Operation

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Qualified Persons

⚠ WARNING

Only qualified persons knowledgeable in the installation, operation, and maintenance of overhead and underground electric transmission and distribution equipment, along with all associated hazards, may install, operate, and maintain the equipment covered by this publication. A qualified person is someone 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 special precautionary techniques, personal protective equipment, insulated 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

Thoroughly and carefully read this instruction sheet and all materials included in the product's instruction handbook before installing or operating the Mark VI Circuit-Switcher. Become familiar with the Safety Information on pages 3 and 4 and Safety Precautions on page 5. The latest version of this publication is available online in PDF format at **sandc.com/en/contact-us/product-literature/**.

Retain This Instruction Sheet

This instruction sheet is a permanent part of the Mark VI Circuit-Switcher. Designate a location where users can easily retrieve and refer to this publication.

Proper Application

⚠ WARNING

The equipment in this publication is only intended for use in the switching and protection of capacitor banks and substation transformers. The application must be within the ratings furnished for the equipment. The ratings for this Mark VI Circuit-Switcher are listed on the nameplate on the side of the Mark VI CS-1A Switch Operator. They can also be found in S&C Specification Bulletin 712-31.

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to the product. Become familiar with these types of messages and the importance of these 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 any portion of this instruction sheet is unclear and assistance is needed, contact the nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C's website **sandc.com**, or call the S&C Global Support and Monitoring Center at 1-888-762-1100.

NOTICE

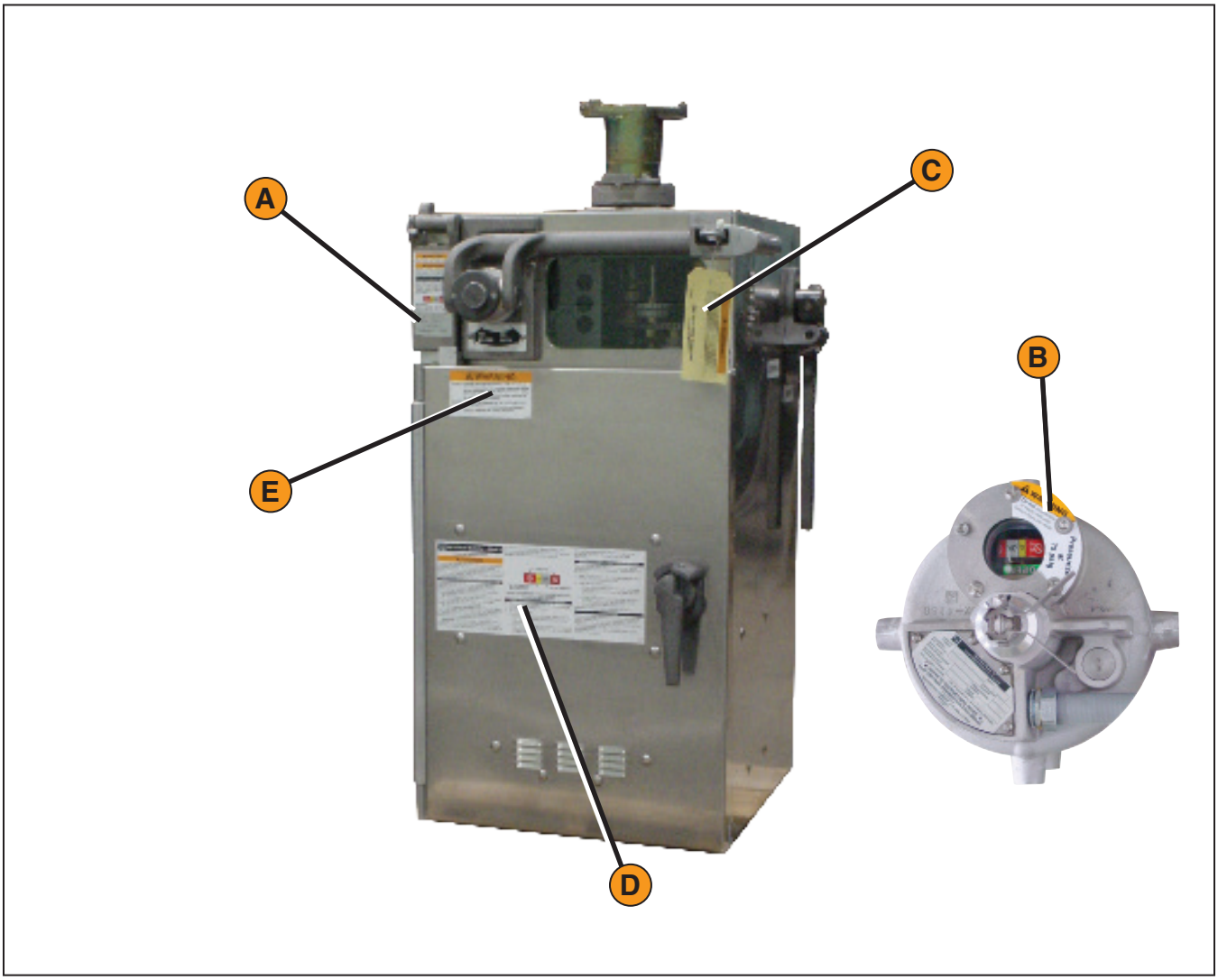
Read this instruction sheet thoroughly and carefully before operating the S&C Mark VI Circuit-Swtcher.

