Instructions for Operation

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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 transmission and distribution substation 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 nonlive 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

NOTICE

Read this instruction sheet thoroughly and carefully before installing or operating your S&C Trans-Rupter II Transformer Protector. Familiarize yourself with the Safety Information and Safety Precautions on pages 3 through 5. 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&CTrans-Rupter II Transformer Protector. These instructions should be stored in the instruction manual holder of the control cabinet.

Proper Application

⚠ WARNING

The equipment in this publication must be selected for a specific application. The application must be within the ratings furnished for the selected equipment.

Warranty

The warranty and/or obligations described in S&C's Price Sheet 150, "Standard Conditions of Sale – Immediate Purchasers in the United States" (or Price Sheet 153, "Standard Conditions of Sale – Immediate Purchasers Outside the United States") 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 the immediate purchaser's or end user's exclusive remedy and a fulfillment of the entire seller's liability. In no event shall the seller's liability to the immediate purchaser or end user exceed the price of the specific product that gives rise to the 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 (or Price Sheet 153), 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 (OR PRICE SHEET 153) 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 (or PRICE SHEET 153.)

Warranty Qualifications

Warranty of the Trans-Rupter II Transformer Protector is contingent upon installation of the Trans-Rupter II Transformer Protector in accordance with S&C's applicable instruction sheets, data sheets, and/or data bulletins.

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels attached to the crate, packing materials, and equipment. Familiarize yourself with these types of messages and the importance of these various signal words:

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices that *can* result in minor personal injury 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.

NOTICE

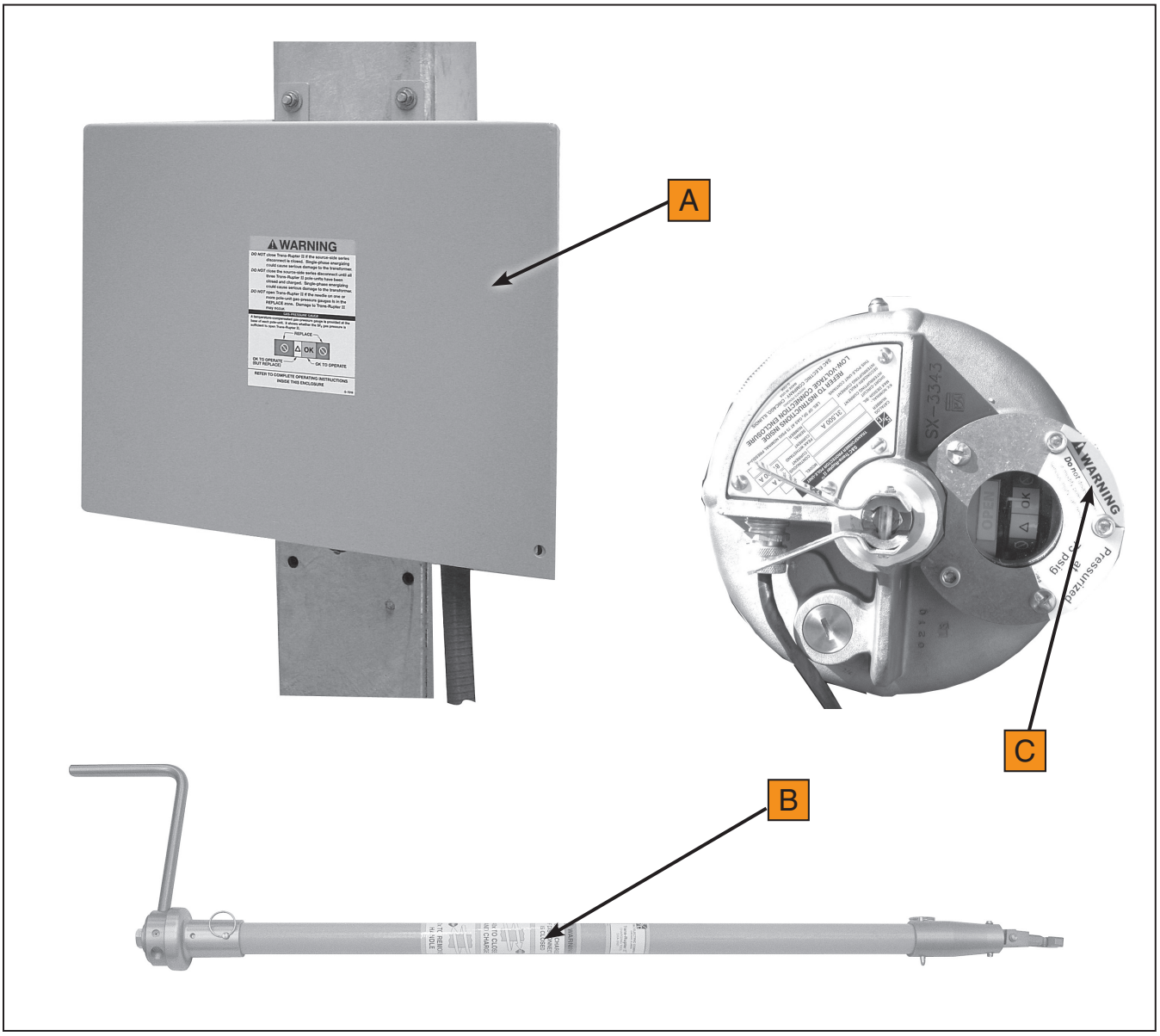
Read this instruction sheet thoroughly and carefully before installing or operating your S&C Trans-Rupter II Transformer Protector.

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	Number
A	⚠ WARNING	Do not close the Trans-Rupter II if. . .	G-7016
B	⚠ WARNING	Do not charge if disconnect is closed. . .	G-7009-1
C	⚠ WARNING	Do not disassemble or modify . . .	G-7015-5

⚠ DANGER

Trans-Rupter II Transformer Protectors operate at high voltage. Failure to observe the precautions below will result in serious personal injury or death.

Some of these precautions may differ from your company's operating procedures and rules. Where a discrepancy exists, follow your company's operating procedures and rules.

