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. The latest version of this publication is available online in PDF format at **sandc.com/Support/Product-Literature.asp**

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 instruction manual holder of the control cabinet.

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 control cabinet.

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. Their telephone numbers are listed on S&C's website **sandc.com** Or call S&C Headquarters at (773) 338-1000; in Canada, call S&C Electric Canada Ltd. at (416) 249-9171.

⚠ DANGER

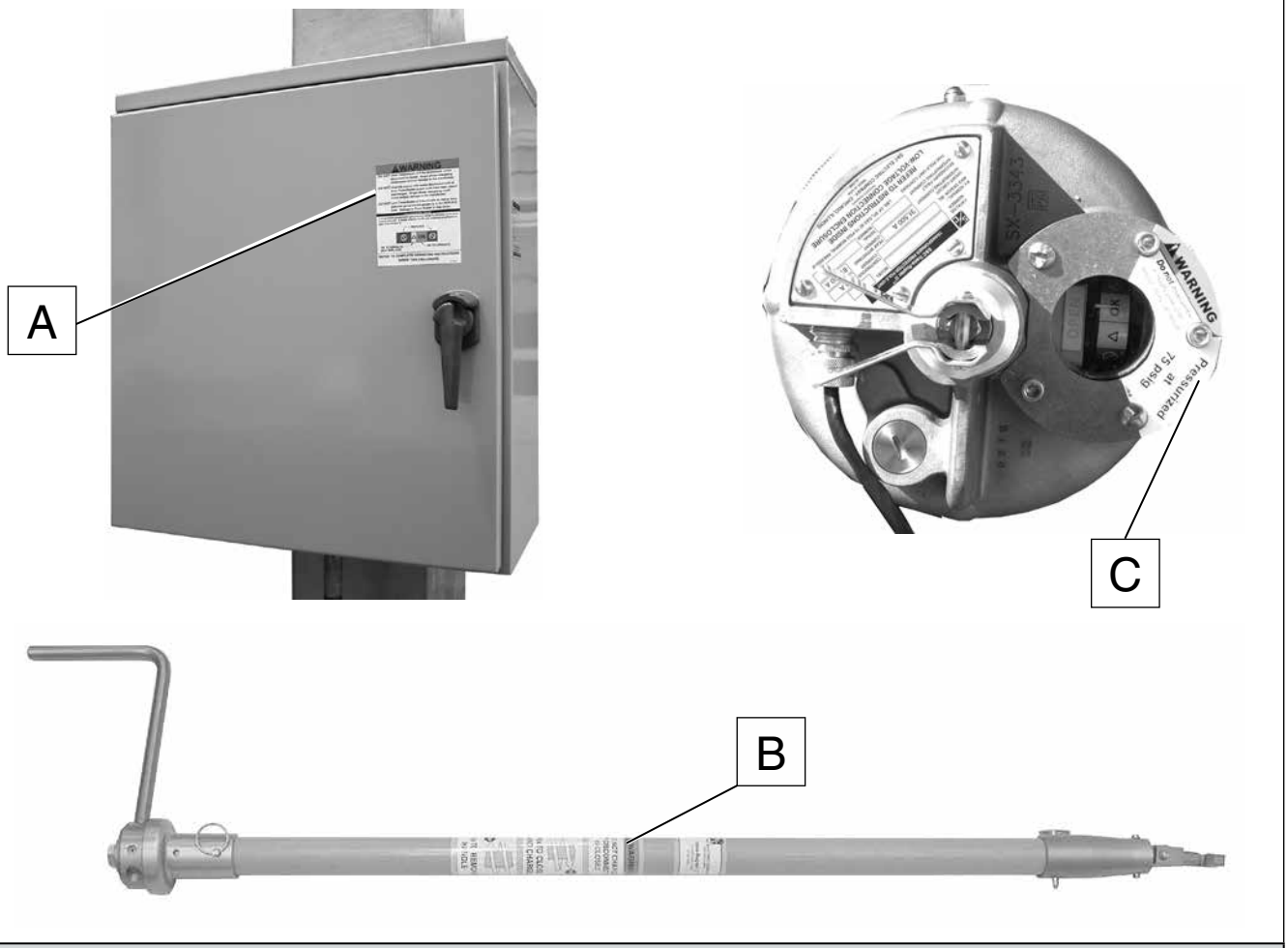
Read this instruction sheet thoroughly and carefully before installing or operating your S&C Trans-Rupter II Transformer Protector.

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 close Trans-Rupter II if the source-side series disconnect is closed.	G-7016R1
B	⚠ WARNING	Do not charge if disconnect is closed.	G-7009-1
C	⚠ WARNING	Do not disassemble or modify pole-units.	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.

Packaging

Each Trans-Rupter II consists of three pole-units, a control cabinet, a manual charging tool, and six terminal pads and their associated hardware. Pole-units are shipped fully pressurized, at 75 psig. 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 control cabinet is packed separately. If furnished, mounting pedestals are shipped separately, bolted to skids. Associated mounting-pedestal hardware is packaged separately and attached to the mounting-pedestal base.

Remove the shipping crate cover. Remove the charging tool and the terminal pads and their hardware from the crate. Remove the control cabinet from its packaging. 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.

⚠ 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.

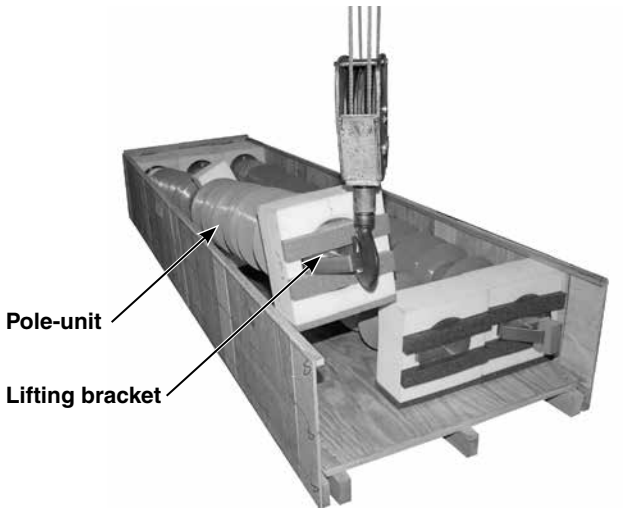


Figure 1. Lift the pole-unit only by the lifting bracket.

⚠ 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 2. Pull the pole-unit carefully upward.

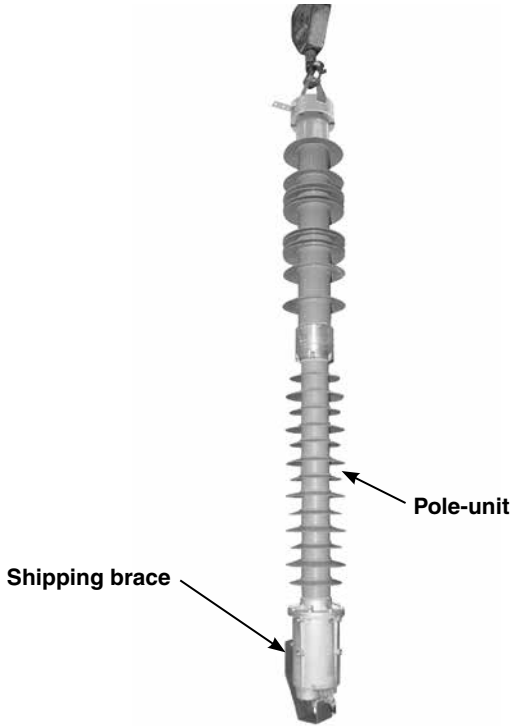


Figure 3. Do not remove the shipping brace at this time.

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.

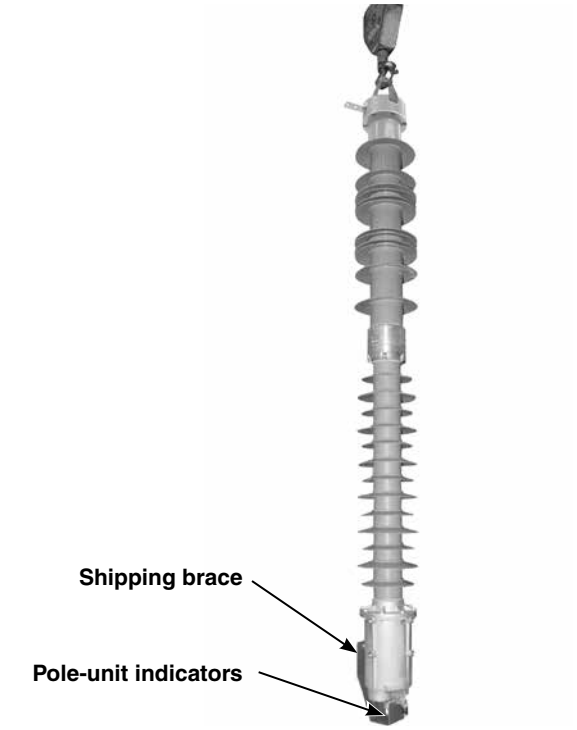


Figure 4. With the pole-unit lifted off the ground, check the gas-pressure gauge on the underside of each pole-unit base.

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.

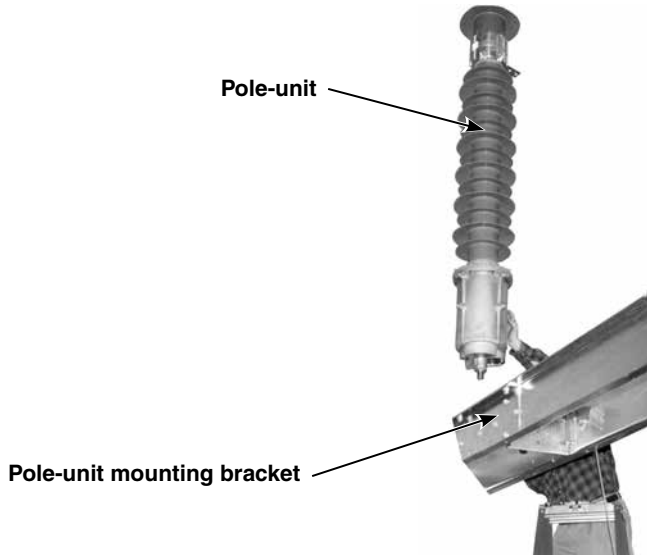


Figure 6. Position the pole-unit base near the pole-unit mounting bracket.

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.

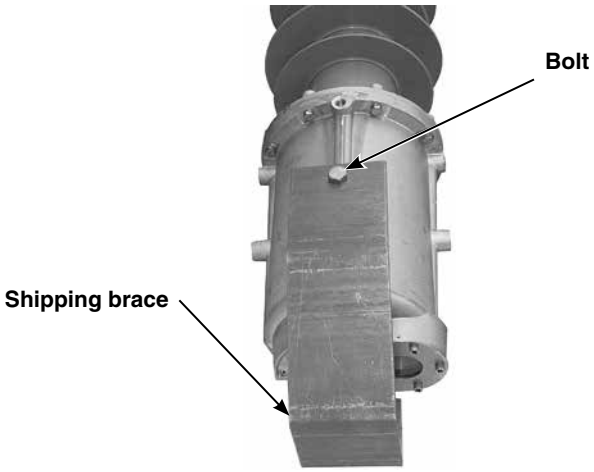


Figure 7. Unbolt the shipping brace.

Step 6

Attach the pole-unit base to the mounting bracket installed in Step 1, using the set of mounting bosses nearest to the bracket. Both the top and bottom mounting bosses must be used. Use the ⅝–11 × 2 stainless-steel studs furnished. Screw each stud until it bottoms, approximately 8 to 9 turns. **DO NOT** remove the hoist sling or lifting device from the pole-unit at this time. See Figure 8.

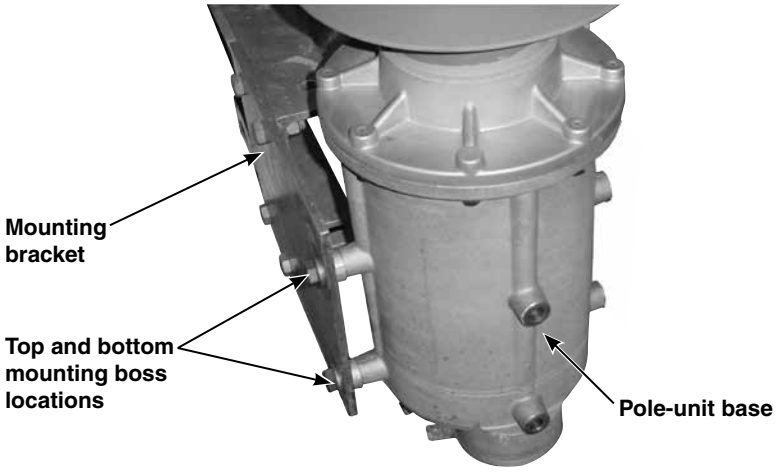


Figure 8. Attach the pole-unit base to the bracket.

Step 7

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. See Figure 9.

⚠ CAUTION

Never exceed the recommended torque limit.

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

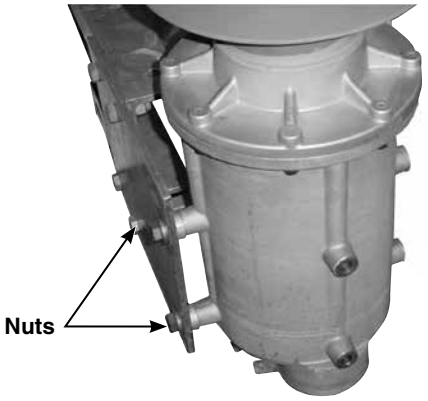


Figure 9. Tighten the nuts.

Step 8

Place a second mounting bracket flush against the bosses on the opposite side of the pole-unit base. Attach the mounting bracket to both the top and bottom mounting bosses. Use shims as required. Then attach the bracket to the structure. Make sure the mounting bracket is aligned with the structure before tightening the studs. See Figure 10.

