Instructions for Operation

Table of Contents

April 24, 2017

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 equipment 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

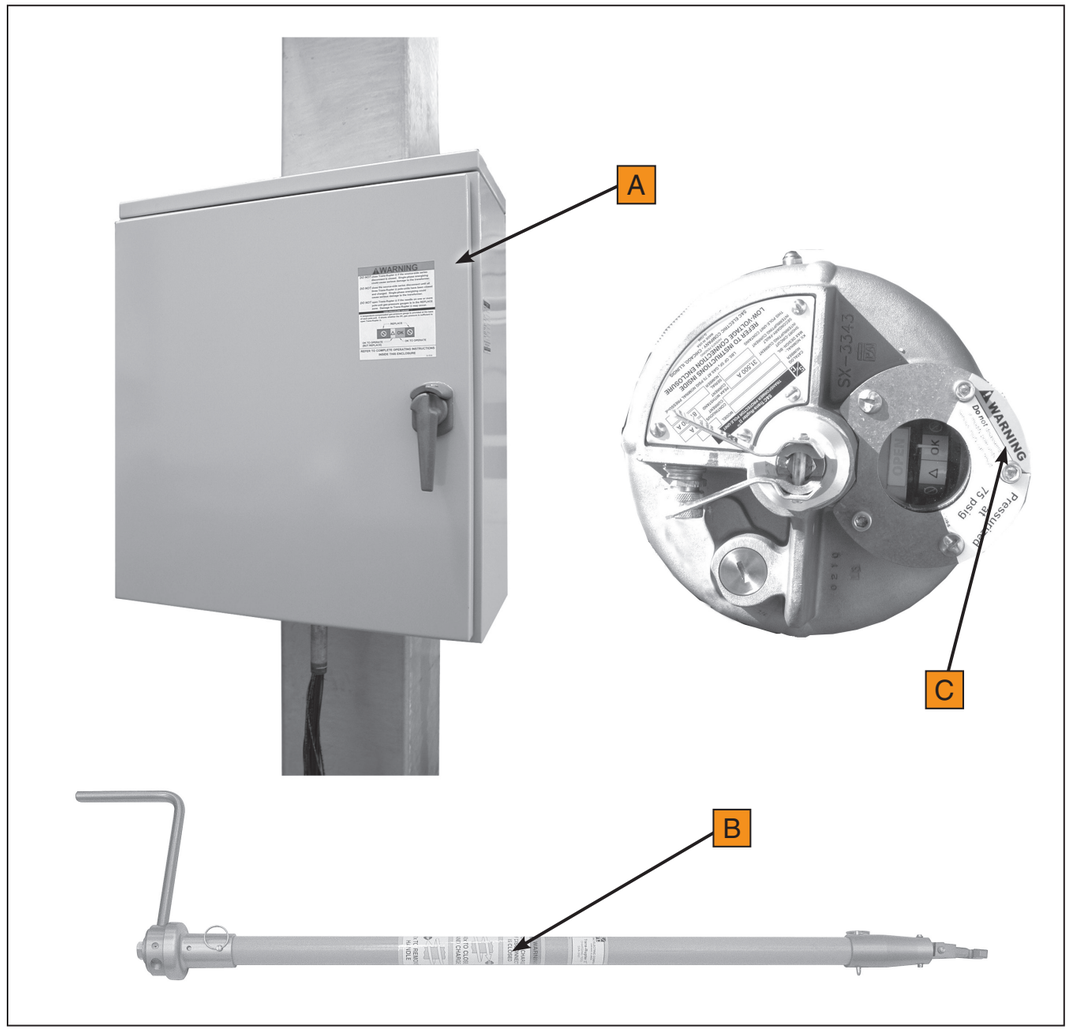
Read this instruction sheet thoroughly and carefully before installing or operating your S&C Trans-Rupter II Transformer Protector.