1. **QUALIFIED PERSONS.** Access to the Trans-Rupter II Transformer Protector must be restricted only to qualified persons. See "Qualified Persons" on page 2.
2. **SAFETY PROCEDURES.** Always follow safe operating procedures and rules.
3. **PERSONAL PROTECTIVE EQUIPMENT.** Always use suitable protective equipment such as rubber gloves, rubber mats, hard hats, safety glasses, and flash clothing, in accordance with safe operating procedures and rules.
4. **SAFETY LABELS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels.
5. **ENERGIZED COMPONENTS.** Always consider all parts live until de-energized, tested, and grounded.
6. **TRANSFORMER PROTECTOR POSITION.** Always confirm the OPEN/CLOSE position of the transformer protector by visually observing the indicator on the underside of the pole-unit. Transformer protectors may be energized from either side.
7. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.
8. **OPERATION.** Circuit breaking is involved in the normal operation of this switch. A source-side, three-pole group-operated disconnect switch is required in series with the Trans-Rupter II Transformer Protector to provide visible air-gap isolation when the interrupters have been tripped. The disconnect is also used to pick up the transformer magnetizing inrush current after all three pole-units have been closed and charged. To operate, follow the operating procedure as outlined in this instruction sheet.

Understanding the Pole-Unit Position Indicator

The pole-unit position indicator is located on the bottom of the pole-unit base. The indicator is only accurate when the charging tool is removed from the pole-unit**.**

If the optional motor operators are furnished, the indicators are only accurate after the motors have completed closing and charging the pole-units.

If the pole-unit is open and discharged, the indicator reads in the **Open** position. See Figure 1.

If the pole-unit is closed and charged, the indicator reads in the **Closed** position. See Figure 2.

Understanding the Gas-Pressure Indicator

A temperature-compensated gas-pressure indicator is located underneath the pole-unit. It shows whether SF_6 gas density is sufficient for a trip operation. The gas-pressure indicator shows three zones:

"OK" To Operate

This is the white zone. If the indicator needle is in this zone, the pole-unit is at normal gas density and can be opened and closed. See Figure 3.

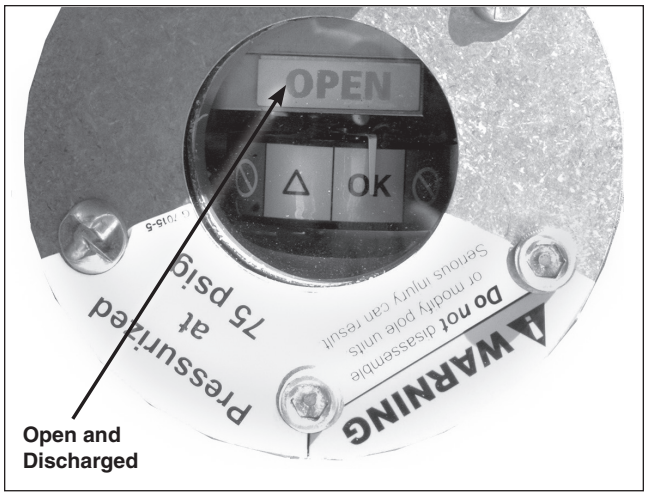


Figure 1. The pole-unit is open and discharged. The indicator reads in the Open position.

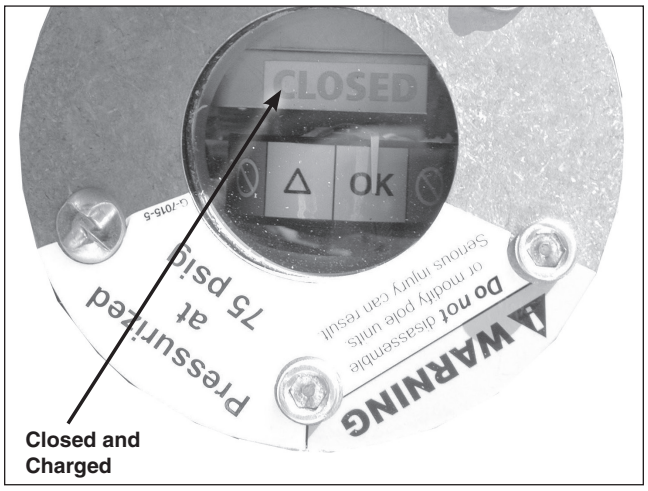


Figure 2. The pole-unit is closed and charged. The indicator reads in the Closed position.

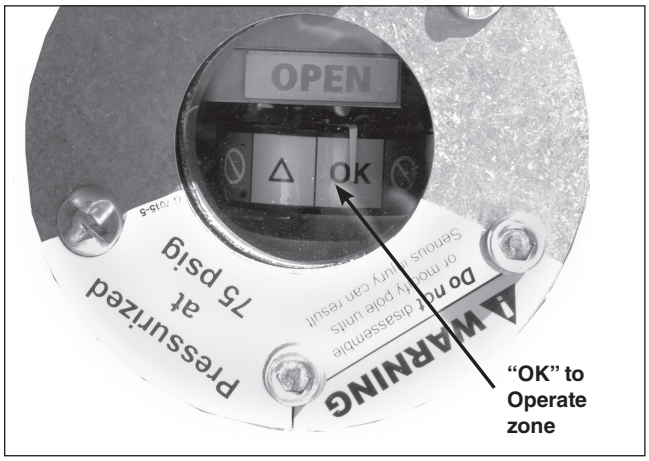


Figure 3. Indicator needle in white noting "OK" to operate zone.

"OK" To Operate (But Replace)

This is the yellow zone. If the indicator needle is in this zone, the pole-unit can be opened and closed. However, the pole-unit has lost gas and should be replaced as soon as possible. See Figure 4.

⚠ WARNING

DO NOT open Trans-Rupter II Transformer Protector unless the needle on each pole-unit gas-pressure indicator is in the "OK" to Operate zone. **Opening Trans-Rupter II Transformer Protector with one or more pole-units in the "Replace" zone can damage the transformer.**

Replace

There are two red zones. If the indicator needle is in the red zone shown in Figure 5, 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 the Trans-Rupter II Transformer Protector.

If the indicator needle is in the red zone shown in Figure 6, the local gas density indicator 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 Transformer Protector.