⚠ CAUTION

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

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

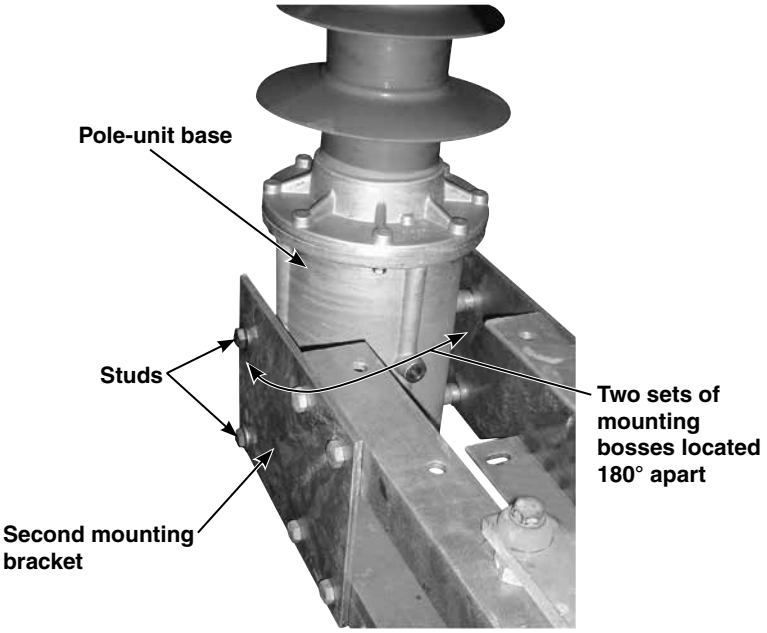


Figure 10. Attach a second mounting bracket to pole-unit base.

Step 9

Tighten the second set of nuts to a torque of 70 to 80 ft.-lbs. See Figure 11.

Step 10

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

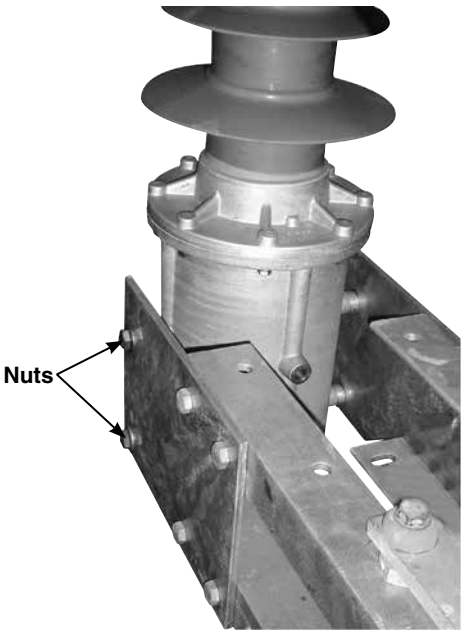


Figure 11. Tighten the nuts.

Mounting the Control Cabinet

Step 11

Drill four 7/16-inch diameter holes in the structure where the control cabinet 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 12.

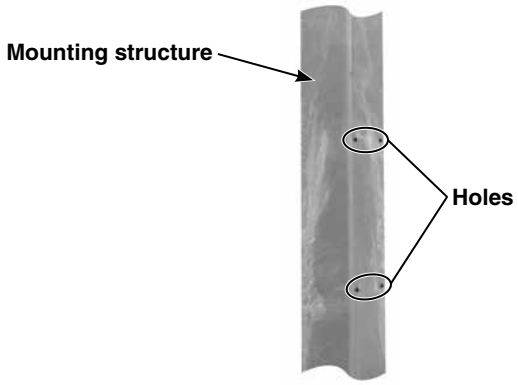


Figure 12. Drill four holes in the structure where the control cabinet will be mounted.

Step 12

Align the control cabinet tabs with the mounting holes in the structure. Then bolt all four tabs to the mounting structure, using user-furnished 3/8-inch hardware. See Figure 13.

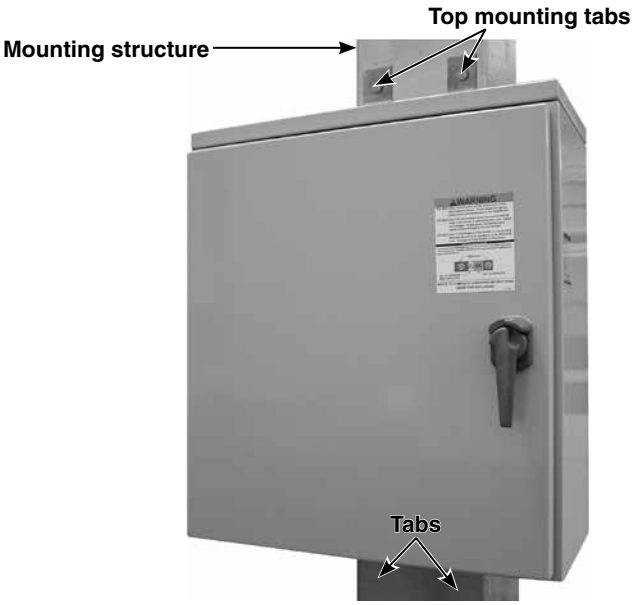


Figure 13. Bolt the tabs of the control cabinet to the mounting structure.

Step 13

Ground the control cabinet by solidly connecting one Number 6 AWG wire (or wires of equivalent cross-sectional area) to the flange at the bottom rear of the enclosure. See Figure 14. Solidly connect the enclosure ground wire to the switch ground wire(s).

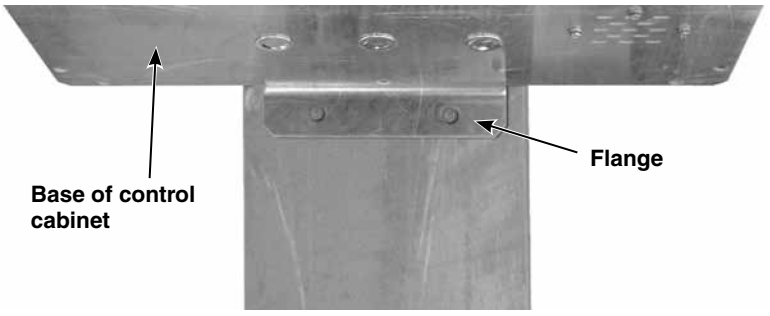


Figure 14. Ground the control cabinet by solidly connecting one Number 6 AWG wire (or wires of equivalent cross-sectional area) to the flange at the bottom rear of the enclosure.

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 cabinet. Then remove the plate and punch the necessary opening(s). Replace the conduit-entrance plate. See Figure 15.

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.**

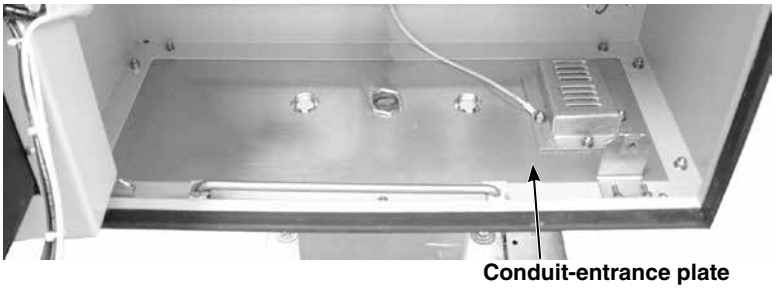


Figure 15. If additional holes for control wiring are required, remove the conduit-entrance plate and punch the necessary opening(s).

Connecting Pole-Units to the Control Cabinet

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 16 and 17.

⚠ WARNING

DO NOT REMOVE the window bolts.

The pole-unit is pressurized to 75 psig.

Serious injury could occur.

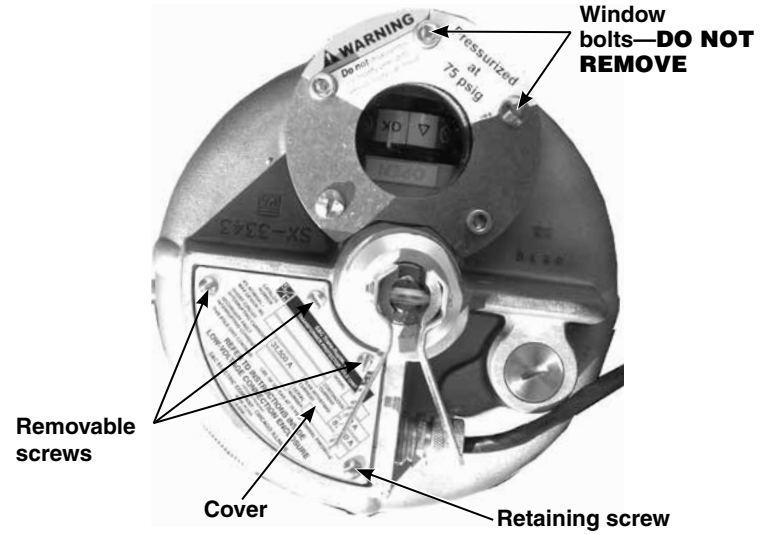


Figure 16. Remove the three removable screws at each pole-unit electrical junction box cover. Loosen the fourth retaining screw.

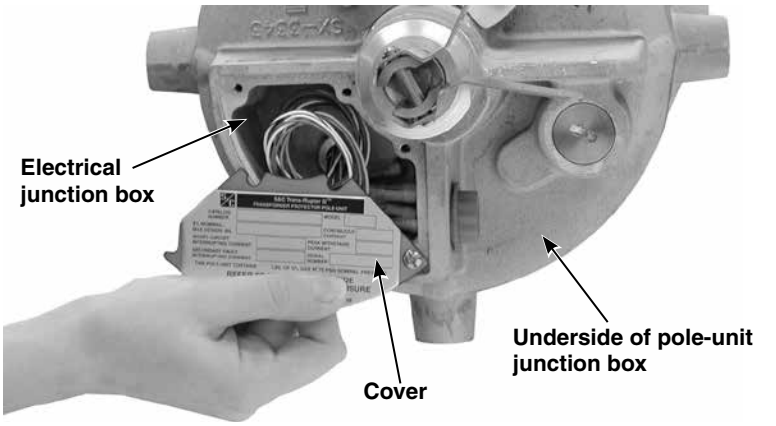


Figure 17. Swing out the cover to access the wiring inside the electrical junction box.

Step 16

Prepare appropriate lengths of conduit to connect the pole-unit electrical junction boxes to the control-circuit conduit. Using watertight fittings, attach the conduit to the junction boxes and to the hole(s) along the bottom of the control cabinet. See Figure 18.

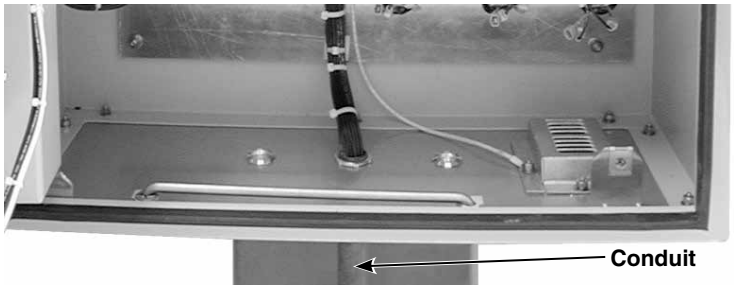


Figure 18. Attach the conduit to the hole(s) along the bottom of the connection enclosure.

Step 17

Following the wiring diagram furnished, connect user-furnished wiring to the appropriate terminal blocks in the control cabinet and to the wiring inside the electrical junction boxes. Use the butt splices attached to the junction-box wiring. The butt splices accommodate 18 to 22 AWG wire. Use of 18-gauge wire is recommended. See Figure 19.

NOTICE

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

Figure 19. Connect pole-unit wiring to terminal blocks in control cabinet, 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 20.

Go to Step 54 on page 32 for installing optional motor operators.

Go to Step 60 on page 34 for connecting user-furnished protective relays and control power.

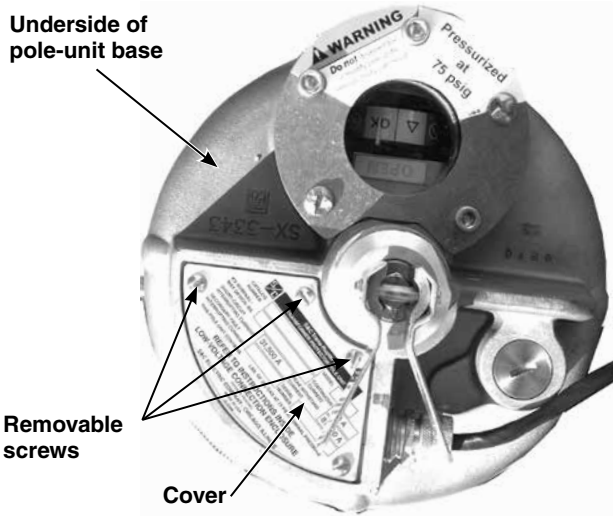


Figure 20. Securely tighten the screws of the electrical junction box cover.

⚠ 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 21.

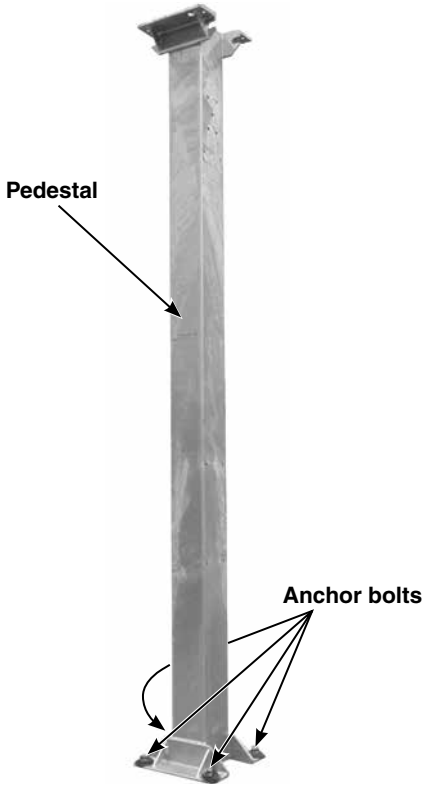


Figure 21. Adjust the lower set of anchor-bolt nuts to generally plumb and level the pedestals.

