Installation

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Qualified Persons

⚠ WARNING

The equipment covered by this publication must be installed, operated, and maintained by qualified persons who are knowledgeable in the installation, operation, and maintenance of overhead electric power distribution equipment along with the associated hazards. A qualified person is one who is trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from non-live parts of electrical equipment.
- The skills and techniques necessary to determine the proper approach distances corresponding to the voltages to which the qualified person will be exposed.
- The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment.

These instructions are intended *only* for such qualified persons. They are *not* intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Read this Instruction Sheet

Read this instruction sheet thoroughly and carefully before installing or operating your S&C Trans-Rupter II Transformer Protector. Familiarize yourself with "Safety Information" on pages 3 and 4.

Retain this Instruction Sheet

This instruction sheet is a permanent part of your S&C Trans-Rupter II. These instructions should be stored in the low-voltage connection enclosure, using the instruction manual holder.

Proper Application

⚠ CAUTION

The equipment in this publication is only intended for primary-side application on distribution substation transformers. **The application must be within the ratings furnished for the equipment.** Ratings for Trans-Rupter II are listed on the ratings label on the side of the low-voltage connection enclosure.

Warranty

The warranty and/or obligations described in S&C's standard conditions of sale, as set forth in Price Sheet 150, plus any special warranty provisions, as set forth in the applicable product-line specification bulletin, are exclusive. The remedies provided in the former for breach of these warranties shall constitute immediate purchaser's or end user's exclusive remedy and a fulfillment of all seller's liability. In no event shall seller's liability to immediate purchaser or end user exceed the price of the specific product which gives rise to immediate purchaser's or end user's claim. All other warranties whether express or implied or arising by operation of law, course of dealing, usage of trade or otherwise, are excluded. The only warranties are those stated in Price Sheet 150, and THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY EXPRESS WARRANTY OR OTHER OBLIGATION PROVIDED IN PRICE SHEET 150 IS GRANTED ONLY TO THE IMMEDIATE PURCHASER AND END USER, AS DEFINED THEREIN. OTHER THAN AN END USER, NO REMOTE PURCHASER MAY RELY ON ANY AFFIRMATION OF FACT OR PROMISE THAT RELATES TO THE GOODS DESCRIBED HEREIN, ANY DESCRIPTION THAT RELATES TO THE GOODS, OR ANY REMEDIAL PROMISE INCLUDED IN PRICE SHEET 150.

The seller's warranties are contingent upon the installation and adjustment of Trans-Rupter II in accordance with S&C's applicable instruction sheets, data sheets, and/or data bulletins.

Understanding Safety-Alert Messages

There are several types of safety-alert messages which may appear throughout this instruction sheet as well as on labels attached to the Trans-Rupter II. Familiarize yourself with these types of messages and the importance of the various signal words, as explained below.

⚠ DANGER

"DANGER" identifies the most serious and immediate hazards which *will likely* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ WARNING

"WARNING" identifies hazards or unsafe practices which *can* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices which *can* result in minor personal injury or product or property damage if instructions, including recommended precautions, are not followed.

NOTICE

"NOTICE" identifies important procedures or requirements that *can* result in product or property damage if instructions are not followed.

Following Safety Instructions

If you do not understand any portion of this instruction sheet and need assistance, contact your nearest S&C Sales Office or S&C Authorized Distributor, or call S&C Headquarters at (773) 338-1000, Monday through Friday between 8:30 AM and 5:00 PM Central Standard Time. (In Canada, call S&C Electric Canada Ltd. at (416) 249-9171, Monday through Friday between 8:00 AM and 5:00 PM Eastern Standard Time.)

⚠ DANGER

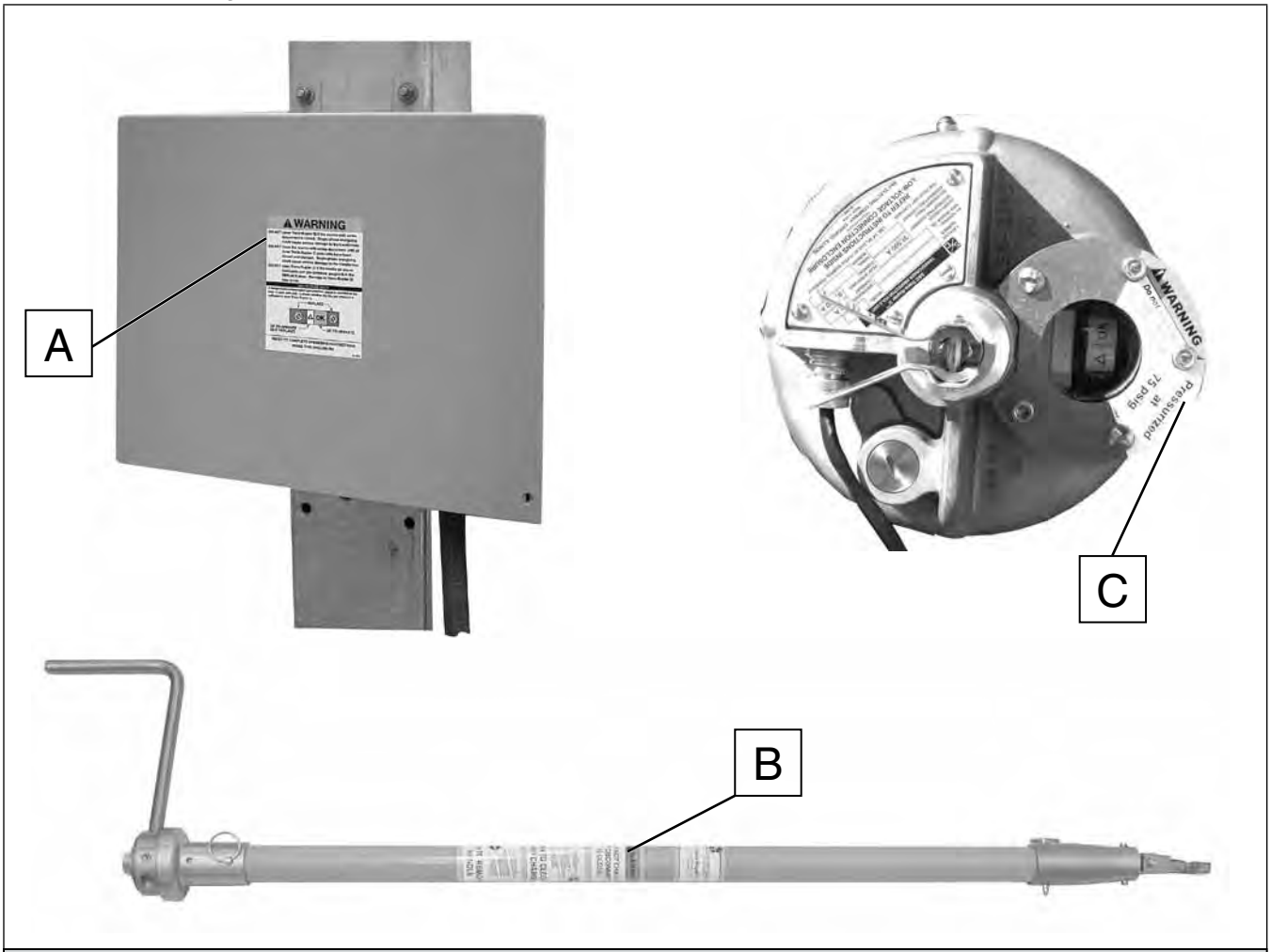
Read this instruction sheet thoroughly and carefully before installing or operating your S&C Trans-Rupter II Transformer Protector.

Replacement Instructions and Labels

If you need additional copies of this instruction sheet, contact your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

It is important that any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

Location of Safety Labels



Reorder Information for Safety Labels			
Location	**Safety-Alert Message**	**Description**	**Part Number**
A	⚠ WARNING	Do not open pole-units while disconnect . . .	G-7016
B	⚠ WARNING	Do not open pole-units while disconnect . . .	G-7009-1
C	⚠ WARNING	Do not disassemble or modify . . .	G-7015-5

Inspection

Examine the shipment for external evidence of damage as soon after receipt as possible, preferably before removal from the carrier's conveyance. Check the bill of lading to make sure that all shipping skids, crates, and containers listed thereon are present.

If there is visible loss and/or damage:

1. Notify the delivering carrier immediately.
2. Ask for a carrier inspection.
3. Note condition of shipment on all copies of the delivery receipt.
4. File a claim with the carrier.

If concealed damaged is discovered:

1. Notify the delivering carrier within 15 days of receipt of shipment.
2. Ask for a carrier inspection.
3. File a claim with the carrier.

Also notify S&C Electric Company in all instances of loss and/or damage.

Packing

Each Trans-Rupter II consists of three pole-units, a low-voltage connection enclosure, a manual charging tool, and six terminal pads and their associated hardware. Pole-units are shipped fully pressurized, at 75 PSIG, in the open position. The pole-units and charging tool are packed together in a wood crate. The terminal pads and hardware are shipped in the foam packing at the base of the middle pole-unit. The connection enclosure is packed separately. If furnished, mounting pedestals are shipped separately, bolted to skids. Associated mounting-pedestal hardware is packed separately and attached to the mounting-pedestal base. Copies of this instruction sheet, the operation instructions, the wiring diagram and the catalog drawing can be found in the low-voltage enclosure.

Remove the shipping crate cover. Remove the charging tool and the terminal pads and their hardware from the crate. Remove the connection enclosure from its packing. Set these items aside in a protected area. If mounting pedestals are furnished, remove the conduit assembly from the cross base.

⚠ WARNING

DO NOT disassemble or modify the pole-units.

The pole-units are pressurized at 75 PSIG.

Serious injury can result.

Optional accessories like motor operators or the bypass accessory for the Trans-Rupter II are shipped in a separate crate. It is important when storing or installing multiple Trans-Rupter II Transformer Protectors, especially when the motors have different control voltages, that the motors are kept with their associated pole-units. Check the motors before installation to make sure they are the appropriate control voltage; motor control voltage cannot be changed in the field.

⚠ CAUTION

The user-furnished mounting structure must meet the guidelines for static and dynamic loading limits listed in S&C Data Bulletin 731-60.

Failure to observe these guidelines can result in equipment damage.

Installing the Pole-Unit

Repeat Steps 1 through 10 for each pole-unit.

Step 1

Bolt a mounting bracket to the structure at the location where the pole-unit will be attached. The mounting bracket must be fabricated of at least ¼-inch-thick steel.

Step 2

Remove the pole-unit from the shipping crate and lift it, using the following procedure:

⚠ CAUTION

Lift the pole-unit only by the lifting bracket.

Lifting it by any other means can damage the pole-unit.

Wrap a hoist sling or other lifting device around the lifting bracket at the top of the pole-unit. Carefully pull the pole-unit upward. The foam wrappings around the top, mid-section, and base should come off as the pole-unit is lifted. Remove these wrappings if they do not come off. Do not remove the shipping brace at this time. See Figures 1, 2, and 3.

⚠ CAUTION

DO NOT remove the shipping brace around the base of the pole-unit at this time.

Damage to the operating shaft can occur.

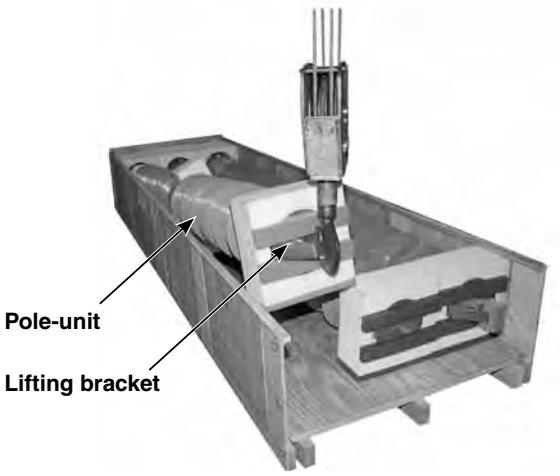


Figure 1. Lift the pole-unit only by the lifting bracket.

Figure 2. Pull the pole-unit carefully upward.

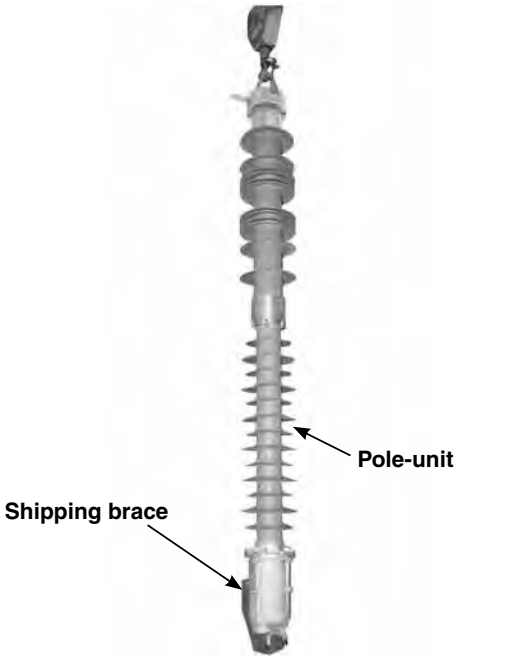


Figure 3. Do not remove the shipping brace at this time.

Step 3

With the foam wrapping around the pole-unit base removed and the pole-unit lifted off the ground, check that the gas-pressure gauge on the underside of the pole-unit base is in the "OK" to operate zone. See Figures 4 and 5.

NOTICE

The gas-pressure gauge needle should be in the "OK" to operate zone. If the gauge is not in this position, stop the installation and notify S&C Electric Company.

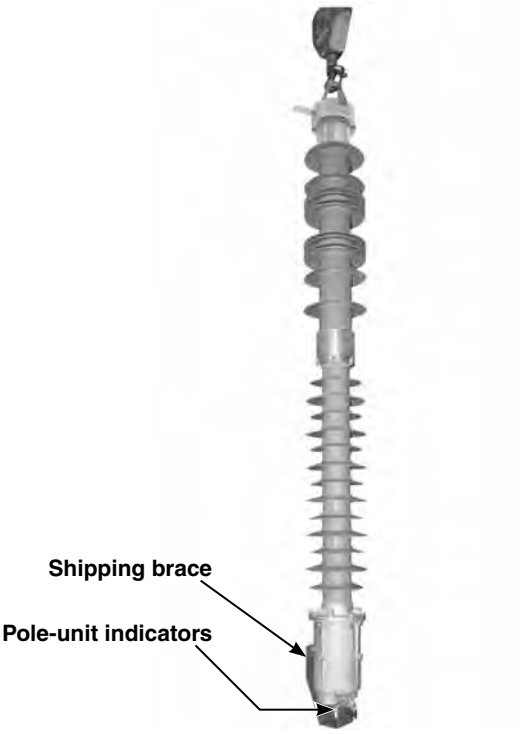


Figure 4. With the pole-unit lifted off the ground, check the gas-pressure gauge on the underside of each pole-unit base.

Figure 5. Check that the gas-pressure gauge on each pole-unit is in the "OK" to operate zone.

Step 4

Position the pole-unit so that its base is near the pole-unit mounting bracket. If necessary, rotate the pole-unit so that its electrical junction box and terminal-pad attachment locations are appropriate for the installation. See Figure 6.

NOTICE

The terminal pad of each pole-unit can be mounted in one of four positions located 90° apart. Determine where terminal pads will be attached before mounting the pole-unit.

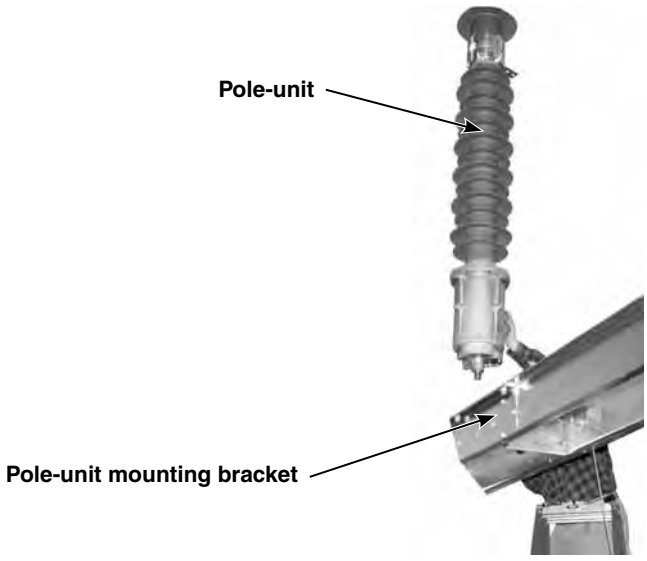


Figure 6. Position the pole-unit base near the pole-unit mounting bracket.

Step 5

Remove the shipping brace from the pole-unit base. See Figure 7.

⚠ CAUTION

DO NOT rest the pole-unit on its base after the shipping brace has been removed.

Damage to the operating shaft can occur.

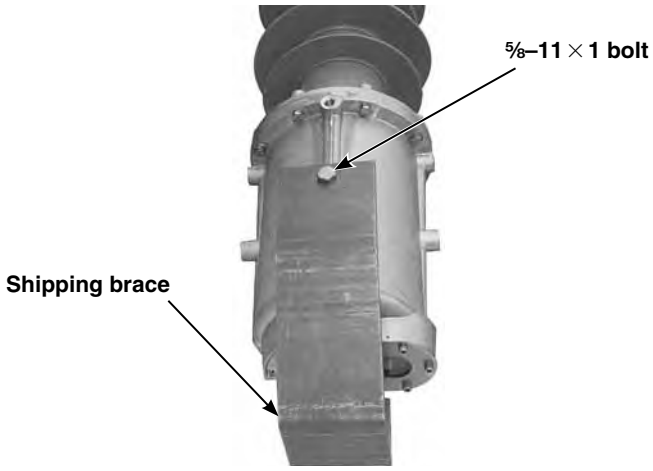


Figure 7. Unbolt the shipping brace.

Step 6

Attach the pole-unit base to the user-furnished pole-unit mounting bracket with the ⅝–11 × 2 stainless-steel studs furnished, using the set of mounting bosses nearest to the bracket. Both the upper and lower mounting bosses must be used.

Screw each of the studs in until they bottom, approximately 8 or 9 turns and hand tighten. **DO NOT** remove the hoist sling or lifting device from the pole-unit at this time See Figure 8.

