

Installation

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Introduction

Qualified Persons

WARNING

Only qualified persons knowledgeable in the installation, operation, and maintenance of overhead and underground electric distribution and transmission 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 V Circuit-Switcher. Become familiar with the Safety Information and Safety Precautions on page 3 through 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 V Circuit-Switcher. Designate a location where users can easily retrieve and refer to this publication. Keep a copy in the operator's instruction book holder if an operator is available.

Proper Application

WARNING

The equipment in this publication is only intended for a specific application. The application must be within the ratings furnished for the equipment. Ratings for the Mark V Circuit-Switcher are listed in the ratings table in S&C Specification Bulletin 711-31. The ratings are also on the nameplate affixed to the switch operator.

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, or call the S&C Global Support and Monitoring Center at 1-888-762-1100. Telephone numbers are also listed on S&C’s website, sandc.com.

NOTICE	
Read this instruction sheet thoroughly and carefully before installing the Mark V Circuit-Switcher.	

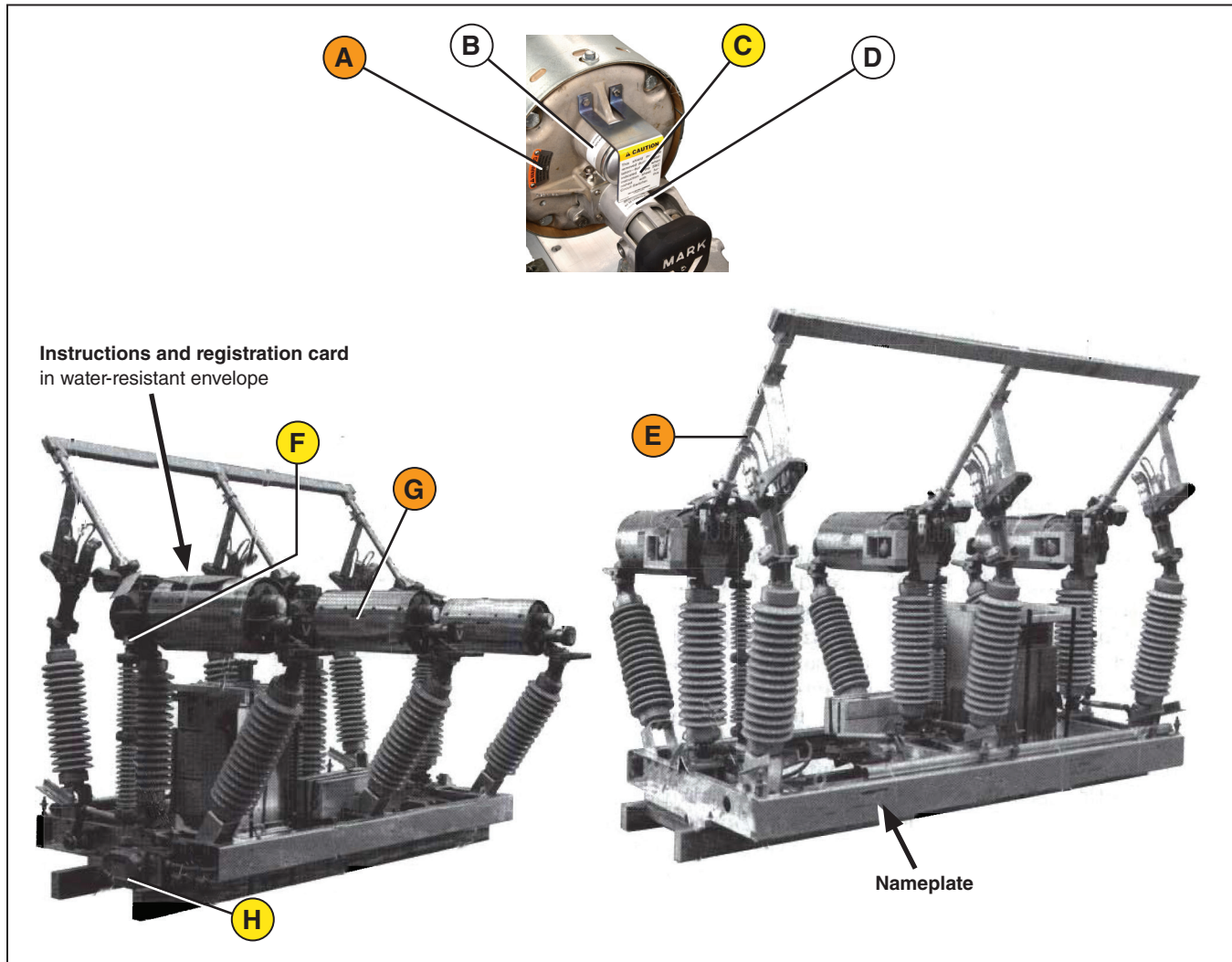
Replacement Instructions and Labels

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.