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 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 an 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 device. 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 underneath the pole-unit base. The indicator is only meaningful when the charging tool is removed from the pole-unit.

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.

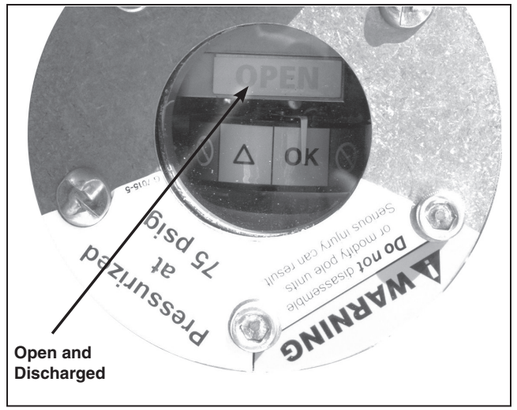


Figure 1. The pole-unit is open and discharged. The indicator reads in the Open position.

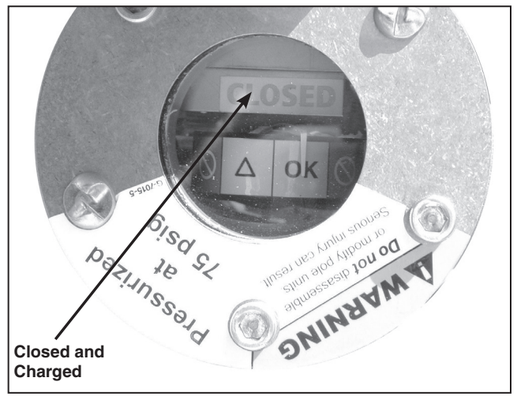


Figure 2. The pole-unit is closed and charged. The indicator reads in the Closed position.

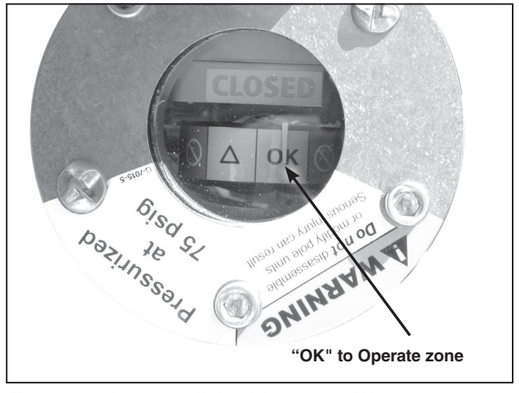


Figure 3. Indicator needle in white noting "OK" to operate zone.

"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.**

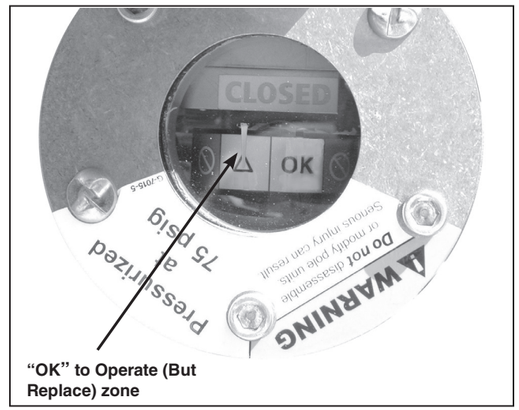


Figure 4. Indicator needle in yellow noting "OK" to Operate (but Replace) zone.

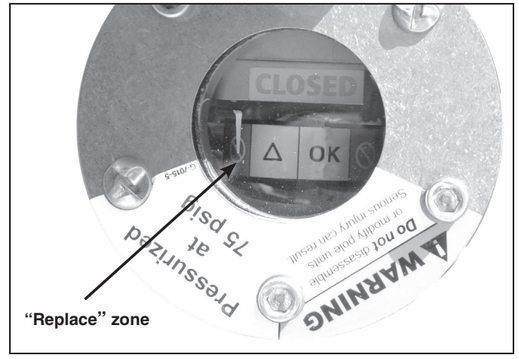


Figure 5. Indicator needle in red noting "Replace" zone.