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 22.

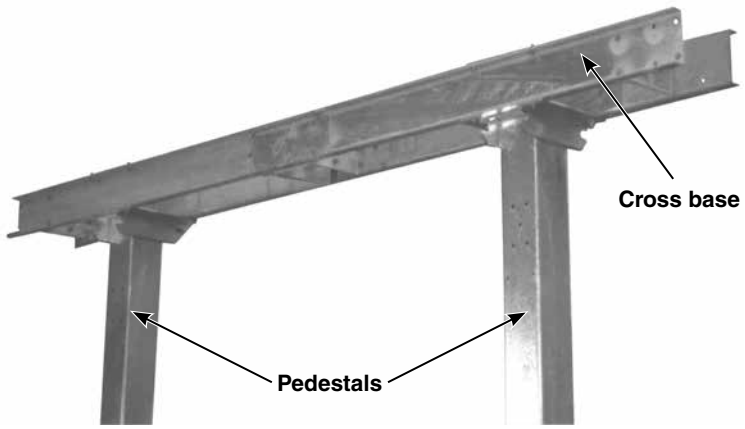


Figure 22. Lift the cross base atop the mounting pedestals.

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 23.

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 24.

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 25.

Step 26

Securely tighten the upper set of anchor-bolt nuts at each mounting pedestal. See Figure 25.

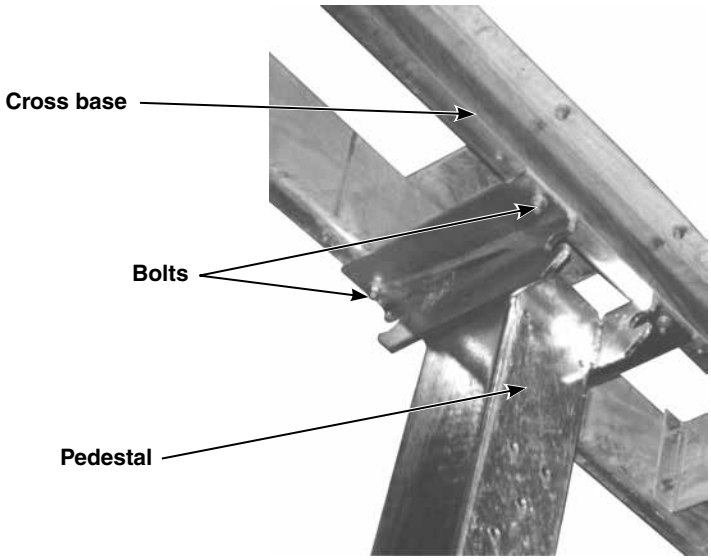


Figure 23. Bolt the cross base to the pedestals.

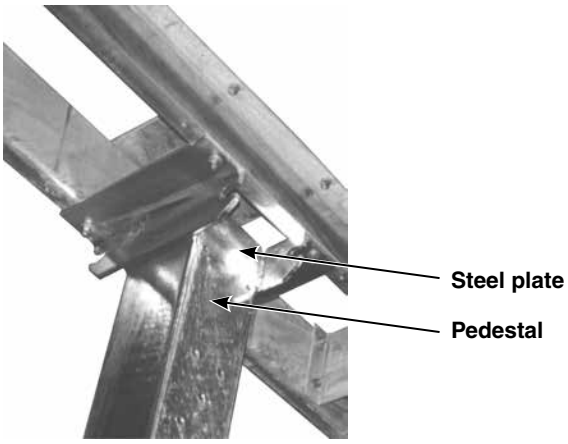


Figure 24. Slip the furnished steel plates over the top of each pedestal.

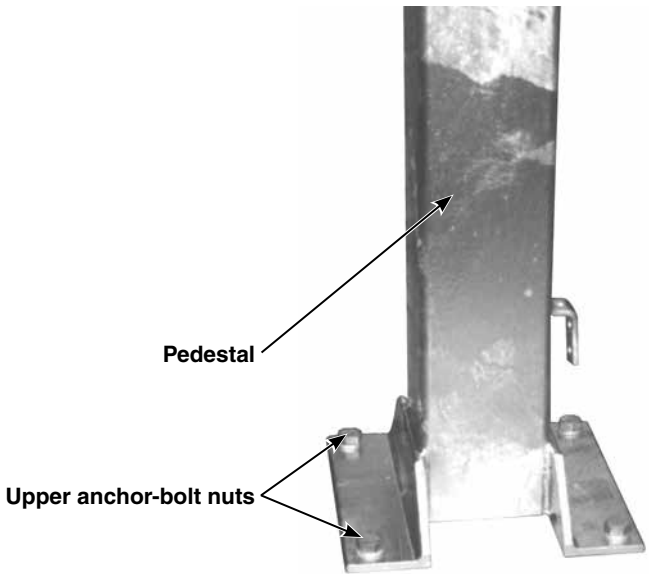


Figure 25. Securely tighten the upper set of anchor-bolt nuts at each mounting pedestal.

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 26, 27, and 28.

⚠ CAUTION

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

Damage to the operating shaft can occur.

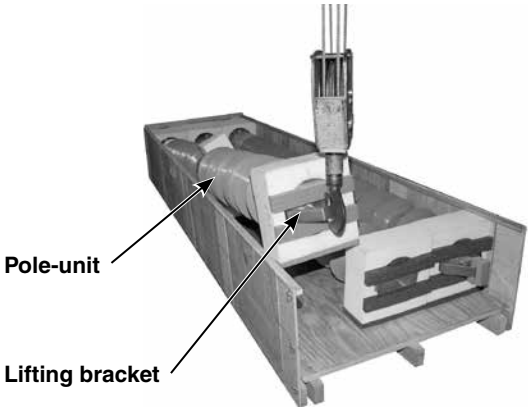


Figure 26. Lift the pole-unit only by the lifting bracket.

Figure 27. Pull the pole-unit carefully upward.

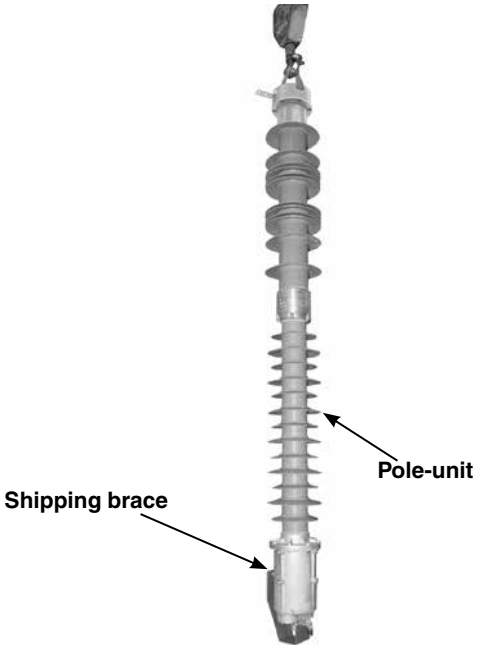


Figure 28. Do not remove the shipping brace at this time.

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 29 and 30.

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.**

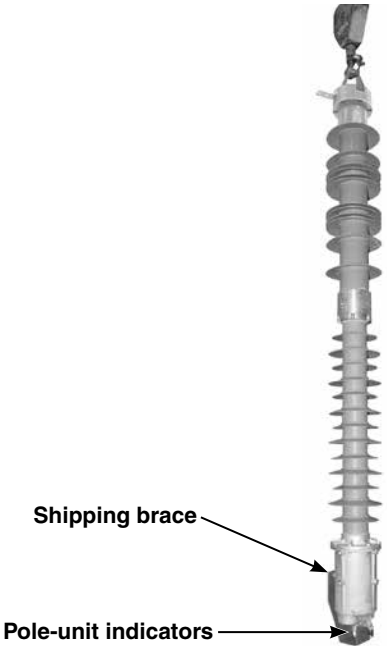


Figure 29. With the pole-unit lifted off the ground, check the gas-pressure gauge on the underside of each pole-unit base.

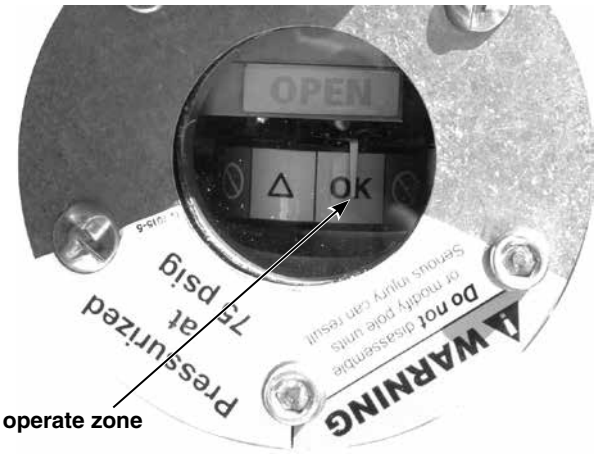


Figure 30. Check that the gas-pressure gauge on each pole-unit is in the "OK" to operate zone.

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 31.

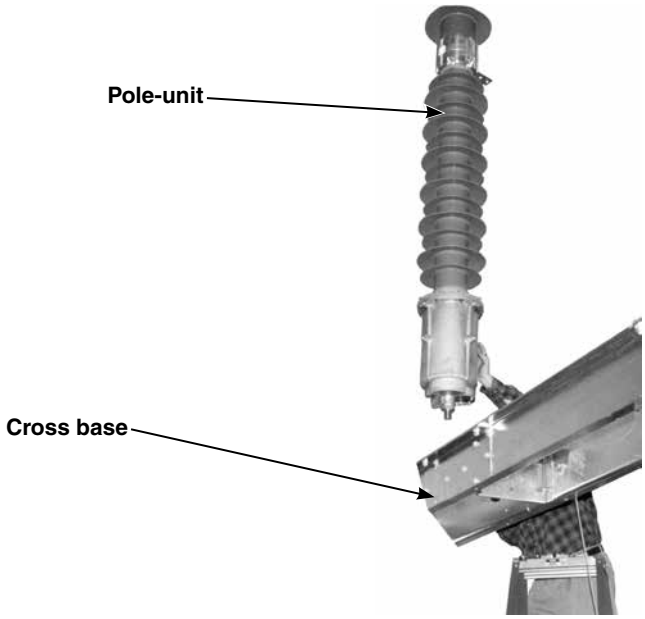


Figure 31. Position the pole-unit base just above the cross base.

Step 30

Remove the shipping brace from the pole-unit base. See Figure 32.

⚠ CAUTION

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

Damage to the operating shaft can occur.

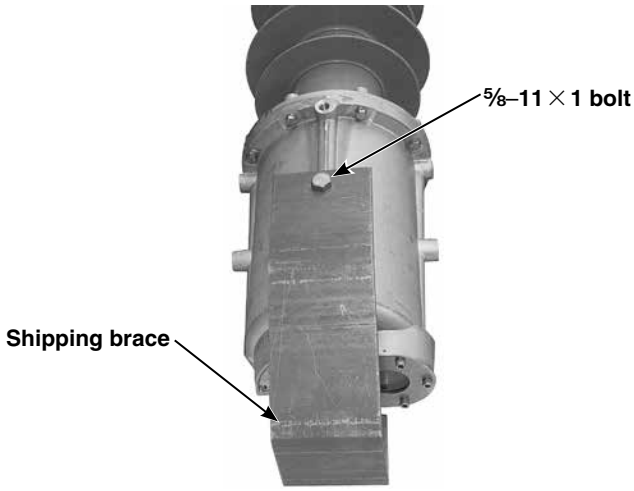


Figure 32. Unbolt the shipping brace.

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 mounting bracket. See Figure 33.

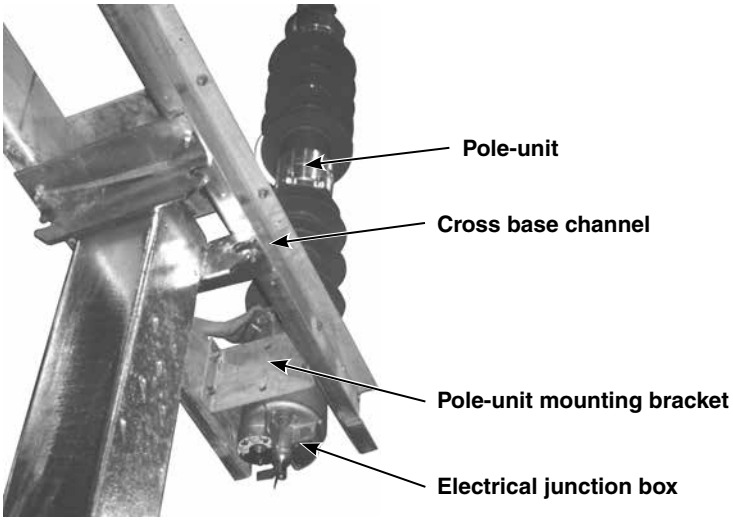


Figure 33. Place the pole-unit in the cross base channel so that the mounting bosses are aligned with the holes on the cross base and pole-unit mounting bracket.

Step 32

Attach the pole-unit base to the mounting bracket and both sides of the cross base using the ⅝–11 stainless-steel studs furnished. Both the top and bottom mounting bosses must be used. Screw each stud until it bottoms, approximately 8 to 9 turns. **DO NOT** remove the hoist sling or lifting device from the pole-unit at this time. See Figure 34.