NOTICE

At temperatures below -31°F (-35°C), the indicator needle will be in the red zone because of 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, the gas-pressure indicator does not accurately indicate whether a pole-unit is losing SF_6.**

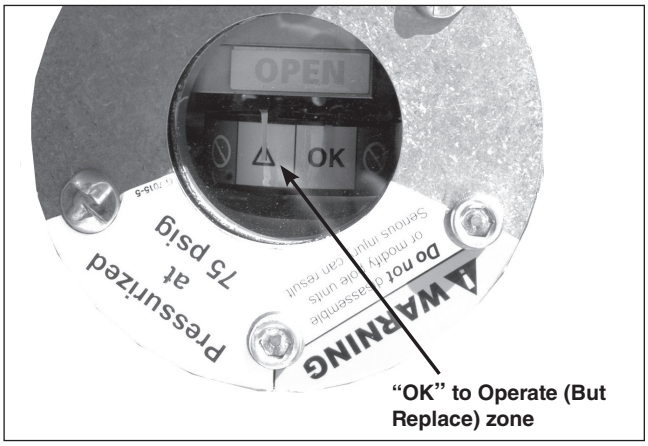


Figure 4. Indicator needle in yellow noting "OK" to Operate (but Replace) zone.

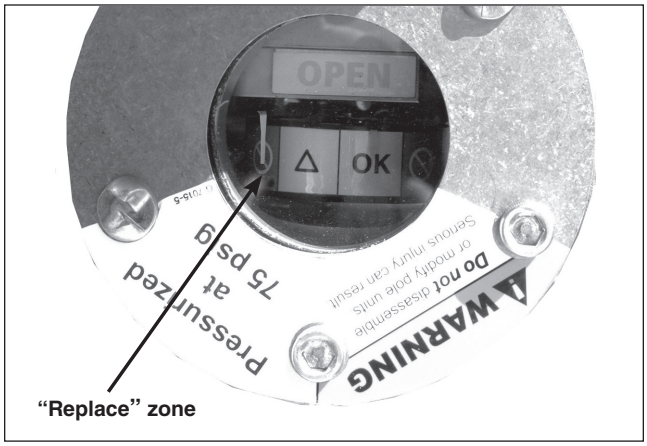


Figure 5. Indicator needle in red noting "Replace" zone.

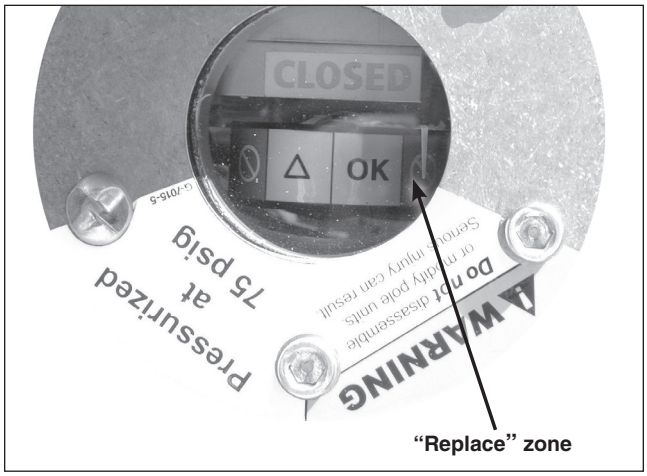


Figure 6. Indicator needle in red noting "Replace" zone.

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 Transformer Protector.

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. At such low temperatures, 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.**

How to Trip the Trans-Rupter II Transformer Protector

⚠ WARNING

DO NOT open a Trans-Rupter II Transformer Protector unless the needle on each pole-unit gas-pressure indicator is in the "OK" to Operate zone. **Opening Trans-Rupter II Transformer Protector with one or more pole-units in the "Replace" zone can damage the transformer.**

STEP 1. Make sure the needle on the gas-pressure indicator of each pole-unit is in the "OK" to Operate zone and the charging tool is not attached to any of the pole-units. See Figure 7.

STEP 2. Trip Trans-Rupter II Transformer Protector using the controls inside the low-voltage connection enclosure. See Figure 8.

(a) If a LOCAL/REMOTE selector switch has not been furnished: Press the TRIP pushbutton for about one second.

(b) If a LOCAL/REMOTE selector switch has been furnished: Place the selector switch in the **Local** position. Then press the TRIP pushbutton for about one second.

(c) If a local TRIP pushbutton has not been furnished: Provide a trip signal from the user-furnished remote control switch for about one second.

All three pole-units will open simultaneously.

⚠ CAUTION

Pole-units cannot be opened manually. **DO NOT** attempt to open pole-units with the changing tool. **Attempts to open the device manually can damage the Trans-Rupter II Transformer Protector.**

STEP 3. Check that all three pole-units are open and discharged. See Figure 9 on page 10.

STEP 4. Open the source-side series disconnect to provide visible air-gap isolation. Fully isolate the Trans-Rupter II Transformer Protector in accordance with established company procedures.

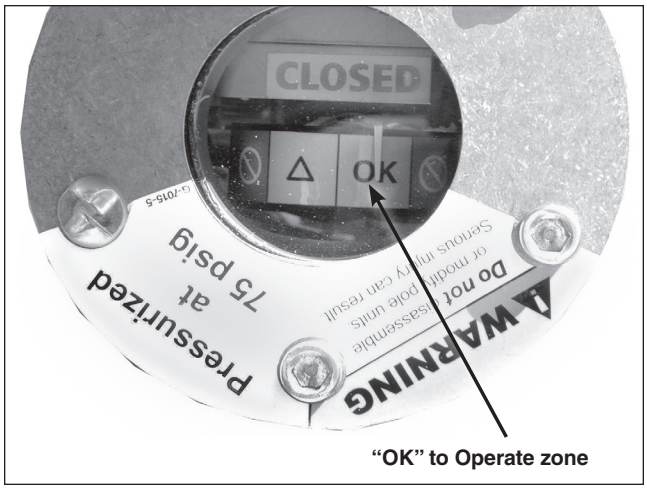


Figure 7. Check that the gas-pressure indicator of each pole-unit is in the "OK" to Operate zone.