Replacement Instructions and Labels

If additional copies of this instruction sheet are required, contact the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

It is important any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting the 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	Use pushbutton control to open or close ...	G-9025
B	⚠ WARNING	Do not disassemble or modify ...	G-7015-5
C	⚠ WARNING	Do not operate the Circuit-Switcher with ...	G-9024
D	⚠ WARNING	Unauthorized changes should not be made ...	G-9027
E	⚠ WARNING	Do not operate the Circuit-Switcher with ...	G-9026
F	*NOTICE*	This contactor or relay has been blocked ...	G-3684R4●■
G	*NOTICE*	The S&C Instruction Sheet is a permanent part ...	G-3733R2■
H	*NOTICE*	Auxiliary switch cams are individually adjustable.	G-4746R2■

● Label should be removed before placing the circuit-switcher in service.

■ Label is inside the operator and not visible in photo.

⚠ DANGER

S&C Mark VI Circuit-Switchers 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 substation switching equipment 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. Voltage levels can be as high as the peak line-to-ground voltage last applied to the unit. Units that have been energized or installed near energized lines should be considered live until tested and grounded.
6. **GROUNDING.** The Mark VI Circuit-Switcher must be connected to a suitable earth ground at the base of the utility pole, or to a suitable building ground for testing, before energizing the switch and at all times when energized.

   The ground wire(s) must be bonded to the system neutral, if present. If the system neutral is not present, proper precautions must be taken to ensure the local earth ground, or building ground, cannot be severed or removed.
7. **CIRCUIT-SWITCHER POSITION.** Always confirm the **Open/Close** position of circuit-switchers by visually observing the position of the blades. Switches may be energized from either side and with the blades in either position.
8. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.
9. **OPERATION.** Circuit making and breaking is involved in the normal operation of this interrupter switch and, as a result, "partway" opening or closing is undesirable. To operate, follow the operating procedure as outlined in this Instruction Sheet.

Circuit-Switcher Position Indication

Circuit-switcher position can be determined in one of three ways:

1. Locally, by visually verifying the position of the integral disconnect blades. See Figure 1.
2. Locally, via POSITION INDICATING lamps on the Mark VI CS-1A Switch Operator (if furnished). See Figure 2.
3. Remotely, via auxiliary position-indication contacts furnished with the circuit-switcher.

Circuit-switchers may be in one of two positions:

Open

The integral disconnect will be in the **Open** position and the interrupter indicators will show "CLOSED."

Closed

The integral disconnect will be in the **Closed** position and the interrupter indicators will show "CLOSED."

Note: See the section, "Understanding the Interrupter Indicators" on page 7 for details on the function of the interrupter indicators.

NOTICE

The interrupter indicators only indicate the state of the interrupter contacts and do not indicate the state of the entire circuit-switcher. Verify the position of the disconnect blades to determine the **Open** or **Closed** status of the circuit-switcher.

Figure 1. Mark VI Circuit-Switcher with blades in the Open position.

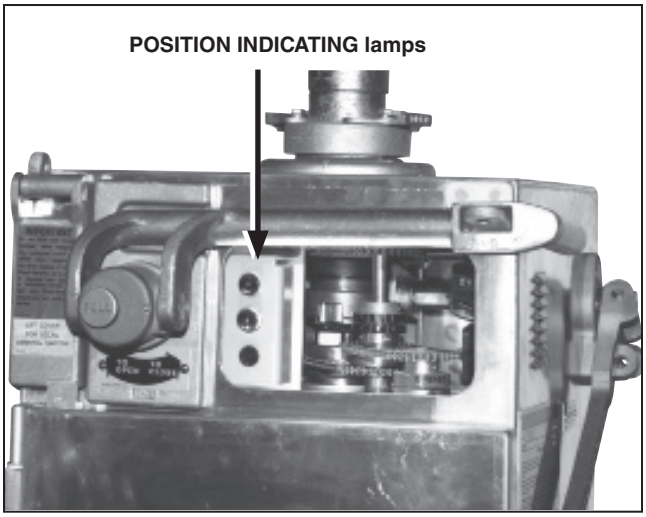


Figure 2. Location of the POSITION INDICATING lamps.

Understanding the Interrupter Indicators

An indicator is located on the underside of each interrupter. The indicators are not meaningful while the interrupters are being closed and charged. Wait for the interrupter charging motors to cease operation before checking indicator position. The interrupters will be automatically closed and charged following an **Opening** operation.

If the interrupter is in the **Closed and Charged** position, the indicator reads "CLOSED." See Figure 3.

If the interrupter is **Open and Discharged** position, the indicator reads "OPEN." See Figure 4.

During normal operation, the interrupter indicators will only read "OPEN" for a brief moment after the interrupters have tripped— before the interrupter charging motors begin closing and charging the interrupters. If the manual trip device (catalog number suffix "-T") is furnished, the interrupters will read "OPEN" after a **Manual Trip** operation. Refer to the instructions for using the manual trip device in "Tripping (Opening) the Circuit-Switcher Using the Optional Manual Trip Device" on page 15.