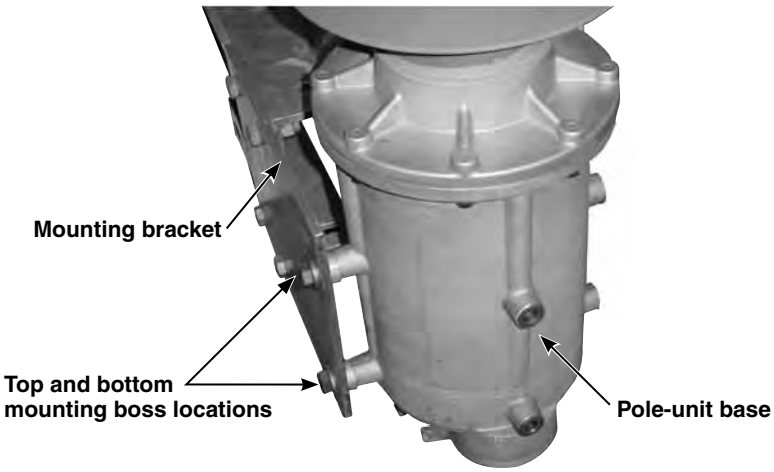


Figure 8. Attach the pole-unit base to the bracket.

If the optional motor operators are furnished: Before attaching the pole-unit base to the mounting bracket, insert one of the two ¼-inch-thick "L"-shaped motor brackets from the underside of the structure, and position it as shown in Figure 9. If the motor bracket and the first pole-unit mounting bracket are using a common set of mounting bosses, make sure the motor bracket is inserted between the pole-unit mounting bracket and the pole-units base. The "L" must be facing away from the indicator window side of the pole-unit. See Figure 9.

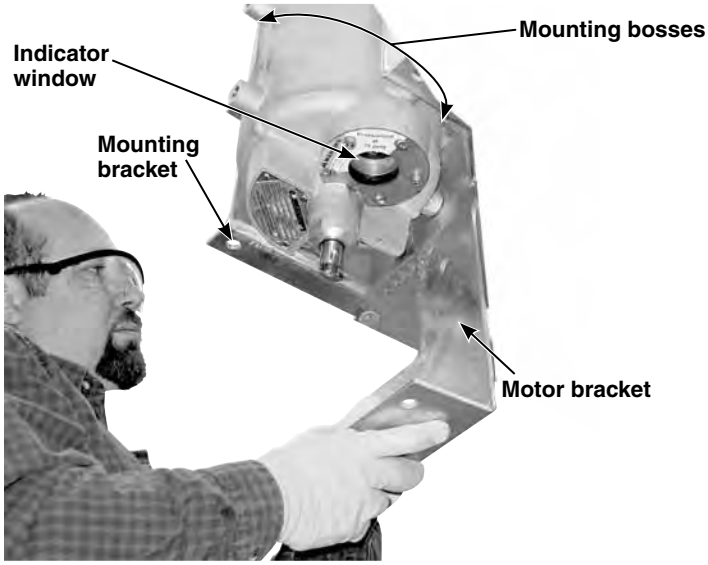


Figure 9. Insert motor mounting bracket if applicable.

Step 7

Attach ⅝–11 hex nuts to the studs and tighten them to a torque of 70 to 80 ft.-lbs. Use a flat washer and a lockwasher on each stud. See Figure 10.

⚠ CAUTION

Never exceed the recommended torque limit. The pole-unit base is pressurized.

Damage to the pole-unit may occur.

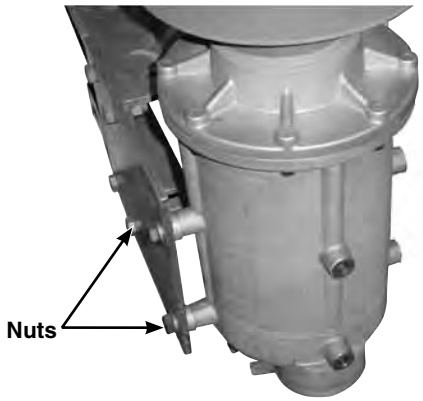


Figure 10. Tighten the nuts.

Step 8

Place a second pole-unit mounting bracket flush against the bosses on the opposite side of the pole-unit base. Attach the pole-unit mounting bracket to both the upper and lower mounting bosses. Use shims as required. Then attach the bracket to the structure. Make sure the pole-unit mounting bracket is aligned with the structure before tightening the studs. See Figure 11.

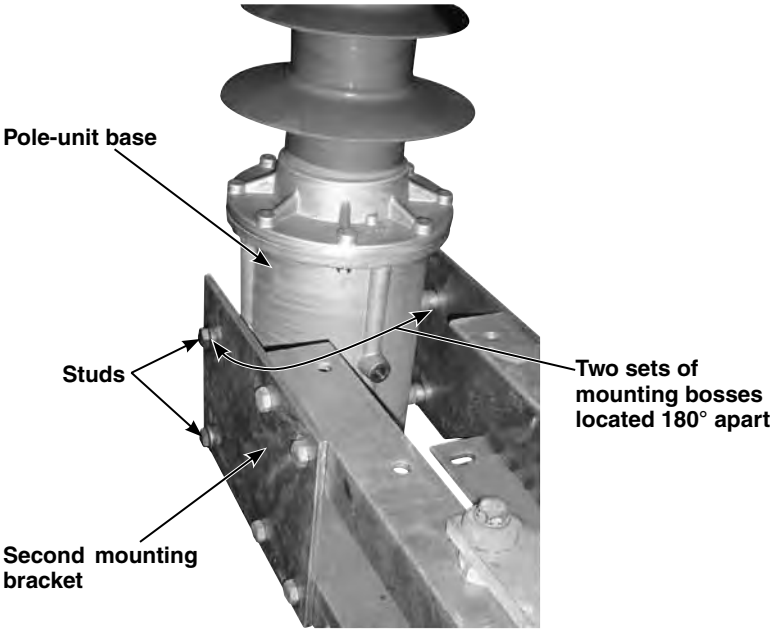


Figure 11. Attach a second pole-unit mounting bracket to pole-unit base.

If optional motor operators are furnished: Place the second ¼-inch-thick motor bracket flush against the bosses 180° from the bosses used in Step 6. If the motor bracket and second pole-unit mounting bracket are using a common set of mounting bosses, make sure that the motor bracket is inserted *between* the pole-unit mounting bracket and the pole-unit base. Attach the pole-unit and motor bracket to the structure using the ⅝–11 × 2 stainless-steel studs furnished. Screw each of the studs in until they bottom, approximately 8 or 9 turns. See Figure 12.

⚠ CAUTION

Two sets of mounting bosses must be used to mount the pole-unit. These two sets must be positioned 180° apart.

If the correct mounting bosses are not used, the pole-unit will not be adequately supported and the pole-unit base could be damaged.

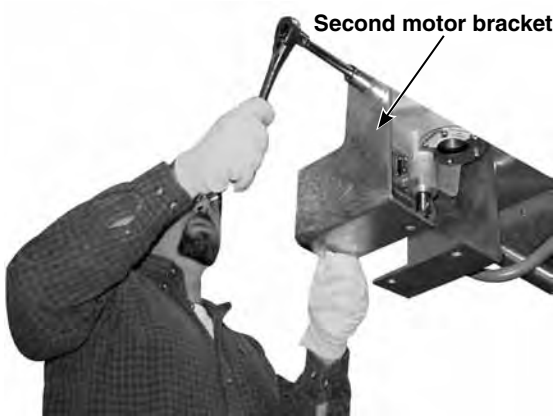


Figure 12. If motor operators are furnished, place the second motor bracket on the opposite side between the pole-unit base and the second mounting bracket.

Step 9

Attach 5⁄8–11 hex nuts to the studs and tighten both the pole-unit bracket and motor bracket nuts to a torque of 70 to 80 ft.-lbs. Use a flat washer and a lockwasher on each stud. See Figure 13.

Step 10

Remove the hoist sling or lifting device from the pole-unit.

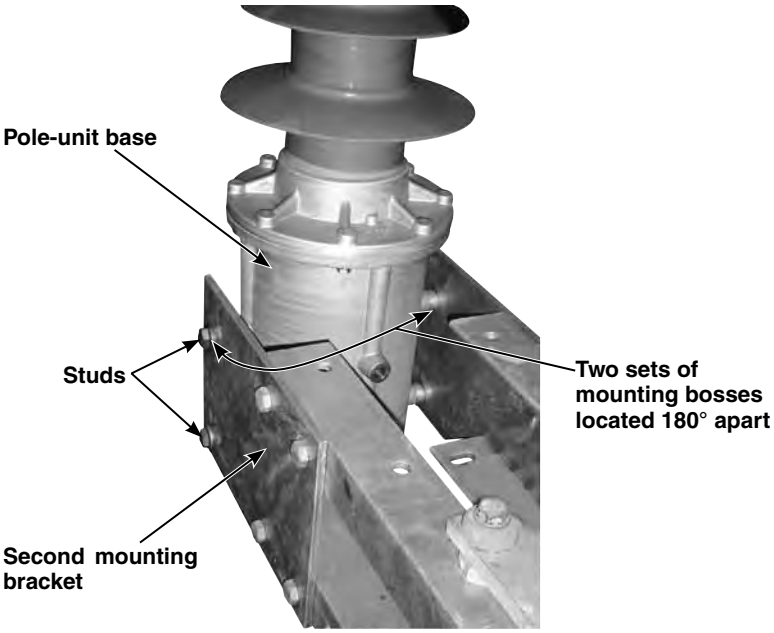


Figure 13. Tighten the nuts.

Mounting the Low-Voltage Connection Enclosure

Step 11

Drill four 7⁄16-inch diameter holes in the structure where the low-voltage connection enclosure will be mounted. Refer to the catalog drawing for appropriate locations for the holes. Make sure the mounting height allows for convenient access to the enclosure. See Figure 14.

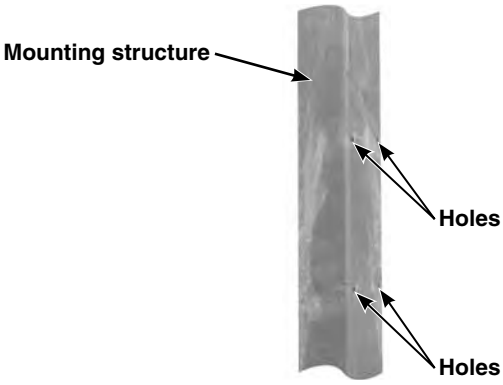


Figure 14. Drill four holes in the structure where the low-voltage connection enclosure will be mounted.

Step 12

Align the connection enclosure tabs with the mounting holes in the structure. Then bolt both the top and bottom tabs to the mounting structure, using user-furnished 3⁄8-inch hardware. Refer to the catalog drawing for exact placement of mounting holes. Make sure to utilize all four tabs. See Figure 15.

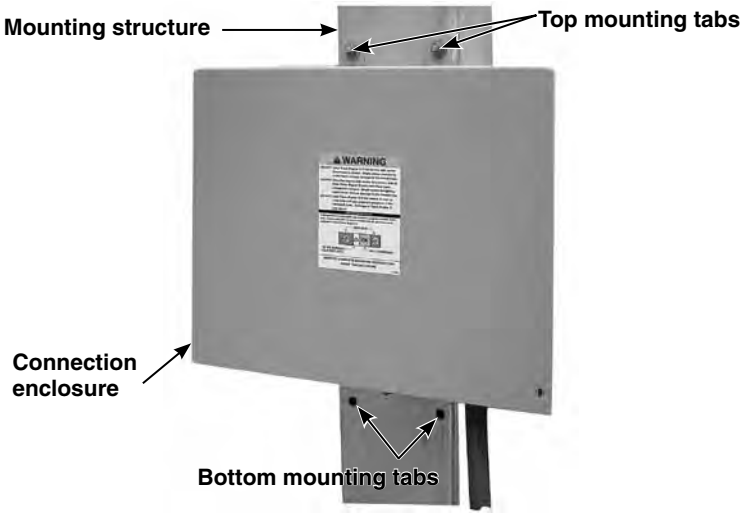


Figure 15. Bolt the top and bottom tabs of the enclosure to the mounting structure.

Connecting Pole-Units to the Low-Voltage Connection Enclosure

Step 13

Remove the enclosure cover by sliding it upward, then remove the clear shield. Set these items aside in a protected area. Remove the snap-in plug from the hole along the enclosure bottom. **DO NOT** remove the aerator from the bottom of the enclosure. See Figures 16, 17, and 18.

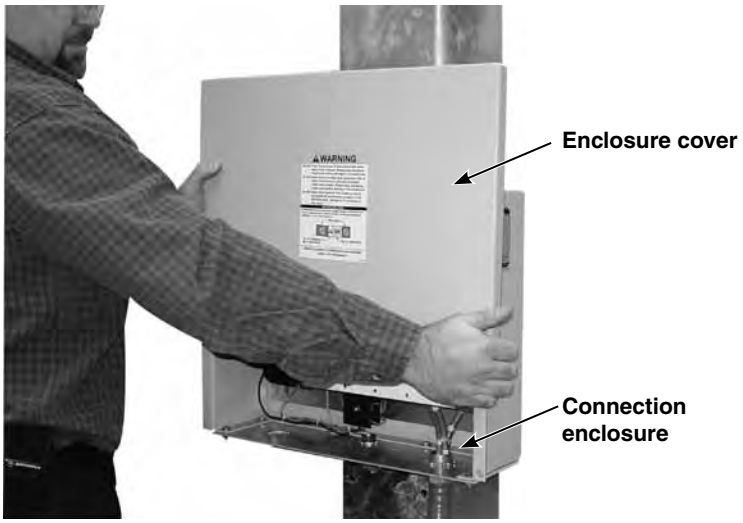


Figure 16. Remove the enclosure cover by sliding it upwards.

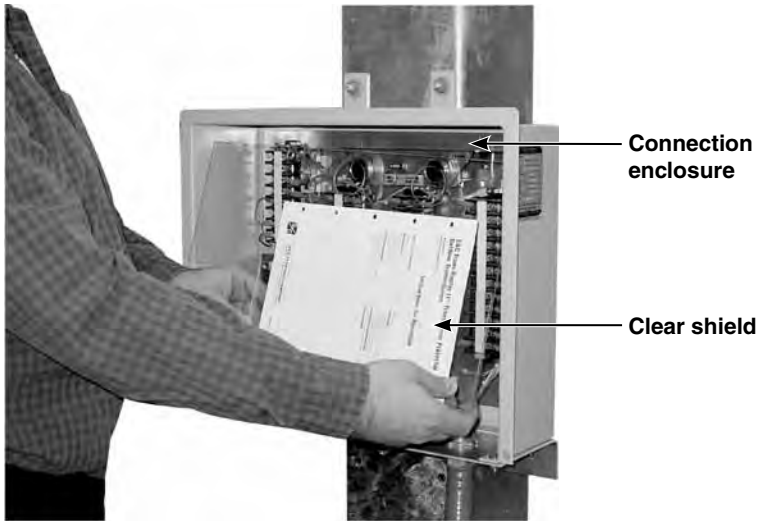


Figure 17. Remove the clear shield.

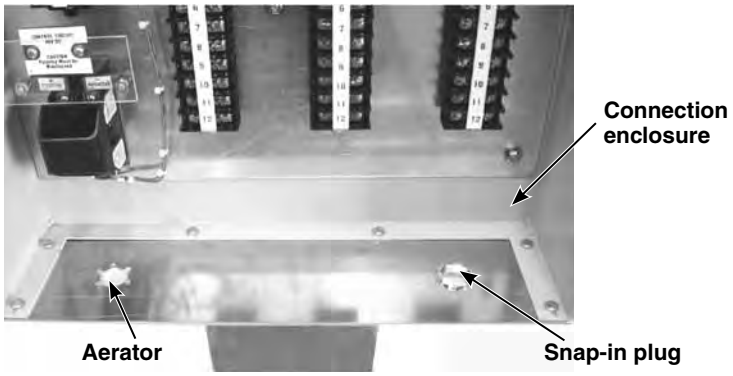


Figure 18. Remove the snap-in plug from the hole along the enclosure bottom. DO NOT remove the aerator.

Step 14

To add holes for control-circuit conduit(s) for control power and relays, mark the location(s) on the conduit-entrance plate at the bottom of the enclosure. Then remove the plate and punch the necessary opening(s). Replace the conduit-entrance plate. See Figure 19.

NOTICE

Punch holes for conduit(s) only on the bottom of the cabinet. **The cabinet is not designed to accommodate holes in any other location.**

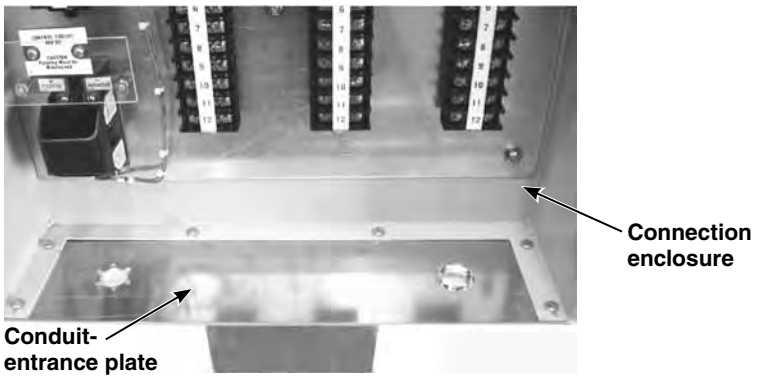


Figure 19. If additional holes for control wiring are required, remove the conduit-entrance plate and punch the necessary opening(s).

Step 15

Remove the three removable screws at each pole-unit electrical junction box cover. Retain the screws. Loosen the fourth retaining screw. Then swing out the cover to access the wiring inside the electrical junction box. See Figures 20 and 21.

⚠ WARNING

DO NOT remove the window bolts.

The pole-unit is pressurized to 75 PSIG.

Serious injury could occur.