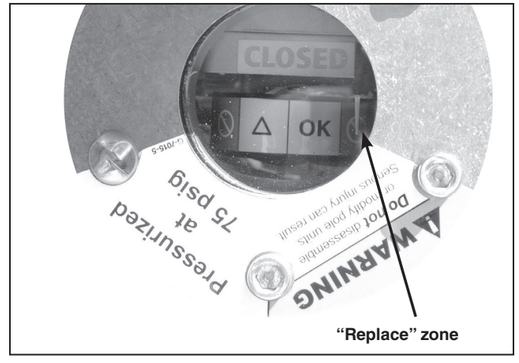


Figure 6. Indicator needle in red noting "Replace" zone.

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), 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 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.**

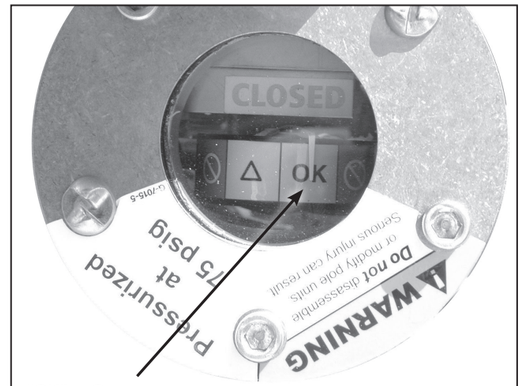
STEP 1. Make sure the needle on the gas-pressure indicator of each pole-unit is in the "OK" to Operate zone and the charging tool is not attached to any of the pole-units. See Figure 7.

STEP 2. Trip the Trans-Rupter II Transformer Protector:

(a) If the transformer is carrying load, press the local TRIP pushbutton inside the control cabinet for about one second. See Figure 8.

(b) If the transformer is de-energized, crank the manual Trip device handle to trip the Trans-Rupter II Transformer Protector. Crank the handle about 10 times. The red LED indicator will start flashing when the manual-trip device is fully charged. See Figure 9. Afterward, press the local TRIP pushbutton. The manual Trip device only retains its charge for about 1 minute, so press the pushbutton promptly. See Figure 10.

All three pole-units will open simultaneously.



"OK" to Operate zone

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

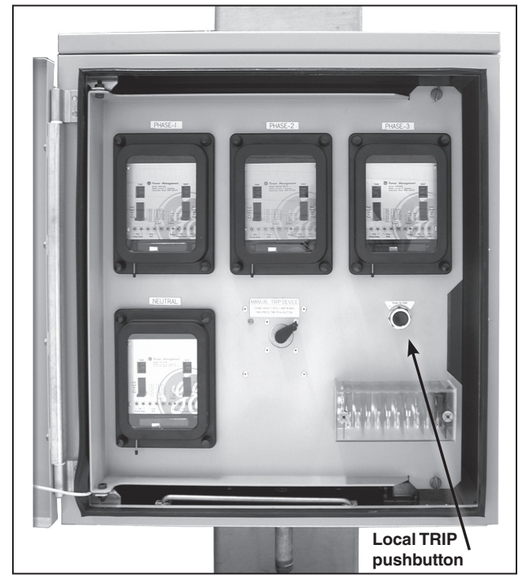


Figure 8. If the transformer is carrying load, press the local TRIP pushbutton to trip the Trans-Rupter II Transformer Protector.

⚠ 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 11.

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.