Safety Information

Location of Safety Labels



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Part Number
A	⚠ WARNING	Interrupter pressurized to 38 PSI. Install protective shields prior to removal.	G-9686
B	INSTRUCTION	Interrupter Part Number. Replace with catalog number...	G-6376
C	⚠ CAUTION	This shield must be removed during installation-- but only when indicated...	G-6043●
D	INSTRUCTION	Do not lift here.	G-3824
E	⚠ WARNING	Do not lift the brain and interrupting unit by attaching slings to the disconnect blade.	G-4093
F	⚠ CAUTION	The high-energy solenoid in this housing is designed for intermittent duty...	G-4947
G	⚠ WARNING	DO NOT remove steel outer wrapper until installation is complete.	G-5993
H	⚠ CAUTION	The high-energy solenoid in this housing is designed for intermittent duty...	G-4947■

● This is removed and discarded after the circuit-switcher is installed and adjusted.

■ Shunt-trip option only.

⚠ DANGER



Mark V 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.

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. QUALIFIED PERSONS. Access to Mark V Circuit-Switchers must be restricted only to qualified persons. See the "Qualified Persons" section 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. OPERATING MECHANISM AND BASE. Mark V Circuit-Switchers contain fast-moving parts that can severely injure fingers. Do not remove or disassemble operating mechanisms or remove access panels unless directed by S&C Electric Company. 6. ENERGIZED COMPONENTS. Always consider all parts live until de-energized, tested, and grounded. Voltage levels can be as high as the | <p>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.</p> <ol style="list-style-type: none"> 7. GROUNDING. The Mark V 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. 8. SWITCH POSITION. Always confirm the Open/Closed position of each switch. <ul style="list-style-type: none"> ○ Switches and terminal pads may be energized from either side. ○ Switches and terminal pads may be energized with the switches in any position. 9. MAINTAINING PROPER CLEARANCE. Always maintain proper clearance from energized components. |
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Shipping and Handling

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 all listed shipping skids, crates, cartons, and containers 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 damage 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 or damage.

Packing

An S&C erection drawing is contained in a water resistant envelope attached to the interrupter container on one of the three circuit-switcher pole-units. Study the erection drawing carefully and check the bill of material to be sure all parts are at hand:

The circuit-switcher shipment should include the following items, as shown in Figure 1 on page 7:

1. The three single-pole upright units, on a mounting frame weldment, with an integrated single-offset power train providing rigid torsional interphase coupling, all factory-installed and adjusted, as well as the S&C Shunt-Trip Device (if specified) and its associated conduit and control wiring
2. A crate that contains couplings for the vertical shaft, mounting hardware, grounding strap, and grounding-strap connector
3. The vertical operating-shaft section(s) bundled and strapped to the mounting-frame weldment (These operating-shaft sections are cut to length if specified. Otherwise, the correct number of operating-shaft sections are shipped for field cutting in accordance with the dimensions specified on the erection drawing.)

4. An S&C Mounting Pedestal (if specified) consisting of a single rectangular tubular column of formed steel plate construction
5. An S&C Type CS-1A Switch Operator (if specified)
6. Any accessories specified, such as grounding switch, pre-insertion inductors, bypass accessory, or manual geared operating handle

Note: Regarding the interrupter target, circuit-switchers are usually shipped with the interrupters in the **Open** position. Therefore, the interrupter target, located on the side of each brain housing, will appear yellow. See Figure 2 on page 7. During the step-by-step instructions in this instruction sheet, the disconnect blades will be moved to the fully **Closed** position. This will close the interrupter and charge and latch the stored-energy source within the brain, and the target will appear gray (normal).

Note: Regarding gas pressure, circuit-switchers have sealed interrupters containing gas under pressure. Loss of gas pressure from damage during shipping or handling may result in improper interrupting action. Low gas pressure is signaled by a red target in the GAS PRESSURE indicator at the terminal end of each interrupter. A gray target indicates normal pressure. See Figure 3 on page 7.

Options and Accessories

Shunt-Trip Device

If the optional shunt-trip device has been specified, a shunt-trip solenoid housing will be attached to the mounting-frame weldment near the rotating insulator of each pole-unit. An insulated operating shaft will be connected between this shunt-trip solenoid housing and the shaft extending from the shunt-trip linkage housing on the pole-unit brain.

Factory-installed conduit and control wiring is provided between the shunt-trip solenoid housings, ready for connection to factory-installed conduit and control wiring inside the mounting pedestal (if an S&C Mounting Pedestal has been specified). The conduit and the control wiring on the mounting-frame weldment can be connected to the conduit and control wiring inside the mounting pedestal any time after the mounting-frame weldment is installed on the mounting pedestal.

Control wiring for the shunt-trip solenoids should be left disconnected at the switch operator end until the vertical operating pipe installation has been completed. Refer to S&C Instruction Sheet 711-600 for recommended wire sizes for the control wiring.