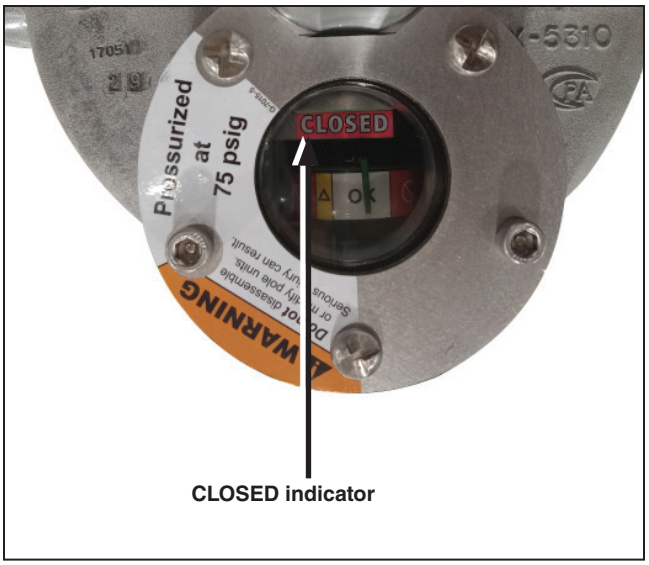


Figure 3. The interrupter is Closed And Charged. The indicator reads "CLOSED."

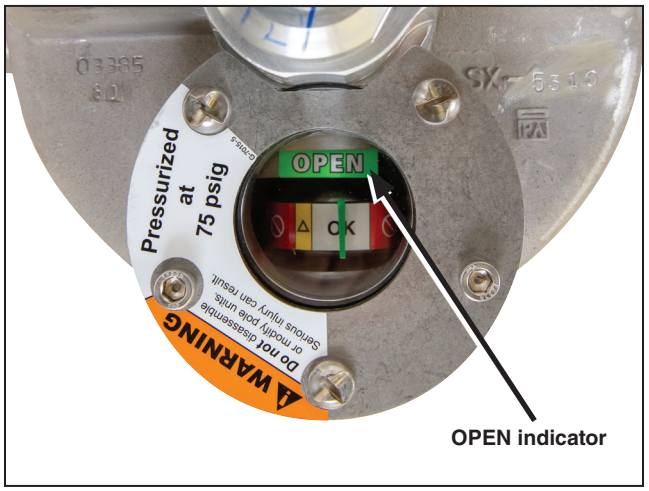


Figure 4. The interrupter is Open And Discharged. The indicator reads "OPEN."

Understanding the Gas-Pressure Gauge

A temperature-compensated gas-pressure gauge is located on the underside of each interrupter. 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 interrupter is at normal gas density and can be opened and closed. See Figure 5.

OOK to Operate (but Replace)

This is the yellow zone. If the gauge needle is in this zone, the interrupter can be opened and closed with full ratings. However, the interrupter has lost gas and should be replaced as soon as possible. See Figure 6.

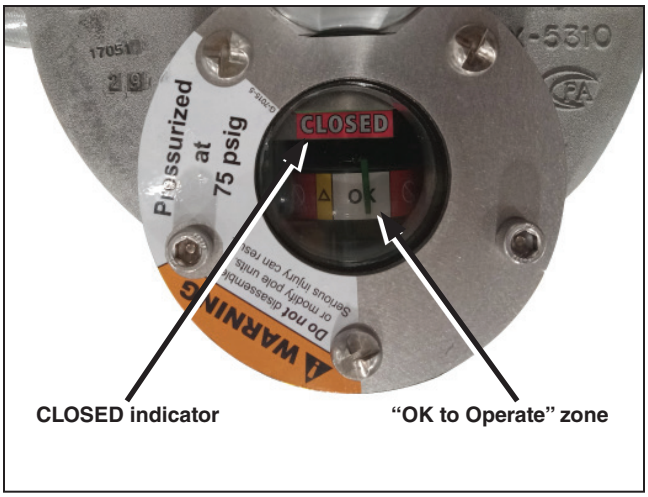


Figure 5. Gauge needle in the white OK to Operate zone.

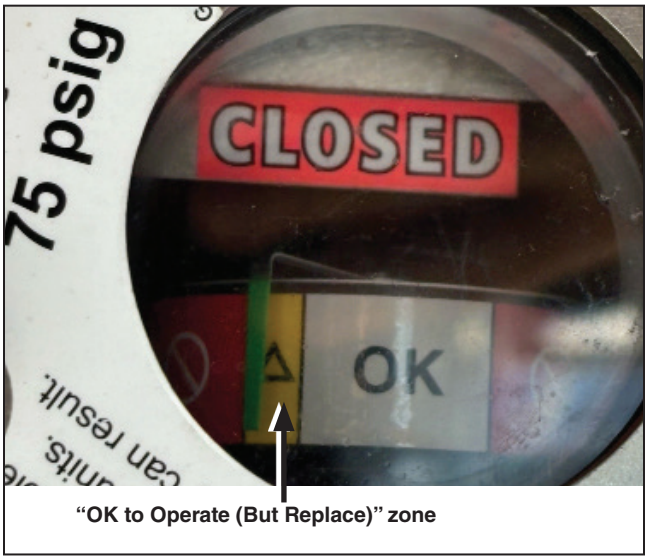


Figure 6. Gauge needle in the yellow OK to Operate (But Replace) zone.