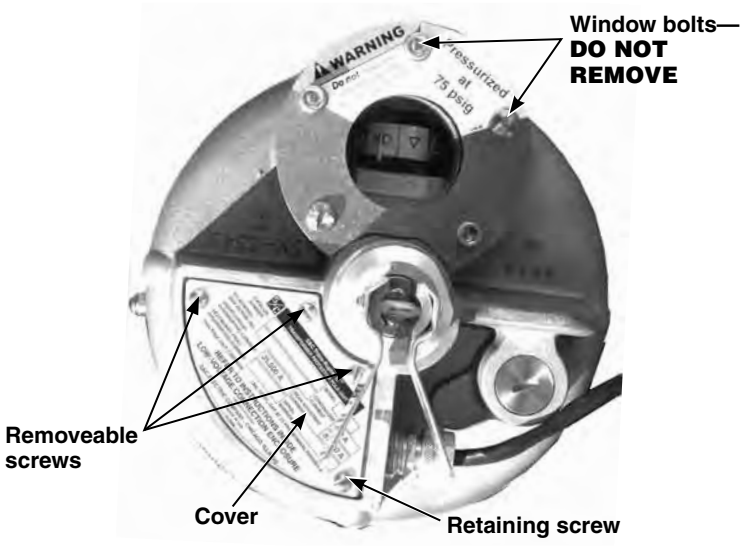


Figure 20. Remove the three removable screws at each pole-unit electrical junction box cover. Loosen the fourth retaining screw.

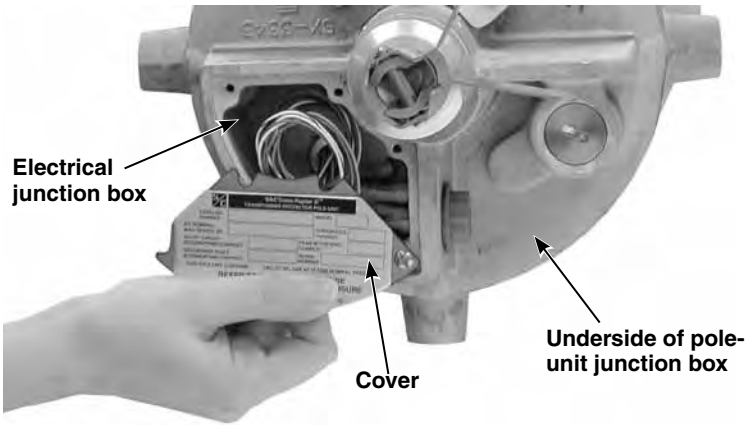


Figure 21. Swing out the cover to access the wiring inside the electrical junction box.

Step 16

Prepare appropriate lengths of conduit to connect the pole-unit electrical junction boxes to the connection enclosure.

Using watertight fittings, attach the conduit to the junction boxes and to the hole(s) along the bottom of the connection enclosure. See Figure 22.

If optional motor operators are furnished: Prepare conduit to connect the main run of conduit, the pole-unit junction box and the ½–14 NPT conduit tap on the motor.

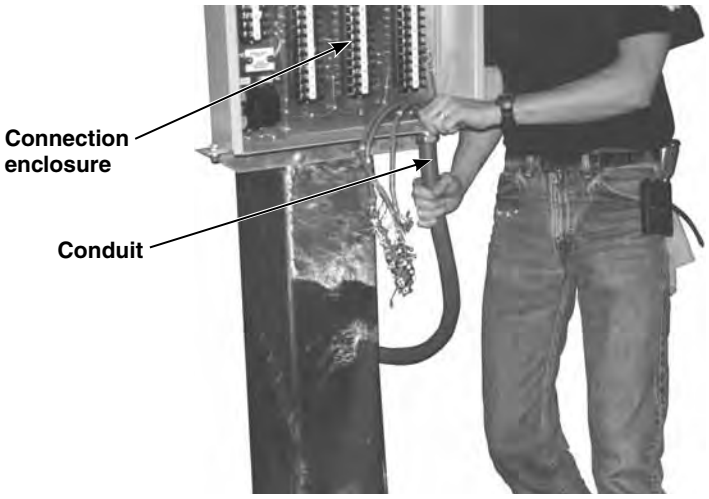


Figure 22. Attach the conduit to the hole(s) along the bottom of the connection enclosure.

Step 17

Following the wiring diagram furnished, connect user-furnished wiring to the three pole-unit electrical junction boxes and the motor operators (if furnished.) Use the butt splices supplied to make the junction-box wiring connections. The butt splices accommodate 18 to 22 AWG wire. Use of 18-gauge wire is recommended. See Figure 23.

NOTICE

To ensure proper crimping of the butt splices, use the Panduit controlled-cycle hand tool (CT-1550) or a company-standard tool for attaching 18- to 20-gauge insulated ring lugs.

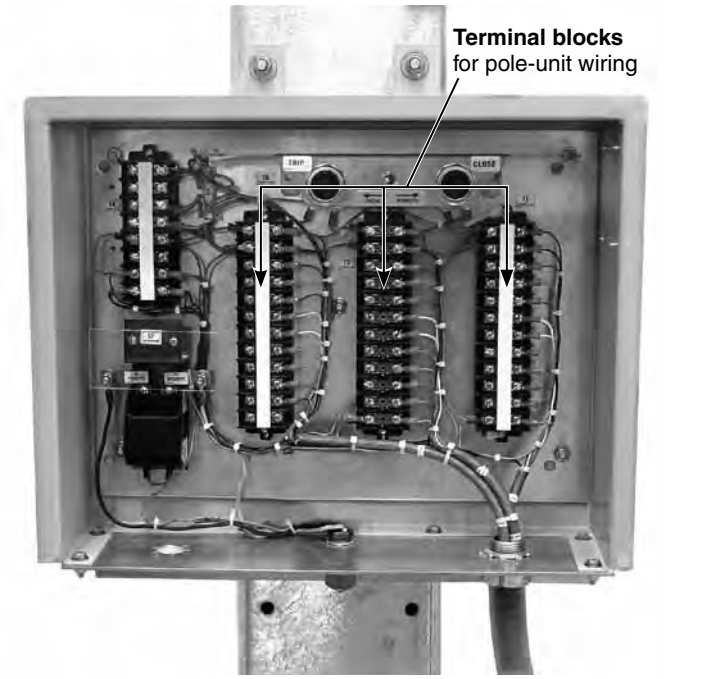


Figure 23. Connect pole-unit wiring to terminal blocks in low-voltage connection enclosure, in accordance with the wiring diagram furnished.

Step 18

Rotate the cover of each electrical junction box and replace the retained screws. Securely tighten all screws. See Figure 24.

Go to Step 46 on page 29 for installing optional motor operators.

Go to Step 52 on page 32 for connecting user-furnished protective relays and control power.

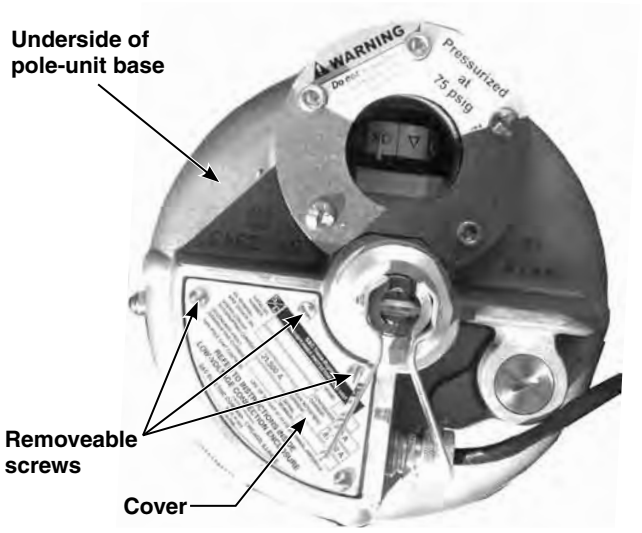


Figure 24. Remove the three removable screws at each pole-unit electrical junction box cover. Loosen the fourth retaining screw.

⚠ CAUTION

The foundations for S&C Mounting Pedestals must be designed to meet the loading limits specified in the appropriate S&C Data Bulletin 731-60.

Failure to meet these loading limits can result in equipment damage.

Installing S&C Mounting Pedestals

Step 19

Cut the steel straps that bind the mounting pedestals and cross base. Unbolt the mounting pedestals from the skids.

Step 20

Install the pedestals.

a. To lift a pedestal into position, attach eyebolts to the holes along the top gusset of each pedestal. Make sure that the grounding pads are positioned properly for the installation. **Also make sure that the pedestals are positioned such that holes for the connection enclosure face the desired direction, per the catalog drawing.**

b. Adjust the lower set of anchor-bolt nuts to generally plumb and level the pedestals. The upper set of anchor-bolt nuts should be only loosely attached at this time. See Figure 25.

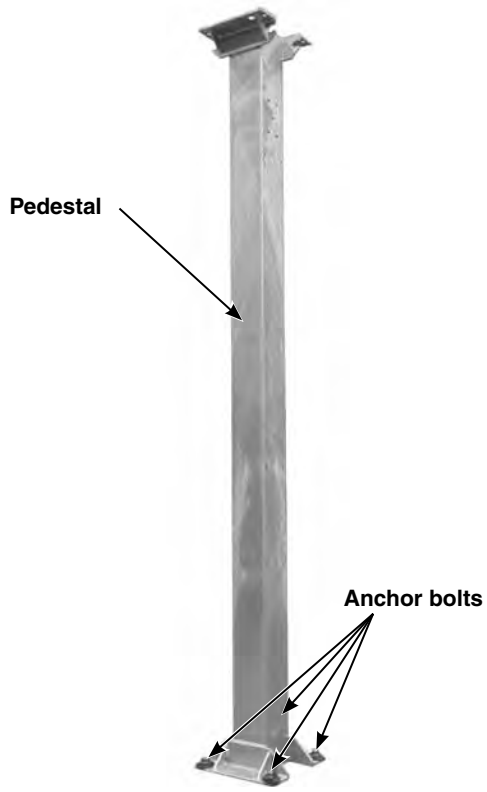


Figure 25. Adjust the lower set of anchor-bolt nuts to generally plumb and level the pedestals.

Step 21

Install the cross base.

a. Attach four suitable lifting slings to the cross base.

b. Lift the cross base atop the pedestals. Avoid sudden starts and stops.

c. Position the cross base on the pedestals. **Make sure the cross base is positioned such that the side to which the conduit assembly will be attached, is facing the desired direction for the installation.** Refer to the catalog drawing. See Figure 26.

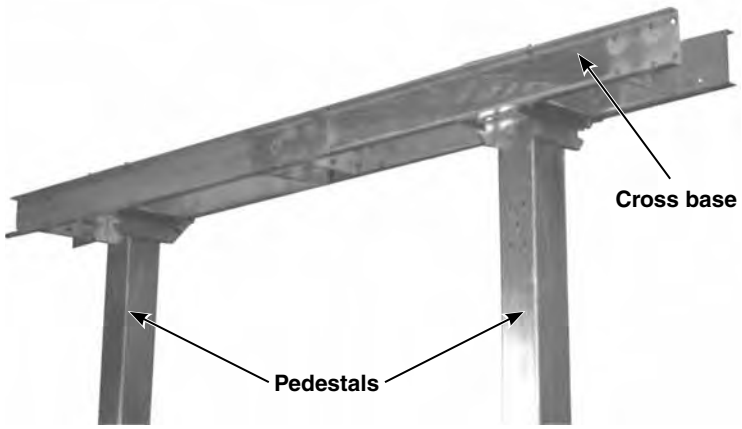


Figure 26. Lift the cross base atop the mounting pedestals.

Step 22

For 69-kV Trans-Rupter II with 84-inch phase spacing; 115-kV Trans-Rupter II; and 138-kV Trans-Rupter II:

Loosely bolt the cross base to the pedestals using the ½–13 × 1¾ bolts furnished. Using a level, verify that the cross base is horizontal, both lengthwise and side-to-side. Adjust the anchor bolts as necessary to achieve this condition. Then securely tighten the ½–13 × 1¾ bolts. See Figure 27.

Step 23

For 69-kV Trans-Rupter II with 48-inch phase spacing:

a. Loosely bolt the cross base to the pedestal, using the ½–13 × 1¾ bolts furnished.
b. Attach two crossarm attachment brackets to the cross base as shown on the catalog drawing.
c. Attach the two support arms to the mounting pedestal using the ⅝–11 × 10 bolts furnished. Fully tighten the bolts. Refer to the catalog drawing for the placement of the support arms.
d. Attach the support arms to the crossarm attachment brackets using the ⅝ –11 × 1½ bolts furnished. Fully tighten the bolts.
e. Using a level, verify that the cross base is horizontal, both lengthwise and side-to-side. Adjust the anchor bolts as necessary to achieve this condition, then tighten all bolts for the mounting pedestal, cross base, and support arms to a torque of 50-60 ft.-lbs.

Step 24

Slip the furnished steel plate(s) over the top of each pedestal. Make sure the plates extend to both sides of the pedestal. See Figure 28.

Step 25

Check the lower set of anchor-bolt nuts at each mounting pedestal to verify that each is in contact with the bottom of the plate. Hand-tighten these anchor-bolt nuts as needed. See Figure 29.

Step 26

Securely tighten the upper set of anchor-bolt nuts at each mounting pedestal. See Figure 29.

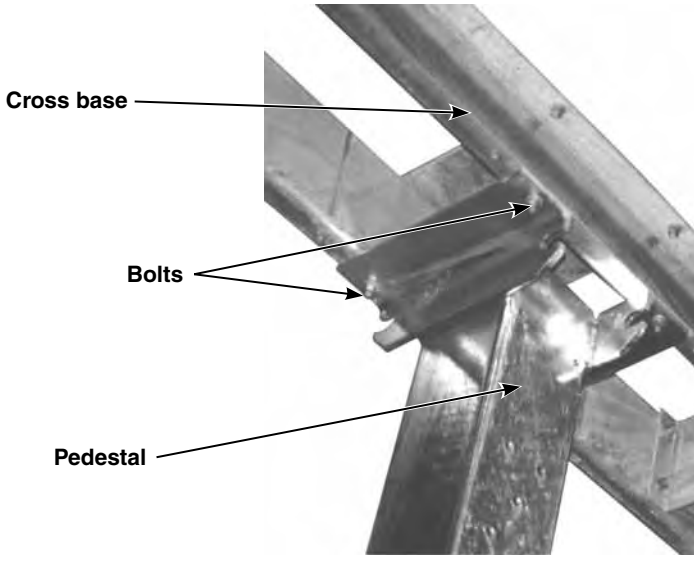


Figure 27. Bolt the cross base to the pedestals.

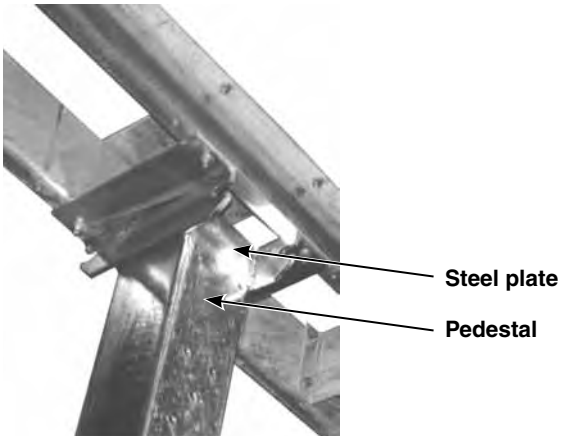


Figure 28. Slip the furnished steel plates over the top of each pedestal.

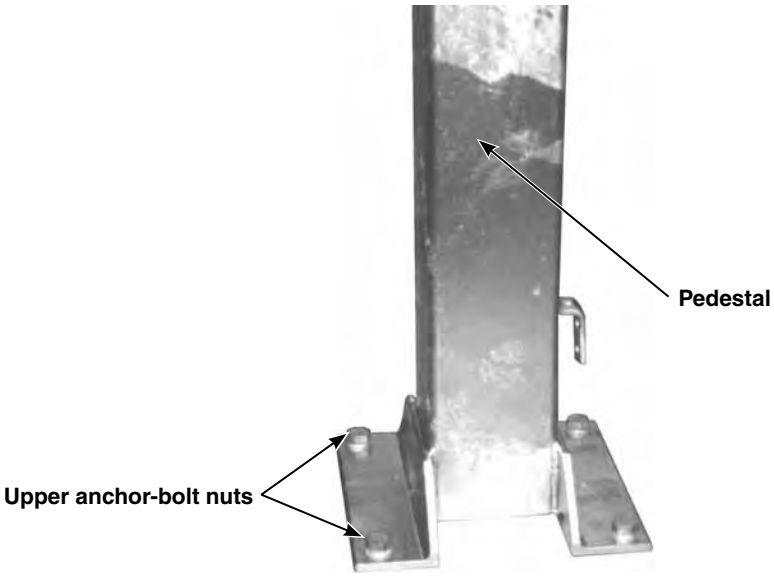


Figure 29. Securely tighten the upper set of anchor-bolt nuts at each mounting pedestal.

Installing the Pole-Unit

Repeat Steps 27 through 34 for each pole-unit.

Step 27

Remove the pole-unit from the shipping crate and lift it, using the following procedure:

⚠ CAUTION

Lift the pole-unit only by the lifting bracket.

Lifting it by any other means can damage the pole-unit.

Wrap a hoist sling or other lifting device around the lifting bracket at the top of the pole-unit. Carefully pull the pole-unit upward. The foam wrappings around the top, mid-section, and base should come off as the pole-unit is lifted. Remove these wrappings if they do not come off. Do not remove the shipping brace at this time. See Figures 30, 31, and 32.

⚠ CAUTION

DO NOT remove the shipping brace around the base of the pole-unit at this time.

Damage to the operating shaft can occur.

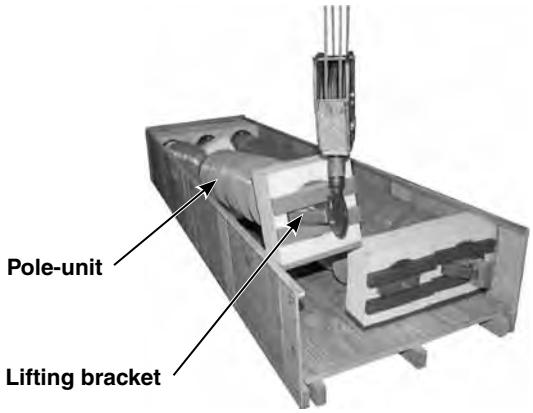


Figure 30. Lift the pole-unit only by the lifting bracket.

Figure 31. Pull the pole-unit carefully upward.