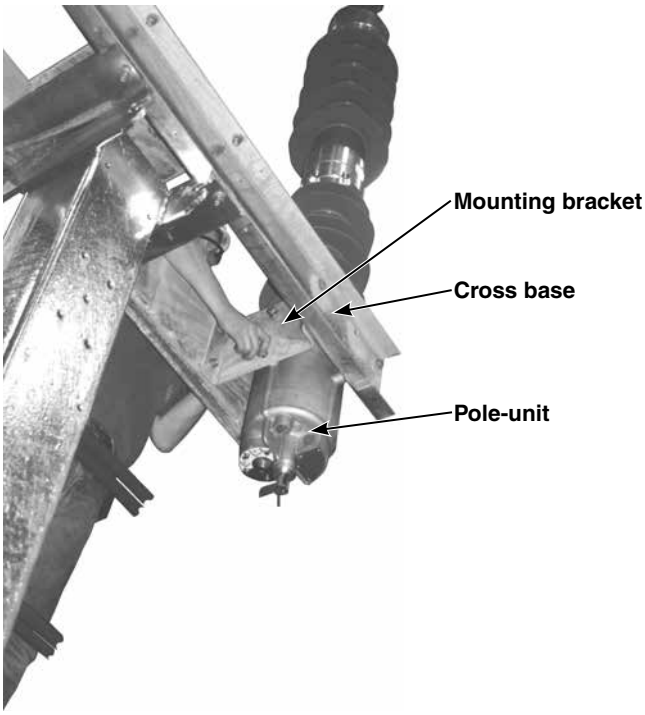


Figure 34. Attach the pole-unit base to the mounting bracket and both sides of the cross base.

Step 33

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 split washer on each stud. See Figure 35.

⚠ CAUTION

Never exceed the recommended torque limit.

Damage to the pole-unit may occur.

Step 34

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

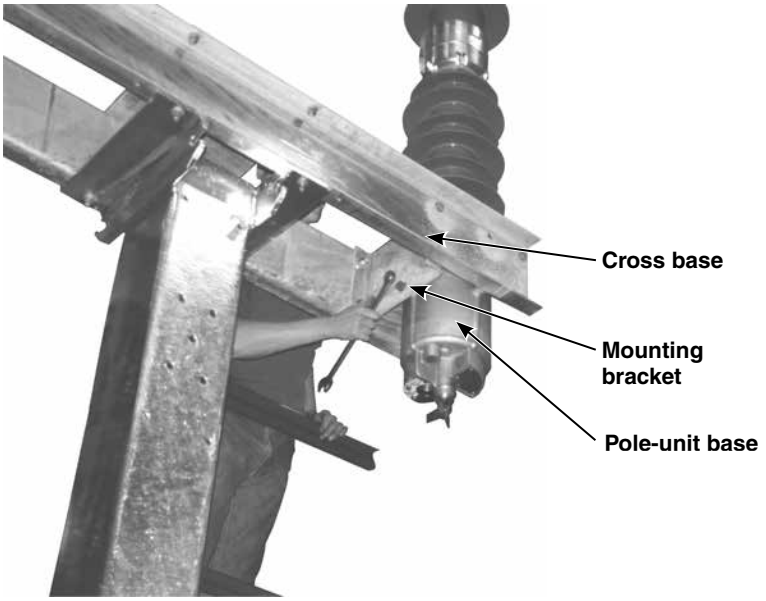


Figure 35. Tighten the nuts.

Mounting the Control Cabinet

Step 35

Attach the control cabinet to the pedestal along which the conduit will run. Align the control cabinet tabs with the mounting holes in the pedestal. Then bolt all four tabs to the pedestal, using the ⅜–16 × 9 carriage bolts furnished. See Figure 36.

Figure 36. Bolt the tabs of the control cabinet to the pedestal.

Step 36

Ground the control cabinet by solidly connecting one Number 6 AWG wire (or wires of equivalent cross-sectional area) to the flange at the bottom rear of the enclosure. See Figure 37. Solidly connect the enclosure ground wire to the switch ground wire(s).

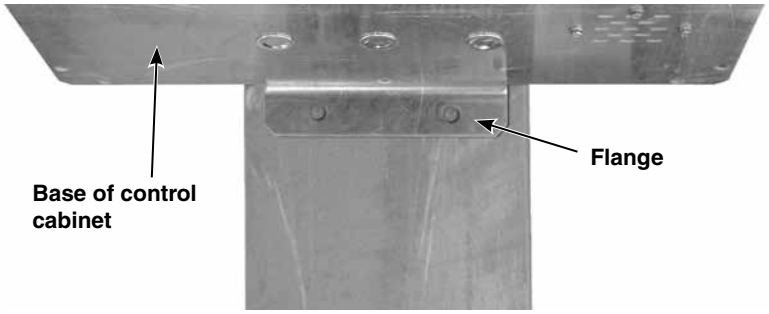


Figure 37. Ground the control cabinet by solidly connecting one Number 6 AWG wire (or wires of equivalent cross-sectional area) to the flange at the bottom rear of the enclosure.

Step 37

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

Step 38

To add holes for control-circuit conduit(s) for relays and control power, mark the location(s) on the conduit-entrance plate at the bottom of the cabinet. Then remove the plate and punch the necessary opening(s). Replace the conduit-entrance plate. See Figure 38.

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.**

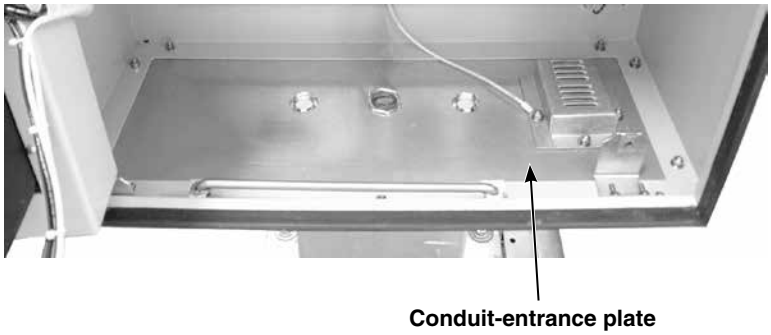


Figure 38. If additional holes for control wiring are required, remove the conduit-entrance plate and punch the necessary opening(s).

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 opposite the control cabinet. Make sure the conduit is placed along the pedestal to which the control cabinet is attached. Position the conduit ends near the electrical junction boxes of the pole-units. See Figure 39.

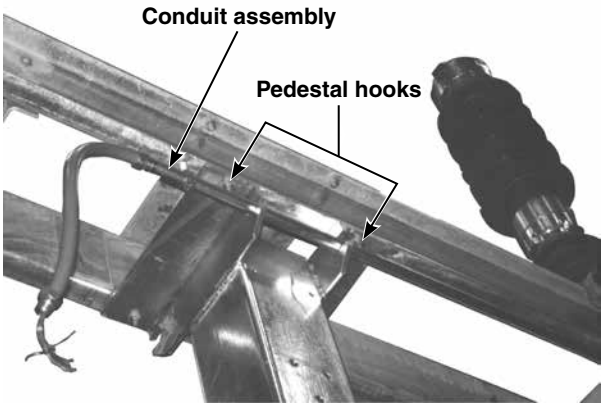


Figure 39. Set the conduit assembly in the hooks at the top of the pedestals.

Step 40

Using the offset mounting brackets, attach the conduit assembly to the cross base. Bolt the brackets through the predrilled holes. See Figure 40.

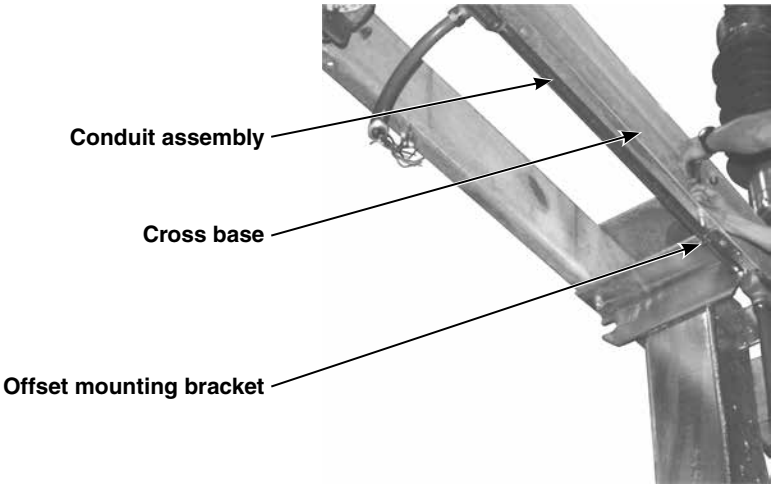


Figure 40. Using the offset mounting brackets, attach the conduit assembly to the cross base.

Step 41

Using the offset mounting brackets, attach the conduit assembly to the pedestal. See Figure 41.

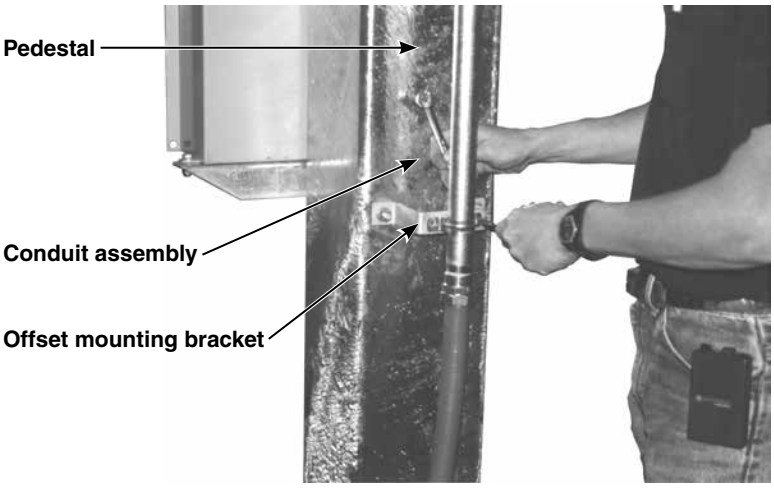


Figure 41. Using the offset mounting brackets, attach the conduit assembly to the pedestal.

Wiring the Pole-Unit Connections

For optional quick-connect control cable skip to Step 44.

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 42 and 43.

⚠ WARNING

DO NOT remove the window bolts.

The pole-unit is pressurized to 75 psig.

Serious injury could occur.

Step 43

Following the wiring diagram furnished, connect the conduit wiring to the wiring inside the electrical junction boxes. Use the butt splices attached to the junction-box wiring. The butt splices accommodate 18 to 22 AWG wire. Use of 18-gauge wiring is recommended.

NOTICE

To ensure proper crimping of the butt splices, use the Panduit controlled-cycle hand tool (CT-1550), or equivalent 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 44.

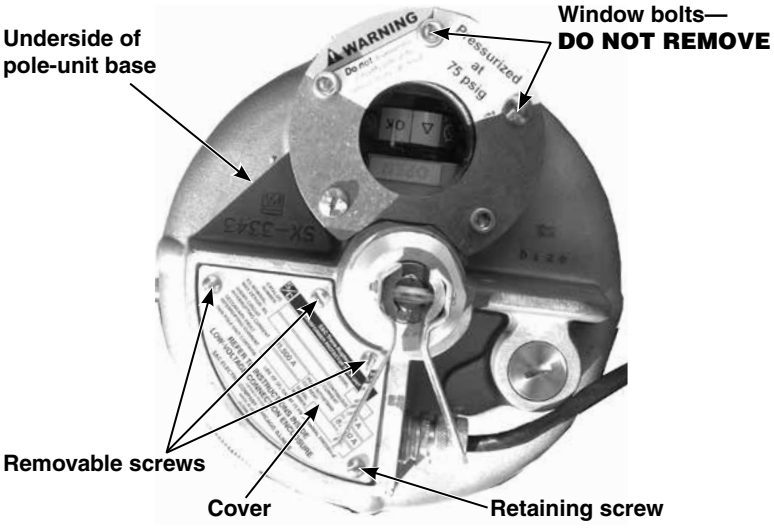


Figure 42. Remove the three removable screws at each pole-unit electrical junction box cover. Loosen the fourth retaining screw.

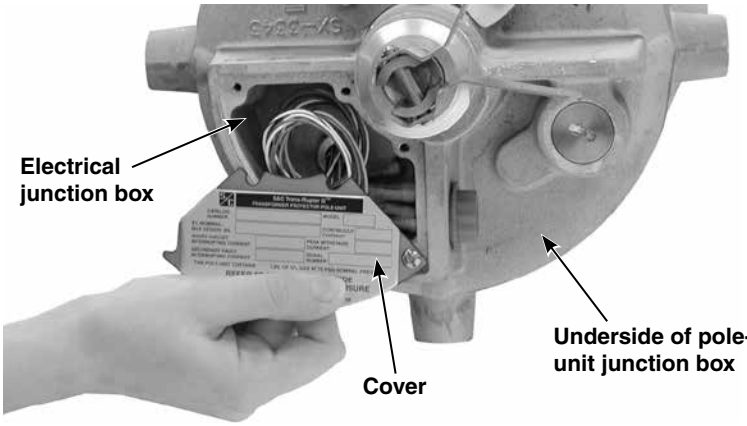


Figure 43. Swing out the cover to access the wiring inside the electrical junction box.

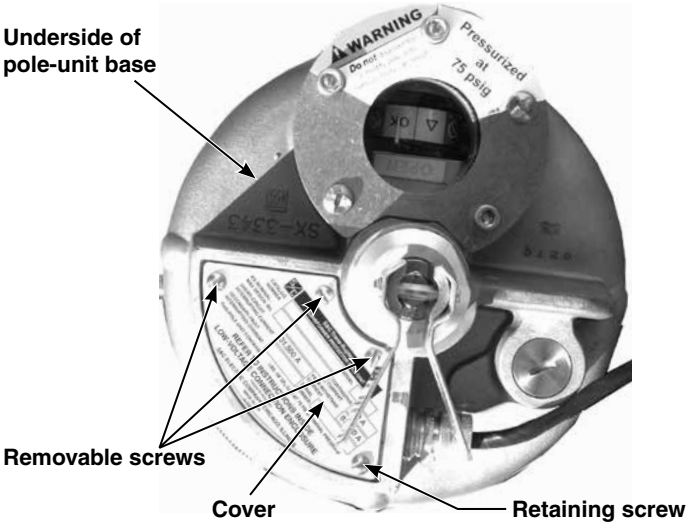


Figure 44. Securely tighten the screws of the electrical junction box covers.

Step 45

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

The male plug is keyed to the female socket. See Figure 45. Push the plug into the socket and turn the black ring until the red line around the outside of the socket is obscured. See Figures 46 and 47.