Replace

There are two red zones. If the indicator needle is in the red zone shown in Figure 7, the gas density in the interrupter has dropped below the minimum functional level and the interrupter will not maintain full interrupting or dielectric ratings. The interrupter should be removed from service and replaced promptly. Do not operate the Mark VI Circuit-Switcher.

If the indicator needle is in the red zone shown in Figure 8, the local gas-density gauge is damaged and cannot be relied on to provide an accurate indication of gas density. The interrupter should be removed from service and replaced promptly. Contact the local S&C Sales Office. Do not operate the Mark VI Circuit-Switcher.

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 interrupter will not have full interrupting or dielectric ratings. **At these temperatures, the gas-pressure gauge does not provide accurate indication of whether an interrupter is losing SF_6 gas.**

Figure 7. Gauge needle in the red Replace zone.

Figure 8. The other red Replace zone.

Understanding the Remote Gas-Density Indicator

If furnished, the REMOTE GAS-DENSITY indicator provides contacts for each interrupter that allow remote monitoring of two low-gas-pressure alarms:

Level 1 Alarm

When a **Level 1** alarm is issued, the interrupter can be opened and closed as usual. However, the interrupter has lost gas and should be replaced as soon as possible.

The remote gas-density **Level 1** alarm contact opens at 93% 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 interrupter has dropped below the minimum functional level. The interrupter will not maintain full interrupting or dielectric ratings. The interrupter should be removed from service and replaced promptly. Do not operate this Mark VI Circuit-Switcher.

The remote gas-density **Level 2** alarm contact opens at 88% of normal density, or 65 PSIG at 68° (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 because of the cold temperature. At such low temperatures, gas density is below the interrupter's minimum functional level, so the interrupter will not have full interrupting or dielectric ratings. **At these temperatures, a Level 2 alarm does not accurately indicate whether an interrupter is losing SF_6 gas.**

Before Operating

Note: The MANUAL OPERATING handle is only intended to be used during installation, checkout, and inspection of the circuit-switcher.

Before operating the Mark VI Circuit-Switcher:

STEP 1. Make sure the internal decoupling mechanism inside the Mark VI CS-1A Switch Operator to verify it is in the **Coupled** position. See Figure 9. The SELECTOR handle should be tagged or padlocked.

STEP 2. Make sure the MANUAL OPERATING handle is in the **Storage** position and tagged or padlocked. See Figure 10.

STEP 3. Unlock and open the switch operator main door.

Note: Unlocking and opening the door is necessary because a tab on the main door secures the pushbutton protective cover. See Figure 10.

STEP 4. Make sure the two-pole pull-out fuseholder for the motor (and space heater, if furnished) is inserted. See Figure 11.

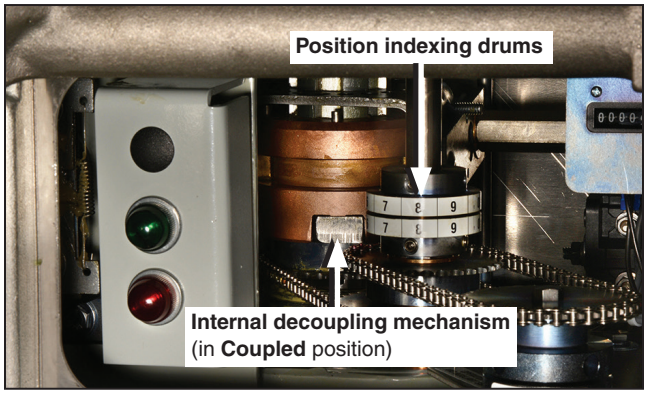


Figure 9. The decoupling mechanism and position indexing drums.

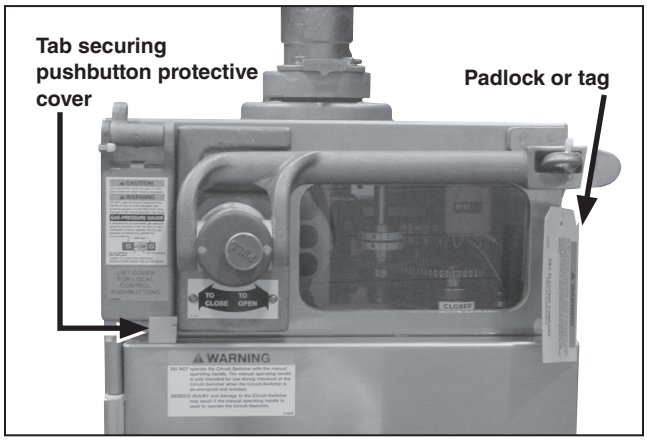


Figure 10. The MANUAL OPERATING handle tagged and/or padlocked.