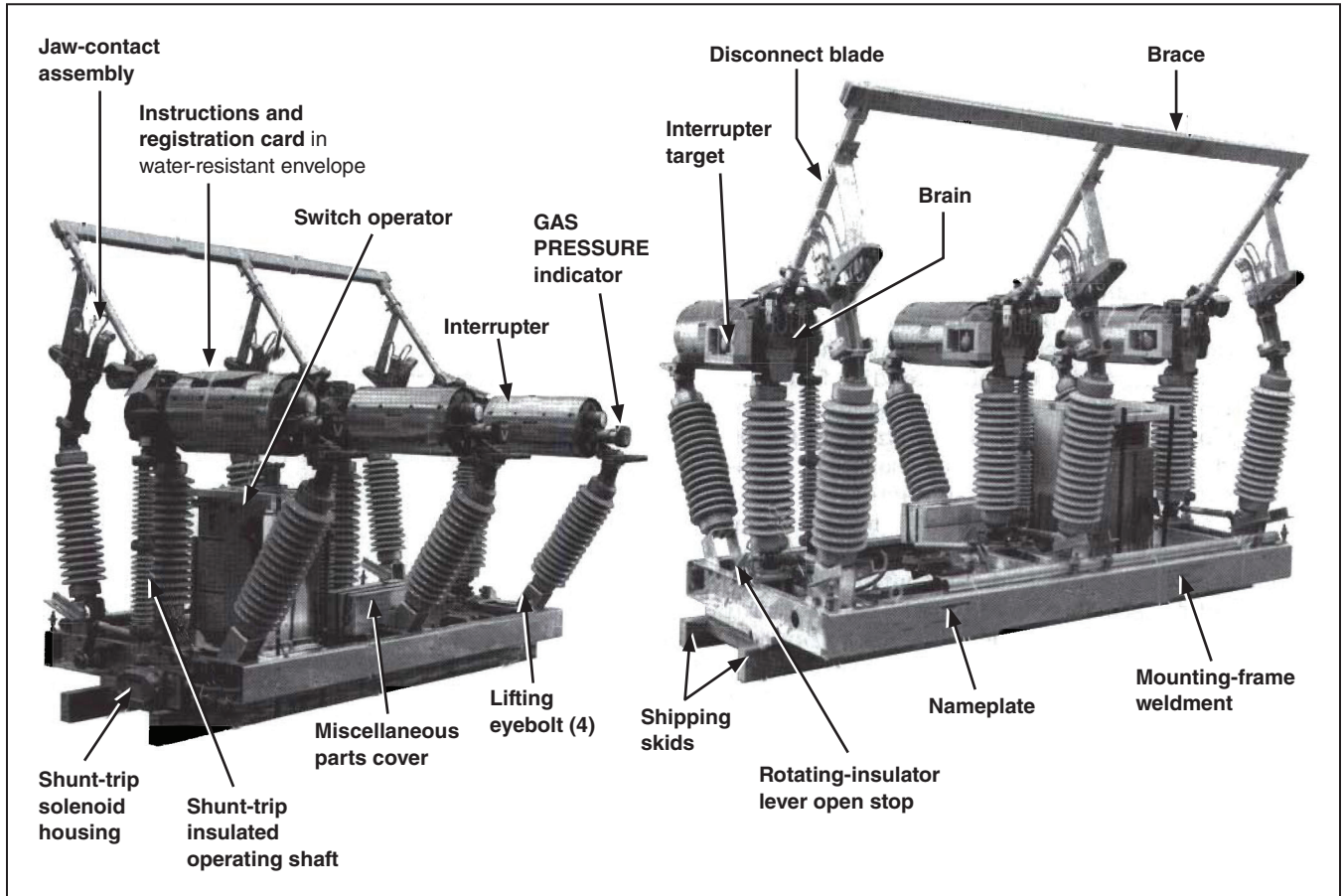


Figure 1. A three-pole integer-style Mark V Circuit-Switcher, 69 kV nominal, including a Type CS-1A Switch Operator, as arranged for shipping.

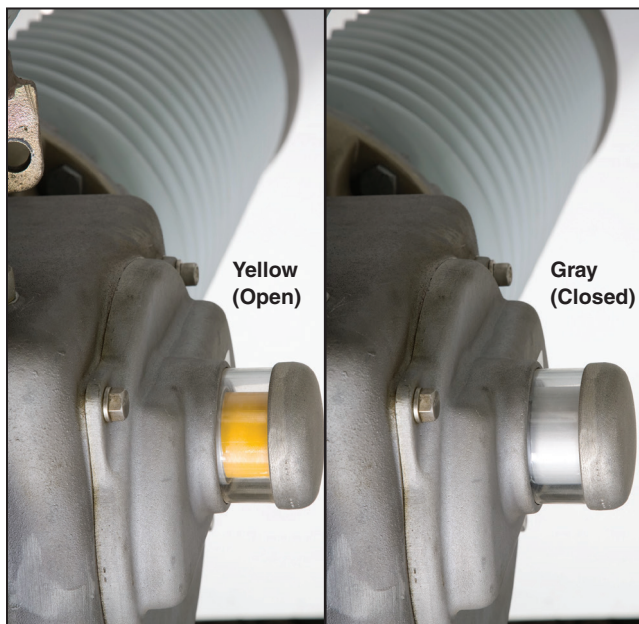


Figure 2. An interrupter target.

