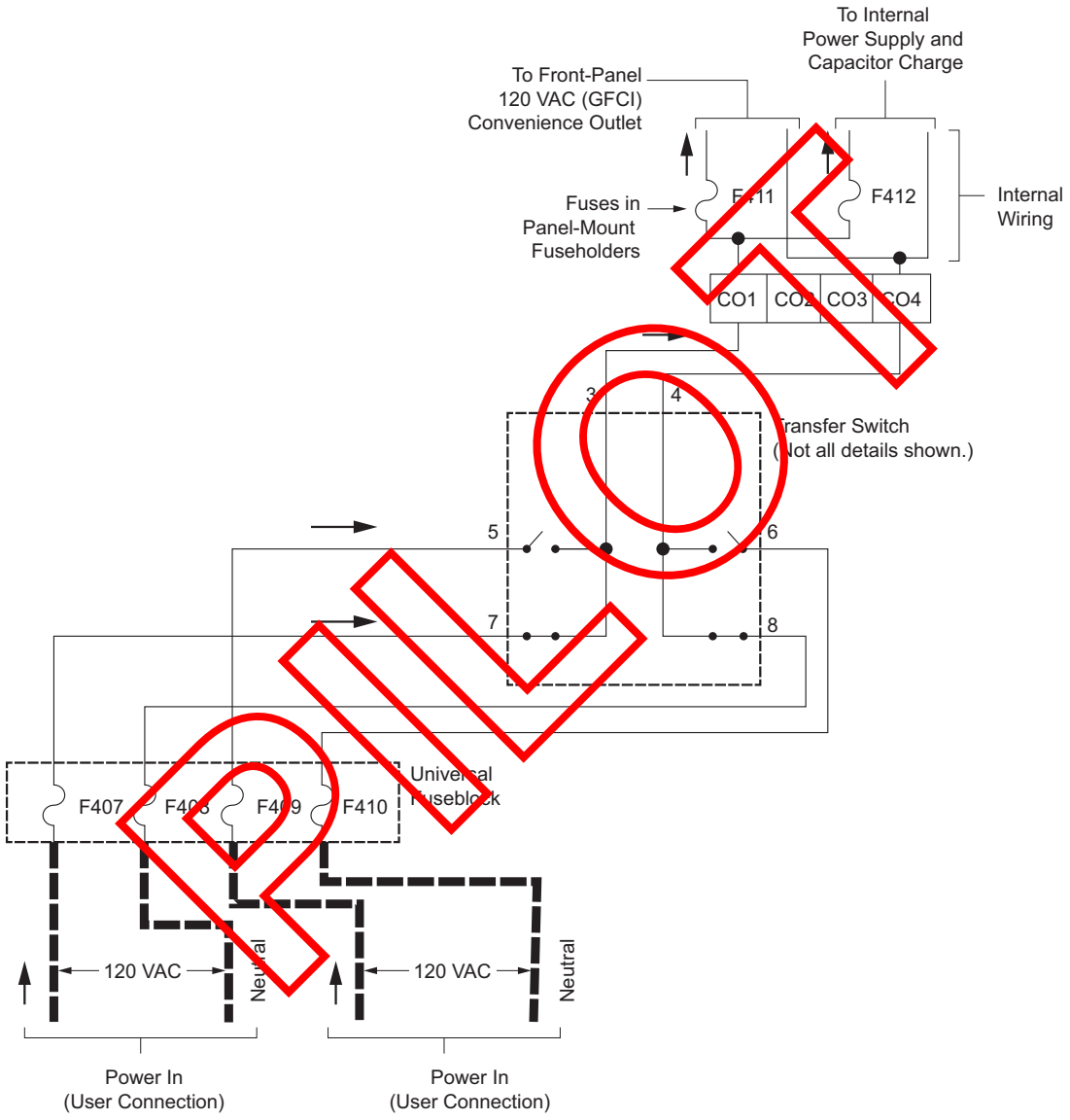
Figure ISGD URCI 100P–1: SEL 651R 120 VAC Connection Detail



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4.0 Prior to Commissioning, After Construction Status

After the installation of the URCI, the equipment needs to be commissioned by Distribution Apparatus Test. The construction crew shall configure the equipment for Distribution Apparatus Test as follows:

- Line and Load disconnect positions 2 and 3 on the bypass switch connected to both the source and the recloser
- Line and Load disconnect positions 2 and 3 on the bypass switch in the OPEN position
- URCI breaker in the OPEN position
- Bypass switch TIE position in CLOSED position, unless otherwise indicated on the Work Order
- PT(s) connected to the primary circuit
  1. If the circuit is energized, check for 120 V at the controller and connect the controller battery
  2. If the circuit is not energized, controller battery shall not be connected
- Release to substation jurisdiction that recloser has been installed and is NOT READY FOR SERVICE; Follow the procedure stated in System Operating Bulletin #25

5.0 Equipment Ratings and SAP Codes

Table ISGD URCI 100P–1: G&W Viper Ratings for 4/12/16 kV Applications

Rating	27 kV Apparatus
Maximum Voltage (kV)	27
Continuous Current (A)	600
Interrupting Current (kA, symmetrical)	12.5
Fault Close (kA, symmetrical)	20

Description	SAP Code
Universal Remote-Controlled Interrupter	10181792
SEL 651R Controller	10185334

6.0 Recommended Structures and Working Clearances

6.1 For structure requirements reference:
UGS SS 530, use 6' x 8'-6" slab box

6.2 Front and Rear High Voltage compartment doors require 8 feet of clearance, 4 feet of the equipment clearances are measured from the edge of the concrete pad outward.