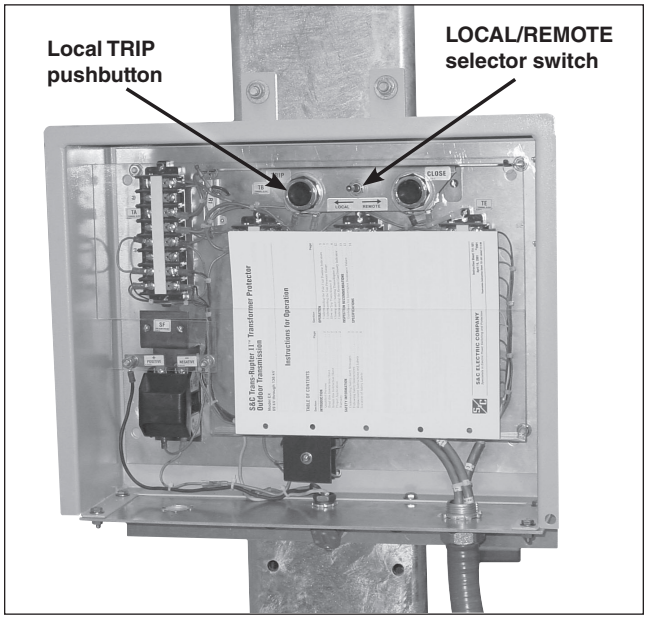


Figure 8. If furnished, press the local TRIP pushbutton to trip the Trans-Rupter II Transformer Protector.

Closing and Charging the Trans-Rupter II Transformer Protector with the Manual Charging Tool

If Trans-Rupter II Transformer Protector has been furnished with optional motor operators, proceed to page 14.

⚠ WARNING

DO NOT close a Trans-Rupter II Transformer Protector if the source-side series disconnect is closed. The Trans-Rupter II Transformer Protector is not intended to be closed into live circuits. **Serious damage to the Trans-Rupter II Transformer Protector will occur and the transformer could potentially be damaged.**

STEP 5. Check the indicator at the base of each pole-unit to make sure the pole-unit is open and discharged Also check that the gas-pressure indicator is in the "OK" to Operate zone. See Figure 10.

STEP 6. If an optional key interlock is provided, remove the key from the disconnect. Use the key to lock the tool head in place. See Figure 11.

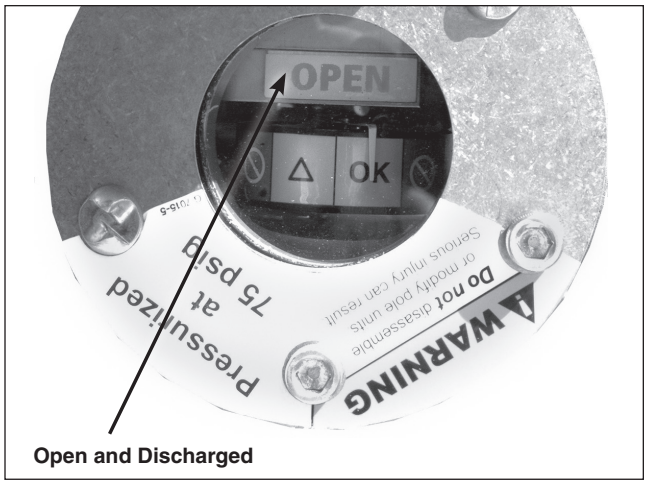


Figure 9. Check that all three pole-units are open and discharged.

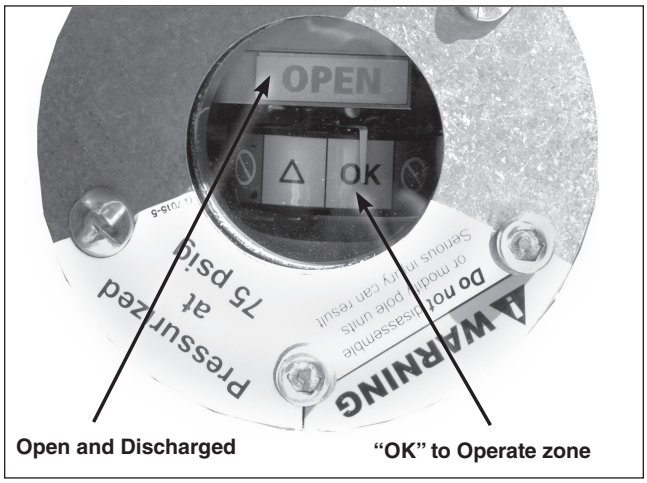


Figure 10. Make sure the pole-unit is open and discharged. Also make sure the gas-pressure indicator is in the "OK" to Operate zone.

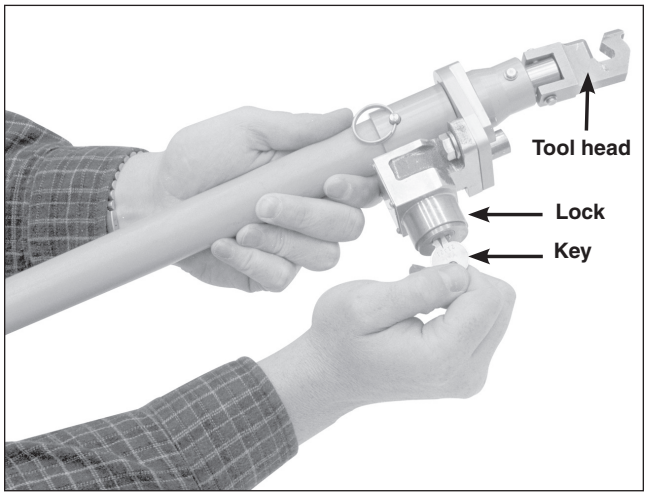


Figure 11. If furnished, use the key from the disconnect to lock the tool head in place.

STEP 7. 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 12, 13, and 14.

⚠ CAUTION

Use only the manual charging tool provided by S&C for charging and closing pole-units. **Use of any other tool can damage the Trans-Rupter II Transformer Protector.**

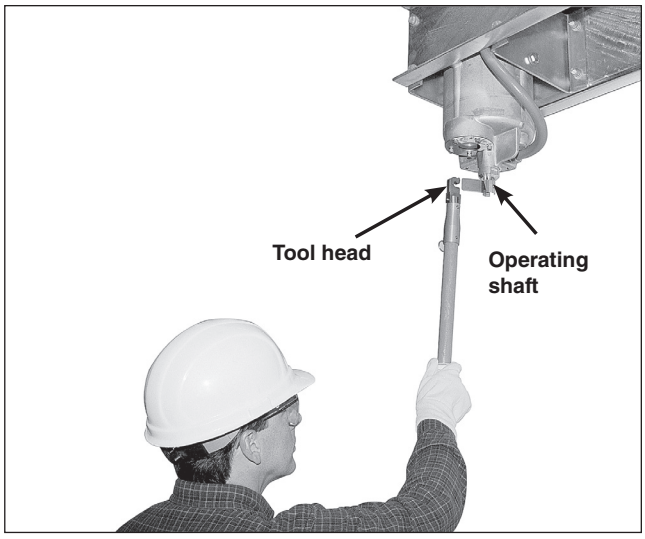


Figure 12. Guide the hooked end of the charging tool between the ears of the operating shaft.