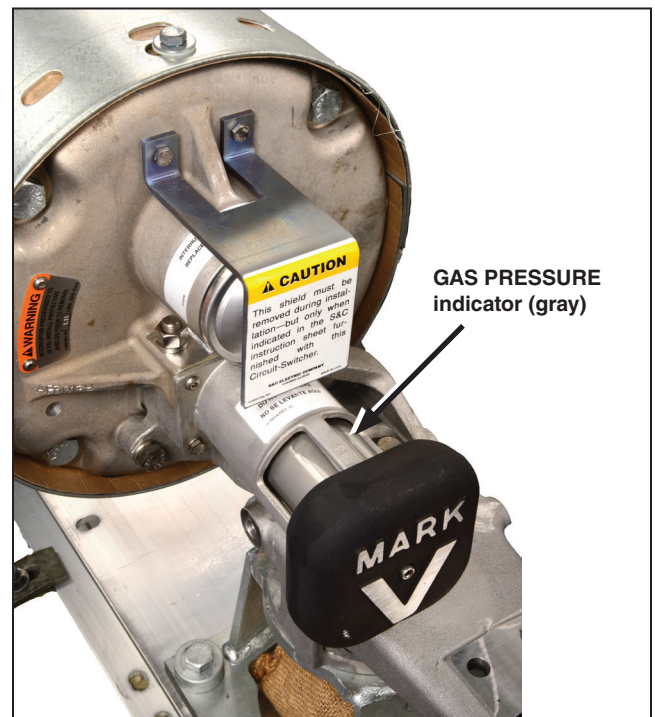


Figure 3. A GAS PRESSURE target indicator.

Shipping and Handling

Mounting Pedestals

The high operating speed that makes possible many of the Mark V Circuit-Switcher's superior performance features when power operated generates high acceleration and deceleration rates, resulting in high dynamic forces for which S&C Mounting Pedestals were specifically designed and are thus highly recommended. Alternately, circuit-switchers can be installed on the user's steel pedestals or supporting structures, which must meet specific static and dynamic deflection limits shown in S&C information bulletins, so the dynamic forces will be absorbed by the pedestals and not transferred to adjoining bus or other apparatus (e.g., bushings).

Use of flexible-conductor connections at the circuit-switcher's terminal pads will compensate for inherent insulator-column deflection. The weight of the bus plus any associated ice load exerts a vertical force on the circuit-switcher terminal pads. This vertical force must not exceed 400 pounds (181 kg) on any terminal pad.

Mark V Circuit-Switchers, when installed with the recommended S&C Mounting Pedestals and anchor bolts, are capable of withstanding seismic loading of 0.2-g ground acceleration in any direction as well as performing as intended during such loading and afterward.

Handling

WARNING

Do not lift the switch pole-units by rigging on the "live parts" or subject these parts to undue stress from slings or fall lines.

Lifting the switch by the live parts will damage the switch. Rough handling may cause damage to the blades and contacts.

Failure to lift the switch properly can result in switch damage, causing improper operation, arcing or electrical shock.

WARNING

Do not remove the protective shields around the interrupters until the installation is complete. Interrupters are pressurized to 75 PSIG.

Failure to keep the shields in place during installation may cause equipment damage or serious personal injury.

NOTICE

Do not intermix components from different installations.

S&C maintains an historical record, by serial number, of every circuit-switcher produced. This record lists information pertinent to each installation, such as application, date of shipment, and any service performed by S&C factory service specialists. This record is invaluable when questions arise relative to modifications or replacements. It is important, therefore, that various components belonging to a specific circuit-switcher installation not be intermixed with components belonging to a different installation.

For this reason, each circuit-switcher is serially numbered. This serial number is stamped on the nameplate affixed to the mounting-frame weldment and also on the nameplate affixed to the switch operator (or the manual geared operating handle if the circuit-switcher is manually operated).

To facilitate identification during erection, the serial number, the sales-order number, and the erection-drawing (ED) number are marked on the circuit-switcher mounting-frame weldment and on the switch operator shipping crate, and on all crates, boxes, and bundles for the other components associated with the installation.

Pre-Assembly for 69 kV Circuit-Switchers

For circuit-switchers rated 69 kV only: To reduce shipping volume, the jaw-contact insulators have been tilted toward the interrupters and, as a result, the disconnect blades have been shipped in a partially **Open** position. See Figure 4. Two factory-adjusted stud assemblies are provided on the mounting-frame weldment, at each pole-unit position, for use in repositioning the jaw-contact insulators to the correct angle.

Reposition each jaw-contact insulator as follows:

- STEP 1.** Remove and discard the wood brace attached to the three disconnect blades.
- STEP 2.** Remove and discard the brace between the jaw-contact terminal pad and the disconnect blade at each pole-unit position.