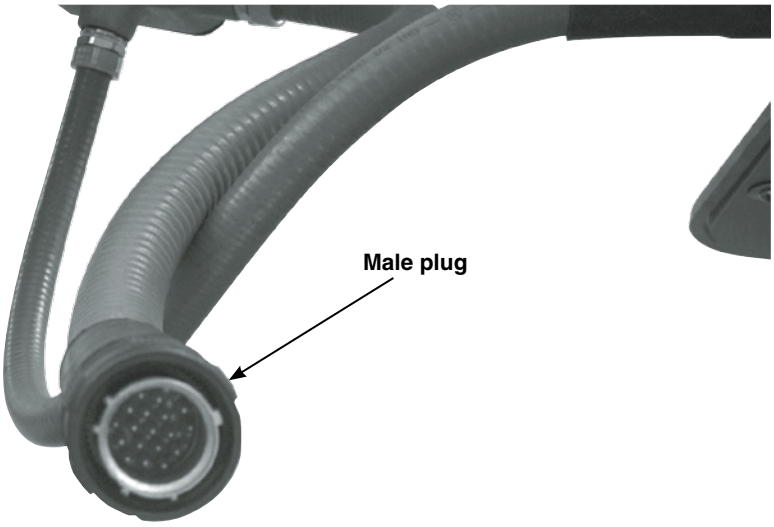


Figure 45. Optional quick-connect control cable.

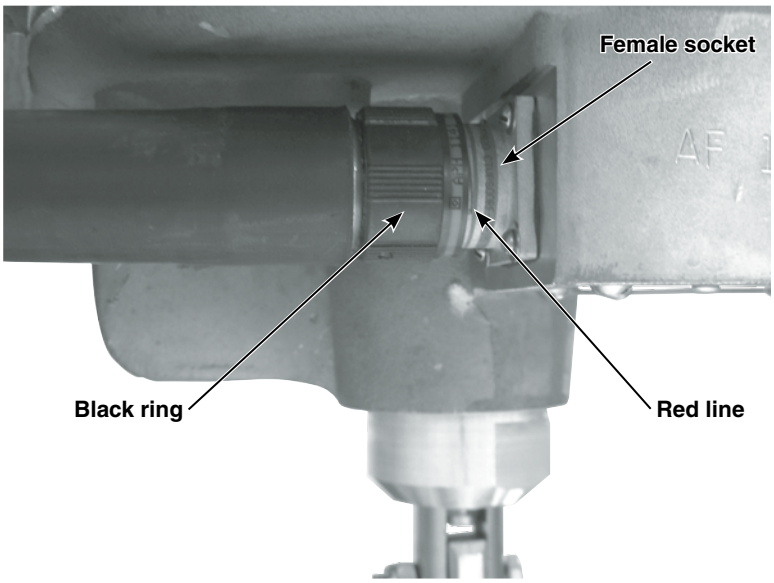


Figure 46. Turn ring until red line is obscured.

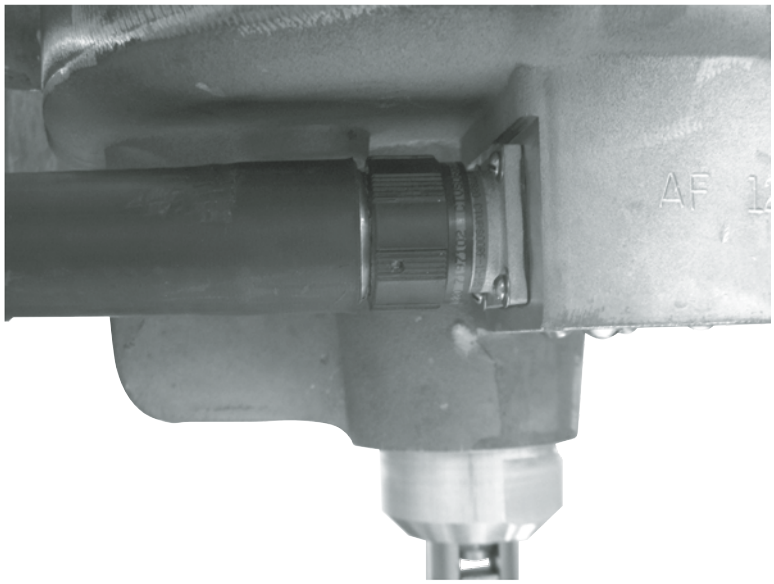


Figure 47. Quick connector fully tightened.

Step 46

Attach the conduits for pole-unit wiring and control-circuit wiring to the punched holes on the cabinet bottom, then pull the wires through to the connection enclosure. Be sure that the fittings are properly sealed to prevent water ingress. See Figure 48.

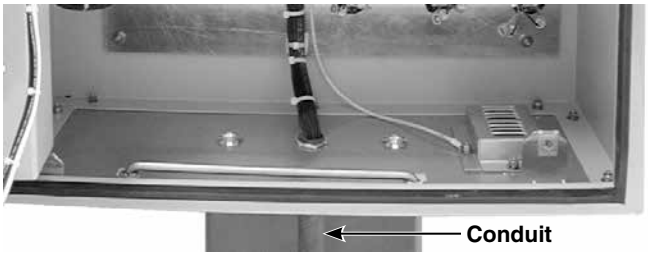


Figure 48. Attach the conduit for pole-unit wiring to the punched holes on the enclosure bottom.

Step 47

Connect the pole-unit wiring and user-furnished control-circuit wiring to the appropriate termination blocks in the control cabinet, in accordance with the wiring diagram furnished. See Figure 49.

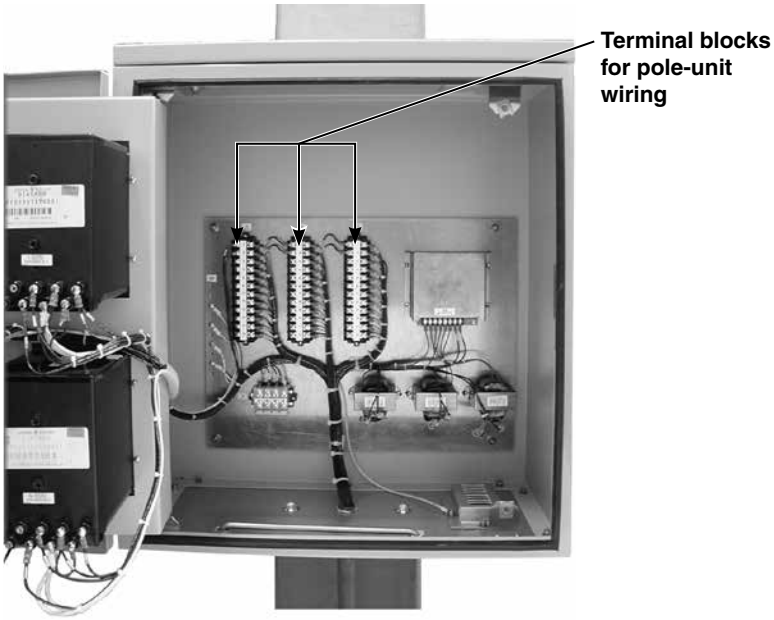


Figure 49. Connect pole-unit wiring to terminal blocks in the control cabinet, in accordance with the wiring diagram furnished.

Connecting Current Transformers to the Control Cabinet

Before connecting current transformers, the relays inside the Model SE control cabinet should be configured in accordance with the instructions in the furnished relay manual.

NOTICE

Make sure the CTs conform to the allowable values listed S&C Data Bulletin 731-60. **If these guidelines are not followed, the overcurrent protection system may not function properly.**

Step 48

Following the wiring diagram furnished, connect user-furnished current transformers (CTs) to the shorting blocks in the control cabinet. Follow standard operating procedures for connecting CTs to relaying equipment. See Figure 50.

⚠ CAUTION

DO NOT connect any monitoring devices to the Model SE trip-energy circuit.

The trip-energy supply cannot support additional loads.

Failure of the Trans-Rupter II to open when signaled could result.

NOTICE

The manual trip device cannot be used to test the trip-energy supply, and vice versa. Current from each device is connected directly to the trip solenoid and is prevented from powering the other device (diode blocked).

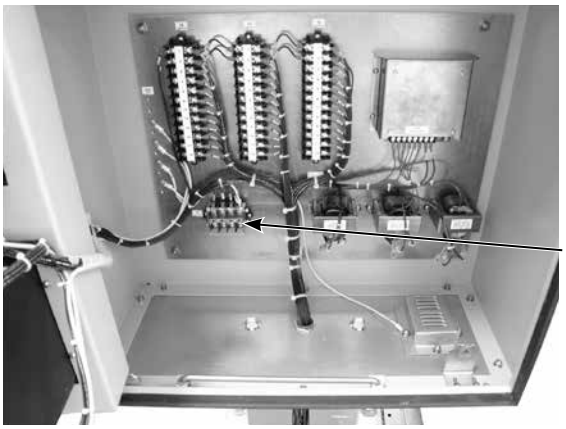


Figure 50. Following the wiring diagram furnished, connect user-furnished CTs to the shorting blocks in the control cabinet.

Testing Control Devices

Steps 48 through 52 detail procedures for verifying proper operation of control components. If any control device does not meet the criteria detailed in the procedures below, stop the installation and notify S&C Electric Company.

Repeat Steps 48 through 50 for each relay.

Step 49

Pole-units are shipped in the "OPEN" and discharged position. Close and charge each pole-unit as follows:

a. Guide the hooked end of the charging tool between the ears of the pole-unit operating shaft and engage the operating shaft pin. See Figures 51, 52, and 53.

⚠ CAUTION

Use only the manual charging tool provided by S&C for charging and closing pole-units.

Use of any other tool can damage Trans-Rupter II.

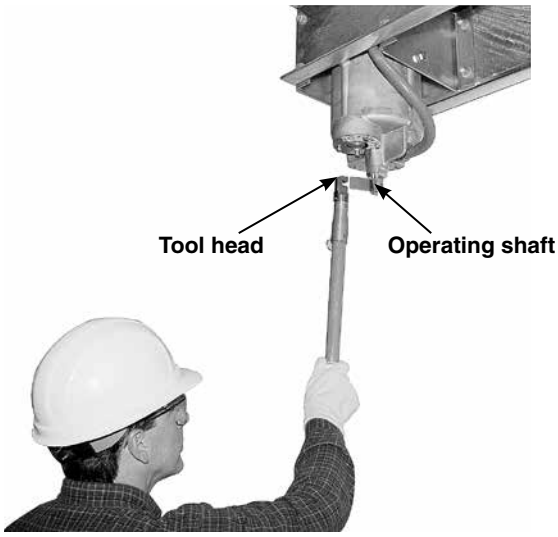


Figure 51. Guide the hooked end of the charging tool between the ears of the operating shaft.

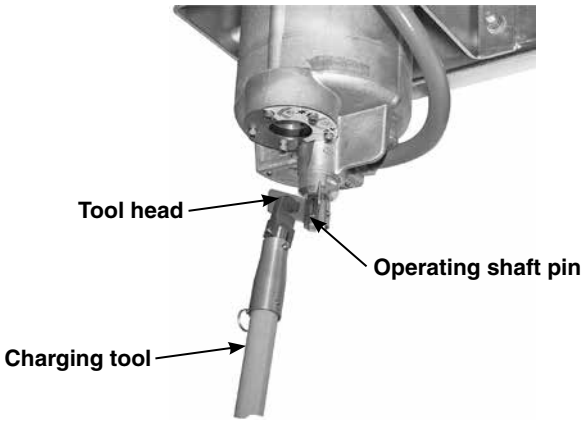


Figure 52. Engage the operating shaft pin.

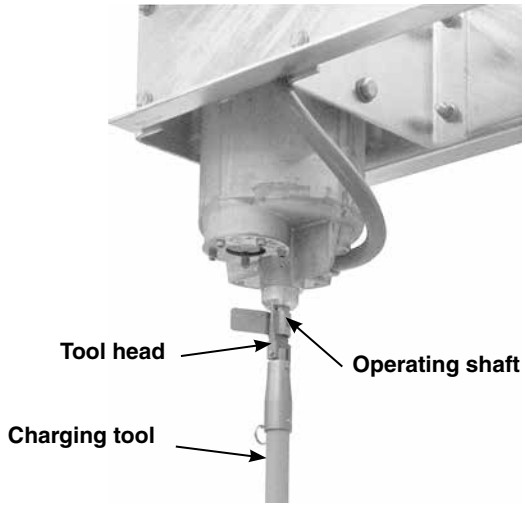


Figure 53. Make sure the operating shaft pin is engaged (shown).

b. Rotate the charging tool handle *counter-clockwise*, as indicated on the tool, to close and charge the pole-unit. See Figure 54. Approximately 40 revolutions are needed. Keep turning until the internal stop is reached. The torque limiter will slip after this point. The charging tool cannot be removed until this step has been completed, so **DO NOT** attempt to remove the tool at this time.

c. Rotate the charging tool handle *clockwise*, as indicated on the tool, to reset the pole-unit mechanism. See Figure 55. Approximately 40 revolutions are needed. Keep turning until the internal stop is reached. Then remove the charging tool.

⚠ CAUTION

The charging tool must be removed from the pole-unit when it is fully closed and charged. **Leaving the tool on a pole-unit can prevent proper operation of Trans-Rupter II.**

d. Check that the pole-unit position indicator is "CLOSED" and charged. If the pole-unit position indicator shows "OPEN" and discharged, repeat Steps a through c. See Figure 56.

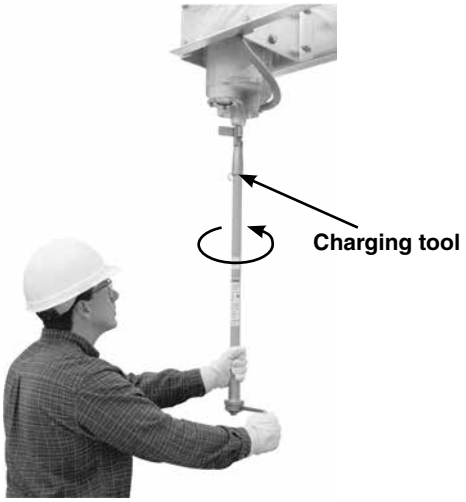


Figure 54. Rotate the tool handle counterclockwise until the internal stop is reached.