6.3 See TX 160 for general anchoring, stenciling, and sealing requirements for pad-mounted equipment.

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7.0 Equipment Outline

Figure ISGD URCI 100P–2: URCI Installation Single Line Diagram

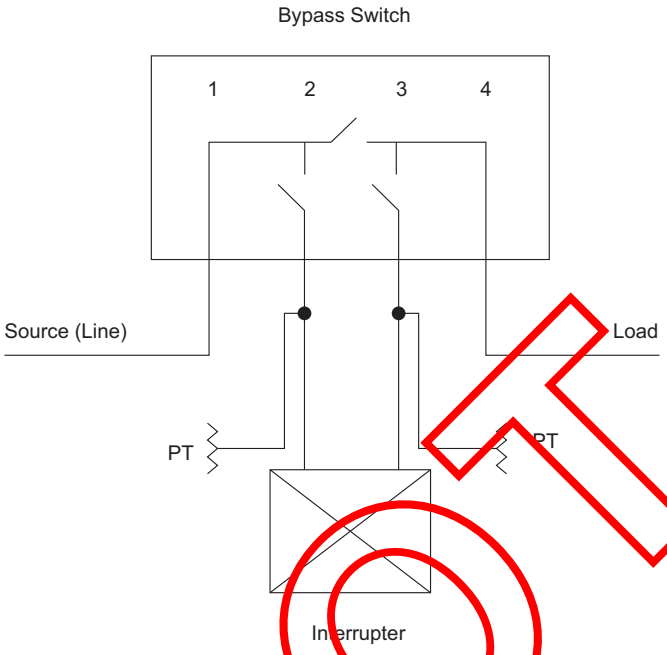

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Figure ISGD URCI 100P–3: Manual Trip Lever View of Pad-Mounted Viper URCI