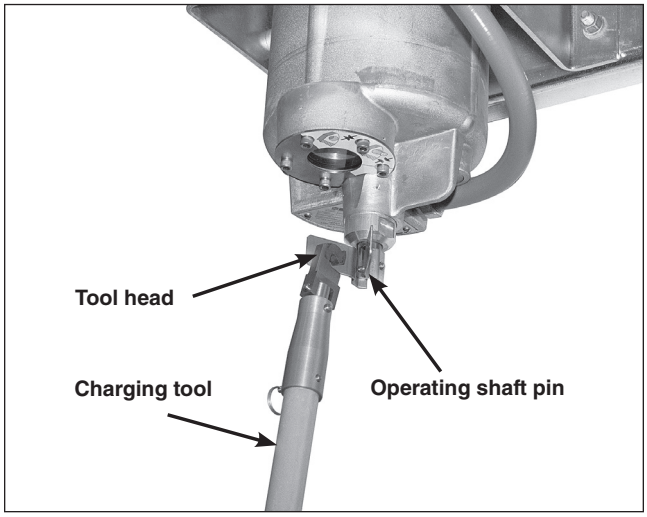


Figure 13. Engaged the operating shaft pin.

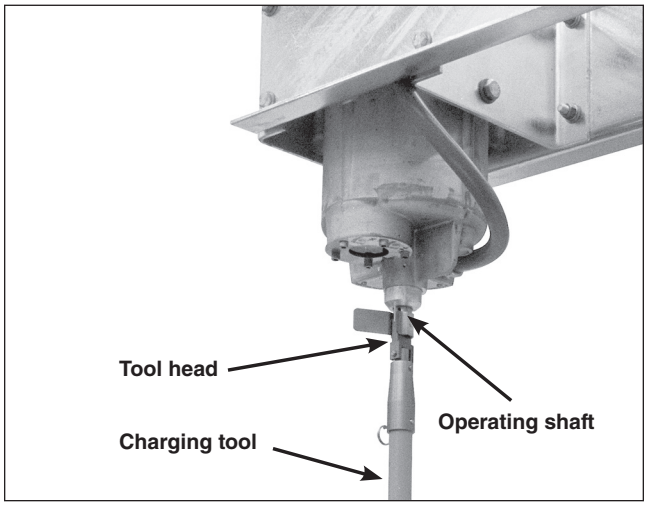


Figure 14. Make sure the operating shaft pin is engaged (shown).

STEP 8. Rotate the charging tool handle *counterclockwise*, as indicated on the tool, to close and charge the pole-unit. See Figure 15. 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 Step 9 has been completed, so DO NOT attempt to remove the tool at this time.

STEP 9. Rotate the charging tool handle *clockwise*, as indicated on the tool, to reset the pole-unit mechanism. See Figure 16. Approximately 40 revolutions are needed. Keep turning until the internal stop is reached, and 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 a Trans-Rupter II Transformer Protector.**

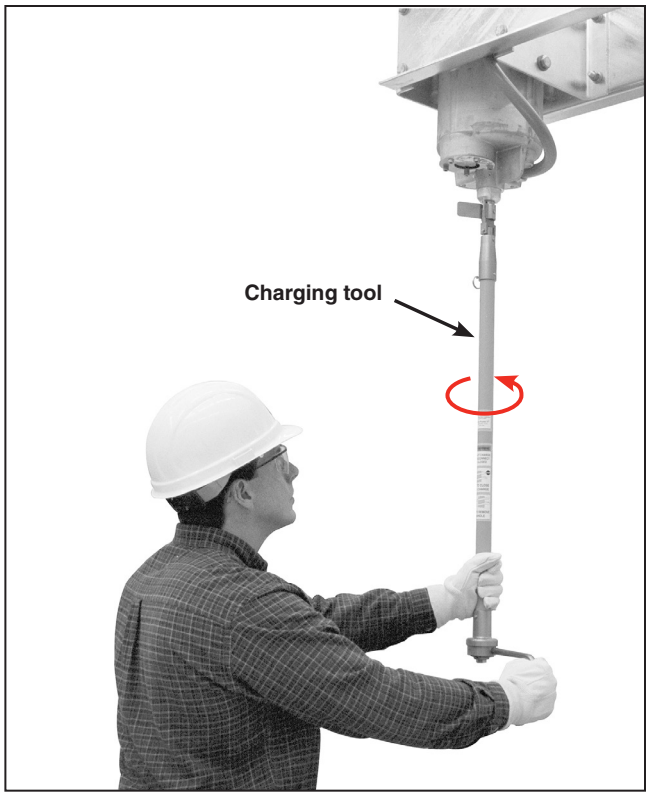


Figure 15. Rotate the tool handle counterclockwise until the internal stop is reached.