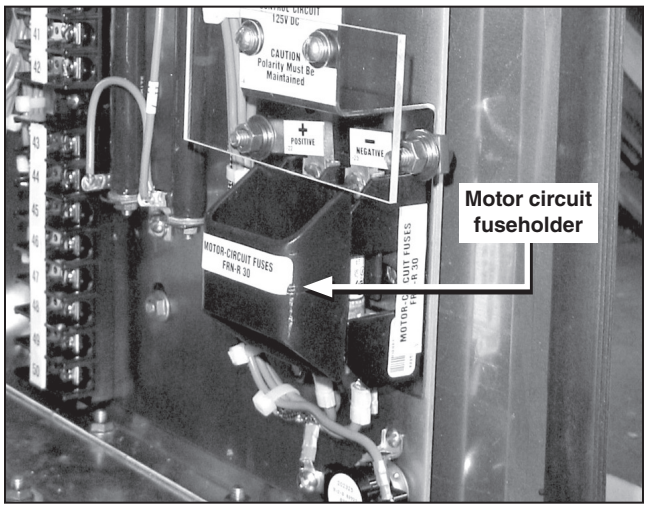


Figure 11. Make sure the motor circuit fuseholder is in place.

Closing the Circuit-Switcher

⚠ WARNING

Do not operate the Mark VI Circuit-Switcher with the manual operating handle while the switch is energized. The manual operating handle should only be used during inspection and maintenance of the switch. **Manual operation of an energized Mark VI Circuit-Switcher could, in the event of a fault or loss of control power to the operator, cause serious injury or death as well as damage to the circuit-switcher.**

When a **Close** signal is received by the switch operator, the disconnect will close, closing the circuit. To close the circuit-switcher:

STEP 1. Verify each interrupter is in the **Closed** position and the gas-pressure gauge is in the OK to Operate zone. See Figure 12. Verify the circuit-switcher disconnect is in the **Open** position.

STEP 2. Lift the pushbutton protective cover of the Mark VI CS-1A Switch Operator. For circuit-switchers with the optional remote-control blocking switch (catalog number suffix "-Y"), opening the pushbutton protective cover prevents remote operation of the switch operator. See Figure 13.

STEP 3. Press the CLOSE pushbutton for about one second. See Figure 13.

If the CLOSE pushbutton has not been furnished (catalog number suffix "-J"): Send a user-furnished **Close** signal to the operator.

The circuit-switcher disconnect blades will **Close**, restoring the circuit.

STEP 4. Close the pushbutton protective cover, and make sure the switch operator enclosure door is tagged and padlocked in accordance with standard system operating procedures.

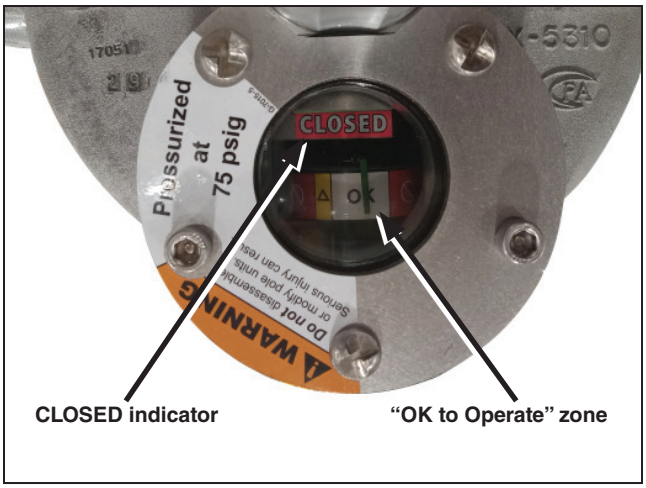


Figure 12. Interrupter is closed and charged. The indicator reads "CLOSED." The gas-pressure gauge needle is in the white OK to Operate zone.

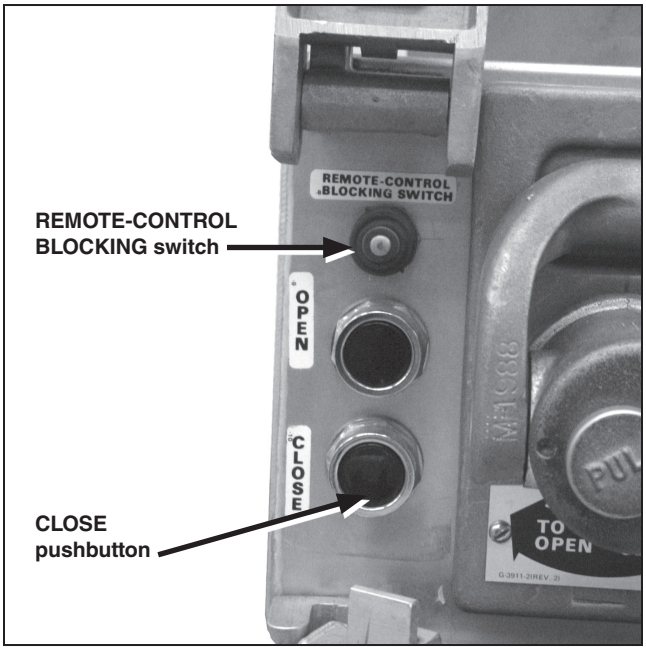


Figure 13. Lift the pushbutton protective cover, and press the CLOSE pushbutton.

Opening the Circuit-Switcher

⚠ WARNING

Do not operate the Mark VI Circuit-Switcher with the manual operating handle while the switch is energized. The manual operating handle should only be used during inspection and maintenance of the switch. **Manual operation of an energized Mark VI Circuit-Switcher could, in the event of a fault or loss of control power to the operator, cause serious injury or death as well as damage to the circuit-switcher.**

To open the circuit-switcher:

STEP 1. Verify each interrupter is in the **Closed** position and the gas-pressure gauge is in the OK to Operate zone. See Figure 14.