STEP 3. Remove from each stud assembly the top nut, lockwasher, and one of the two flat washers. See Figure 4 (inset). Leave the second flat washer in place. Do not disturb the factory setting of the remaining three nuts on each stud assembly.

STEP 4. Remove and discard the two upper bolts that secure the insulator support at each pole-unit position. See Figure 4 (inset). Loosen the two lower bolts that secure the insulator support at each pole-unit position and tilt the insulator forward until it rests on the flat washers remaining on the stud assemblies.

STEP 5. Replace on each stud assembly the flat washer, lock washer, and nut removed in Step 3. Securely tighten the two lower bolts at each pole-unit position loosened in Step 4.

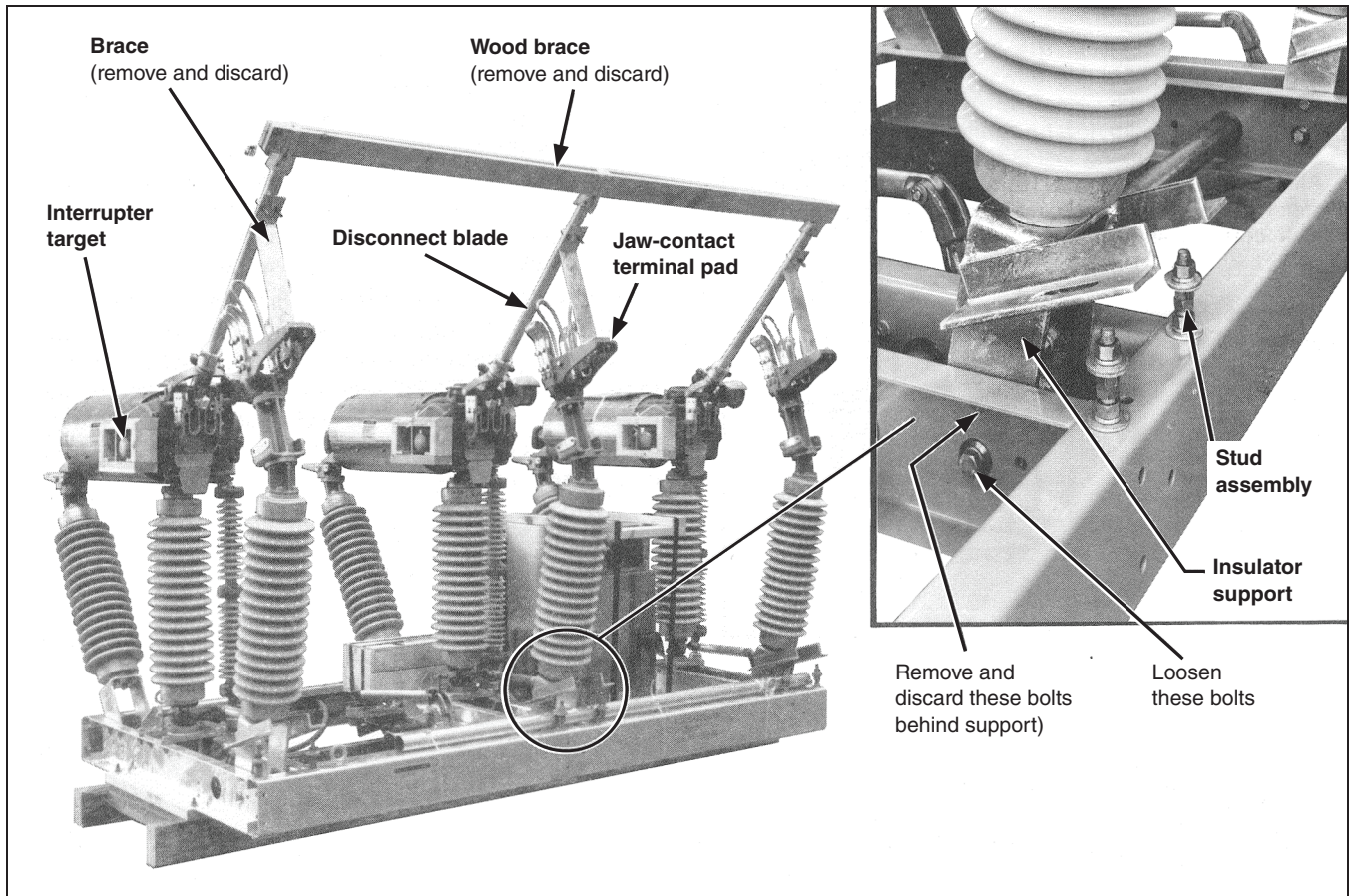


Figure 4. A 69-kV integer-style Mark V Circuit-Switcher with insulators tilted in position for shipment.