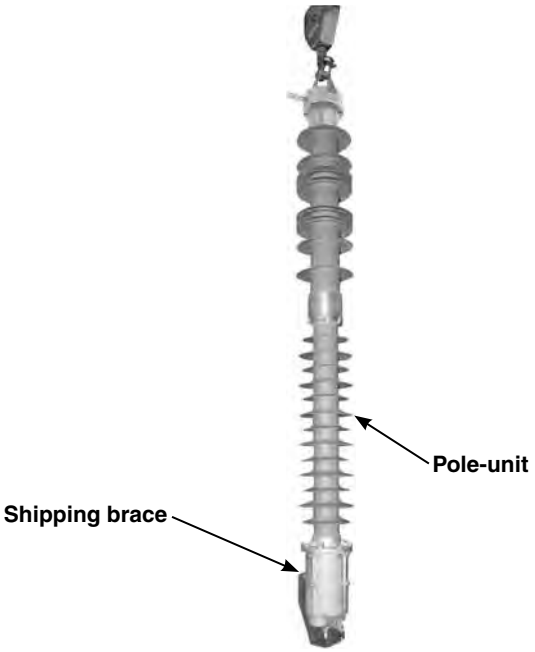


Figure 32. Do not remove the shipping brace at this time.

Step 28

With the foam wrapping around the pole-unit base removed and the pole-unit lifted off the ground, check that the gas-pressure gauge on the underside of the pole-unit base is in the "OK" to operate zone. See Figures 33 and 34.

NOTICE

The gas-pressure gauge needle should be in the "OK" to operate zone. If the gauge is not in this position, stop the installation and notify S&C Electric Company.

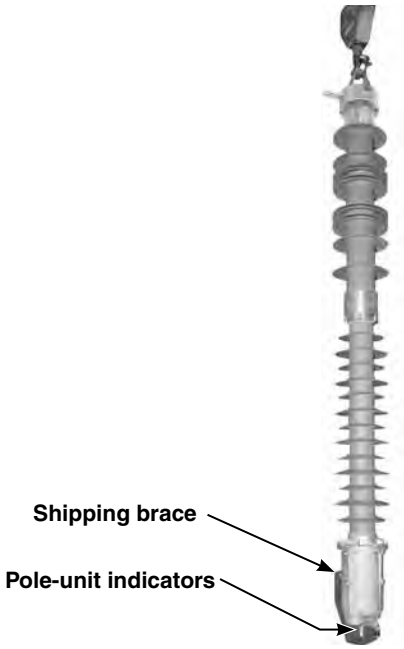


Figure 33. With the pole-unit lifted off the ground, check the gas-pressure gauge on the underside of each pole-unit base.

Figure 34. Check that the gas-pressure gauge on each pole-unit is in the "OK" to operate zone.

Step 29

Position the pole-unit so that its base is just above the cross base. If necessary, rotate the pole-unit so that its electrical-junction box is positioned to the side of the cross base, where the conduit will be attached. See Figure 35.

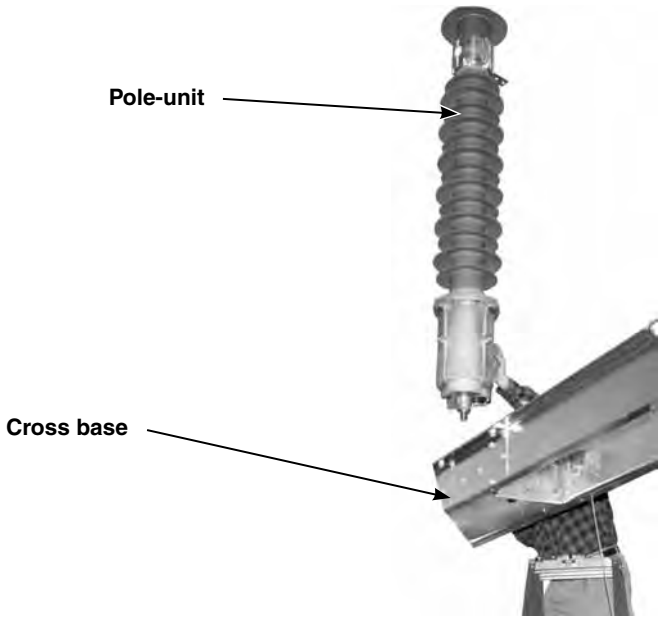


Figure 35. Position the pole-unit base just above the cross base.

Step 30

Remove the shipping brace from the pole-unit base. See Figure 36.

⚠ CAUTION

DO NOT rest the pole-unit on its base after the shipping brace has been removed.

Damage to the operating shaft can occur.

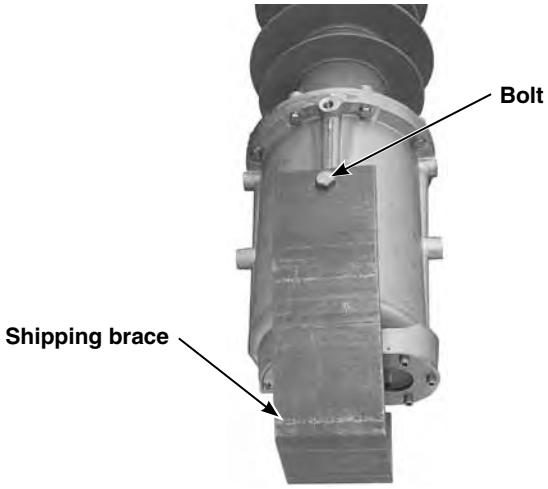


Figure 36. Unbolt the shipping brace.

Step 31

Place the pole-unit in the cross-base channel so that the mounting bosses are aligned with both sides of the cross base and the pole-unit mounting bracket. See Figure 37.

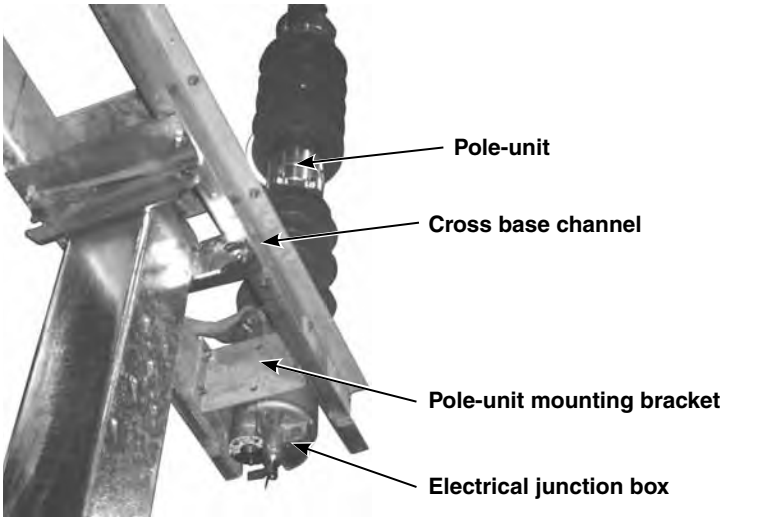


Figure 37. Place the pole-unit in the cross base channel so that the mounting bosses are aligned with the holes on the cross base and pole-unit mounting bracket.

Step 32

Attach the pole-unit base to both sides of the cross base with the $\frac{5}{8}$–11 × 2 stainless-steel studs furnished. Screw each of the studs in until they bottom, approximately 8 or 9 turns. Both the upper and lower mounting bosses must be used. See Figure 38.

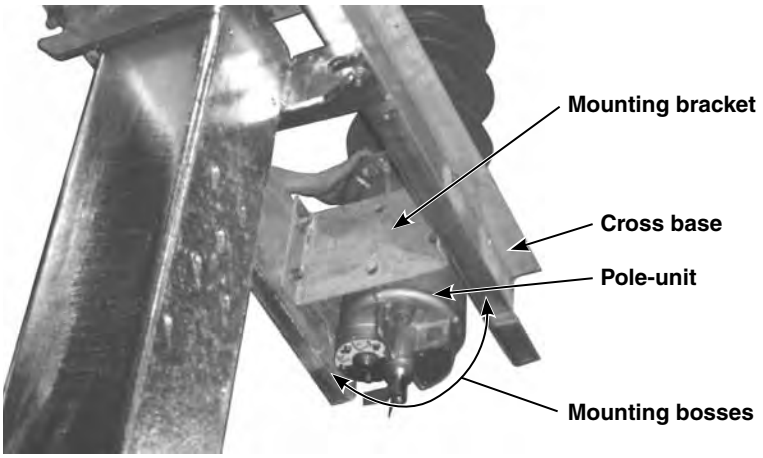


Figure 38. Attach the pole-unit base to both sides of the cross base.

Step 33

Insert the ¼-inch-thick spacer plate between the pole-unit mounting bracket and pole-unit mounting bosses. Align the mounting bosses with the holes in the spacer plate and mounting bracket. See Figure 39.

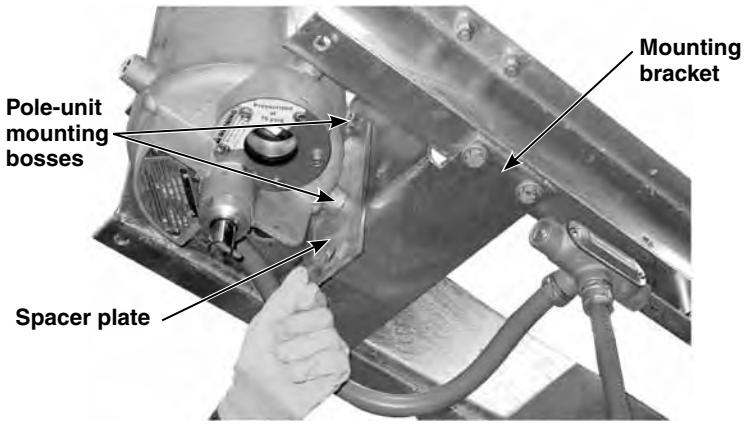


Figure 39. Insert the spacer plate.

Attach the pole-unit base to the mounting bracket with the ⅝–11 × 2 stainless-steel studs furnished. Both the upper and lower mounting bosses must be used. Screw each of the studs in until they bottom, approximately 8 or 9 turns. See Figure 40.

DO NOT remove the hoist sling or lifting device from the pole-unit at this time.

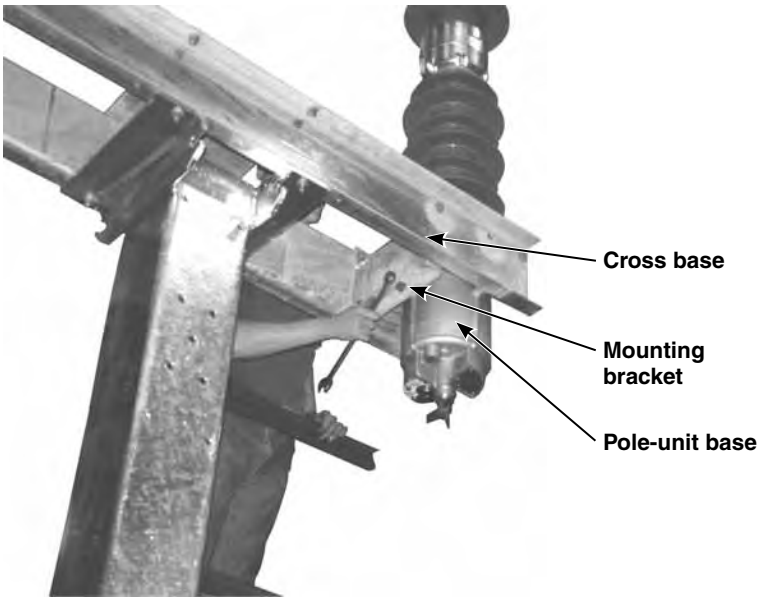


Figure 40. Attach the pole-unit base to the mounting bracket and both sides of the cross base.

If optional motor operators are furnished:

a. Insert one of the two ¼-inch-thick "L"-shaped motor brackets in place of the spacer plate from the underside of the cross-base. Position it between the pole-unit mounting bosses positioned as shown in Figure 41.

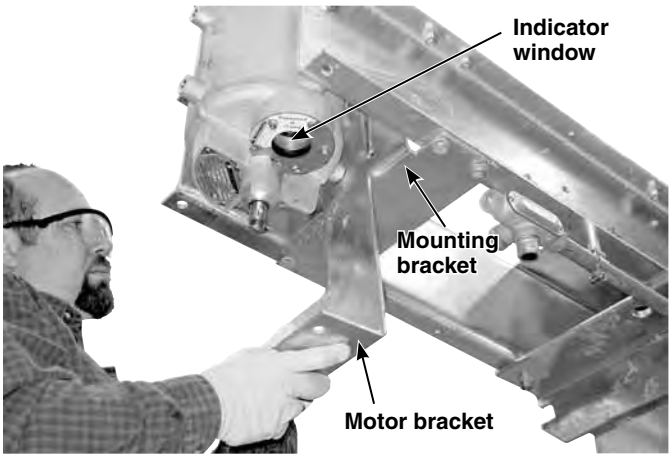


Figure 41. Insert motor mounting bracket if applicable.

b. Place the second motor bracket on the opposite side of the pole-unit. Attach both brackets to the pole-unit base using the ⅝–11 × 2 stainless-steel studs furnished. Screw each of the studs in until they bottom, approximately 8 or 9 turns. Both the upper and lower mounting bosses must be used. The motor bracket must be positioned as shown in Figure 42.

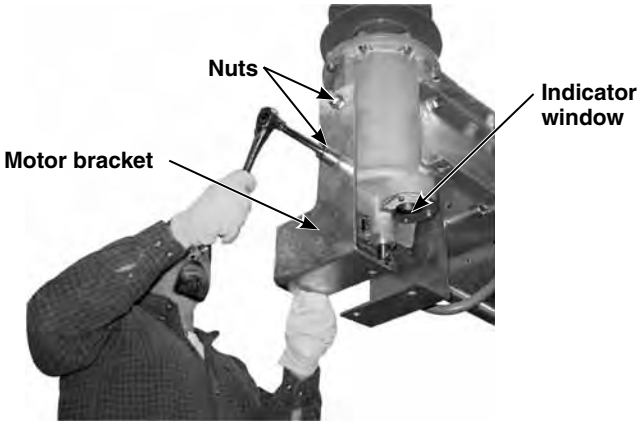


Figure 42. Place the second motor bracket on the opposite side if applicable.

Step 34

Attach ⅝–11 hex nuts to the studs and tighten both the pole-unit and motor bracket nuts to a torque of 70 to 80 ft.-lbs. Use a flat washer and a lockwasher on each stud.

⚠ CAUTION

Never exceed the recommended torque limit.

The pole-unit base is pressurized and damage to the pole-unit may occur.

Step 35

Remove the hoist sling or lifting device from the pole-unit.

Mounting the Low-Voltage Connection Enclosure

Step 36

Attach the connection enclosure to the pedestal along which the conduit will run. Align the connection enclosure tabs with the mounting holes in the pedestal. Then bolt both the top and bottom tabs to the pedestal, using the ⅜–16 × 9 carriage bolts furnished. See Figure 43.

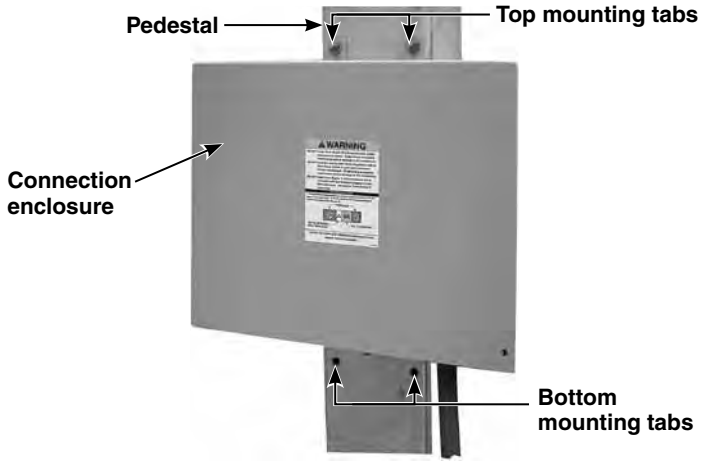


Figure 43. Bolt the top and bottom tabs of the enclosure to the pedestal.

Step 37

Remove the enclosure cover by sliding it upward, then remove the clear shield. Set these items aside in a protected area. Remove the snap-in plug from the hole along the enclosure bottom. **DO NOT** remove the aerator from the bottom of the enclosure. See Figures 44, 45, and 46.

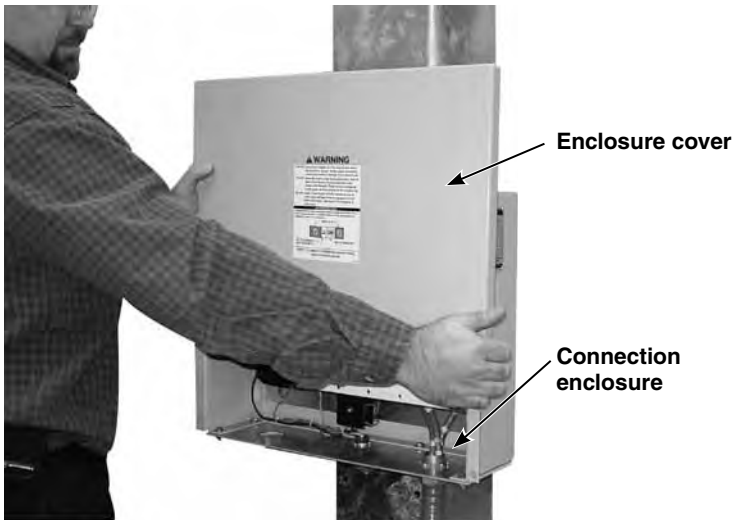


Figure 44. Remove the enclosure cover by sliding it upwards.