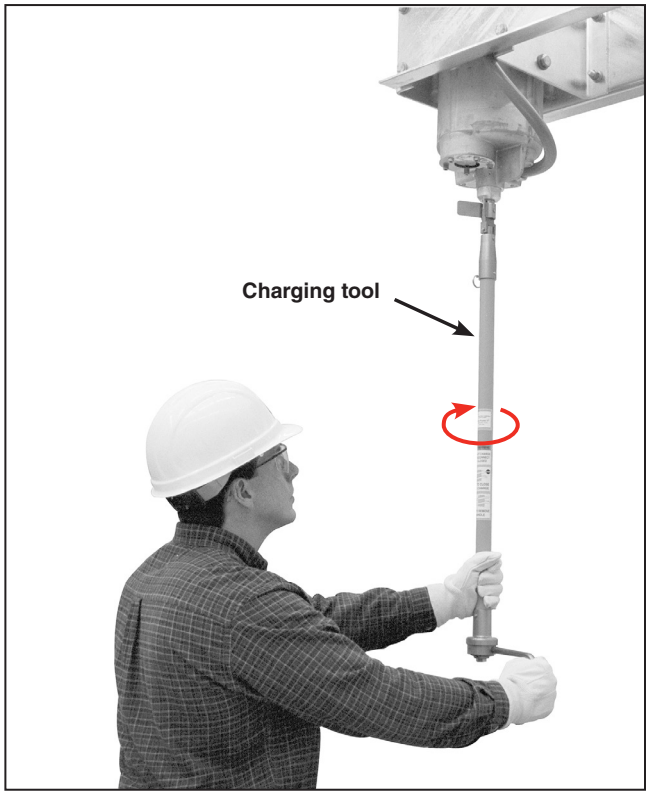


Figure 16. Rotate the tool handle clockwise until the internal stop is reached.

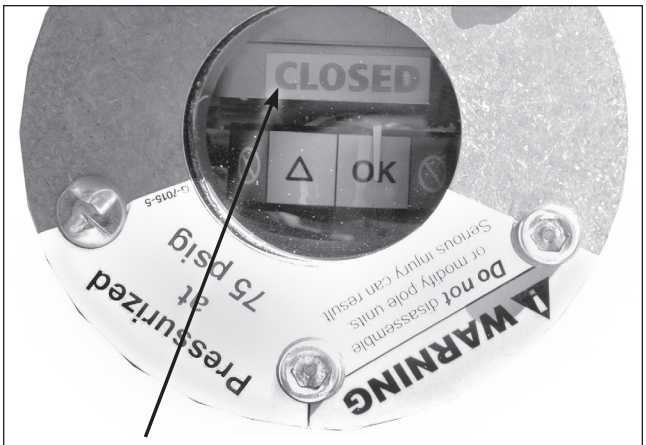
STEP 10. Check that the pole-unit position indicator is in the **Closed and Charged** position. See Figure 17. If the indicator still shows the **Open and Discharged** position, repeat Steps 7 through 9 on pages 10 through 12. The indicator is only accurate when the charging tool is removed from the pole-unit.

STEP 11. Repeat Steps 7 through 9 for the other two pole-units.

⚠ WARNING

DO NOT close the source-side series disconnect unless all three pole-units are closed and charged. A **Trans-Rupter II Transformer Protector cannot protect the transformer until all three pole-units are closed and charged.**

STEP 12. Once all three pole-units are closed and charged, the source-side series disconnect can be closed to pick up transformer magnetizing inrush current, in accordance with the user's standard operating and safety practices.



Closed and Charged

Figure 17. Check that the indicator is in the Closed and Charged position.

Closing and Charging the Trans-Rupter II Transformer Protector with Optional Motor Operators

⚠ WARNING

DO NOT close a Trans-Rupter II Transformer Protector if the source-side series disconnect is closed. The Trans-Rupter II Transformer Protector is not intended to be closed into live circuits. **Serious damage to the Trans-Rupter II Transformer Protector will occur and the transformer could potentially be damaged.**

STEP 13. Check the indicator at the base of each pole-unit to make sure the pole-unit is open and discharged. Also check that the gas-pressure indicator is in the "OK" to Operate zone. See Figure 18.

STEP 14. Close the Trans-Rupter II Transformer Protector using the controls inside the low-voltage connection enclosure. See Figure 19.

(a) If a LOCAL/REMOTE selector switch has not been furnished: Press the CLOSE pushbutton for about one second.

(b) If a LOCAL/REMOTE selector switch has been furnished: Place the selector switch in the **Local** position, and then press the CLOSE pushbutton for about one second.

(c) If a local CLOSE pushbutton has not been furnished: Provide a close signal from the user-furnished remote control switch for one second.

NOTICE

If control power is lost while the Trans-Rupter II motor operators are closing and charging the pole-units, the motor operators will reset to the beginning of the 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.

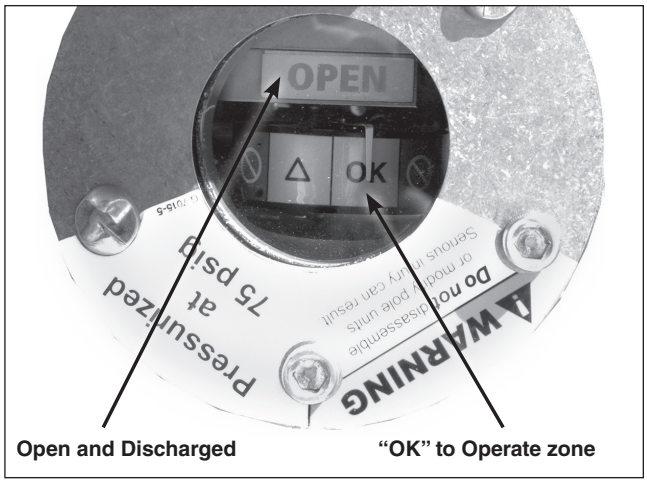


Figure 18. Make sure the pole-unit is open and discharged. Also make sure the gas-pressure indicator is in "OK" to Operate zone.

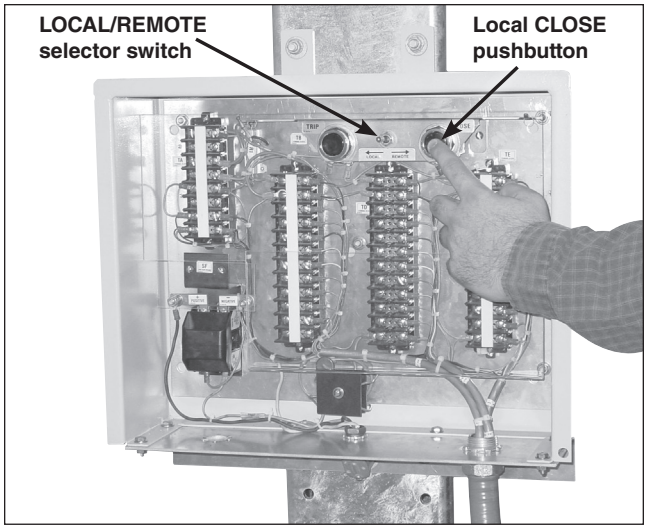


Figure 19. If furnished, press the local CLOSE pushbutton to close the Trans-Rupter II Transformer Protector.