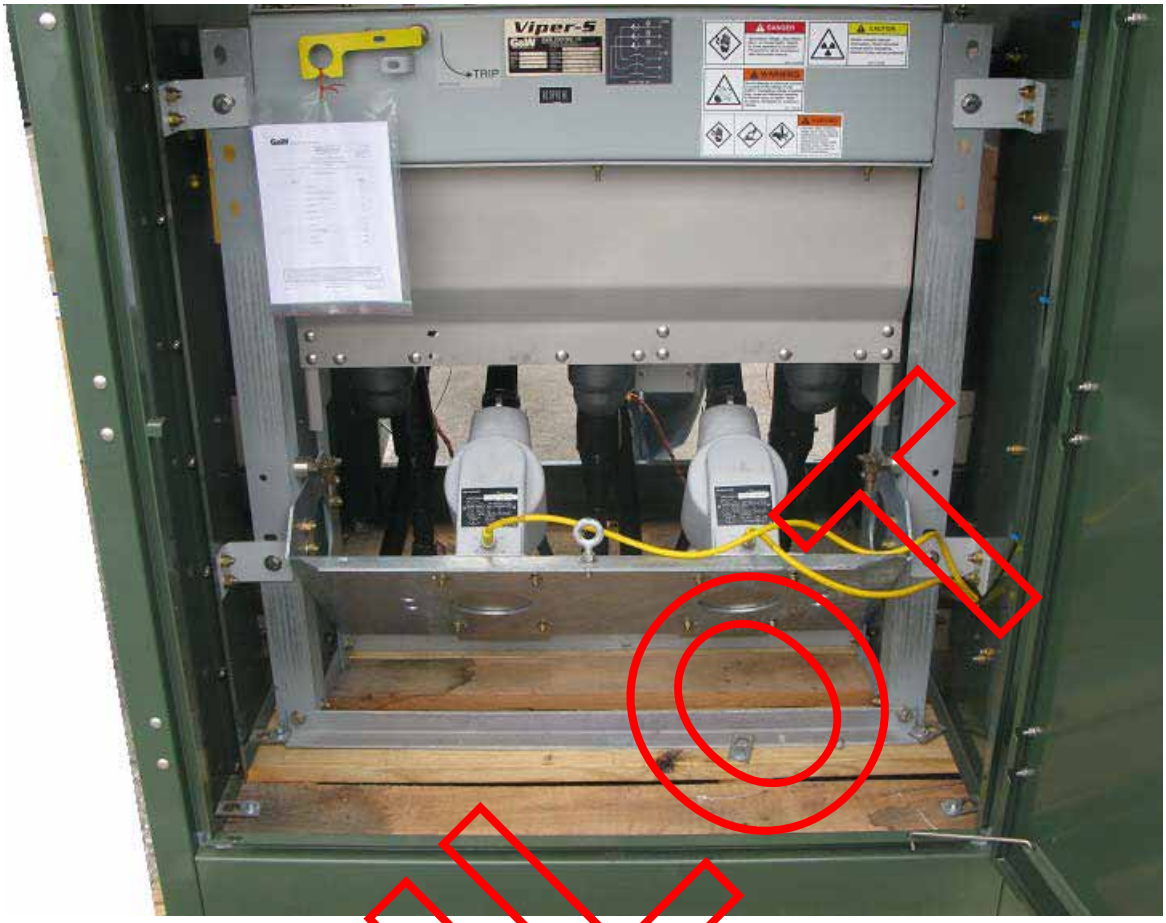

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Figure ISGD URCI 100P–4: Cable Connections View of Pad-Mounted Viper URCI

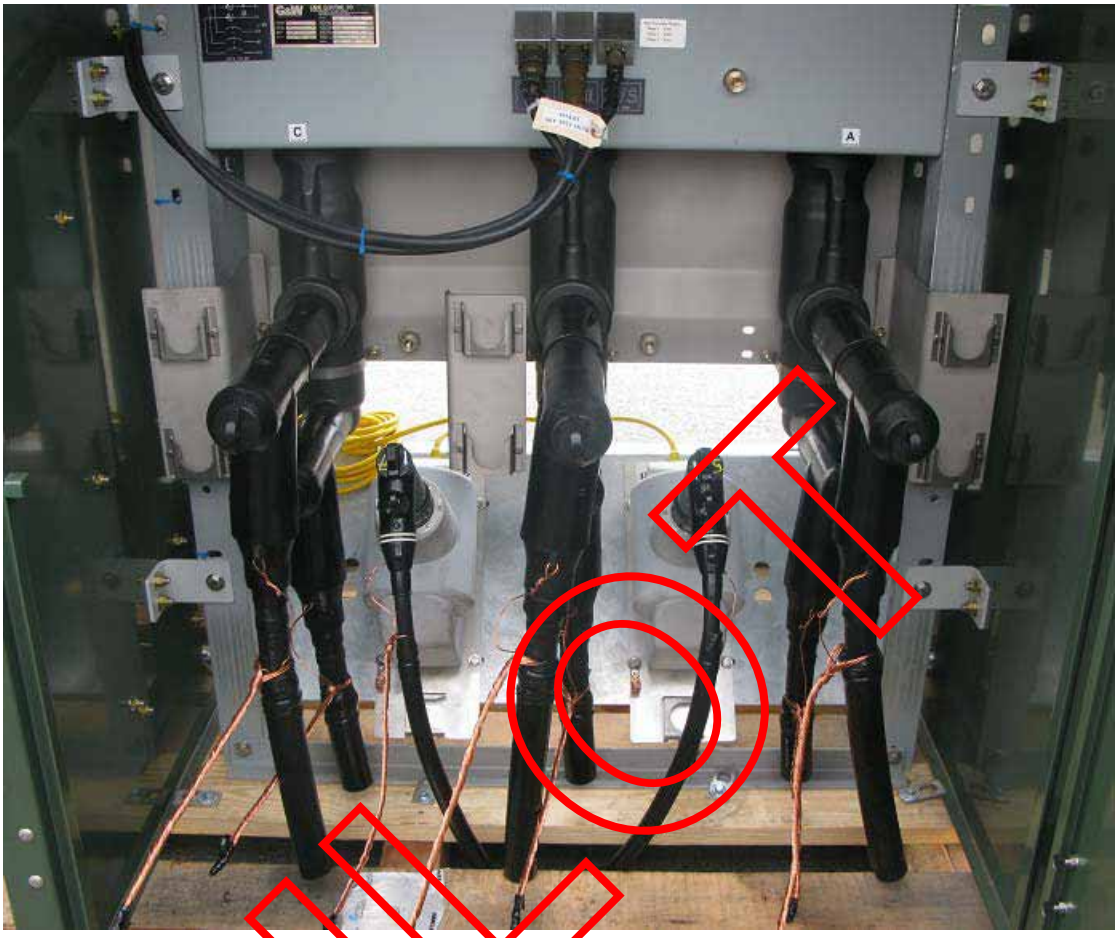

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Figure ISGD URCI 100P–5: Cabinet Dimensions (in Inches) – Front View