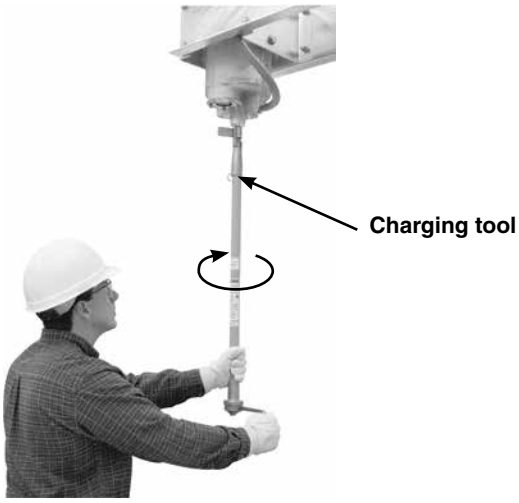


Figure 55. Rotate the tool handle clockwise until the internal stop is reached.

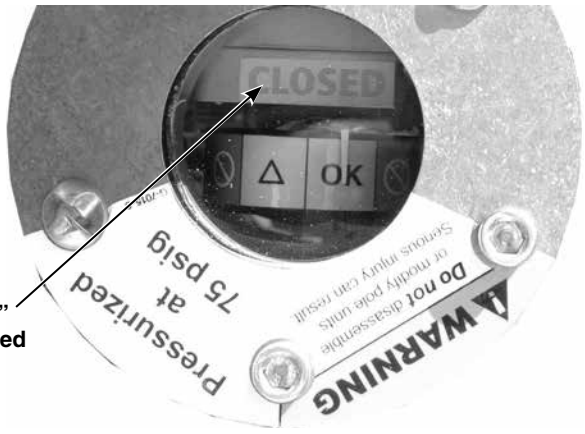


Figure 56. Check that the pole-unit position indicator is in the "CLOSED" and charged position.

Step 50

To initiate a trip operation, inject secondary current into the relay. Refer to the relay manufacturer's instructions.

Step 51

Verify that the pole-units operated properly. Check that each pole-unit position indicator shows "OPEN" and discharged. See Figure 57.

Step 52

To initiate a trip operation, inject secondary current into the relay. Refer to the relay manufacturer's instructions.

To check operation of the trip-energy supply, inject single-phase secondary current above 600 mA, but *below* the pick-up setting of the relays, into the trip-energy supply, with 600 mA input current the trip-energy supply will charge in approximately 3 seconds. Use a user-furnished secondary current-injection kit as follows:

a. **If an optional test switch *is* furnished,** remove the test-switch cover and inject secondary current in accordance with standard operating procedure. See Figure 58.

b. **If the optional test switch *is not* furnished,** use the CT shorting blocks in the control cabinet to inject secondary current. Use the furnished pins to short the CTs, then inject secondary current, in accordance with standard operating procedures. See Figure 59.

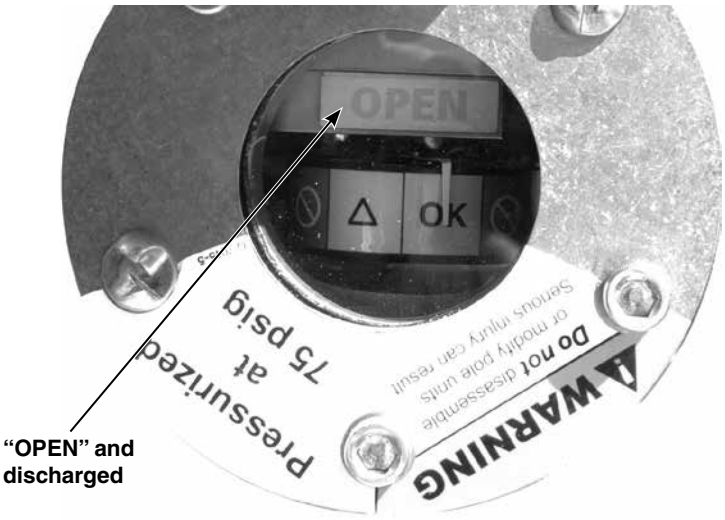


Figure 57. Check that each pole-unit position indicator shows "OPEN" and discharged.

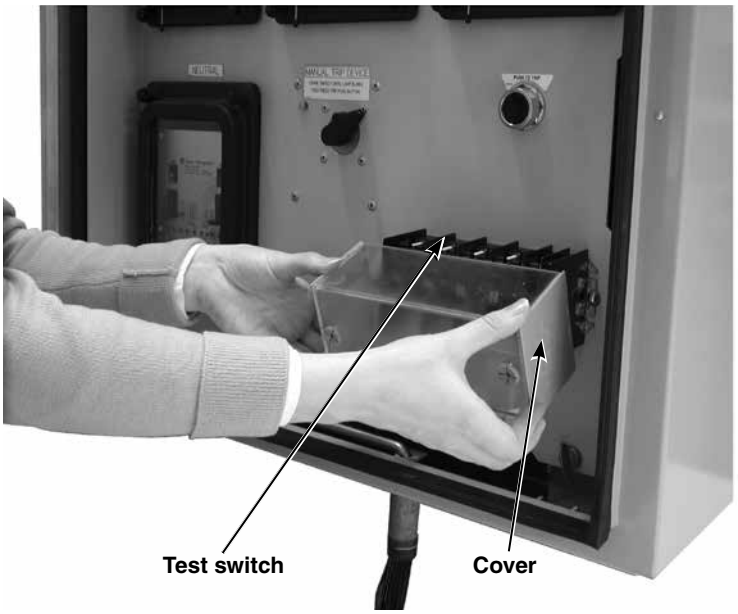


Figure 58. Remove the test-switch cover and inject secondary current, in accordance with standard procedure.

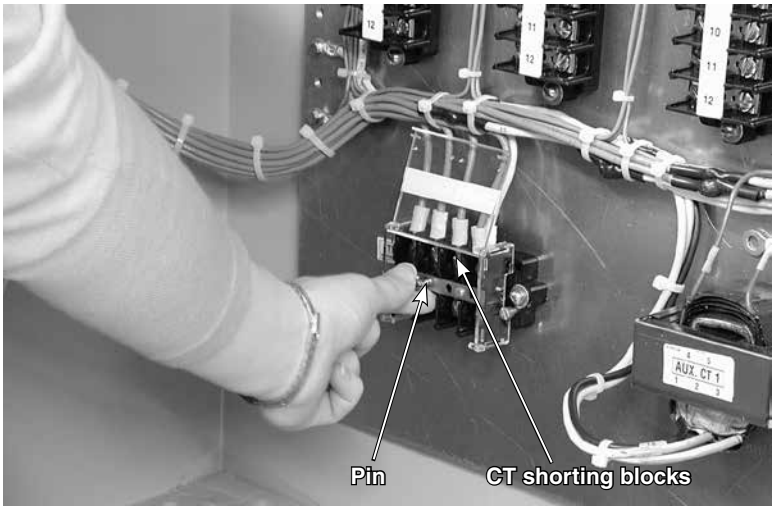


Figure 59. If optional test switch *is not* furnished, place pins in the CT shorting blocks.

Step 53

To initiate a trip operation, inject secondary current into the relay. Refer to the relay manufacturer's instructions.

Verify that the trip-energy supply is storing energy. Open the swing out panel to access the circuit board of the trip-energy supply. Press the push button on the circuit board. See Figure 60. If the trip-energy supply is functioning properly, the red LED on the board will light continuously.

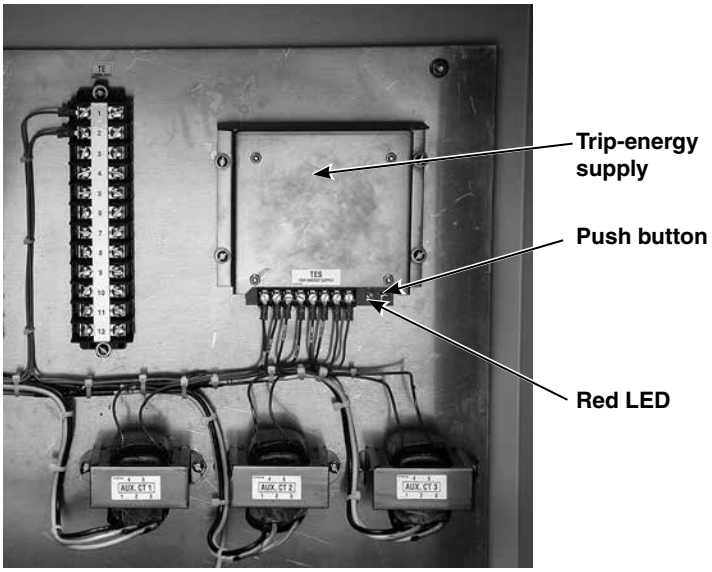


Figure 60. To verify the trip-energy supply is storing energy, press the push button on the trip-energy supply circuit board. If the trip-energy supply is functioning properly, the red LED on the board will light continuously.

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 34 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 54

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 55

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 61. 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.

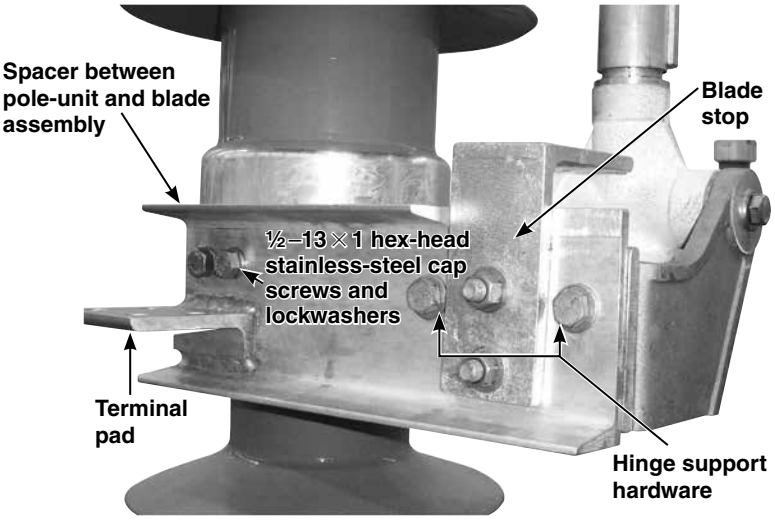


Figure 61. Attach lower bypass blade assembly. Rear view.

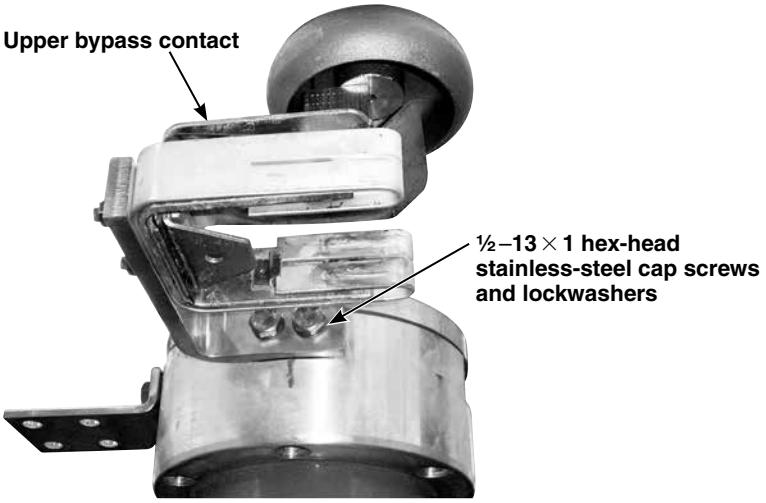


Figure 62. Attach the upper bypass contact to the pole-unit.

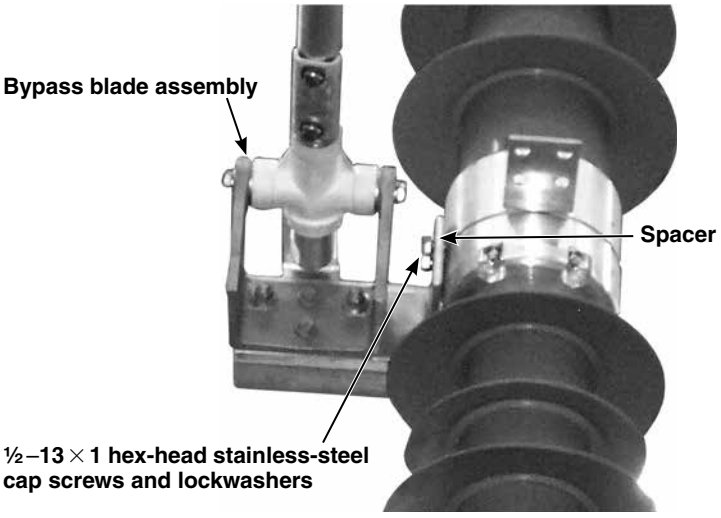


Figure 63. Attach lower bypass blade assembly. Front view.

Step 56

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 to 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 62 and 63 on page 32.

Step 57

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 63. If the blade assembly needs adjustment, loosen the hinge support and blade stop bracket hardware. See Figure 64. 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.

Operation

Step 58

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 65.

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. See Figure 64.

Step 59

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

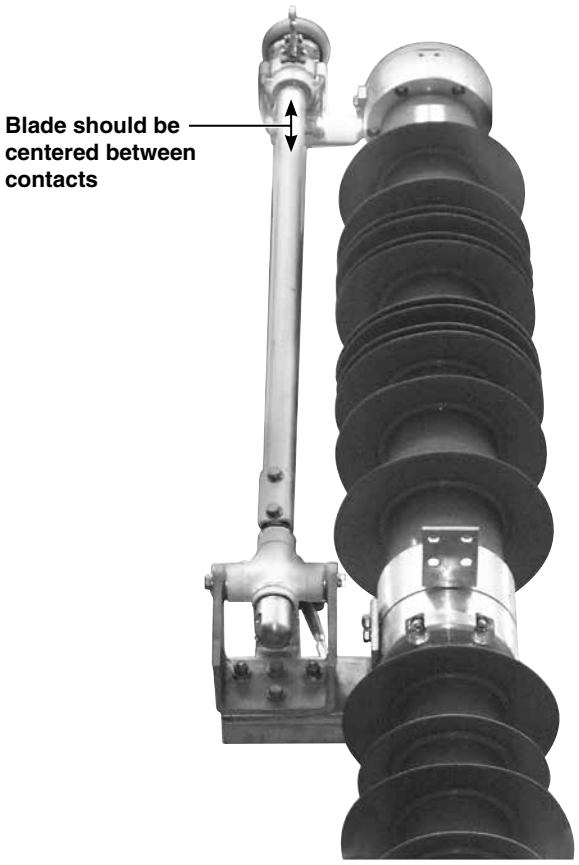


Figure 64. Center blade between contacts. Blade in bypass position.