STEP 15. Check that all three pole-units are in the **Closed and Charged** position. See Figure 20.

STEP 16.

⚠ WARNING

DO NOT close the source-side series disconnect until all the motor operators have stopped and all three pole-units are closed and charged. The **Trans-Rupter II Transformer Protector cannot protect the transformer until all three pole-units are closed and charged.**

Once all three pole-units are closed and charged, the source-side series disconnect can be closed to pick up transformer magnetizing inrush current in accordance with the user's standard operating and safety practices.

STEP 17. **If a LOCAL/REMOTE selector switch has been furnished:** Place the selector switch in the **Remote** position.

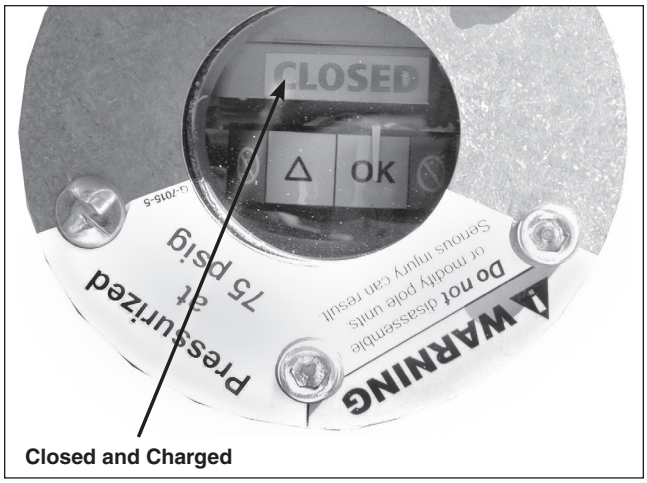


Figure 20. Check that all three pole-units are in the Closed and Charged position.

Removing Motor Operators for Manual Closing and Charging

In the event that control power is lost, the motor operators can be removed, and the pole-units can be closed and charged with the manual charging tool furnished.

⚠ WARNING

DO NOT close a Trans-Rupter II Transformer Protector if the source-side series disconnect is closed. The Trans-Rupter II Transformer Protector is not intended to be closed into live circuits. **Serious damage to the Trans-Rupter II Transformer Protector will occur and the transformer could potentially be damaged.**

STEP 18. Check the indicator at the base of each pole-unit to make sure the pole-unit is open and discharged. Also check that the gas-pressure indicator is in the "OK" to Operate zone. See Figure 21.

STEP 19. Remove the copper slugs from the low-voltage enclosure and set them aside in a protected area. See Figure 22.

⚠ CAUTION

DO NOT remove motor operators before removing the copper slugs from the low-voltage connection enclosure. The operators could start moving if control power is unexpectedly restored. **Moving parts could cause injury.**

STEP 20. Remove and retain the four ½–13 x 1 hex-head stainless steel cap screws and flat washers that secure each motor operator to its motor brackets. See Figure 23.

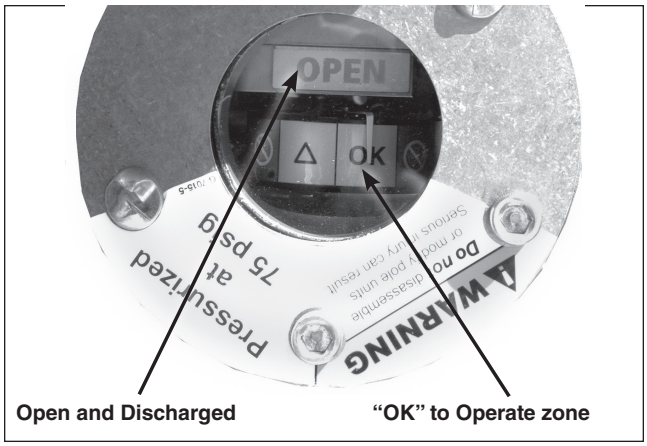


Figure 21. Make sure the pole-unit is open and discharged. Also make sure the gas-pressure indicator is in "OK" to Operate zone.

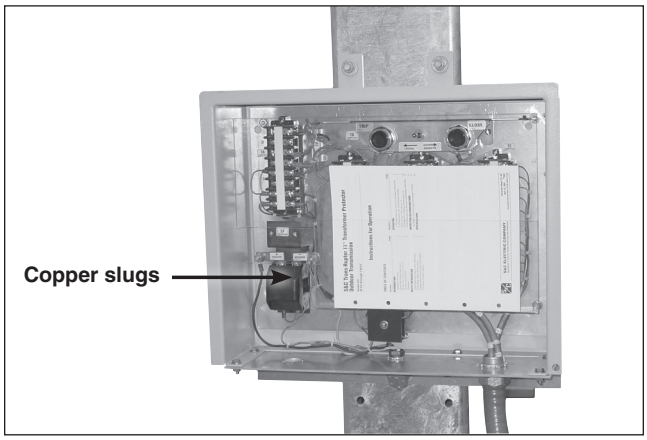


Figure 22. Remove the copper slugs.

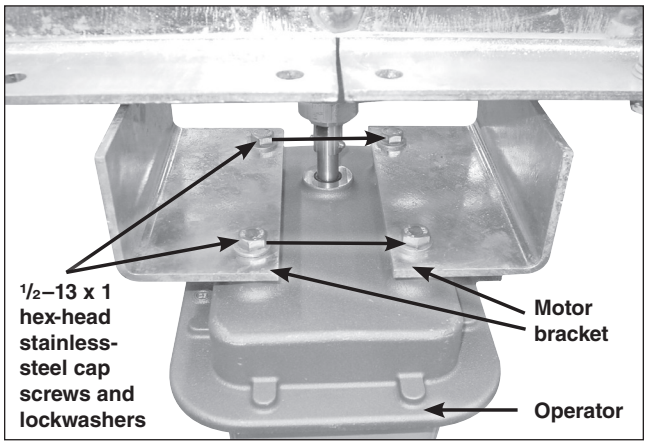


Figure 23. Removing four screws securing motor operator.