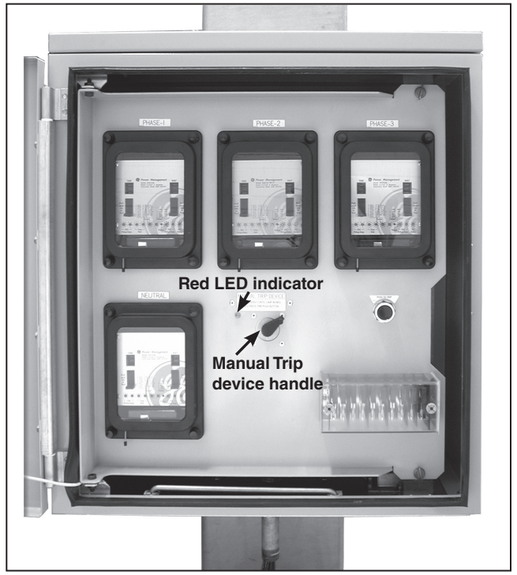


Figure 9. If the transformer is de-energized, crank the manual TRIP device handle until the red LED indicator starts flashing.

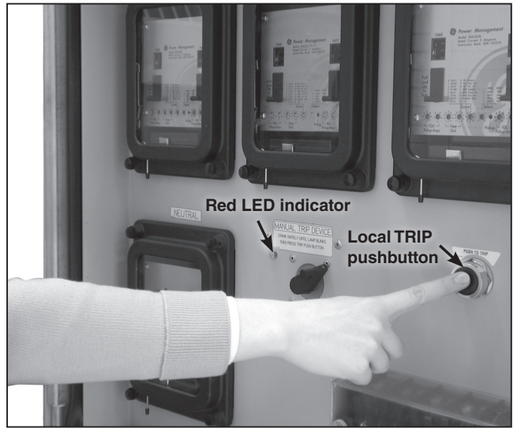


Figure 10. After the red LED indicator starts flashing, press the local TRIP pushbutton to trip Trans-Rupter II Transformer Protector.

Closing and Charging a Trans-Rupter II Transformer Protector

⚠ 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 12.

STEP 6. If an optional key interlock is provided, remove the key from the disconnect. Use the key from the disconnect to lock the tool head in place. See Figure 13.

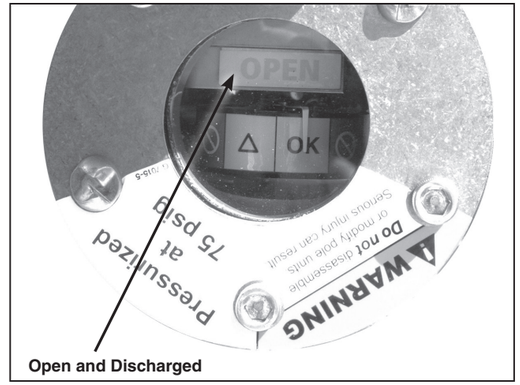


Figure 11. Check that all three pole-units are open and discharged.

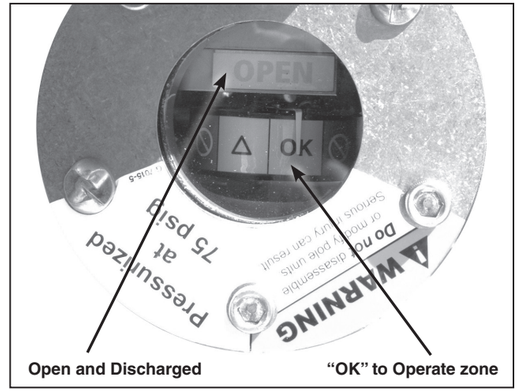


Figure 12. Make sure the pole-unit is open and discharged. Also make sure the gas-pressure indicator is in the "OK" to Operate zone.

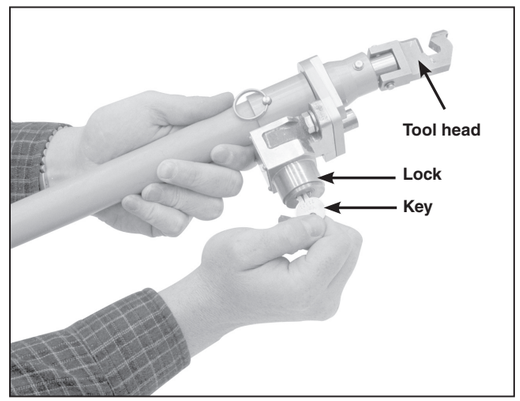


Figure 13. If furnished, use the key from the disconnect to lock the tool head in place.