Installation

Installing the Integer-Style Circuit-Switcher

After installing the S&C Mounting Pedestal per the erection drawing, or user-furnished mounting structure, complete the following steps to install the circuit-switcher:

- STEP 1.** Unbolt the mounting-frame weldment from the shipping skids.
- STEP 2.** Attach suitable lifting slings to the four lifting eyebolts furnished on the mounting-frame weldment. See Figure 5. Be sure the eyebolts are screwed in tightly. Do not apply lifting force to any eyebolt at an angle less than 60° from the horizontal. Avoid sudden starts and stops. Hoist this assembly onto the mounting pedestal, making sure the lifting slings do not bear on the center pole-unit.
- STEP 3.** Bolt the mounting-frame weldment to the base pedestal using eight $\frac{5}{8}$ -11×2-inch hex-head galvanized steel cap screws, 16 flat washers, eight lockwashers, and eight $\frac{5}{8}$ -11-inch hex nuts furnished. Use shims as required. Torque the cap screws to at least 85 foot-pounds.
- STEP 4.** Cut and remove the shipping wires as indicated in Figure 7 on page 11.

Note: If the optional shunt-trip device has been specified, the conduit and the control wiring on the mounting-frame weldment can now be connected to the conduit and control wiring inside the mounting pedestal. Also, fully disengage the retractable bracket that secures the shunt-trip operating shaft extending from each brain, as shown in Figure 6.

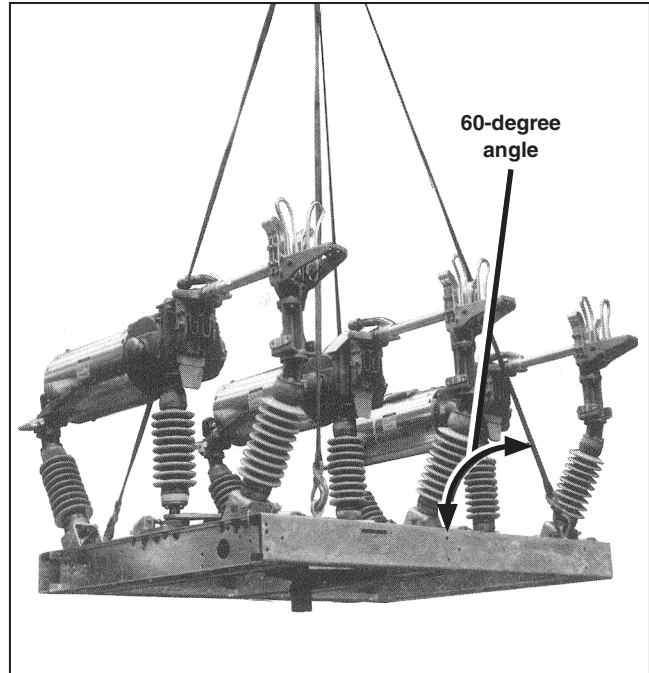


Figure 5. A method of hoisting, using lifting slings.

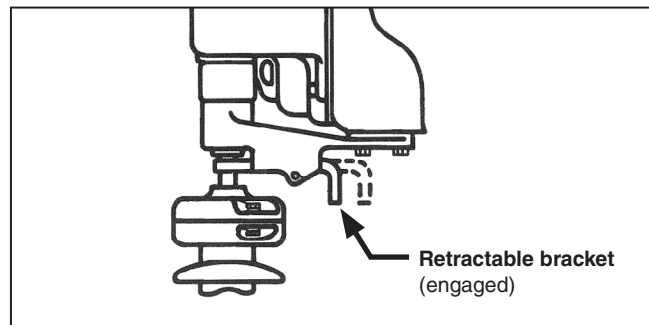


Figure 6. Disengaging the retractable bracket.