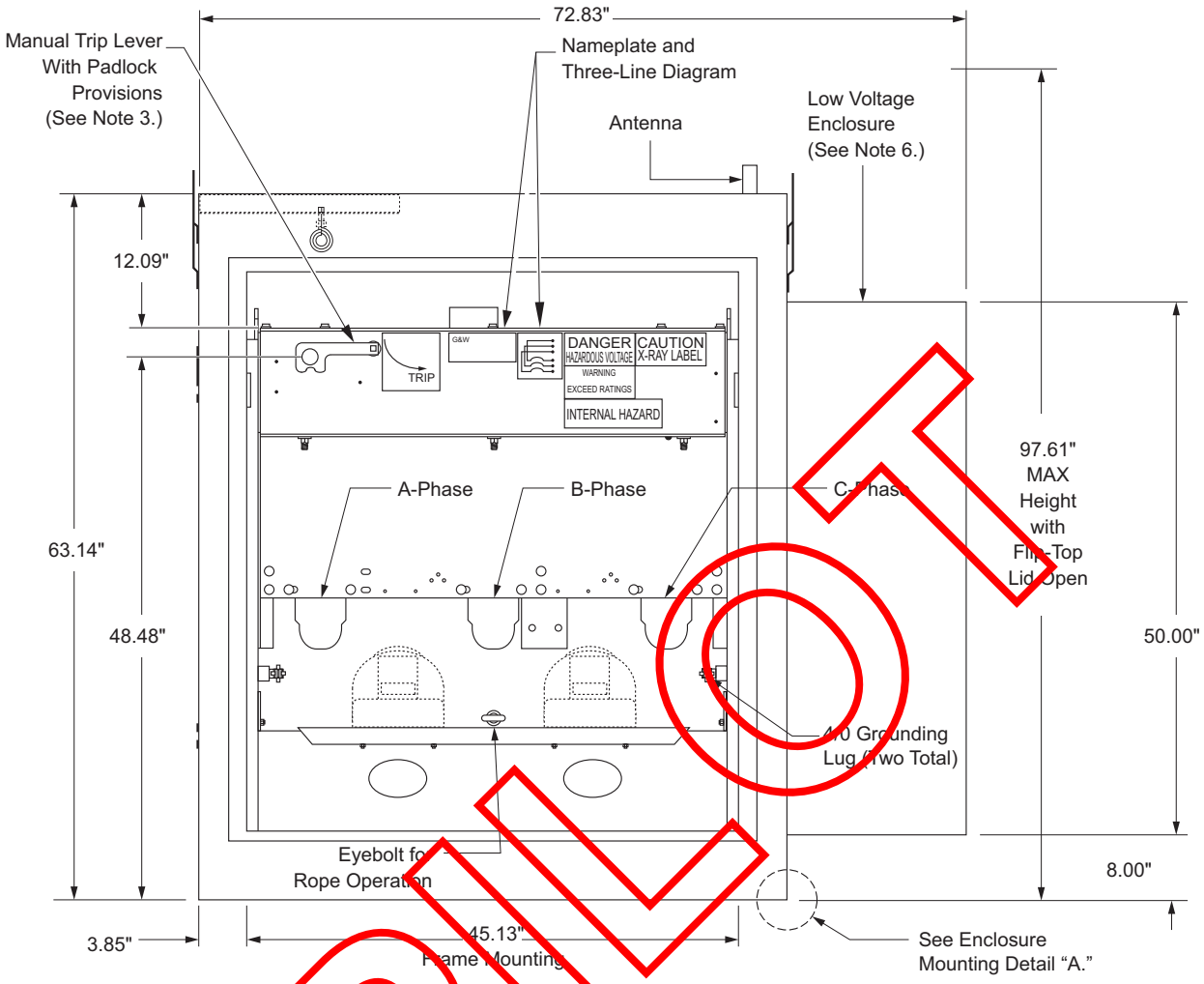

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Figure ISGD URCI 100P–6: Cabinet Dimensions (in Inches) – Back View