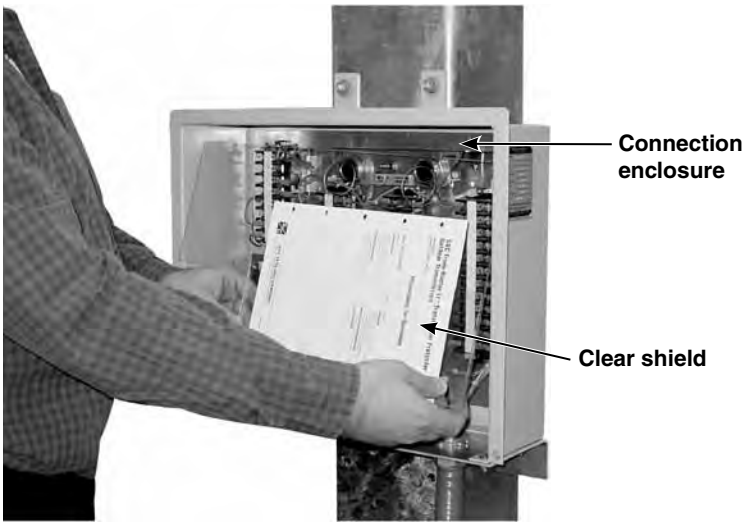


Figure 45. Remove the clear shield.

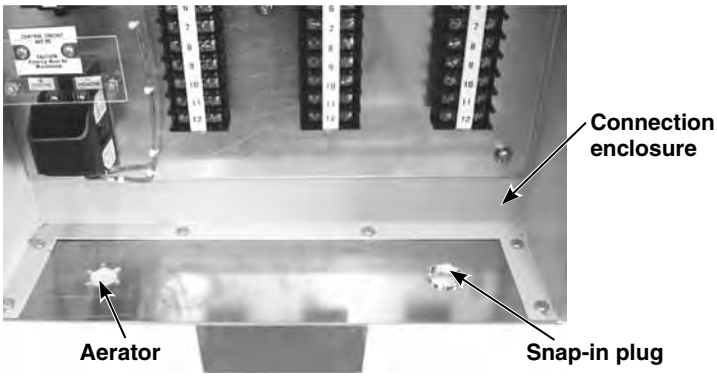


Figure 46. Remove the snap-in plug from the hole along the enclosure bottom. DO NOT remove the aerator.

Step 38

To add holes for control-circuit conduit(s) for control power and relays, mark the location(s) on the conduit-entrance plate at the bottom of the enclosure. Then remove the plate and punch the necessary opening(s). Replace the conduit-entrance plate. See Figure 47.

NOTICE

Punch holes for conduit(s) only on the bottom of the enclosure. The enclosure is not designed for holes in any other location.

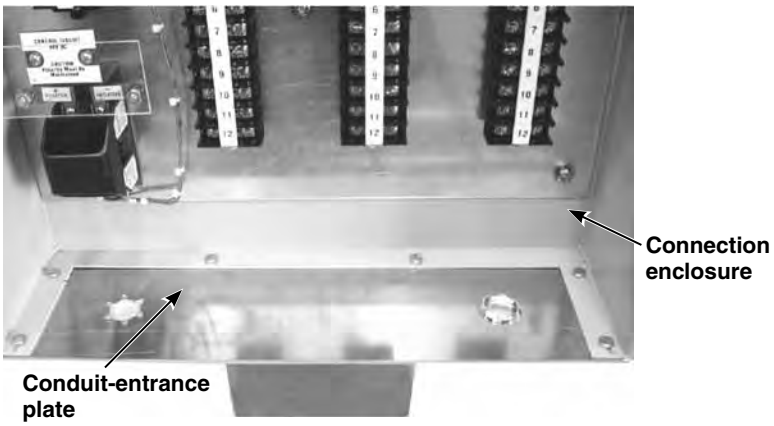


Figure 47. If additional holes for control wiring are required, remove the conduit-entrance plate and punch the necessary opening(s).

Installing the Conduit Assembly

Step 39

Set the conduit assembly in the hooks at the top of the pedestals. The conduit should be attached to the cross-base in accordance with the catalog drawing. Make sure the conduit is directed down the pedestal to which the connection enclosure is attached. See the catalog drawing for details. Position the conduit ends near the electrical junction boxes of the pole-units. See Figure 48.

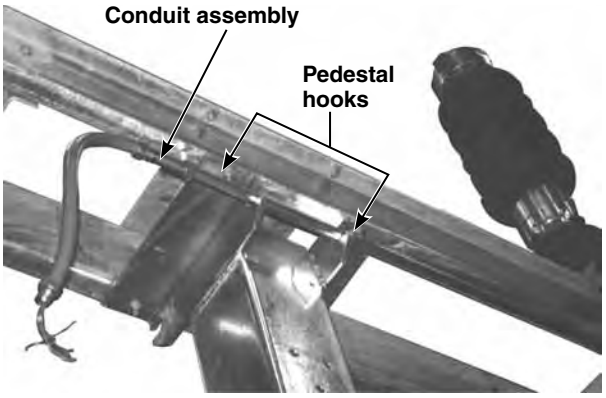


Figure 48. Set the conduit assembly in the hooks at the top of the pedestals.

Step 40

Using the offset mounting brackets, attach the conduit assembly to the cross base. Bolt the brackets through the predrilled holes. See Figure 49.

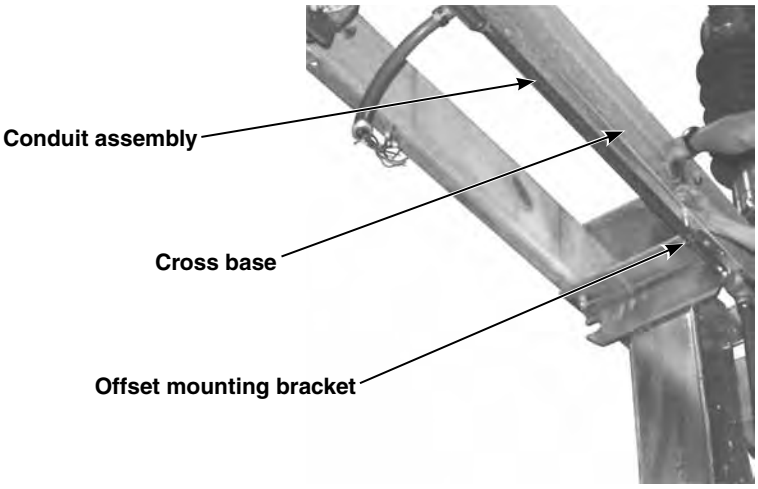


Figure 49. Using the offset mounting brackets, attach the conduit assembly to the cross base.

Step 41

Using the offset mounting brackets attach the conduit assembly to the pedestal. See Figure 50.

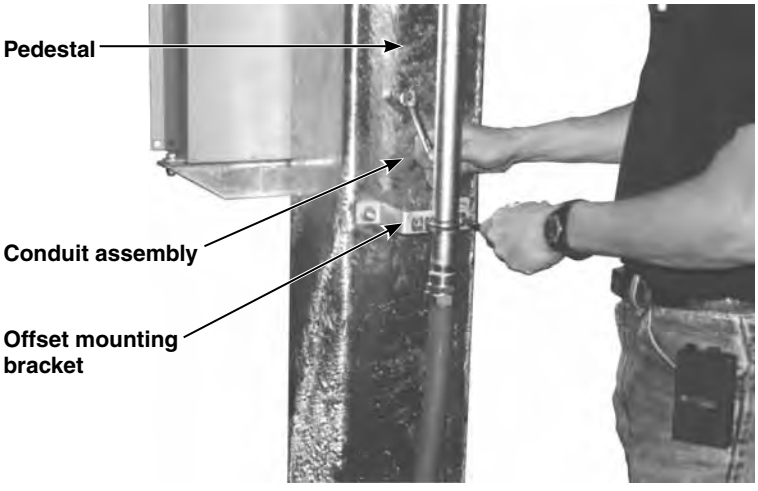


Figure 50. Using the offset mounting brackets, attach the conduit assembly to the pedestal.

Wiring the Pole-Unit Connections

For optional quick-connect control cable skip to Step 45.

Step 42

Remove the three removable screws at each pole-unit electrical junction box cover. Retain the screws. Loosen the fourth retaining screw. Then swing out the cover to access the wiring inside the electrical junction box. See Figures 51 and 52.

Step 43

Following the wiring diagram furnished, connect the conduit wiring to the wiring inside the electrical junction boxes. Use the butt splices supplied with the junction-box wiring. The butt splices accommodate 18 to 22 AWG wire.

NOTICE

To ensure proper crimping of the butt splices, use the Panduit controlled-cycle hand tool (CT-1550), or a company-standard tool for attaching 18- to 20-gauge insulated ring lugs.

Step 44

Rotate the cover of each electrical junction box and replace the retained screws. Securely tighten all screws. See Figure 53.

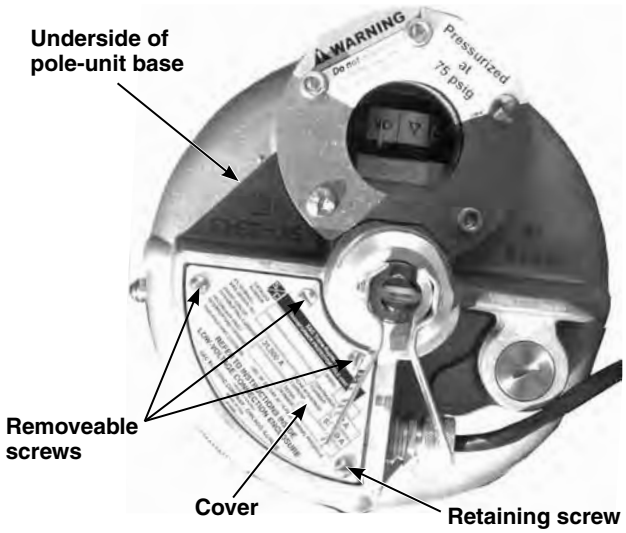


Figure 51. Remove the three removable screws at each pole-unit electrical junction box cover. Loosen the fourth retaining screw.

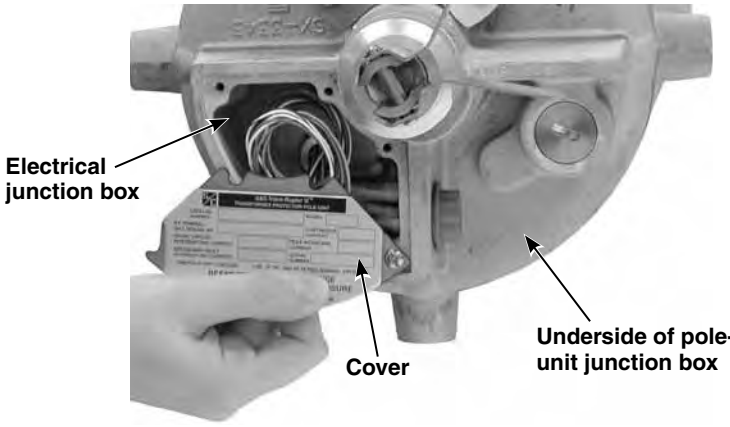


Figure 52. Swing out the cover to access the wiring inside the electrical junction box.

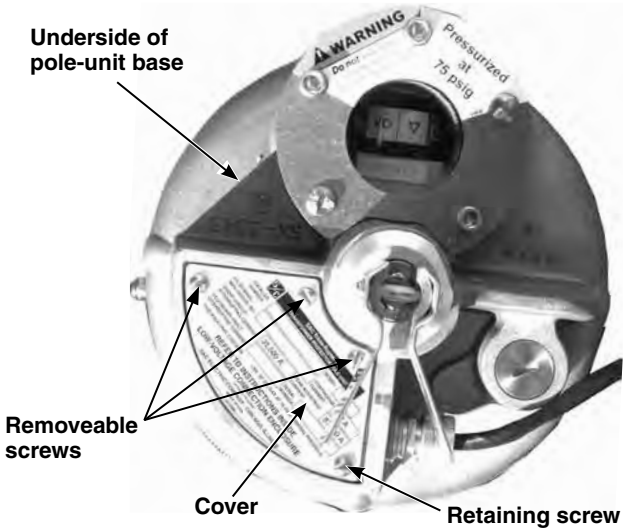


Figure 53. Securely tighten the screws of the electrical junction box covers.

Step 45

When the quick-connect option ("-C2") is specified plug-style connections will replace the butt-splice connection.

The male plug is keyed to the female socket. See Figure 54. Push the plug into the socket and turn the black ring until the thin red line around the outside of the socket is obscured. See Figures 55 and 56.

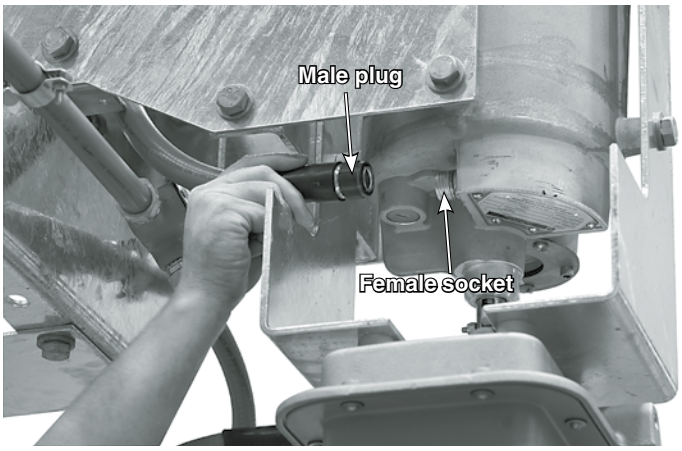


Figure 54. Optional quick-connect control cable. Male plug is keyed into female socket.

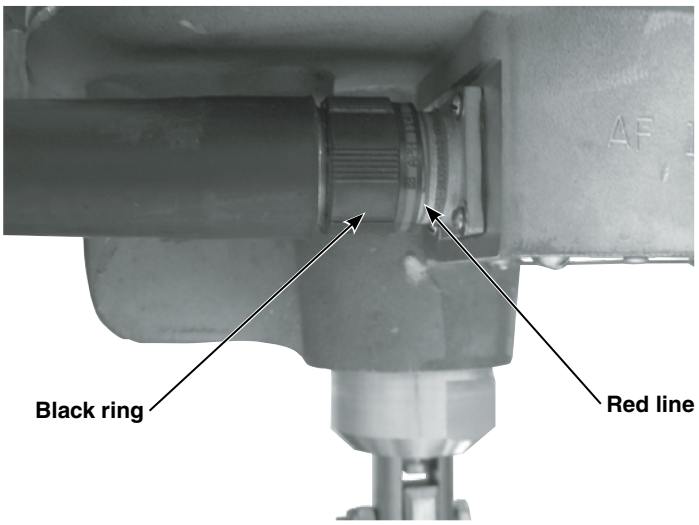


Figure 55. Turn ring until red line is obscured.

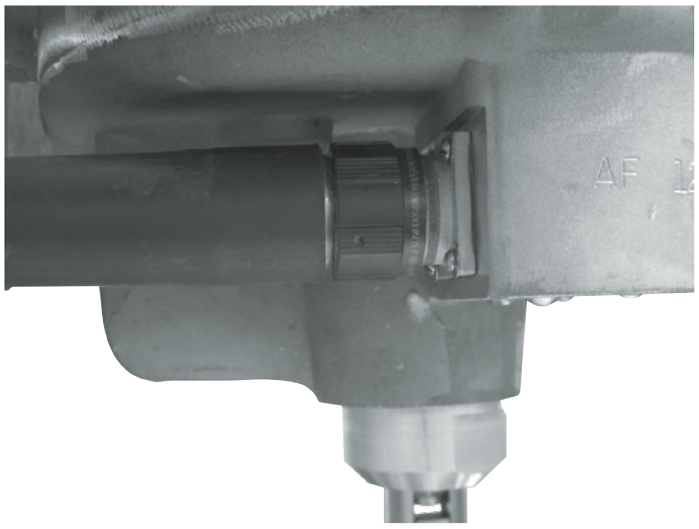


Figure 56. Quick connector fully tightened.

Step 46

Attach the conduit for pole-unit wiring to the punched hole on the enclosure bottom, then pull the wires through the hole into the connection enclosure. Be sure that the fittings are properly sealed to prevent water ingress. See Figure 57.

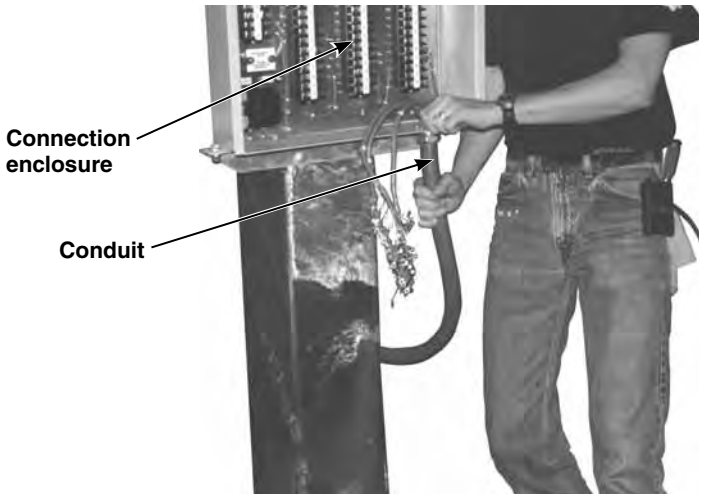


Figure 57. Attach the conduit for pole-unit wiring to the punched hole on the enclosure bottom.

Step 47

Connect the pole-unit and optional motor operator wiring to the appropriate termination blocks in the low-voltage connection enclosure, in accordance with the wiring diagram furnished. See Figure 58.

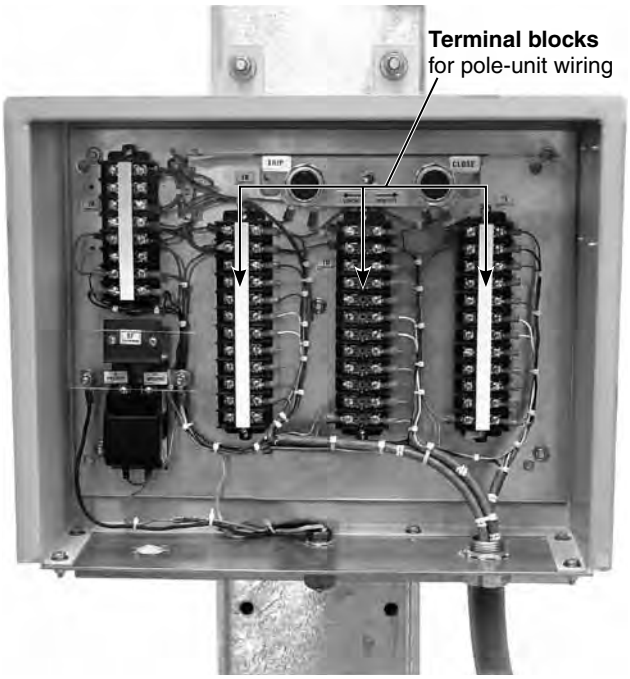


Figure 58. Connect pole-unit wiring to terminal blocks in the low-voltage connection enclosure, in accordance with the wiring diagram furnished.