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 14, 15, and 16.

⚠ CAUTION

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

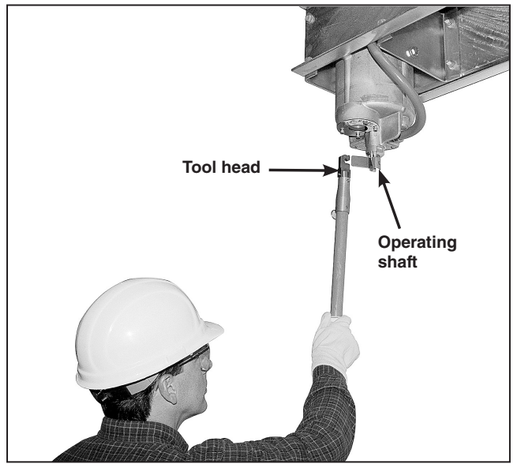


Figure 14. Guide the hooked end of the charging tool between the ears of the operating shaft.

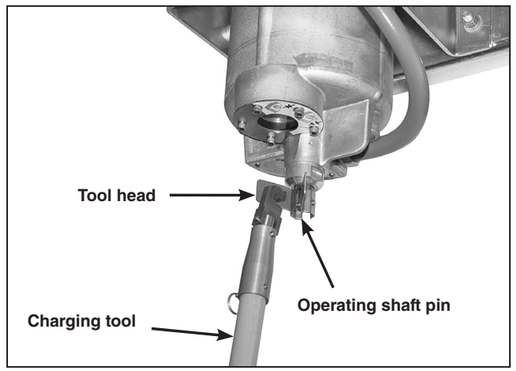


Figure 15. Engage the operating shaft pin.

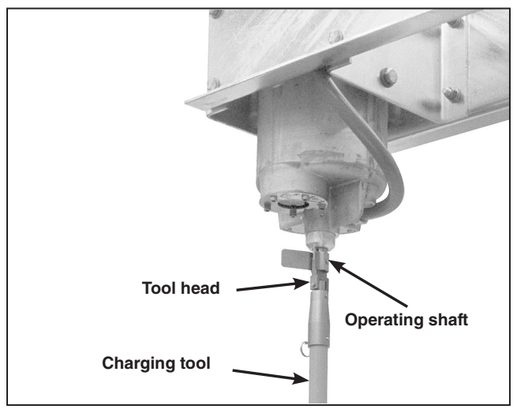


Figure 16. Make sure the operating shaft pin is engaged (shown).

STEP 8. Rotate the charging tool handle *counterclockwise*, as indicated on the tool, to close and charge the pole-unit. See Figure 17. 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 8 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 18. 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.**

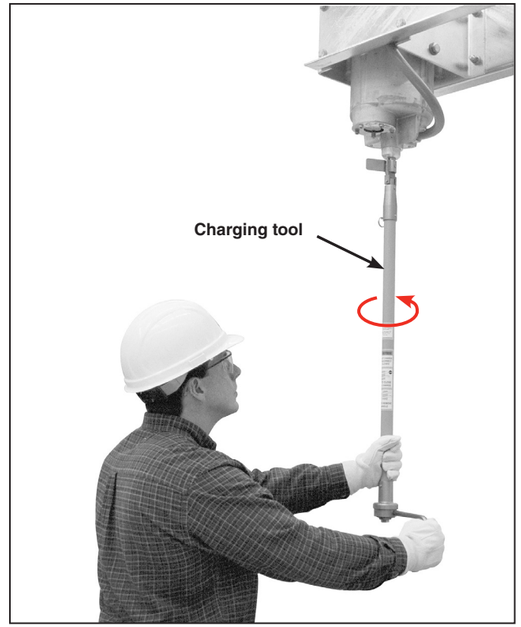


Figure 17. Rotate the tool handle counterclockwise until the internal stop is reached.