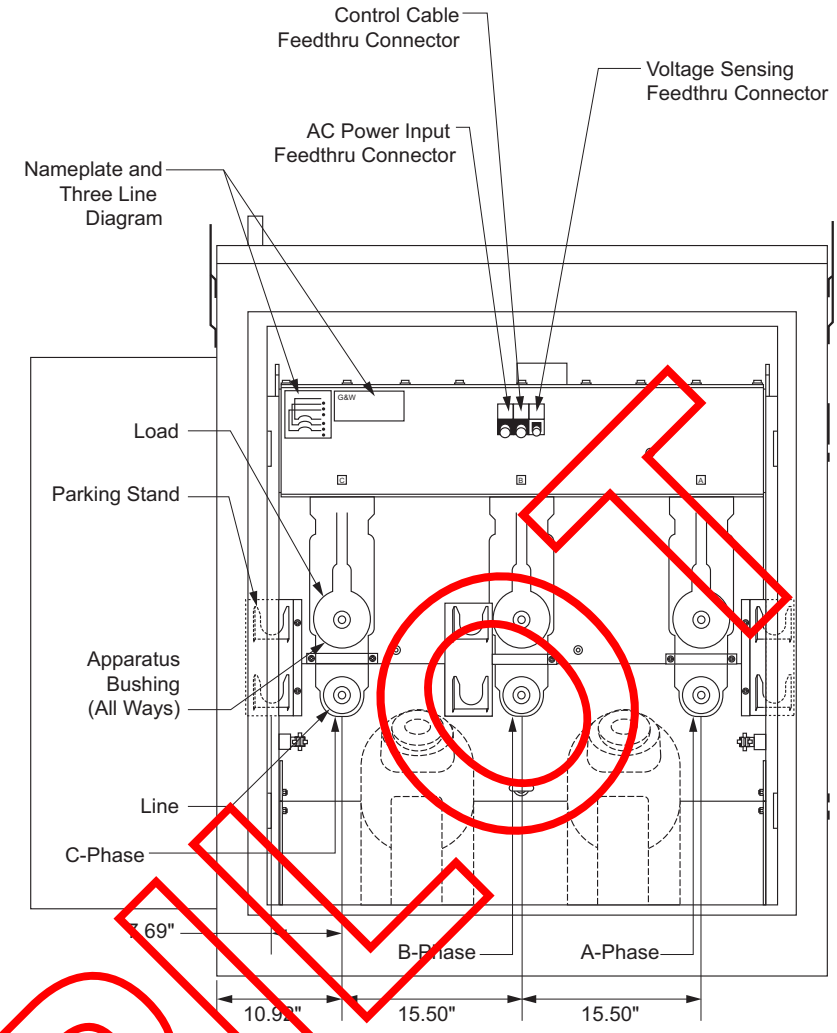

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Figure ISGD URCI 100P–7: Cabinet Dimensions — Bird's Eye View (in Inches)

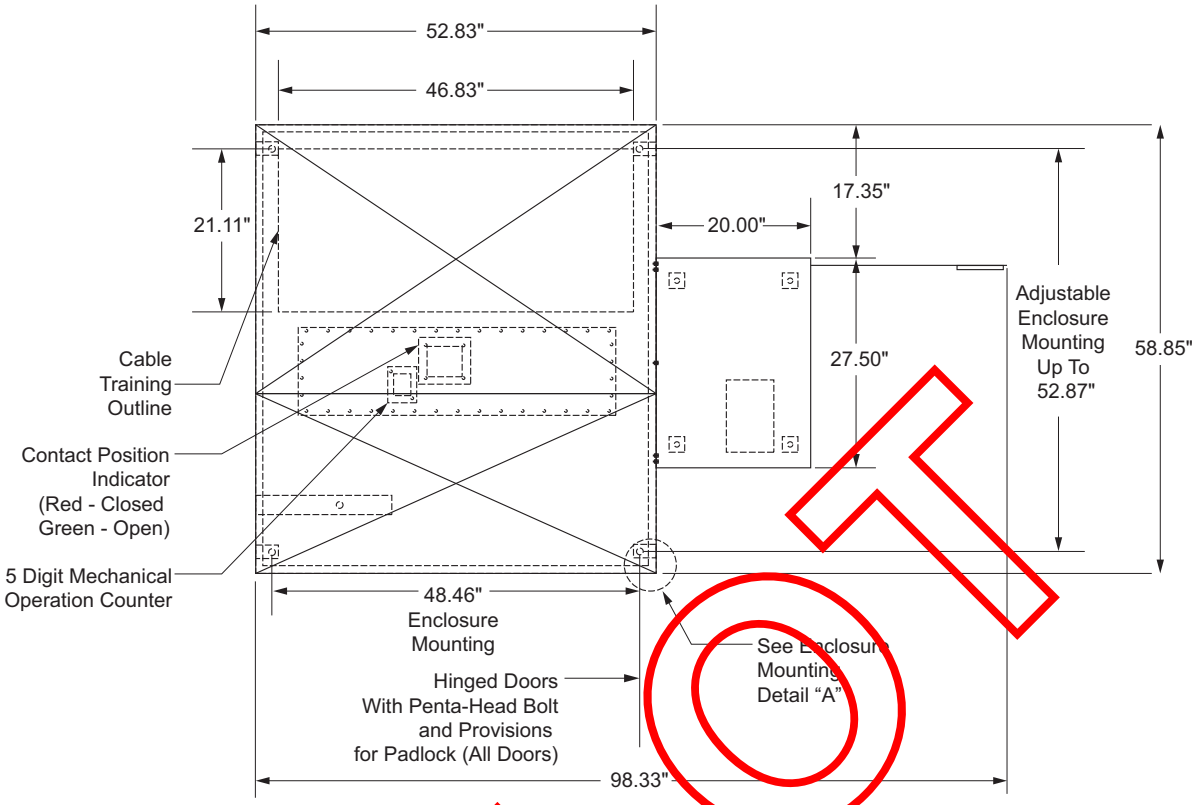

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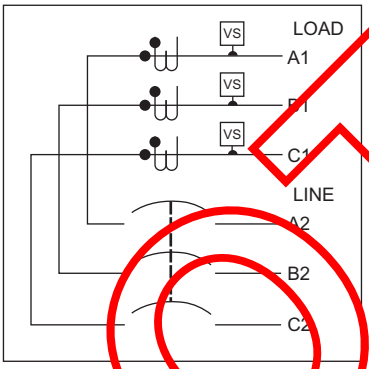
Figure ISGD URCI 100P–8: URCI Nameplate and Schematic