Figure 65. Bypass in open position.

Installing the Terminal Pads

Step 60

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. See Figures 66 and 67.

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

Step 61

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

Step 62

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 Figures 66 and 67.

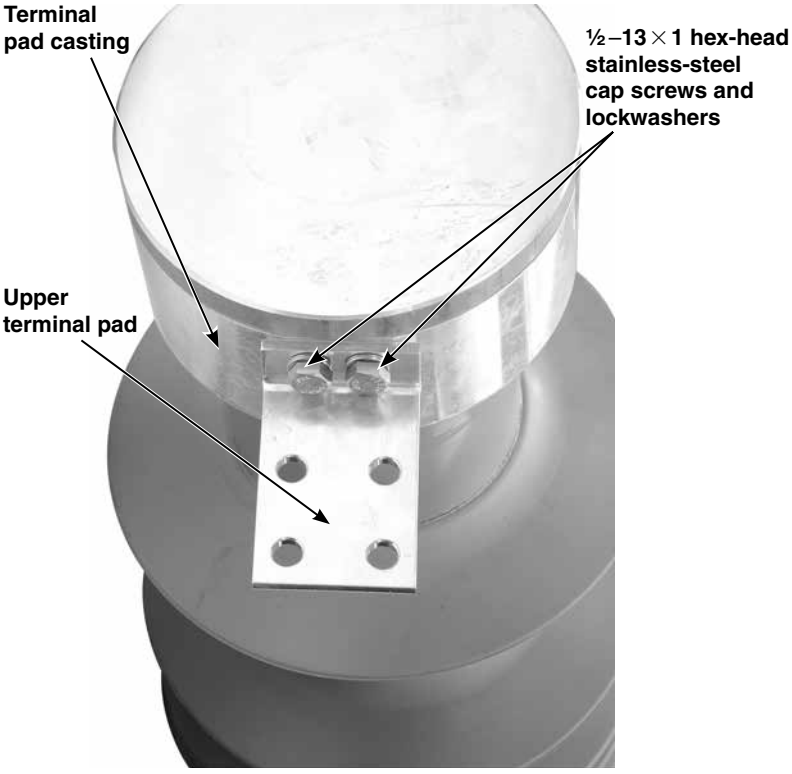


Figure 66. Bolt the upper terminal pad to the pole-unit.

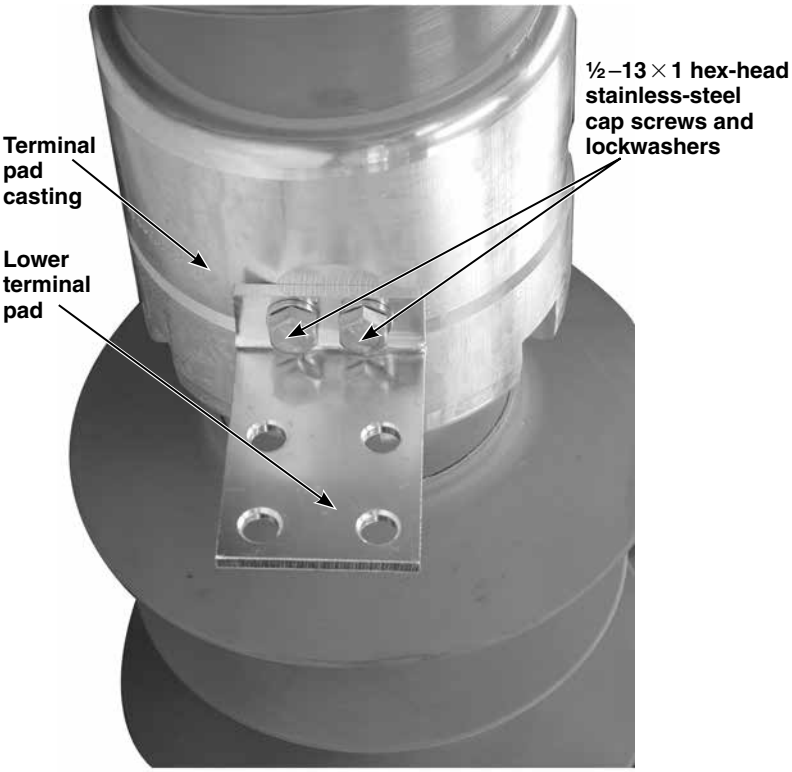


Figure 67. Bolt the lower terminal pad to the pole-unit.

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 63 through 64 for the upper and lower terminal pads of each pole-unit.

Step 63

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 64

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.

Step 65

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

Checklist Before Commissioning Trans-Rupter II

Before putting the Trans-Rupter II in service, verify the following:

- All three pole-units are "CLOSED" and charged. See Figure 68.
- The covers for the relays and test switch, if furnished, are in place and secure. See Figure 69.
- The pins for CT shorting blocks are removed. See Figure 70.

Refer to the relay manufacturer's instructions for set-up and testing procedures for the relays.

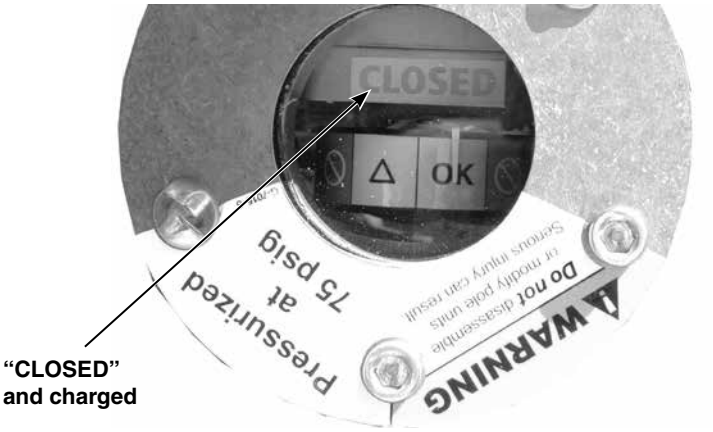


Figure 68. Make sure all three pole-units are "CLOSED" and charged.

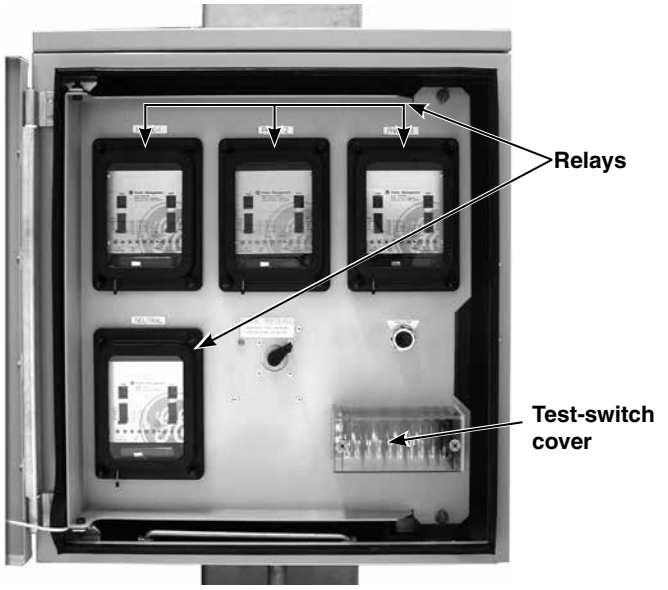


Figure 69. Make sure the covers for the relays and test switch, if furnished, are in place.

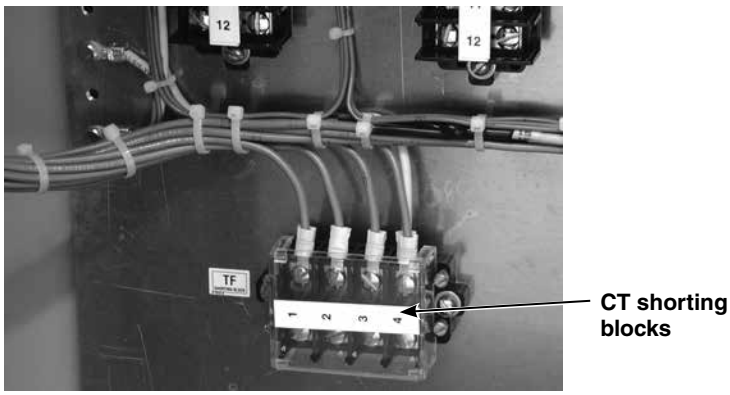


Figure 70. Make sure the pins are removed from the CT shorting blocks.

⚠ WARNING

DO NOT use the charging tool as a hotstick.

Serious injury or death can result. Only use the charging tool for closing and charging Trans-Rupter II pole-units.

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 66

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 71 and 72.

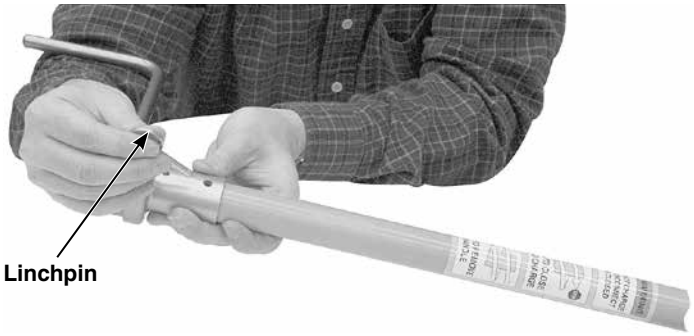


Figure 71. Remove the linchpin between the tool handle and the insulated shaft.

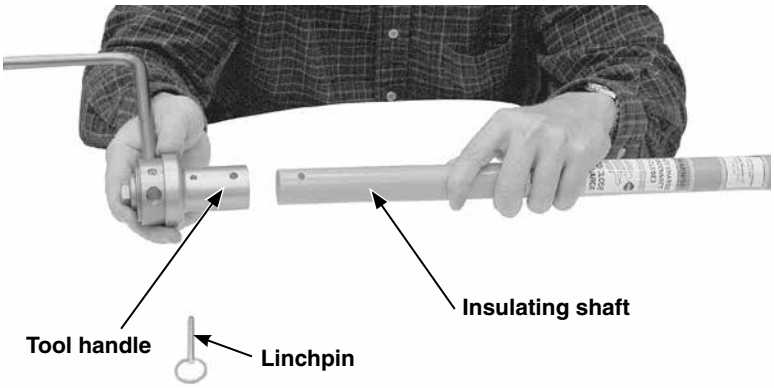


Figure 72. Pull the tool handle and the insulating shaft apart.

Step 67

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 73 and 74.

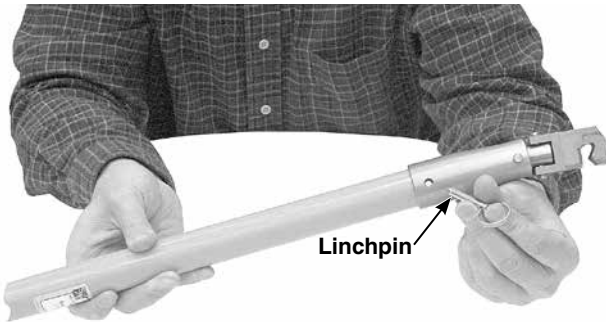


Figure 73. Remove the linchpin between the tool head and the insulating shaft.

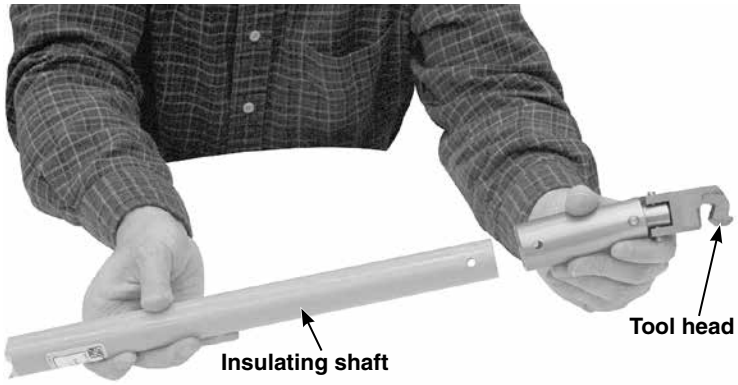


Figure 74. Pull the tool head and the insulating shaft apart.

Assembling the Charging Tool

Step 68

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 75 and 76.

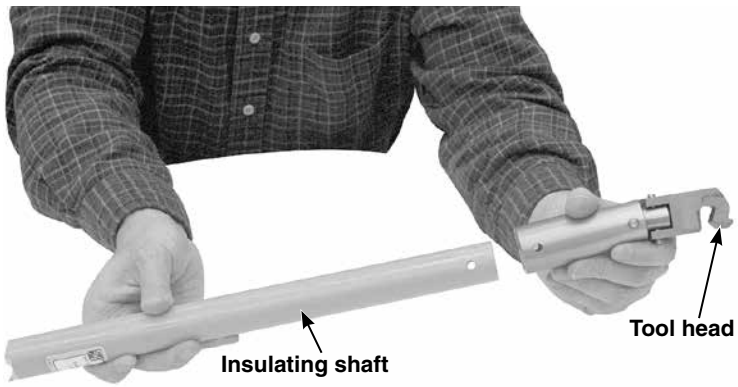


Figure 75. Push the tool head and the insulating shaft together.