NOTICE

Visually verify the disconnect position to determine the **Open** and **Closed** status of the circuit-switcher. The interrupter indicators only indicate the state of the interrupter contacts, and Do not indicate the state of the entire circuit-switcher.

STEP 2. Lift the pushbutton protective cover of the Mark VI CS-1A Switch Operator. For circuit-switchers with the optional REMOTE-CONTROL BLOCKING switch (catalog number suffix "-Y"), opening the pushbutton protective cover prevents remote operation of the switch operator. See Figure 15.

STEP 3. Press the OPEN pushbutton for about one second to trip the circuit-switcher. See Figure 15.

If an OPEN pushbutton has not been furnished (catalog number suffix "-J"): Send a user-furnished **Open** signal to the operator.

When the switch operator receives a **Open** signal, the interrupters will trip, clearing the circuit. The disconnect will then open, providing a visible gap. After the disconnect is fully **Open**, the interrupter charging motors

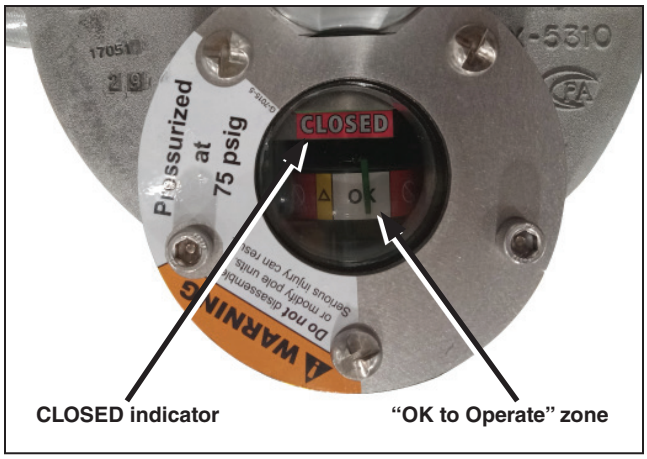


Figure 14. Interrupter is Closed and Charged. The interrupter shows "CLOSED." Gauge needle is in the white OK to Operate zone.

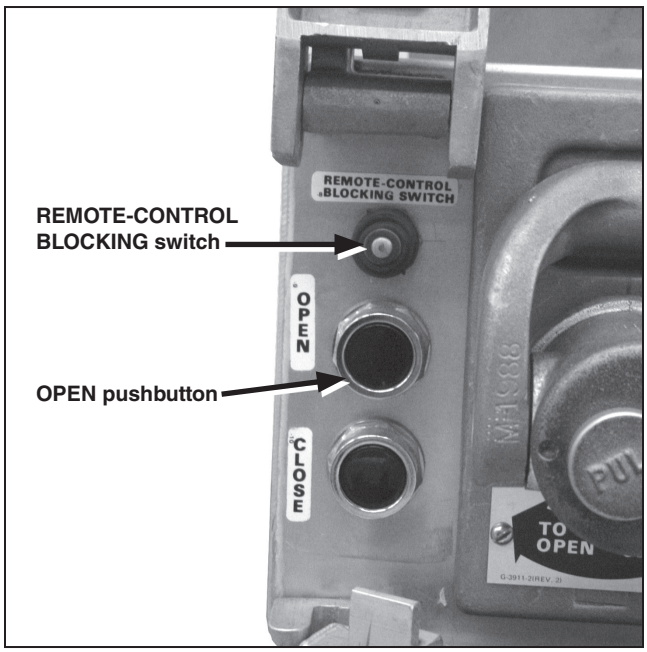


Figure 15. Lift the pushbutton protective cover, and press the OPEN pushbutton.

will reset the interrupters. Charging takes approximately two minutes.

S&C recommends the operator (or control circuit setting) wait five minutes between **Open** and **Close** operations.

NOTICE

Do not disconnect control power while the Mark VI Circuit-Switcher interrupter charging motors are operating. The interrupter charging motors will reset to the beginning of the charging cycle when control power is restored, which may cause the operation of the blade and interrupter to become unsynchronized. If control power is lost during switch operation, contact the local S&C Sales Office.

STEP 4. Close the pushbutton protective cover, and make sure the switch operator enclosure door is tagged and padlocked in accordance with standard system operating procedures.

Tripping (Opening) the Circuit-Switcher Using the Optional Manual Trip Device

If furnished, the manual trip device will be located on a swing-out panel inside the Mark VI CS-1A Switch Operator. See Figure 16. The manual trip device is used to open the circuit locally when there is no control power to the circuit-switcher.

When tripping the Mark VI Circuit-Switcher using the optional manual trip device (catalog number suffix "-T") the interrupters will trip, opening the circuit, but the disconnect will not open. Do not manually open the disconnect with the MANUAL OPERATING handle. If available, use a secondary-side disconnect to isolate the Mark VI Circuit-Switcher to create a visible gap in the circuit. Contact the local S&C Sales Office for more information.