SWITCH ELECTRICAL INFORMATION
SEE NOTES FOR LIMITATIONS

MAXIMUM DESIGN VOLTAGE	27	KV
IMPULSE LEVEL (BIL)	125	KV
AC 1 MIN. WITHSTAND	40	KV
DC 15 MIN. WITHSTAND	78	KV
CURRENT CONTINUOUS	630	AMP
CURRENT INTERRUPTING SYM.	12.5	KA
MAKING CURRENT ASYM.	20	KA
3 SEC. RATING RMS SYM.	12.5	KA



THREE LINE DIAGRAM

WEIGHT 1300 LBS / 590 KG

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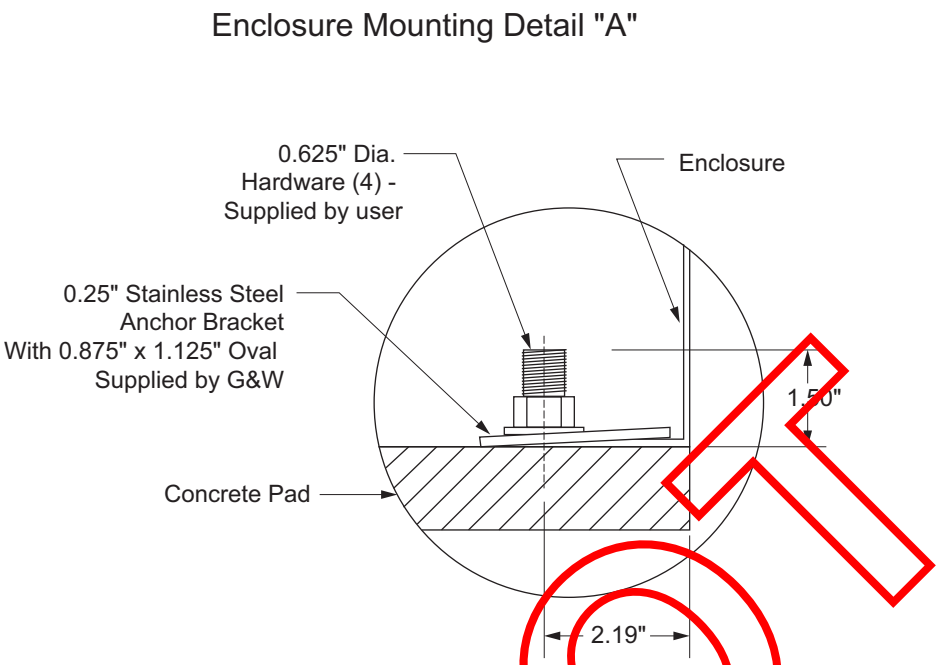
Figure ISGD URCI 100P–9: Cabinet mounting Detail



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ISGD URCI 200P S&C IntelliComm WAN Radio General Information

Scope ISGD URCI 200P.1 S&C IntelliComm WAN Radio General Information

1.0 General Information

The S&C IntelliComm Wide Area Network (WAN) Radio is being tested as a part of the Irvine Smart Grid Demonstration (ISGD) project. This device is intended to be used as a pilot and will be removed at the end of the project.

1.1 S&C IntelliComm WAN Mesh Radio is a high speed two-way radio communication system that allow transmission of information between URCIs and repeater radios.

Figure ISGD URCI 200P–1: S&C IntelliComm WAN

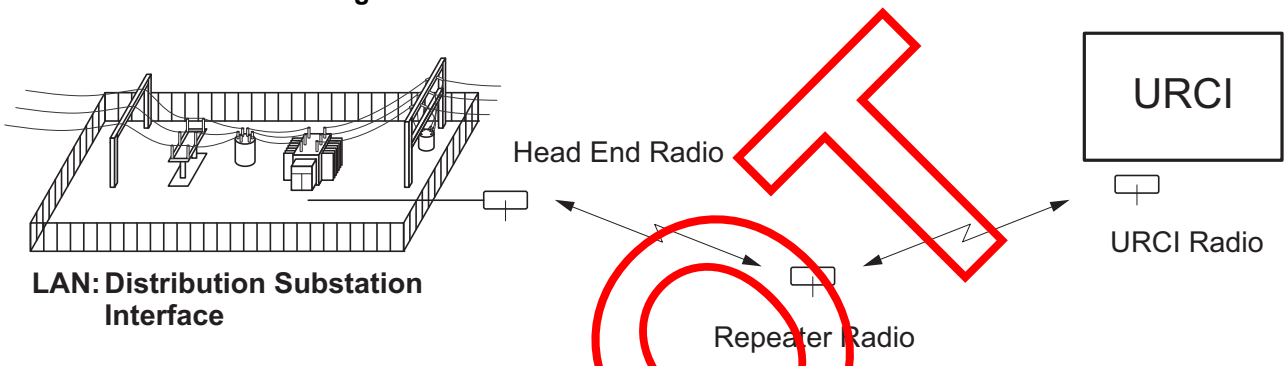

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Figure ISGD URCI 200P–2: S&C IntelliComm WAN Radio

2.0 Application

S&C IntelliComm WAN Radio is outdoor rated equipment and communicate with each other using IEC 61850 protocol at 2.4 GHz. The source voltage is 12VDC.