Before Starting

The bypass accessory allows the interrupter of the Trans-Rupter II to be "bypassed" allowing operation of the Trans-Rupter II and testing of the associated relays without interrupting service.

The Trans-Rupter II Transformer Protector has four sets of upper and two sets of lower terminal pad mounting bosses. (See "Terminal Pad and Conductor Connections" on page 38 for more details.) The upper terminal pad of each pole-unit can be mounted in one of four positions located 90° apart. The lower terminal pad of each pole-unit can be mounted in one of four positions located 180° apart. Determine the appropriate terminal pad locations before proceeding. The bypass accessory must be attached to the terminal pad mounting bosses so that the bypass blade swings at a 90° angle away from the pole-unit and away from other pole-units.

To avoid damage to the bypass blade the bypass should be installed after the pole-unit is secured to its mounting structure but before conductor connections are made. If retrofitting the blade to an existing Trans-Rupter II Transformer Protector, make sure the Trans-Rupter II is de-energized and grounded at all six terminals before beginning. Remove the existing conductors, terminal pads and associated hardware.

Step 48

Thoroughly clean the surface of the Trans-Rupter II casting and the surface of the bypass accessory terminal pads using a soft cloth. Immediately apply a liberal coating of Burndy Penetrox® A or other suitable aluminum connector compound to the clean surfaces.

Step 49

Using the two ½–13 × 1 hex-head stainless-steel cap screws and ½-inch stainless-steel lock washers furnished, attach the upper bypass contact to the appropriate set of tapped holes. The mounting bracket uses the same holes that the terminal pad would normally occupy. The mounting bracket should be perpendicular to the pole-unit as shown in Figure 59. Tighten to a torque of 40 to 45 ft.-lbs.

⚠ CAUTION

Never exceed the recommended torque limit.

The pole-unit base is pressurized and damage to the pole-unit may occur.

Step 50

The lower bypass blade assembly uses two sets of mounting holes and has an integral terminal pad that should be used in place of mounting a terminal pad one of the sets of pole-unit mounting bosses. Spacers are required between the blade assembly and the pole-unit and are furnished with the mounting hardware. An aluminum connector compound can be used to temporarily "glue" the spacers in place while the blade assembly is being installed.

Using the four ½–13 × 1 hex-head stainless-steel cap screws and ½-inch stainless-steel lock washers furnished, attach lower bypass blade assembly to the appropriate sets of tapped holes on the pole-unit. Tighten the screws to a torque of 40 to 45 ft.-lbs. See Figures 60 and 61.

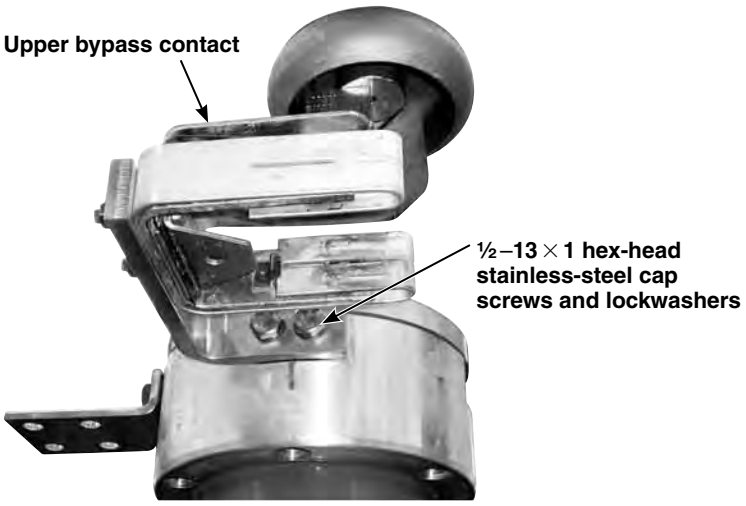


Figure 59. Attach the upper bypass contact to the pole-unit.

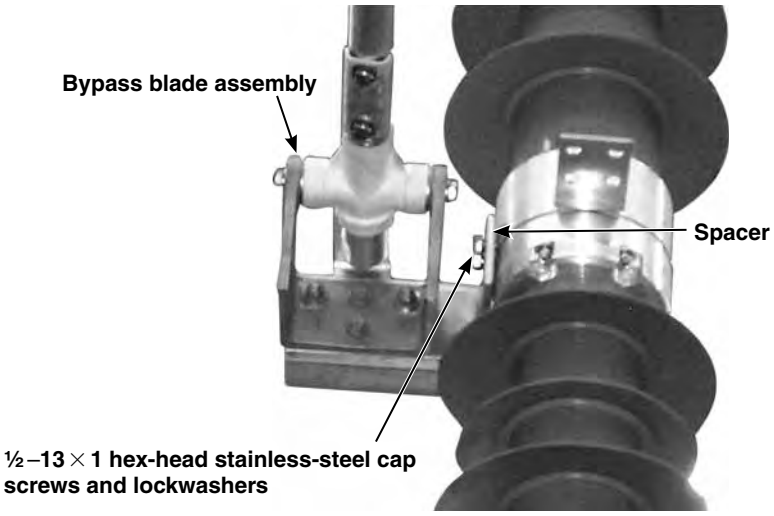


Figure 60. Attach lower bypass blade assembly. Front view.

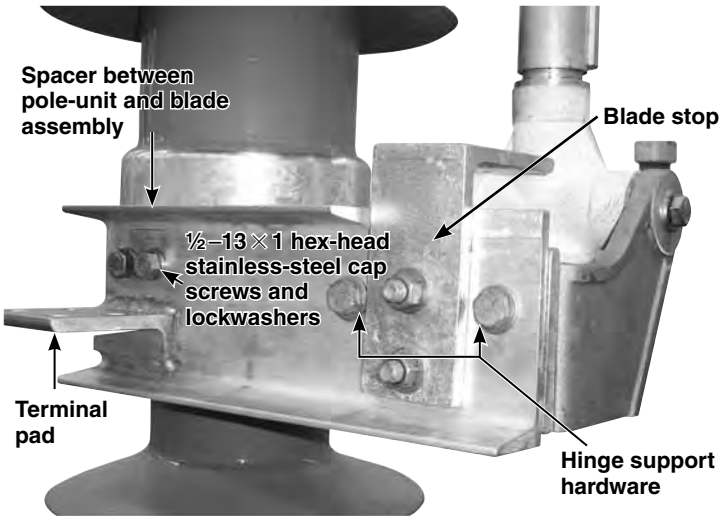


Figure 61. Attach lower bypass blade assembly. Rear view.

Step 51

After the bypass is mounted to the pole-unit, disengage the blade from the upper contact fingers and verify that the centerline of the blade assembly has not shifted by more than ⅛″ from the center line of the contact fingers. See Figure 62. If the blade assembly needs adjustment, loosen the hinge support and blade stop bracket hardware. See Figure 61. Center the blade between upper contact fingers while maintaining 5⁄16″ clearance from top of blade. Tighten hinge support and blade stop bracket hardware to 55 ft-lbs.

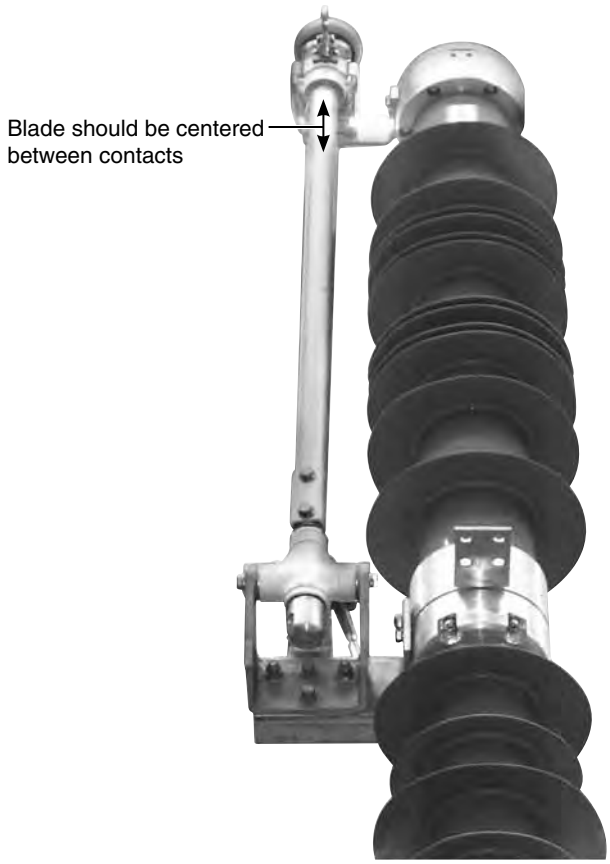


Figure 62. Center blade between contacts. Blade in bypass position.

Operation

Step 52

To open, pull the blade down fully using a S&C Substation Prong or other heavy duty hook stick tool. Support the blade during its travel. Do not let the blade fall or bounce. Once fully open the blade should be horizontal to the ground, approximately 90° from the pole-unit. See Figure 63.

To close, engage the hook stick with the blade pull ring and swing the blade assembly to within two or three inches of the jaw-contact assembly. Then move the blade assembly sharply to the closed position.

Step 53

If adjustment is necessary, loosen and shift blade stop bracket hardware only.

Figure 63. Bypass in open position.

The brackets required for mounting the motor operators must be installed during pole-unit installation. See Steps 6 through 8 on pages 9 and 10 for details on how to install the motor brackets on a user-furnished mounting structure, and Steps 32 through 33 on page 21 for details on how to install the motor brackets on S&C Mounting Pedestals.

NOTICE

The motor operators require either a 125-Vdc or 48-Vdc control voltage. Motor control voltage cannot be changed in the field. Check the motors to make sure they are correct for the installation.

Repeat Steps 54 through 59 for each pole-unit.

Step 54

Manually rotate the operating shaft counterclockwise until it stops. See Figure 64.

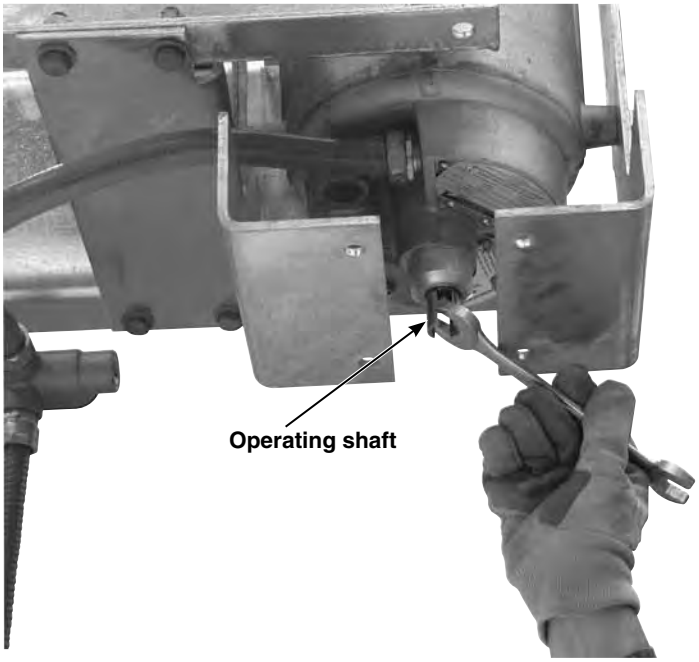


Figure 64. Manually rotate the operating shaft.

Step 55

Locate the four mounting bosses on the top of the motor. See Figure 65. Align the mounting bosses on the motor with the holes in the motor brackets.

If the holes do not align, loosen the studs supporting the motor brackets, and shift them until proper alignment is achieved.

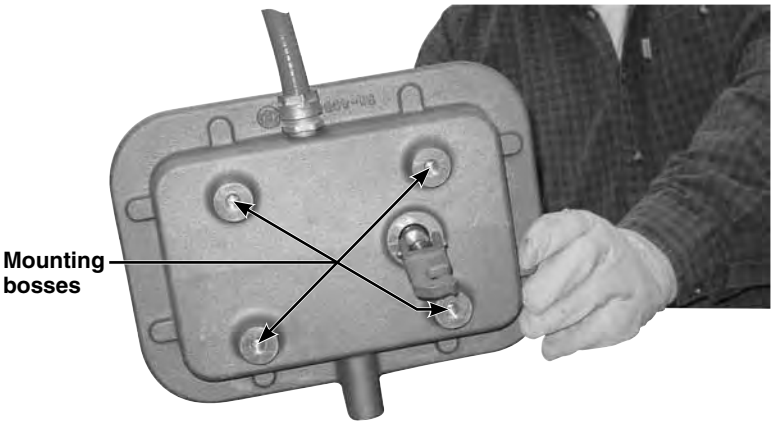


Figure 65. Locate the mounting bosses and align with the motor brackets.

Step 56

Engage the headhook of the motor operator with the operating shaft. See Figure 66. Using the four stainless steel hex-head screws and flat washers furnished, fasten the motor to the brackets. Tighten to 50-60 ft. lbs. See Figure 67.

Retighten any stud nuts loosened in Step 55 to 70 and 80 ft.-lbs.

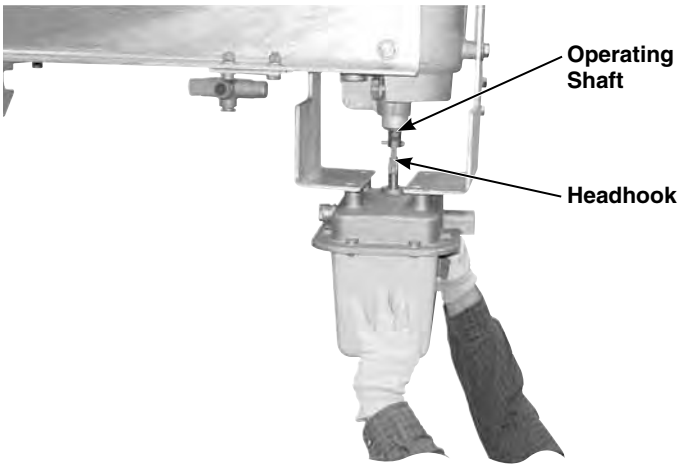


Figure 66. Engage the headhook with the operating shaft.

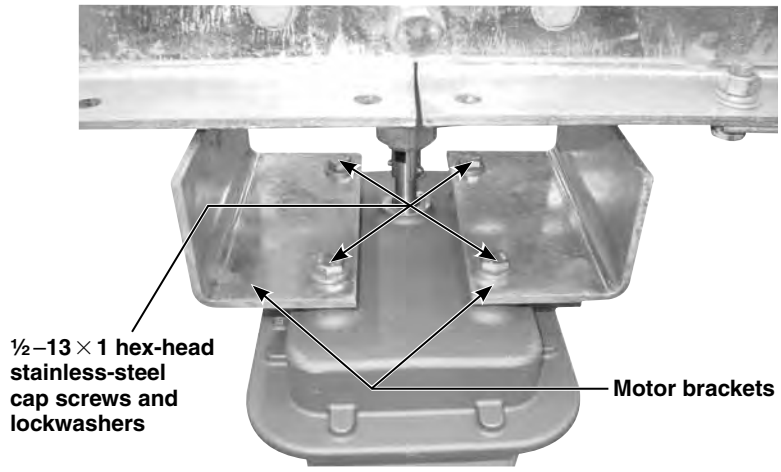


Figure 67. Fasten the motor to the motor brackets.

Step 57

Remove and retain the eight 10–32 × ⅝-inch round-head stainless-steel machine screws that secure the motor cover to the motor housing. Remove the motor cover and set the motor cover and screws aside in a protected area. See Figure 68.

Step 58

Install the conduit:

a. For installations on user-furnished structures: Connect the conduit to the ½–14 NPT tap, and pull the wires through into the motor housing. Use watertight fittings to make all connections. See Figure 69.

b. For installations on S&C Mounting Pedestals: Connect conduit from the "T" in the main conduit run to the ½–14 NPT tap, and pull the wires through into the motor housing. Use watertight fittings to make all conduit connections. See Figure 69.

Step 59

Following the supplied wiring diagram, make the necessary wiring connections to the terminal block in the motor operator. See Figure 70. **DO NOT** remove the jumper between Terminals 8 and 9. Train the motor wiring towards the center of the housing so that the motor wiring does not come in contact with the motor cover. Bend the terminal lugs if necessary. Then replace the motor cover and secure it using the 10–32 × ⅝-inch round-head machine screws retained from Step 57.

NOTICE

If control power is lost while the Trans-Rupter II motor operators are closing and charging the pole-units, the jumper between terminals 8 and 9 will force the motor operators to "reset" to the beginning of their charging cycle when control power is restored. Check the indicators after control power is restored to verify the position of the pole-units before closing the source-side series disconnect. Send the "CLOSE" signal again if necessary.

Figure 68. Remove the motor cover.

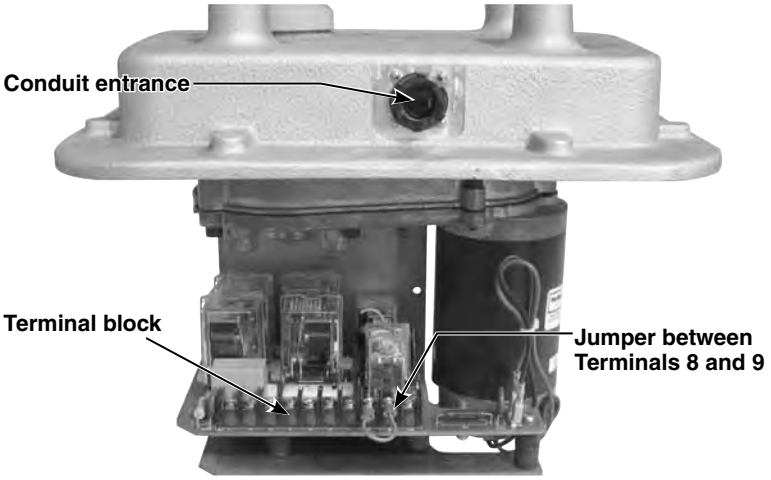


Figure 69. Bring conduit into motor housing. Do not remove the jumper.