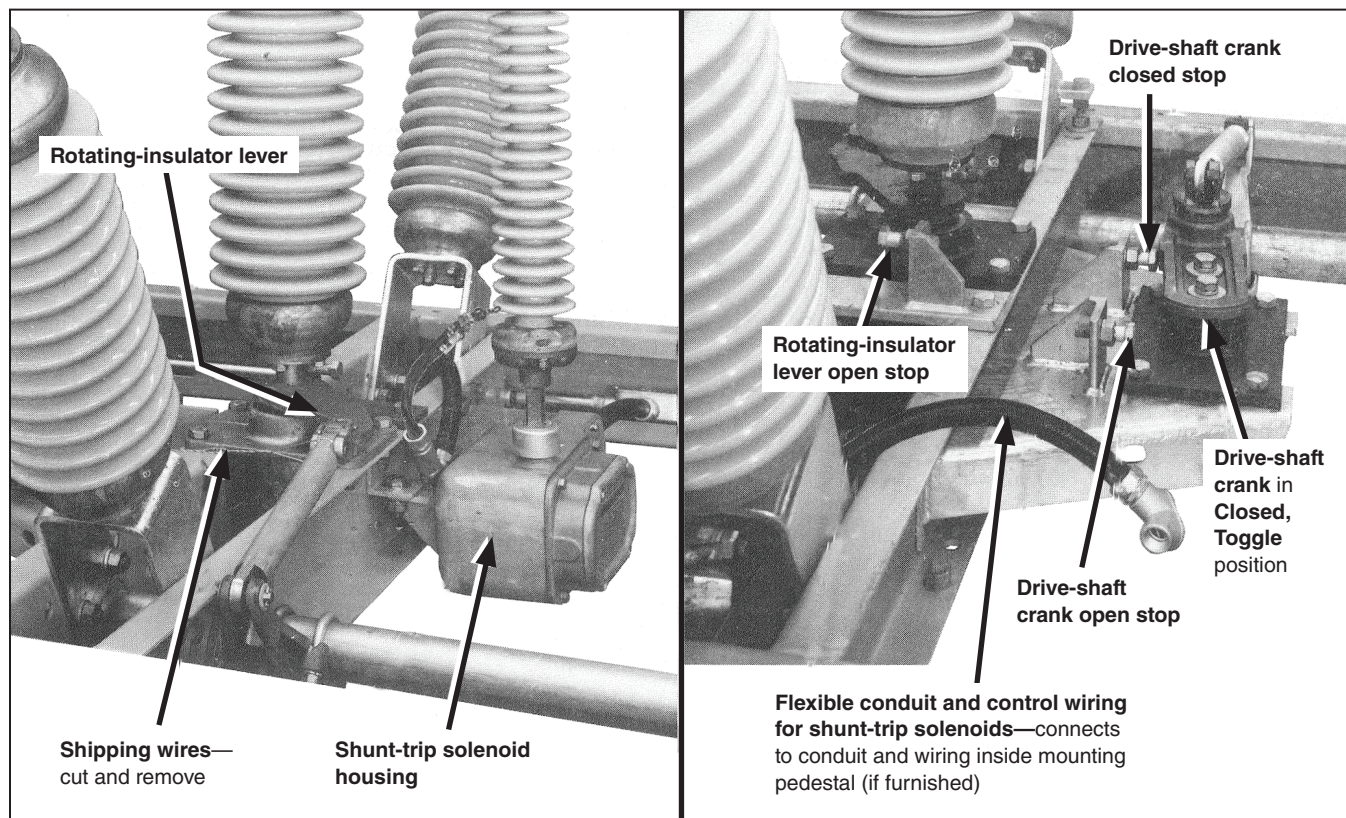


Figure 7. Mounting frame weldment details.

Installing the Type CS-1A Switch Operator

Complete the following steps to install the Type CS-1A Switch Operator:

- STEP 1.** Mount the switch operator as indicated on the erection drawing.

When more than one switch operator is available, select the one intended for the circuit-switcher installation being made. Make sure the circuit-switcher serial number, located on the nameplate on the switch operator, matches the serial number on the nameplate of the integer circuit-switcher.

- STEP 2.** Refer to S&C Instruction Sheet 719-500, which has been placed inside the door of the switch operator, and proceed as outlined in that document in the “Installation” section.

NOTICE

To avoid damage to the circuit-switcher and switch operator, electrical operation of the switch operator should not be attempted until its travel-limit discs have been properly adjusted as described in S&C Instruction Sheet 719-500.

Installing the Vertical Operating Pipe

For 34.5-kV and 46-kV circuit-switchers only: These voltages are shipped with disconnect blades in the fully **Closed** position. To connect the vertical operating pipe, complete the following steps:

- STEP 1.** Manually operate the switch operator to bring it to the same fully **Closed** position as the circuit-switcher.
- STEP 2.** Attach the flexible or universal coupling to the output shaft of the switch operator.

Installation

- STEP 3.** Make sure the cutting tips of the piercing set screws do not protrude through the body of the flexible or universal coupling.
- STEP 4.** Install the vertical shaft as indicated on the erection drawing.
- STEP 5.** Tighten the clamp bolts equally so the clamp pulls down evenly. Then, tighten the piercing set screws, piercing the shaft, and continue turning until feeling a firm resistance.

Refer to S&C Instruction Sheet 719-500, and adjust the switch operator for electrical operation as described in the “Adjusting the Switch Operator” section.

Note: When the switch operator travel-limit adjustments have been completed, all auxiliary contacts being used must be checked for proper operation.

For 69-kV Circuit-Switchers only: These devices are shipped with disconnect blades in a partially **Open** position. To connect the vertical operating pipe, complete the following steps:

- STEP 1.** Attach the flexible or universal coupling to the output shaft of the switch operator.
- STEP 2.** Make sure the cutting tips of the piercing set screws do not protrude through the body of the flexible or universal coupling.
- STEP 3.** Install the vertical shaft as indicated on the erection drawing.
- STEP 4.** Tighten the clamp bolts equally so the clamp pulls down evenly, but do not tighten the piercing set screws at this time. Then, using the switch operator’s manual operating handle, crank the circuit-switcher to the fully **Closed** position.
- STEP 5.** Loosen the clamp bolts on the flexible or universal coupling on the switch operator’s output shaft and crank the switch operator to the **Closed** position, as indicated by its closed position indicator. Retighten the clamp bolts.
- STEP 6.** Tighten the piercing set screws, piercing the shaft, and continue turning until feeling a firm resistance.