Radio Type	Description
Head End Radio	Two-way communication radio that will transmit and receive e.g. Block/Trip commands and SCADA data from and to Substation Gateway
URCI Radio	Two-way communication radio that will transmit and receive e.g. Block/Trip commands and SCADA data to and from the URCI
Repeater Radio	Two-way communication radio that will receives a weak or low-level signal and retransmits it at a higher level so that the signal can cover longer distances without degradation.

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Distribution Energy Storage Integration Table of Contents

Standard	Title
DESI 100P	Distribution Energy Storage Integration 1 (DESI)
DESI 100P.1	Distribution Energy Storage Integration 1

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DESI 100P Distribution Energy Storage Integration 1 (DESI)

Scope DESI 100P.1 Distribution Energy Storage Integration 1

1.0 General Information

1.1 These instructions cover the Distribution Energy Storage Integration 1 project (DESI). The system is to be connected to the Scarlet 12 kV out of Orange Substation. The system should be treated as a Distributed Generation (DG) source. The DESI will be used to peak shave load on the circuit. The equipment is SCE owned, but third party maintained. The equipment is located on an easement on customer property.

1.2 Contact Advanced Technology [Energy Storage Hotline – (909) 469-0224] for more information/questions.

2.0 Major Components

- 2.4 MW Battery Storage Enclosure (Third Party Operated/Maintained)
- 12 kV Switchgear (Third Party Operated/Maintained)
- 480 V Switchgear (Third Party Operated/Maintained)
- 1-2500 kVA 12 kV / 480 V Transformer (Third Party Operated/Maintained)
- 3-150 kVA 12 kV / 480 V Transformer (SCE Operated/Maintained)
- Remote-Controlled Automatic Recloser (SCE Operated/Maintained)
- 12kV Ground Detector (SCE Operated/Maintained)

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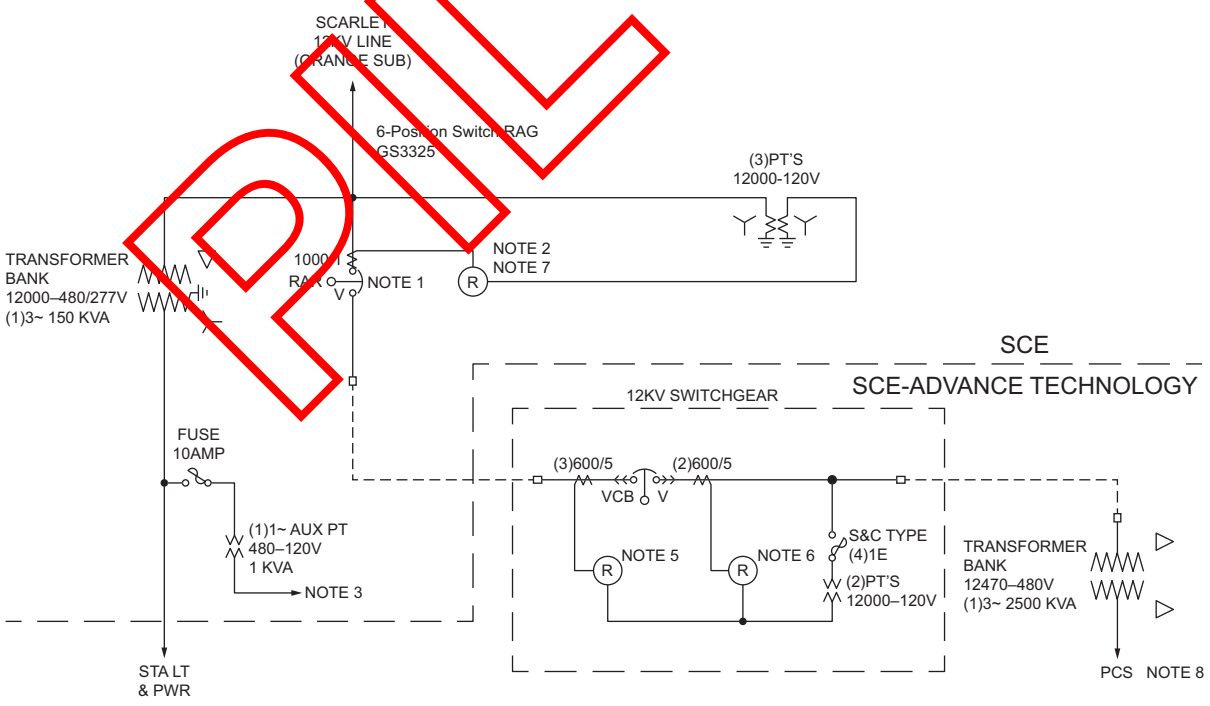
Figure DESI 100P–1: DESI 1 Single Line



Note(s):
1. RAR G&W Viper
2. SEL-351R Relay
3. AC Power to RAR & SEL-351R
4. VCB – Circuit Breaker
5. SEL-751A Relay
6. SEL-735 Relay
7. Phase to Ground Fault detection on the 12 kV cleared by RAR.
8. Phase to Ground fault detection on the 480 V handled by PCS.