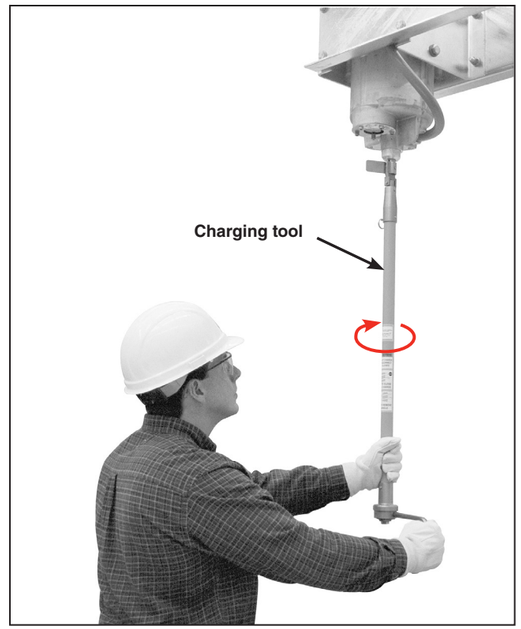


Figure 18. Rotate the tool handle clockwise until the internal stop is reached.

STEP 10. Check that the pole-unit position indicator is in the **Closed and Charged** position. See Figure 19. If the indicator still shows an **Open and Discharged** position, repeat Steps 7 through 9.

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

STEP 12. Make sure the pins have been removed from the CT shorting blocks and the cover on the optional test switch, if furnished, is securely in place. See Figures 20 and 21.

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

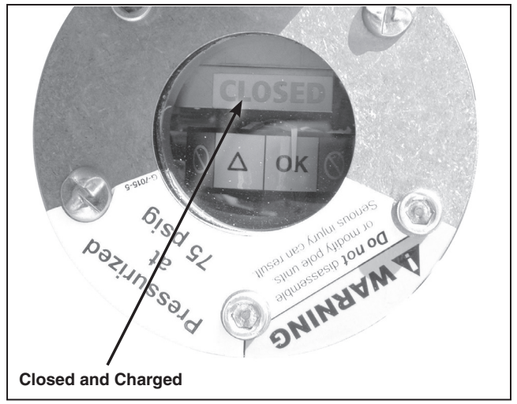


Figure 19. Check that the indicator is in the Closed and Charged position.

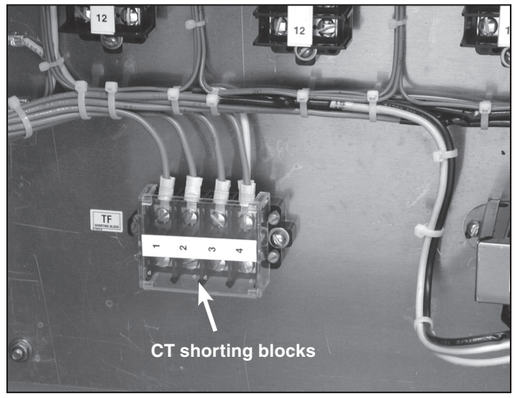


Figure 20. Make sure the pins are removed from the CT shorting blocks.