NOTICE

Do not operate the Mark VI Circuit-Switcher disconnect with the MANUAL OPERATING handle while using the manual trip device. **Manual operation of the Mark VI Circuit-Switcher disconnect could cause a loss of electrical coordination between the interrupters and disconnect**.

Complete the following steps when tripping the circuit-switcher using the optional manual trip device:

STEP 1. Verify each interrupter indicator shows "CLOSED" and the gas-pressure gauge is in the OK to Operate zone. See Figure 17.

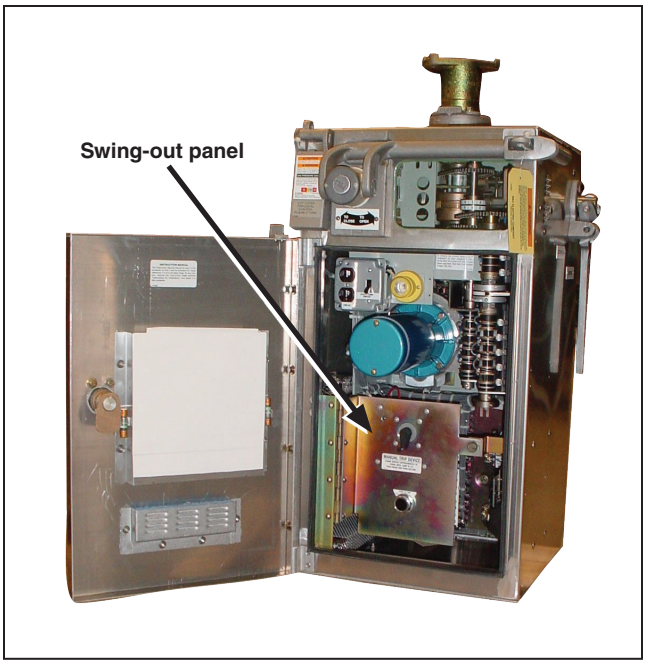


Figure 16. Location of swing-out panel in switch operator.

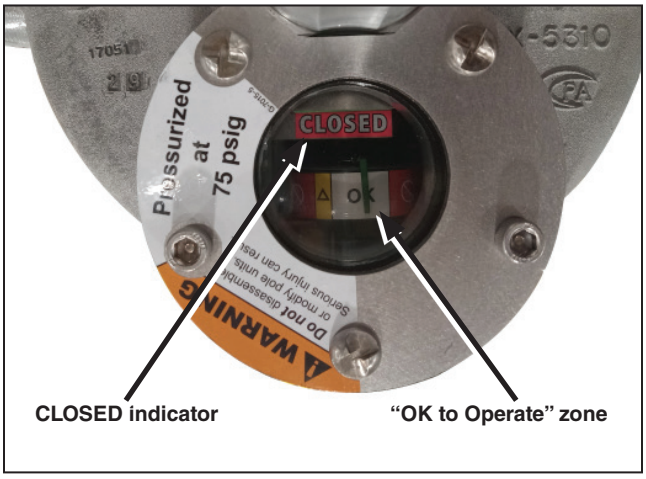


Figure 17. The interrupter in the Closed and Charged position. The interrupter should show "CLOSED." The gauge needle should be in the white OK to Operate zone.

STEP 2. Remove the two-pole pull-out fuseholder for the motor (and space heater, if furnished). See Figure 18.

STEP 3. Open the circuit-switcher with the manual trip device:

(a) Crank the MANUAL TRIP DEVICE handle between 5 and 10 times. The red LED will start flashing when the manual trip device is fully charged.

(b) Press the manual PUSH TO TRIP push-button located underneath the MANUAL TRIP DEVICE handle for about one second. The manual trip device only retains its charge for about five minutes, so press the pushbutton promptly. See Figure 19.

Note: The Mark VI CS-1A Switch Operator's OPEN pushbutton is disabled when control power is not present.

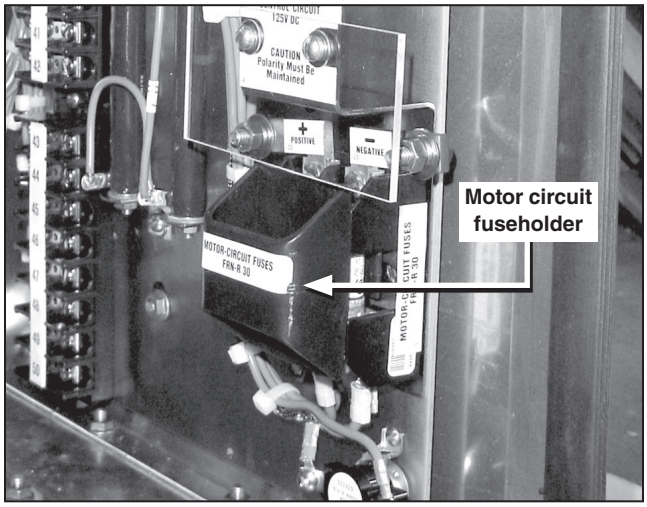


Figure 18. Remove the motor circuit fuseholder.