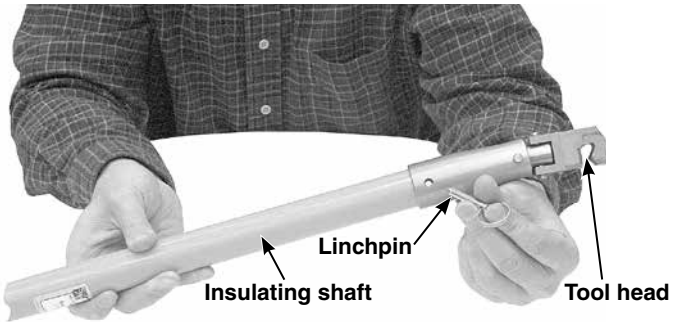


Figure 76. Align the holes on the insulating shaft and the tool head, then push the linchpin through.

Step 69

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 77 and 78.

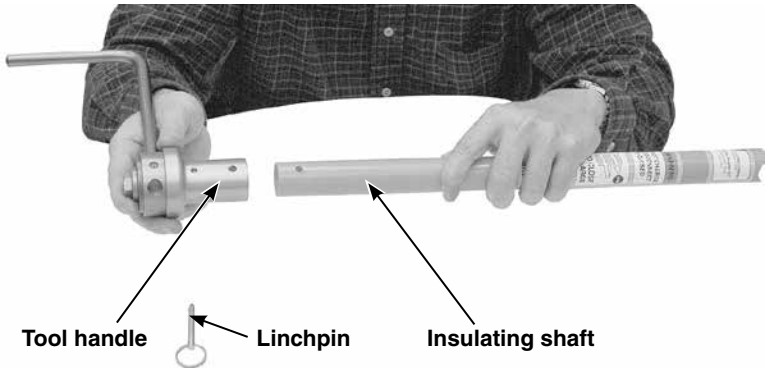


Figure 77. Push the handle and the insulating shaft together.

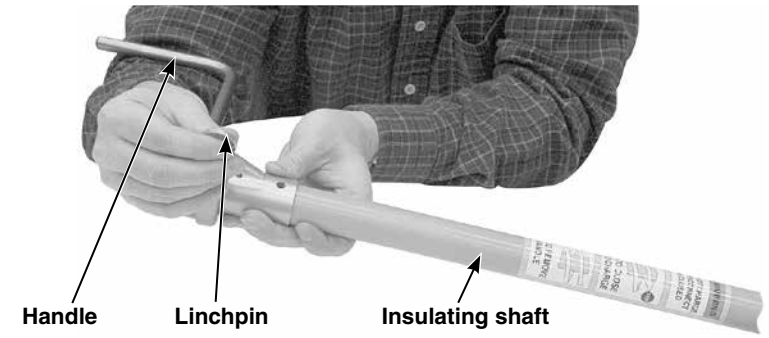


Figure 78. Align the holes on the handle and the insulating shaft, then insert the linchpin.

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.

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 79.

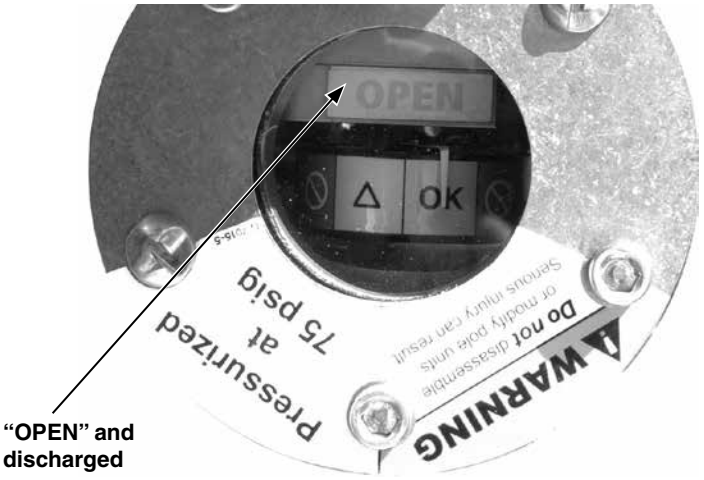


Figure 79. The pole-unit is "OPEN" and discharged. The indicator reads "OPEN."

If the pole-unit is "CLOSED" and charged, the indicator reads "CLOSED." See Figure 80.

Figure 80. 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 81.

Figure 81. 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 82.

⚠ WARNING

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

Opening Trans-Rupter II with one or more pole-units in the "Do not operate" zone can damage the transformer.

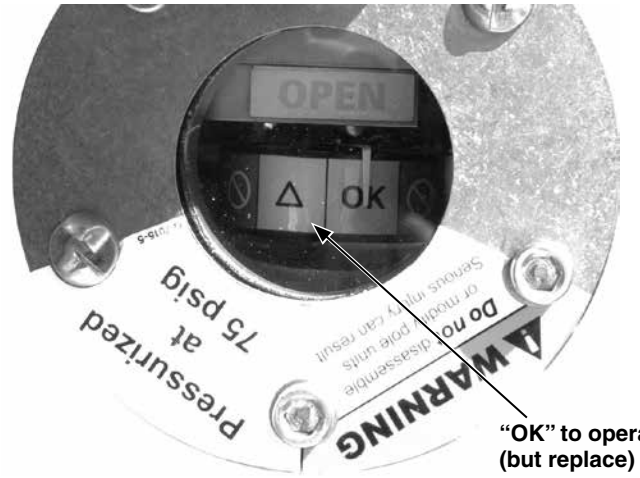


Figure 82. Gauge needle in yellow "OK" to operate (but replace) zone.

REPLACE:

There are two red zones. If the indicator needle is in the red zone shown in Figure 83, 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.

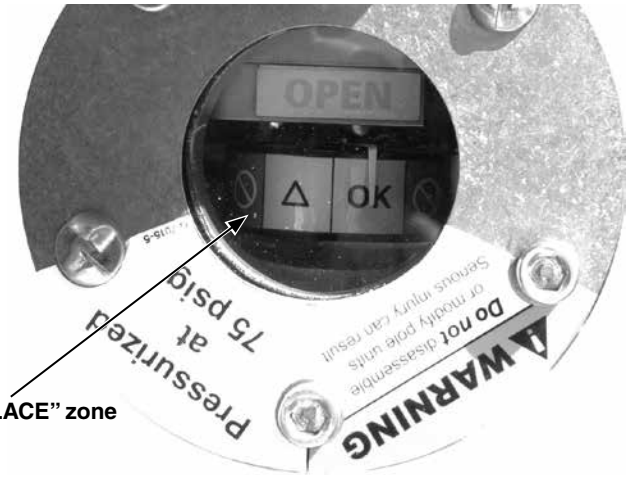


Figure 83. Gauge needle in red "REPLACE" zone.

If the indicator needle is in the red zone shown in Figure 84, 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.

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.**

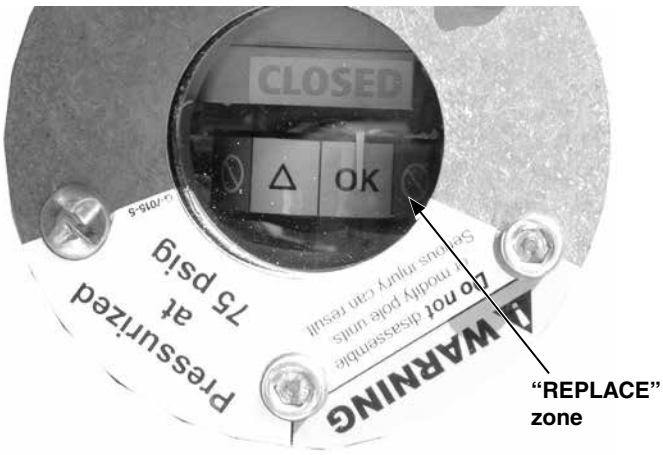


Figure 84. Gauge needle in red "REPLACE" zone.

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 Control Cabinet

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 control cabinet.
- That the gas-pressure gauge is in the white "OK" to operate zone. See Figure 85. 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 40 for "Understanding the Gas-Pressure Gauge."

⚠ WARNING

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.

Manual-Trip Device and Trip-Energy Supply

Verify the following:

- Proper condition of the manual-trip device. Crank it 5 to 10 times. Check that the red LED is flashing. See Figure 86.
- That the trip-energy supply is storing energy. Open the swingout panel to access the circuit board of the trip-energy supply. Press the push button on the trip-energy supply's circuit board. See Figure 87. If the trip energy supply is functioning properly, the red LED on the board will light continuously.

  The trip-energy supply requires 350 mA of three-phase secondary current or 600 mA of single-phase secondary current to power up. Refer to S&C Data Bulletin 731-60 for complete information about the trip energy supply.

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

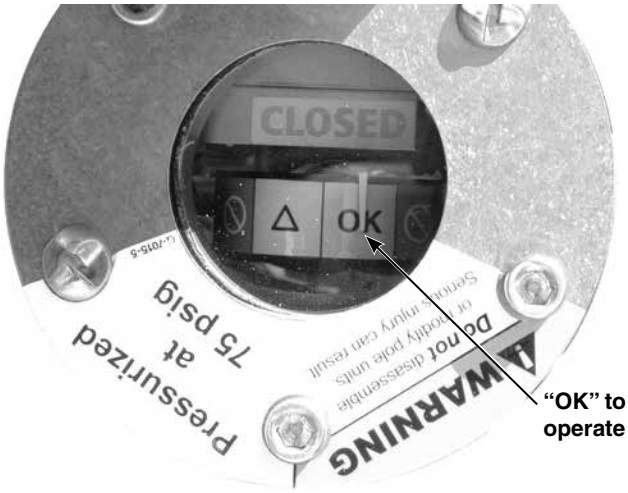


Figure 85. Check that the gas-pressure gauge on each pole-unit is in the "OK" to operate zone.

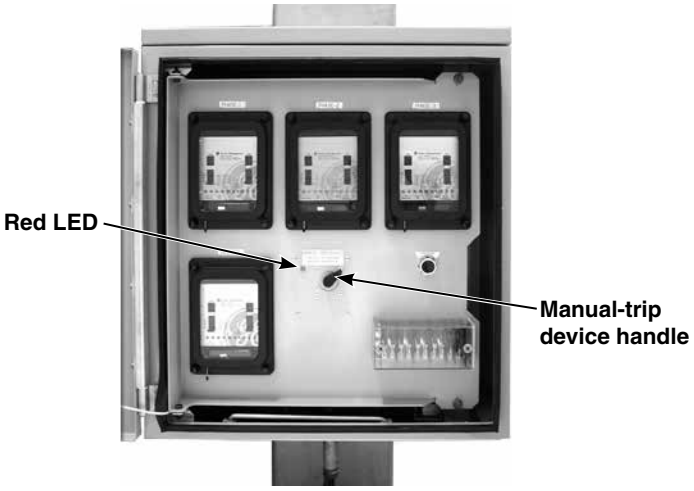


Figure 86. Crank the manual-trip device handle 5 to 10 times until the red LED starts flashing.

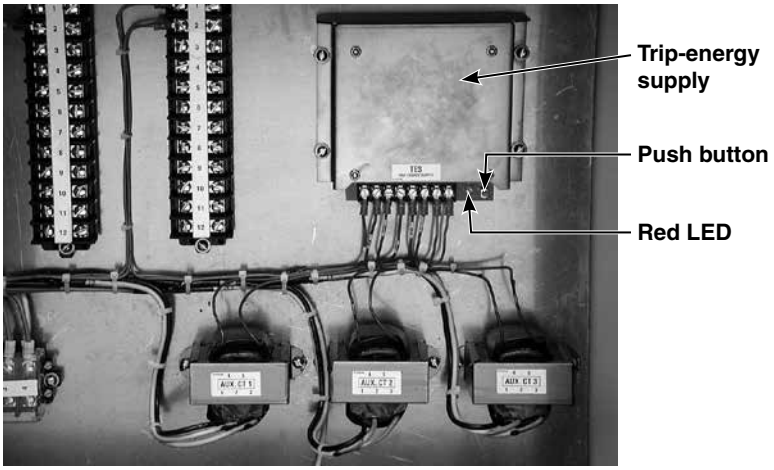


Figure 87. To verify the trip-energy supply is storing energy, press the push button on the trip-energy supply circuit board. The red LED will light continuously if the trip-energy supply is functioning properly.

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. To trip the Trans-Rupter II, inject secondary current into one of the relays. Also trip the Trans-Rupter II using the manual-trip device. Follow the steps in S&C Instruction Sheet 731-503, operating instructions for tripping the Trans-Rupter II when the transformer is de-energized.

If the optional test switch is furnished, make sure its cover is securely in place before re-energizing the transformer. Also make sure the pins are removed from the CT shorting blocks. See Figures 88 and 89.

Refer to the relay manufacturer's instructions for recommendations on testing and inspection of the relays.

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.

Figure 88. If furnished, make sure the test-switch cover is in place and secure.

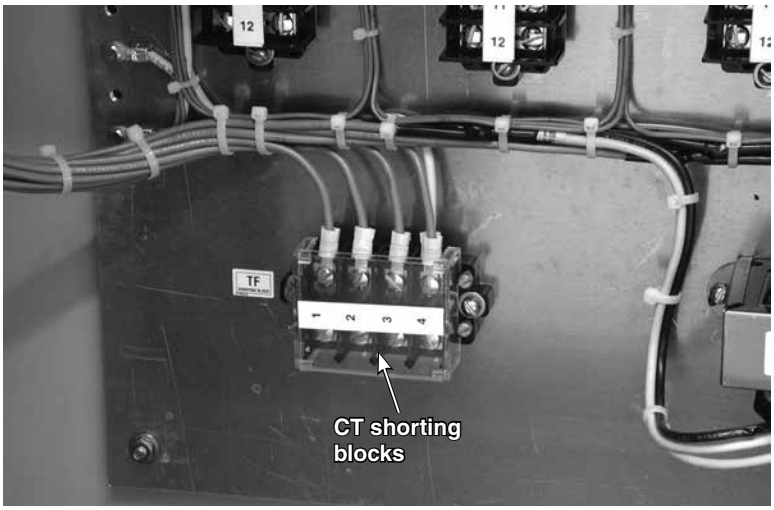


Figure 89. Make sure the pins are removed from the CT shorting blocks.

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