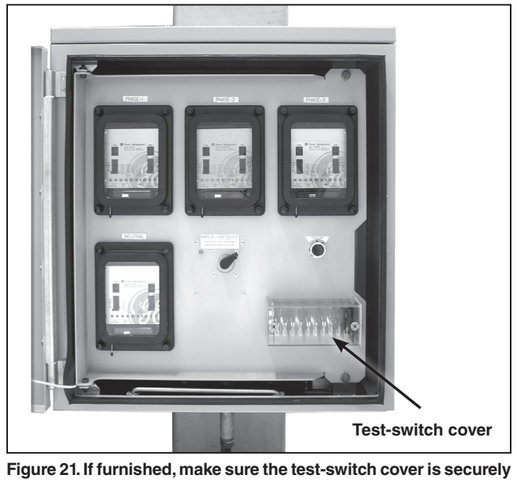


Figure 21. If furnished, make sure the test-switch cover is securely in place.

Pole-Units and Control Cabinet

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 control cabinet

In addition, verify the following:

- Make sure the gas-pressure indicator is in the white "OK" to Operate zone. See Figure 22. If the gas-pressure indicator is in either the yellow or red zones, gas density in the pole-unit has dropped. Refer to "Understanding the Gas-Pressure Indicator" on page 6.

⚠ 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 a 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.

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 indicator is flashing. See Figure 23.)
- That the trip-energy supply is storing energy (Open the swingout panel to access the circuit board of the trip-energy supply. Press the pushbutton on the trip-energy supply's circuit board. See Figure 24. If the trip energy supply is functioning properly, the red LED indicator 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 Information Bulletin 731-60 for complete information about the trip-energy supply.

If any problems are noted, notify S&C Electric Company.

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.

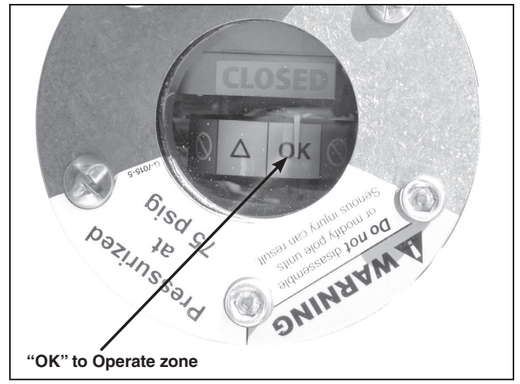


Figure 22. Check that the gas-pressure indicator on each pole-unit is in the "OK" to Operate zone.

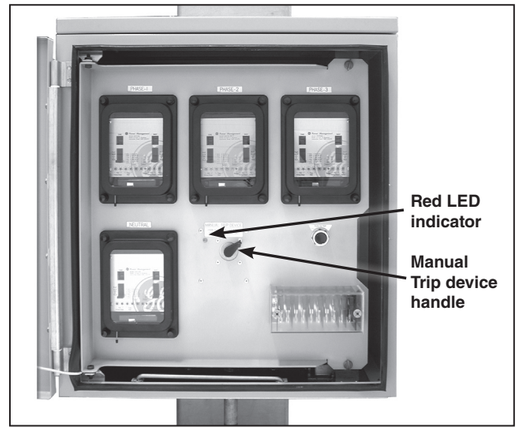


Figure 23. Crank the manual Trip device handle 5 to 10 times until the red LED indicator starts flashing.

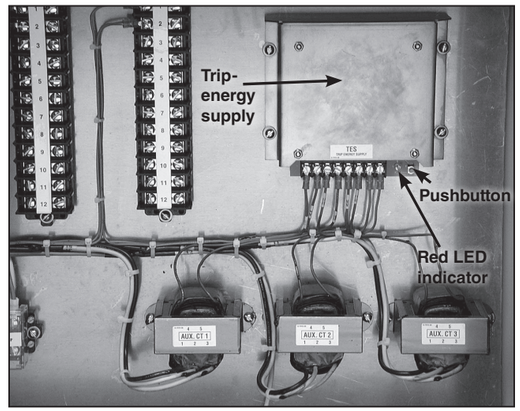


Figure 24. To verify the trip-energy supply is storing energy, press the pushbutton on the trip-energy supply circuit board. The red LED indicator will light continuously if the trip-energy supply is functioning properly.