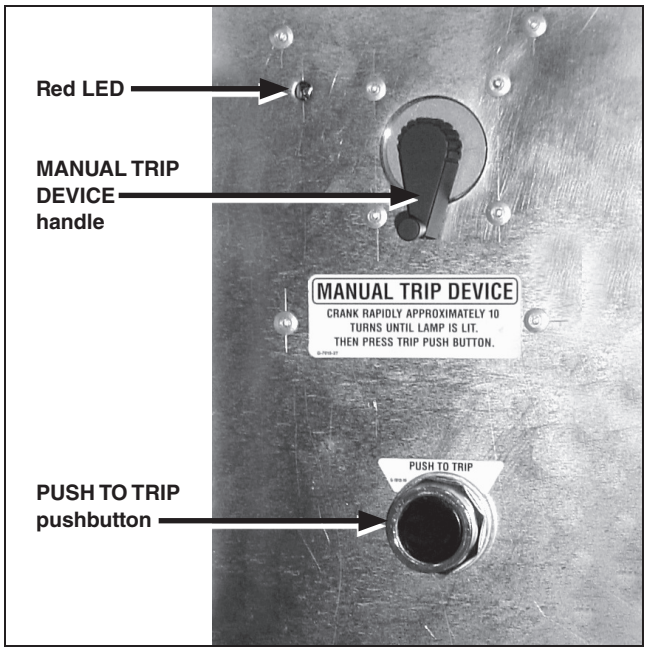


Figure 19. Operating the manual-trip device.

All three interrupters will open simultaneously. The disconnect will not open. Make sure all three interrupters are in the **Open** position. See Figure 20.

STEP 4. When control power is restored, replace the two-pole pull-out fuseholder for the motor (and space heater, if furnished).

(a) Lift the pushbutton protective cover located on the front of the Mark VI CS-1A Switch Operator.

(b) Press the OPEN pushbutton, for about one second, or send a remote **Open** signal to the switch operator. See Figure 21. The disconnect will open, and the charging motors will begin charging the interrupters. Charging takes approximately two minutes.

In the absence of OPEN and CLOSE pushbuttons, momentarily jumper Terminals 1 and 8 to open.

The disconnect is now electrically coordinated with the interrupters.

STEP 5. Close the pushbutton protective cover, and make sure the switch operator enclosure door is tagged and padlocked in accordance with standard system operating procedures.

Inspection Recommendations

To ensure Mark VI Circuit-Switcher's continued proper performance, it should be inspected in accordance with the recommended schedule and procedures contained in the tables in S&C Instruction Sheet 712-590.

Instruction Sheet 712-590 includes instructions for using the MANUAL OPERATING handle and SELECTOR handle to inspect the switch and switch operator, as well as the procedure for exercising and adjusting the switch operator motor brake.

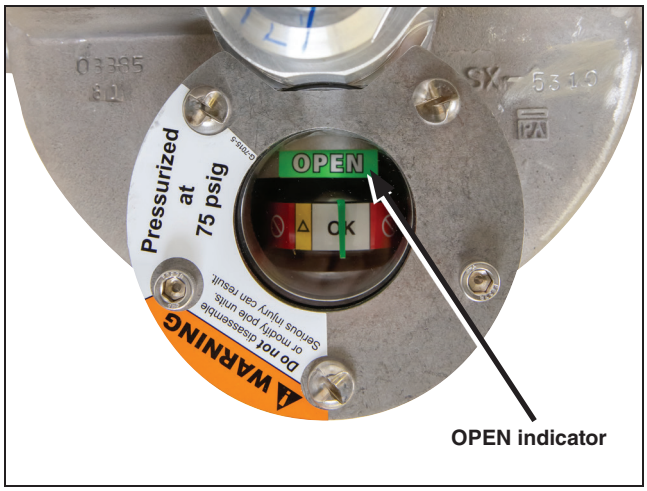


Figure 20. The interrupter is in the Open and Discharged position. The indicator shows "OPEN."

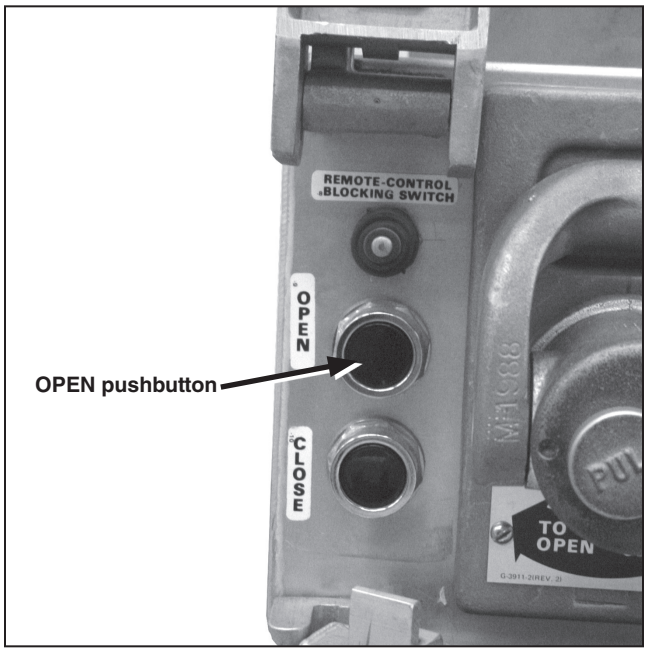


Figure 21. Location of the OPEN pushbutton under the pushbutton protective cover.