STEP 21. Manually rotate each pole-unit operating shaft one or two turns *counterclockwise*, as viewed from the top, until the motor can be easily disengaged from the operating shaft. See Figure 24.

STEP 22. Push upward on the motor operator to disengage the operator from the operating shaft. See Figure 25 and Figure 26 on page 18.

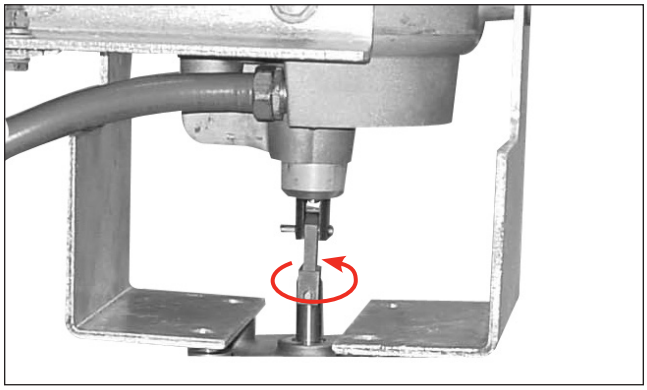


Figure 24. Manually rotate the operating shaft until the motor can be easily disengaged.

Figure 25. Disengage the operator from the operating shaft.

STEP 23. Temporarily attach the motor operator to one of the mounting brackets with one of the cap screws removed in Step 20, as shown in Figure 26. Make sure the motor operator is pivoted away from the operating shaft so there is sufficient clearance to engage the charging tool. See Figure 27.

STEP 24. Repeat Steps 20 through 23 for the other two pole-units.

STEP 25. After all three operators have been removed and temporarily relocated, close and charge the pole-units with the charging tool. See Steps 6 through 11 in the "Closing and Charging Trans-Rupter II Transformer Protector with a Manual Charging Tool" section starting on page 10.

STEP 26. After closing and charging all three pole-units, reengage each motor operator to its respective pole-unit operating shaft. Secure the motor operator to the mounting brackets with the cap screws and washers retained from Step 20.

STEP 27. Replace the copper slugs in the low-voltage enclosure. See Figure 22.

STEP 28.

⚠ WARNING

DO NOT close the source-side series disconnect unless all three pole-units are closed and charged. The **Trans-Rupter II Transformer Protector cannot protect the transformer until all three pole-units are closed and charged.**

Once all three pole-units are closed and charged, the source-side series disconnect can be closed to pick up transformer magnetizing inrush current in accordance with the user's standard operating practices.

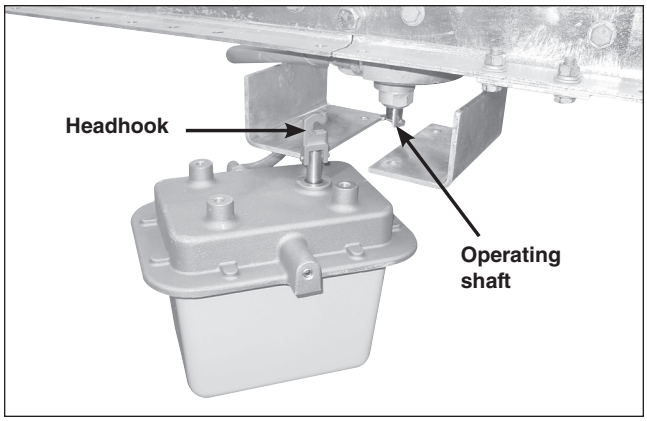


Figure 26. Disengaging motor operator to provide clearance for charging tool.

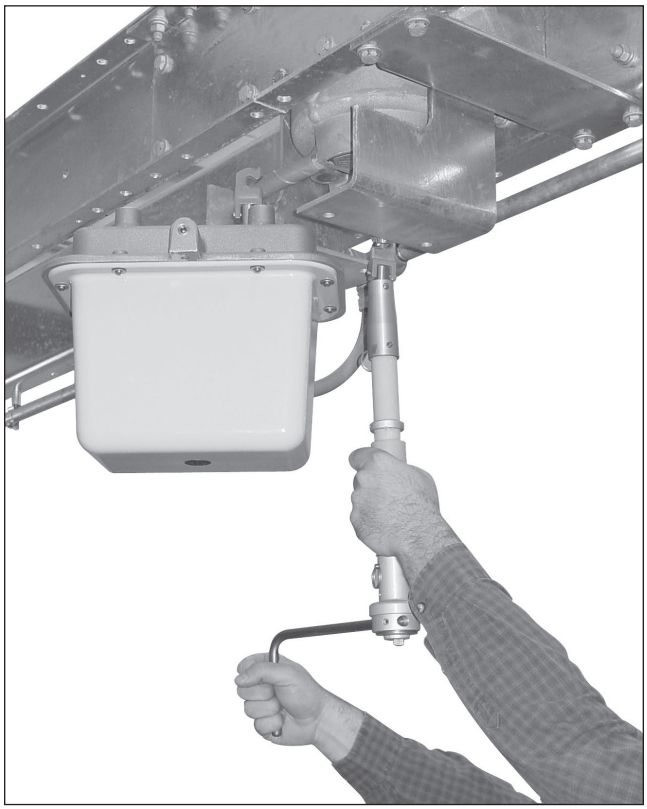


Figure 27. Manually closing and charging pole-unit of motor operator-equipped Trans-Rupter II Transformer Protector.

Pole-Units and Low-Voltage Connection Enclosure

During routine transformer maintenance and/or inspections, the Trans-Rupter II Transformer Protector 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 indicator is in the white "OK" to Operate zone. See Figure 28. If the gas-pressure indicator is in either the yellow or red zones, the gas density in the pole-unit has dropped. Refer to the instructions on page 6 for "Understanding the Gas-Pressure Indicator."

⚠ WARNING

DO NOT open the Trans-Rupter II Transformer Protector unless the needle on each pole-unit gas-pressure indicator is in the "OK" to Operate zone. Opening the Trans-Rupter II Transformer Protector 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 Transformer Protector should be tripped, closed, tripped a second time, and finally closed.

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 pole-unit is outside these values, contact your nearest S&C Sales Office.

Figure 28. Check that the gas-pressure indicator on each pole-unit is in the "OK" to Operate zone.