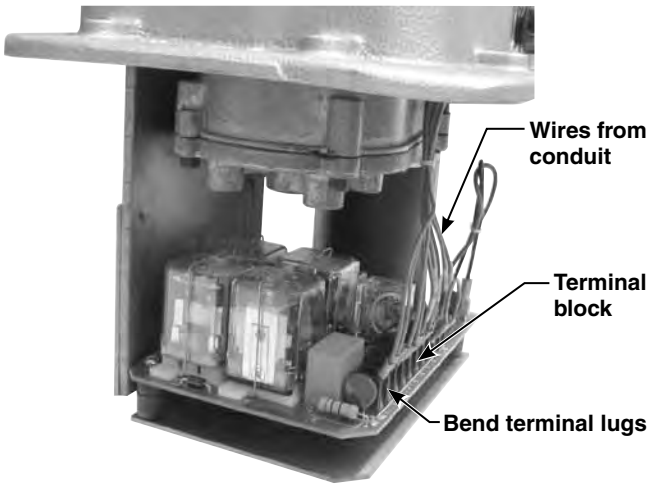


Figure 70. Connect wiring to terminals per the supplier wiring diagram. Train the wires away from the edge of the motor housing to allow clearance between the motor wiring and the motor cover. Bend the terminal wire lugs if necessary.

Step 60

Prepare an appropriate length of conduit to connect the protective relays to the connection enclosure. Attach the conduit to the user-furnished relay enclosure and to one of the holes along the bottom of the connection enclosure (see Step 38), using watertight fittings. Then pull the wires through. Following the wiring diagram furnished, connect the wiring to the appropriate termination blocks in the low-voltage connection enclosure. See Figure 71.

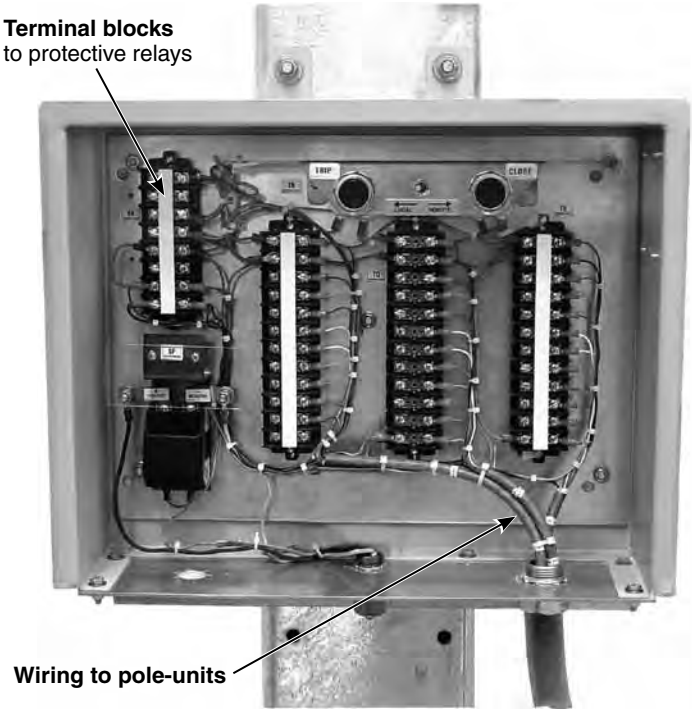


Figure 71. Pull pole-unit wires through a hole along the bottom side of the enclosure, then connect the wiring to the appropriate termination blocks.

Step 61

Prepare an appropriate length of conduit to connect the control power source to the connection enclosure. Attach the conduit to the control power source and to one of the holes along the bottom of the connection enclosure, using watertight fittings. See Figure 72.

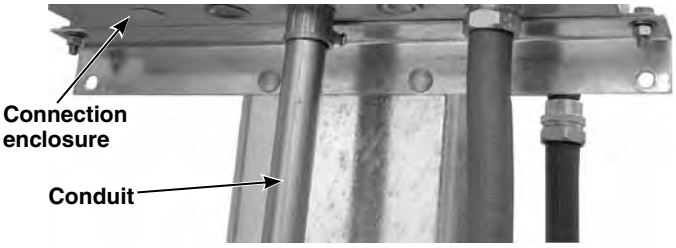


Figure 72. Attach the conduit to one of the holes along the bottom of the connection enclosure.

NOTICE

Trans-Rupter II is shipped wired for a 125-Vdc control-power source. If a 48-Vdc control power source will be used, a jumper wire in the connection enclosure must be moved before Trans-Rupter II is connected to the control-power source. A 48-Vdc control power label is provided for use when voltage is changed. When optional motor operators are furnished, control power is factory-set to match the motor operator voltage. Refer to the wiring diagram furnished.

Step 62

Pull the copper slugs out. Set them aside in a protected area. See Figure 73.

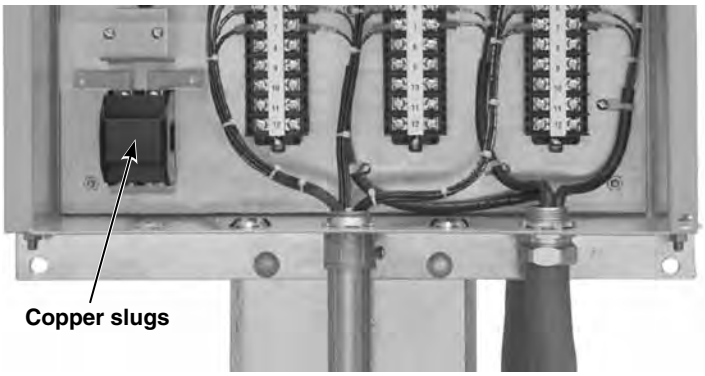


Figure 73. Pull the copper slugs out.

Step 63

Connect the control-power wiring to the termination blocks in the enclosure, in accordance with the wiring diagram furnished. Observe correct polarity, as marked on the control-power terminal blocks. See Figure 74.

⚠ CAUTION

ALWAYS check polarity of the termination block before putting Trans-Rupter II into service.

Incorrect wiring can result in damage to the trip coils, causing Trans-Rupter II to malfunction.

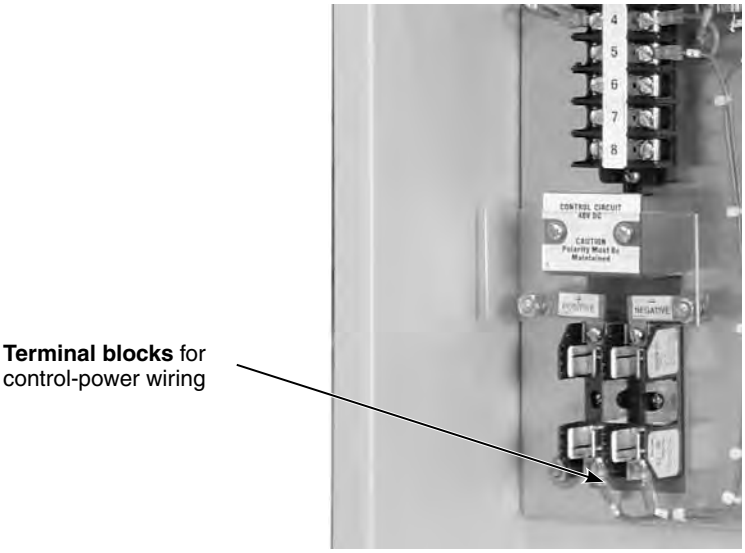


Figure 74. Connect the control-power wiring to the terminal blocks in the enclosure.

Step 64

Push the copper slugs back into their clips. See Figure 75.

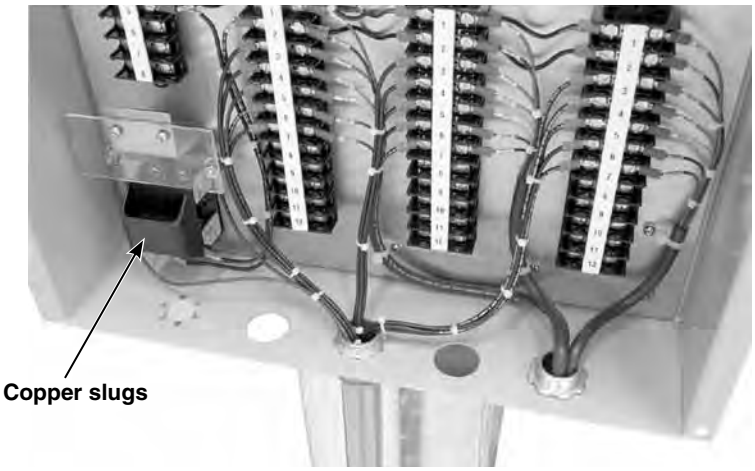


Figure 75. Push the copper slugs back into their clips.

Step 65

Replace the clear shield, then slide the enclosure cover back on. See Figure 76.

Note: When the installation is complete, this instruction manual can be stored in the instruction manual holder on the clear shield.

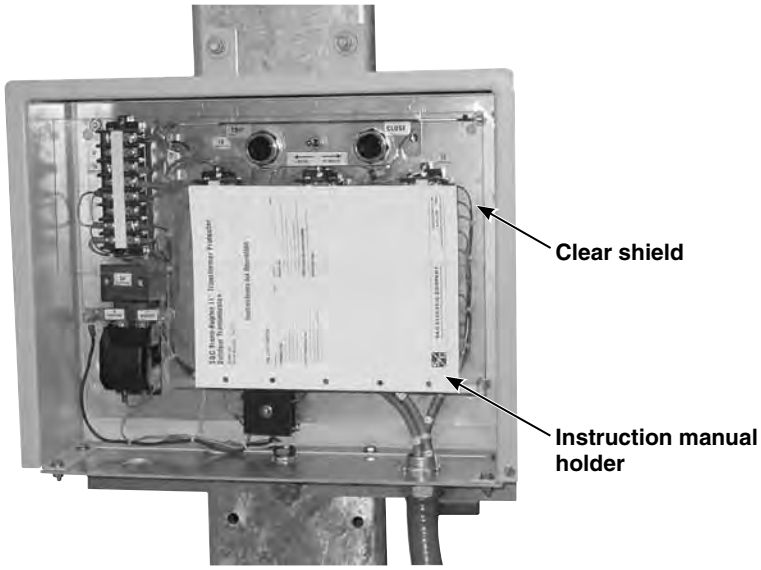


Figure 76. Replace the clear shield.

Installing the Terminal Pads

The upper terminal pad of each pole-unit can be mounted in one of four positions located 90° apart. The lower terminal pad of each pole-unit can be mounted in one of four positions located 180° apart. Determine the appropriate terminal-pad locations before proceeding.

Repeat Steps 66 through 69 for each pole-unit.

Step 66

Remove the lifting bracket. Make sure all packing material has been removed from the top of the pole-unit. See Figure 77.

⚠ CAUTION

The lifting brackets must be removed before energizing Trans-Rupter II.

Failure to do so can result in damage to the Trans-Rupter II.

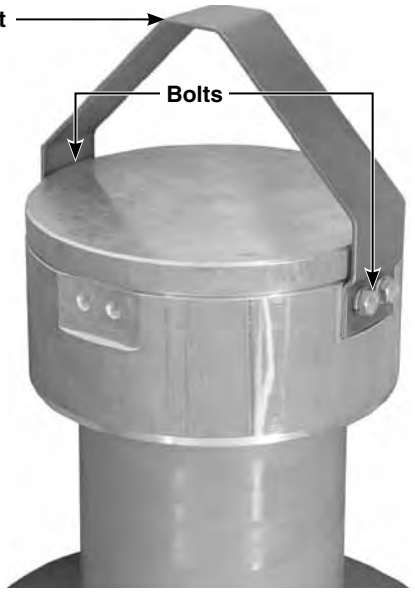


Figure 77. Remove the lifting bracket.

Step 67

Prepare the upper and lower terminal pads attachments as follows:

Thoroughly clean the upper and lower terminal pad castings of the pole-unit using a soft cloth.

Immediately apply a liberal coating of Burndy Penetrox® A or other suitable aluminum connector compound to the clean surfaces.

Step 68

Apply Penetrox® A to the threads of the ½–13 × 1 hex-head stainless-steel cap screws furnished.

Step 69

Using the ½–13 × 1 hex-head stainless-steel cap screws and ½-inch stainless-steel lockwashers furnished, attach the upper and lower terminal pad to the appropriate set of tapped holes on the pole-unit. Tighten the screws to a torque of 40 to 45 ft.-lbs. See Figure 78 (right) and Figure 79 on page 39.

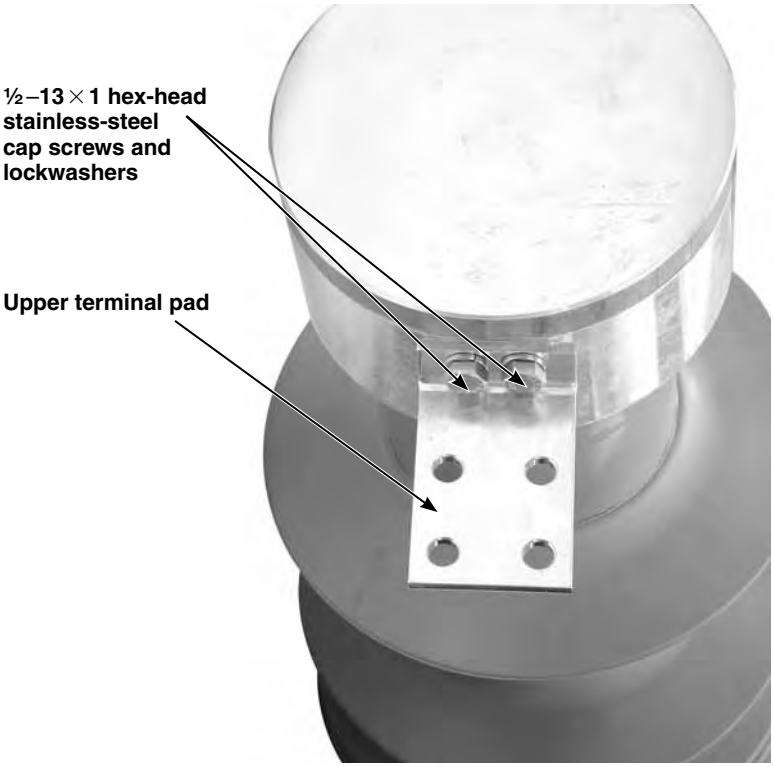


Figure 78. Bolt the upper terminal pad to the pole-unit.

Attaching High-Voltage Conductors

Attach the conductors to their respective terminal pads using flexible-conductor connections. Attach and form the conductors to minimize terminal-pad loadings. Do not exceed the terminal-pad loadings specified in Data Bulletin 731-60.

⚠ DANGER

DO NOT inspect, service, repair, or work on the conductors on either side of the switch without de-energizing and grounding the switch at all six terminals. Consider ***ALL PARTS LIVE*** until de-energized, tested, and grounded.

Interrupters and terminal pads may be energized from either side and in any position. Test for voltage using proper high-voltage test equipment and install suitable grounding equipment.

Failure to observe these precautions may result in serious injury or death.

Repeat Steps 70 through 72 for the upper and lower terminal pads of each pole-unit.

Step 70

Thoroughly wire-brush the current-transfer surface of the flexible-conductor connector and immediately apply a liberal coating of Penetrox A or other suitable aluminum connector compound to the brushed surface.

Step 71

Thoroughly clean the current-transfer surface of the terminal pad with a soft cloth and apply a liberal coating of Penetrox A. Then bolt the connector to the terminal pad.

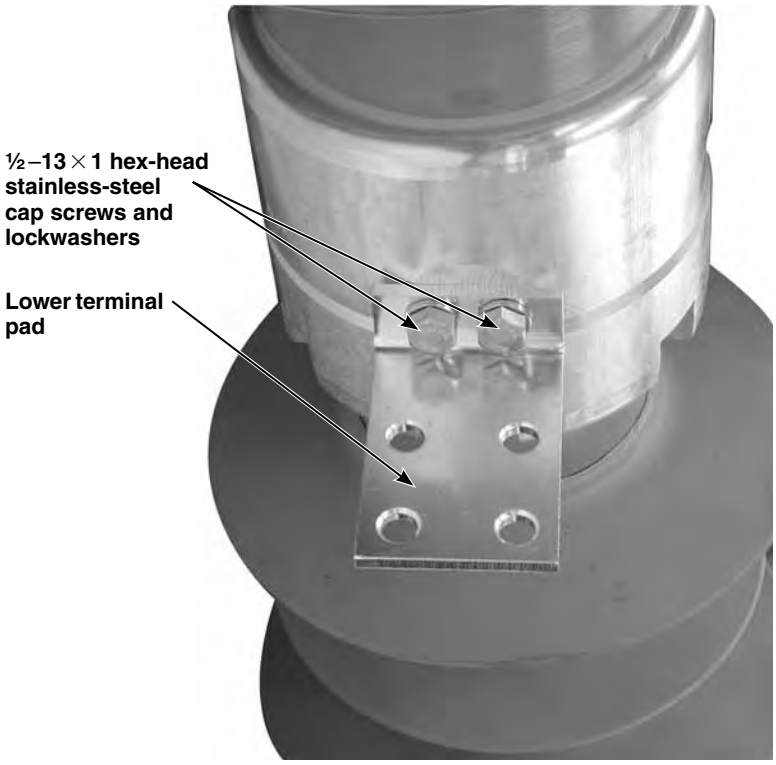


Figure 79. Bolt the lower terminal pad to the pole-unit.

Step 72

Prepare the conductor using established procedures and clamp it in its connectors.

⚠ WARNING

DO NOT use the charging tool as a hotstick.

Only use the charging tool for closing and charging Trans-Rupter II pole-units.

Serious injury or death can result.

The manual charging tool is shipped fully assembled but can be disassembled for storage.

NOTICE

To prevent excessive wear or corrosion, store the Trans-Rupter II charging tool in a dry, protected area when not in use.

Disassembling the Charging Tool

Step 73

Remove the linchpin that attaches the insulating shaft to the tool handle, then pull these components apart. Push the linchpin through the holes of the insulating shaft for storage. See Figures 80 and 81.