Figure DESI 100P–2: 2.4 MW Battery System

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Figure DESI 100P–3: 12 kV Switchgear

Figure DESI 100P–4: 480 V Panel

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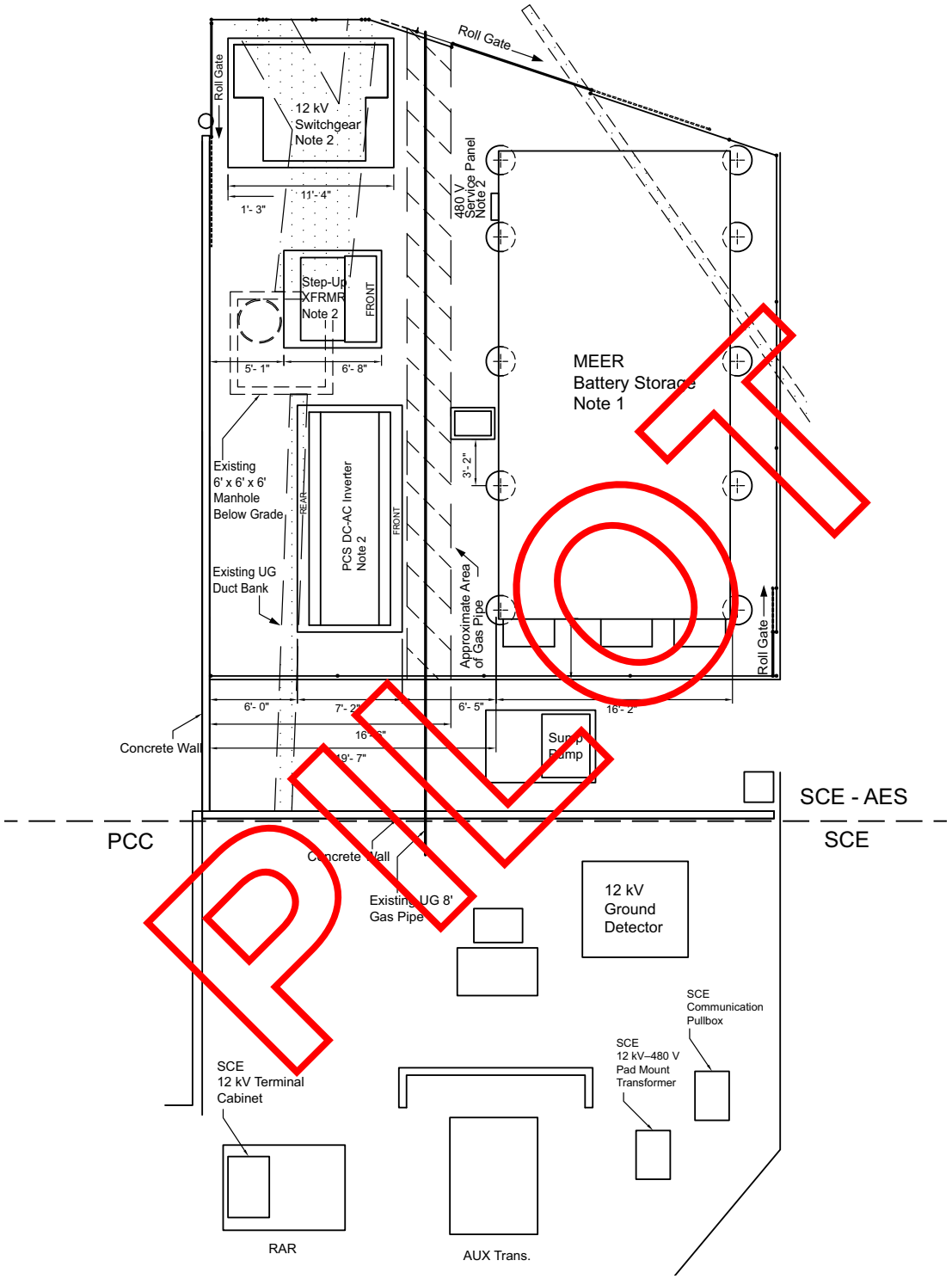
Figure DESI 100P–5: DESI 1 Pilot Plan



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Note(s):
1. Civil site preparation furnished by SCE
2. Equipment design and installed by Contractor