Step 74

Remove the linchpin that attaches the insulating shaft to the tool head, then pull these components apart. Push the linchpin through the holes of the insulating shaft for storage. See Figures 82 and 83.

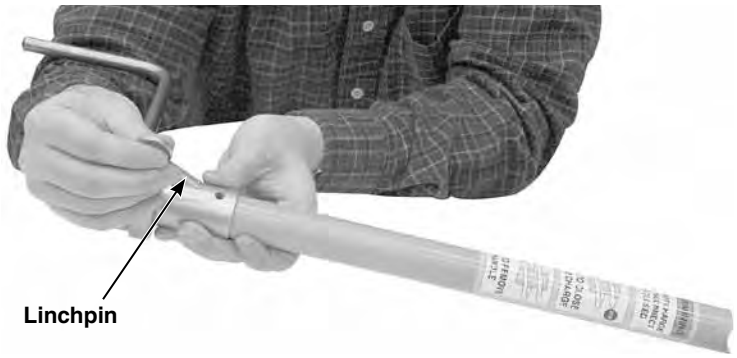


Figure 80. Remove the linchpin between the tool handle and the insulated shaft.

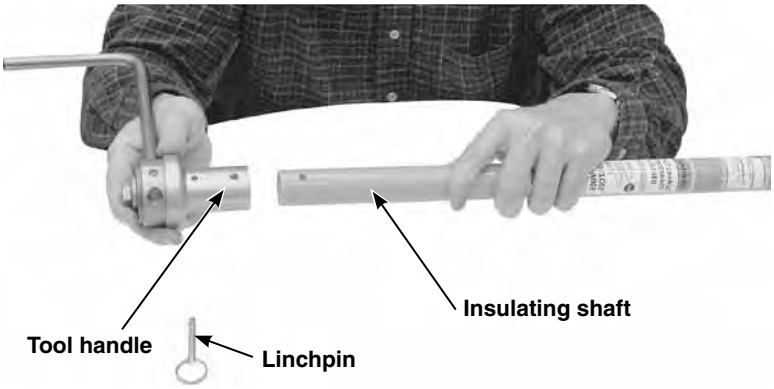


Figure 81. Pull the tool handle and the insulating shaft apart.

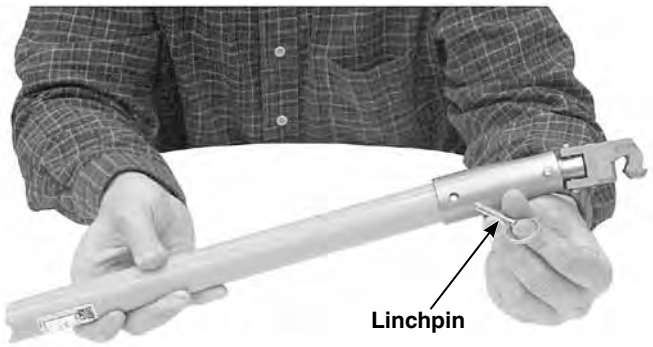


Figure 82. Remove the linchpin between the tool head and the insulating shaft.

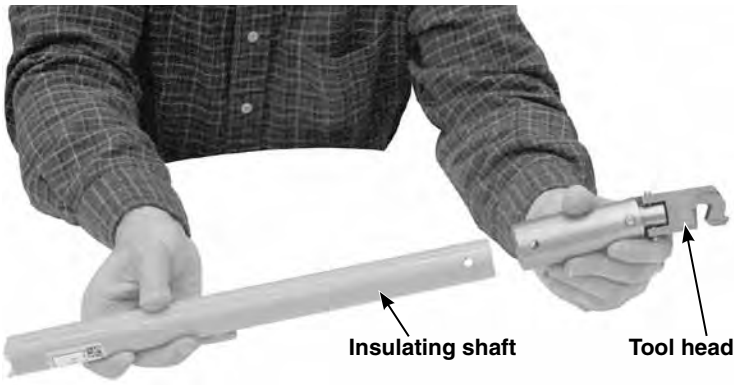


Figure 83. Pull the tool head and the insulating shaft apart.

Assembling the Charging Tool

Step 75

Push the tool head and the insulating shaft together. Align the holes on the tool head and the insulating shaft, then push the linchpin through the holes. See Figures 84 and 85.

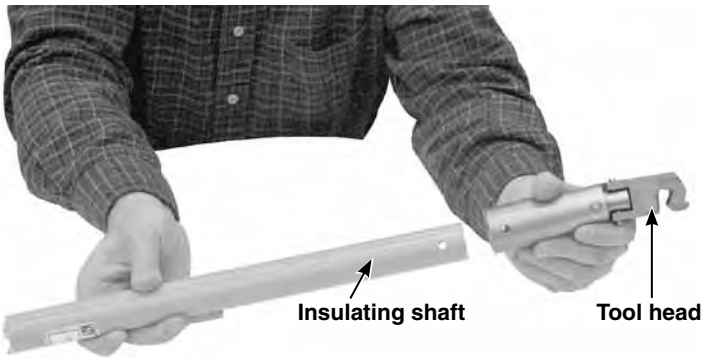


Figure 84. Push the tool head and the insulating shaft together.

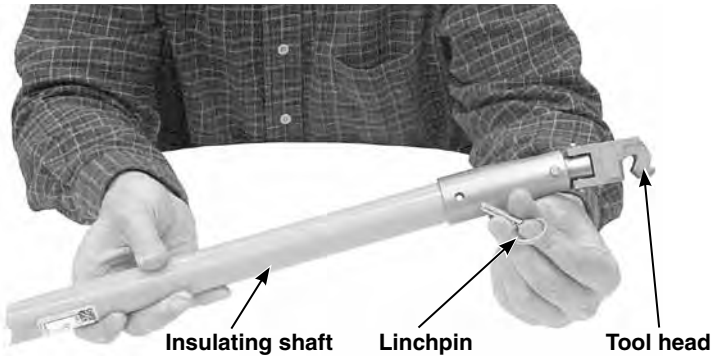


Figure 85. Align the holes on the insulating shaft and the tool head, then push the linchpin through.

Step 76

Push the insulating shaft and the tool handle together. Align the holes on the insulating shaft and the tool handle, then push the linchpin through the holes. See Figures 86 and 87.

Extra Sections for the Charging Tool

Extra sections can be assembled in accordance with the instructions above. It is recommended that a maximum of two 48-inch sections be added to the tool.

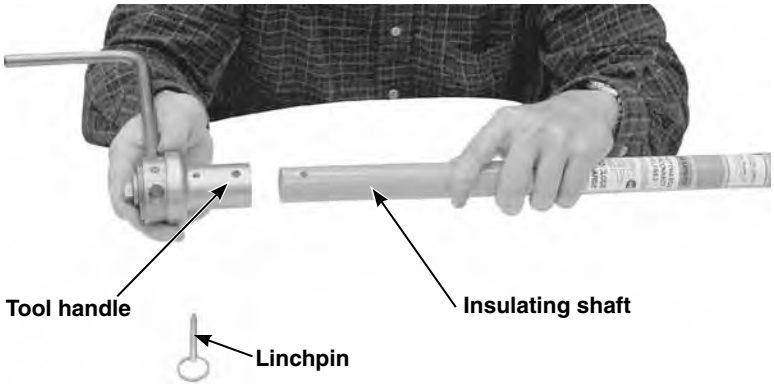


Figure 86. Push the handle and the insulating shaft together.

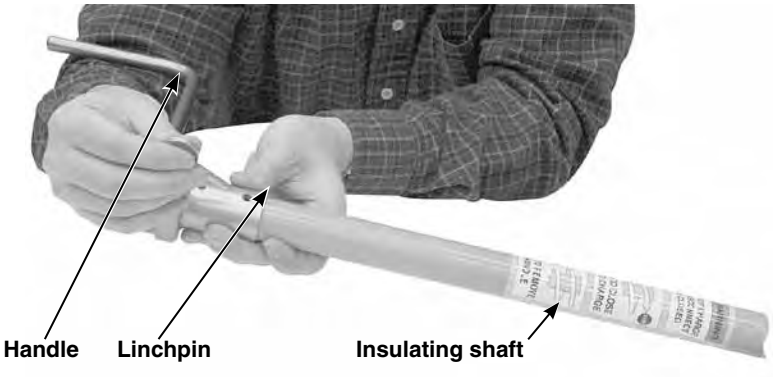


Figure 87. Align the holes on the handle and the insulating shaft, then insert the linchpin.

Understanding the Pole-Unit Position Indicators

The pole-unit position indicators are located underneath the pole-unit base. **The indicators are not meaningful while the pole-units are being closed and charged.**

If the pole-unit is "OPEN" and discharged, the indicator reads "OPEN." See Figure 88.

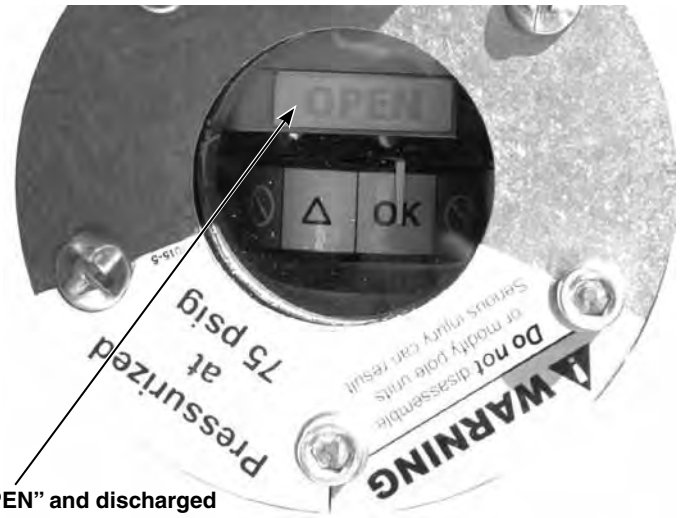


Figure 88. The pole-unit is "OPEN" and discharged. The indicator reads "OPEN."

If the pole-unit is "CLOSED" and charged, the indicator reads "CLOSED." See Figure 89.

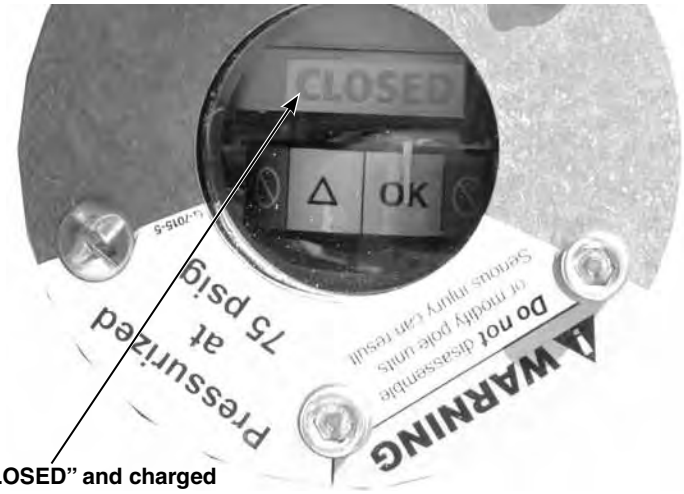


Figure 89. The pole-unit is "CLOSED" and charged. The indicator reads "CLOSED."

Understanding the Gas-Pressure Gauge

A temperature-compensated gas-pressure gauge is provided under the base of each pole-unit. It shows whether SF_6 gas density is sufficient for a trip operation. The gas-pressure gauge shows three zones:

OK to operate:

This is the white zone. If the gauge needle is in this zone, the pole-unit is at normal gas density, and can be opened and closed. See Figure 90.

Figure 90. Gauge needle in white "OK" to operate zone.

OK to operate (but replace):

This is the yellow zone. If the gauge needle is in this zone, the pole-unit can be opened and closed with full ratings. However, the pole-unit has lost gas and should be replaced as soon as possible. See Figure 91.

NOTICE

At temperatures below -31°F (-35°C), the indicator needle will be in the red zone due to the cold temperature. The gas density is below the pole-unit's minimum functional level, so the pole-unit will not have full interrupting or dielectric ratings. **At these temperatures, the gas-pressure gauge does not provide accurate indication of whether a pole-unit is losing SF_6.**

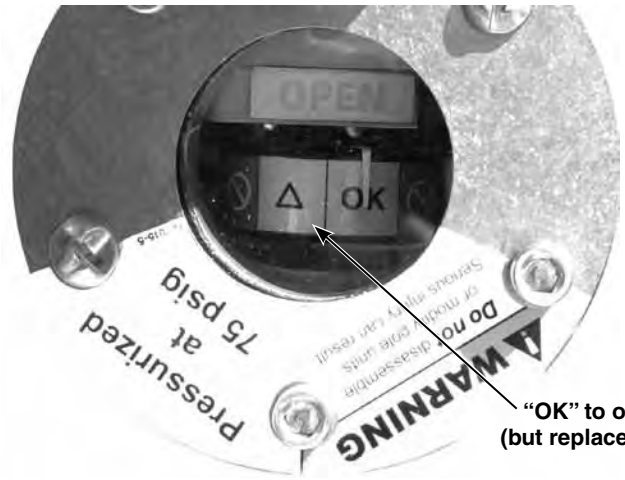


Figure 91. Gauge needle in yellow "OK" to operate (but replace) zone.

Replace:

There are two red zones. If the indicator needle is in the red zone shown in Figure 92, the gas density in the pole-unit has dropped below the minimum functional level and the pole-unit will not maintain full interrupting or dielectric ratings. The pole-unit should be removed from service and replaced promptly. Do not operate this Trans-Rupter II.

Figure 92. Gauge needle in red "REPLACE" zone.

If the indicator needle is in the red zone shown in Figure 93, the local gas-density gauge is damaged, and cannot be relied on to provide an accurate indication of gas density. The pole-unit should be removed from service and replaced promptly. Contact your local S&C Sales Office. Do not operate the Trans-Rupter II.

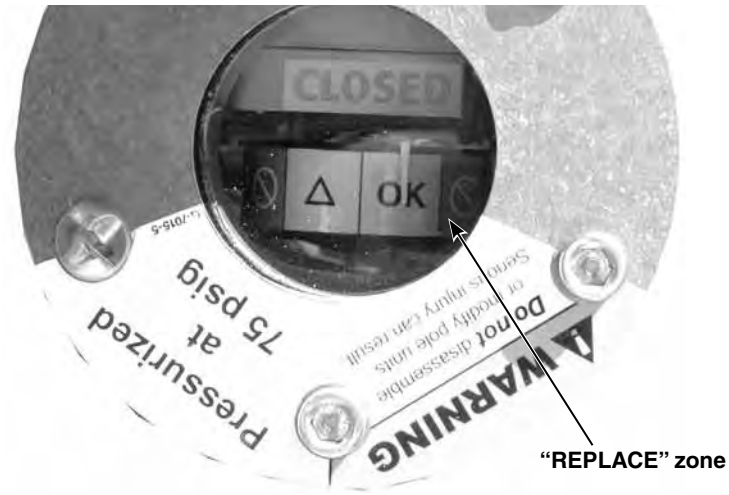


Figure 93. Gauge needle in red "REPLACE" zone.

Understanding the Optional Remote Gas-Density Indicator

If furnished, the remote gas-density indicator provides contacts for each pole-unit that allow remote monitoring of two low-gas-pressure alarms:

Level 1 Alarm:

When a Level 1 Alarm is issued, the pole-unit can be opened and closed as usual. However, the pole-unit has lost gas and should be replaced as soon as possible.

The remote gas-density Level 1 alarm contact opens at 95% of normal density, or 70 psig at 68°F (20°C). Contacts are normally closed at normal operating gas pressure.

Level 2 Alarm:

When a Level 2 Alarm is issued, the gas density in the pole-unit has dropped below the minimum functional level. The pole-unit will not maintain full interrupting or dielectric ratings. The pole-unit should be removed from service and replaced promptly. Do not operate this Trans-Rupter II.

The remote gas-density Level 2 alarm contact opens at 88% of normal density, or 65 psig at 68°F (20°C). Contacts are normally closed at normal operating gas pressure.

NOTICE

At temperatures below -31°F (-35°C), a Level 2 Alarm may be issued due to the cold temperature. The gas density is below the minimum functional level, so the pole-unit will not have full interrupting or dielectric ratings. **At these temperatures, a Level 2 Alarm does not accurately indicate whether a pole-unit is losing SF_6.**

Pole-Units and Low-Voltage Connection Enclosure

During routine transformer maintenance and/or inspections, the Trans-Rupter II should be visually inspected for the following:

- Excessive corrosion at the terminal pads.
- Discoloration, contamination, or other damage to the pole-unit insulation.
- Excessive terminal-pad loading.
- Excessive corrosion or water ingress inside the low-voltage connection enclosure.
- That the gas-pressure gauge is in the white "OK" to operate zone. See Figure 94. If the gas-pressure gauge is in either the yellow or red zones, the gas density in the pole-unit has dropped. Refer to the instructions on page 43 for "Understanding the Gas-Pressure Gauge."

⚠ CAUTION

DO NOT open the Trans-Rupter II unless the needle on each pole-unit gas-pressure gauge is in the "OK" to operate zone.

Opening the Trans-Rupter II with one or more pole-units in the "REPLACE" zone can damage the transformer.

If any of these conditions are found, notify S&C Electric Company.

On occasions when the transformer is taken out of service for maintenance, the Trans-Rupter II should be tripped, closed, tripped a second time, and finally closed.

Figure 94. Check that the gas-pressure gauge on each pole-unit is in the "OK" to operate zone.

Motor Operators

If furnished, visually inspect the motor operator during routine transformer maintenance and/or inspections for the following:

- Debris or dirt around the operating shaft.
- Discoloration, contamination, or other damage to the motor housing.
- Water ingress inside the motor, or blockage of the aerator hole.
- Excessive wear or contamination of the rubber seal around the operating shaft.

Guidelines for Interrupter Resistance Values

Trans-Rupter II interrupters should have resistance values *under* 200 micro-ohms for a new unit, and *under* 500 micro-ohms for a unit that has been in service. If a Trans-Rupter II unit is outside these values, contact your nearest S&C Sales Office.

Inspection Recommendations

To ensure continued proper performance of the bypass accessory, it should be inspected and exercised on a five year schedule, or whenever general substation maintenance occurs. S&C recommends opening and closing each bypass blade, checking for corrosion or wear on the blades.

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