Refer to S&C Instruction Sheet 719-500 and adjust the switch operator for electrical operation as described in the “Adjusting the Switch Operator” section.

Note: When the switch operator travel-limit adjustments have been completed, all auxiliary contacts being used must be checked for proper operation.

Installing the Shunt Trip Device

If the optional shunt-trip device has been specified, the control wiring for the shunt-trip solenoids should be connected to the terminal block in the switch operator at this time. See S&C Instruction Sheet 711-600.

Connecting High-Voltage Conductors

Connect the high-voltage conductors to their respective circuit-switcher terminal pads.

WARNING

Before connecting the conductors to the Mark V Circuit-Switcher, conductors must be de-energized and grounded in accordance with standard system operating practice. Then, proceed with the final checks and adjustments described in the following steps.

Working on an energized circuit-switcher may lead to equipment damage, personal injury, or death.

Checking the Operation

Because this circuit-switcher was carefully adjusted at the factory, the only field adjustments that should be required are those described in this instruction sheet. Several checks should be made to ascertain no adjustments were disturbed during shipment:

- STEP 1.** Operate the switch operator with its manual operating handle to check three-pole group operation.

During the opening operation, an initial peaking of effort will be required as the drive-shaft crank leaves its **Closed** toggle position. Rotation should progress smoothly but with a noticeable increase in effort as the blades pass beyond their **Half Open** position. It is at this position the stored-energy source within each brain assembly begins to charge as the interrupter closes.

As the opening continues, this stored-energy source charges and latches, and a final peaking of effort again will be required as the drive-shaft crank goes into toggle against its open stop. The blades will now be in the fully **Open** position and the interrupters will be closed, as indicated by the gray interrupter

target on the side of each brain. See Figure 2 on page 7.

- STEP 2.** Verify that during the opening sequence, the interrupter target on the side of each brain housing changes from gray to yellow when the interrupter is opened, then back to gray, indicating the normally **Closed** position of the interrupter. In addition, the interrupter target remains gray when the circuit-switcher is closed, indicating the interrupter is closed.
- STEP 3.** Make sure when the circuit-switcher reaches either the fully **Open** or fully **Closed** position, the drive-shaft crank strikes firmly against the appropriate drive-shaft crank stop. See Figure 8. Also, note whether each rotating-insulator lever makes contact with its respective open stop.
- STEP 4.** Make sure the blade crank-arm at the top of each brain rests against the blade crank-arm stop in the fully **Open** position.
- STEP 5.** Make sure there is no more than a 1/32-inch (0.8-mm) gap between each blade crank-arm and its associated blade crank-arm stop in the **Closed** position. See Figure 9.

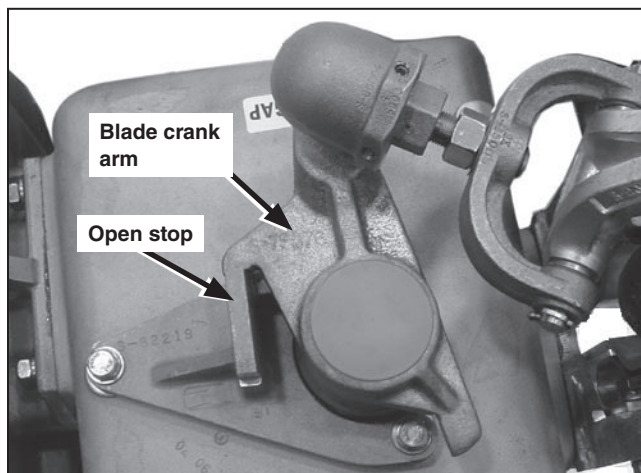


Figure 8. Top of brain, blade crank arm stop. Open position.

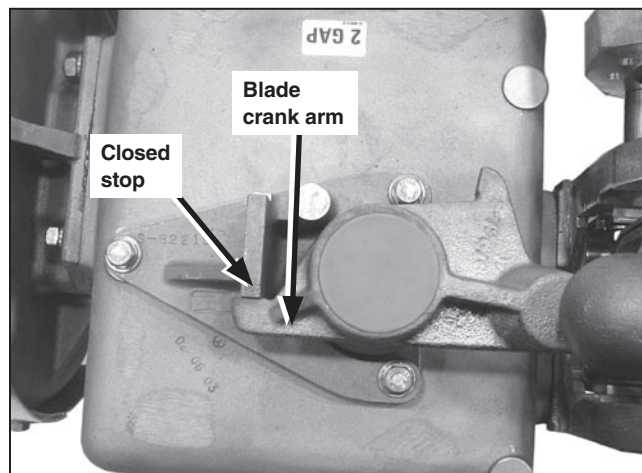


Figure 9. Top of brain, blade crank arm stop. Closed position.

Installation

STEP 6. Upon closing, make sure the current-carrying tongue contacts on each disconnect blade enter the current-carrying jaw contacts with equal clearance on each side. See Figure 10.

Should any of the foregoing checks indicate adjustments are required, contact the nearest S&C Sales Office.

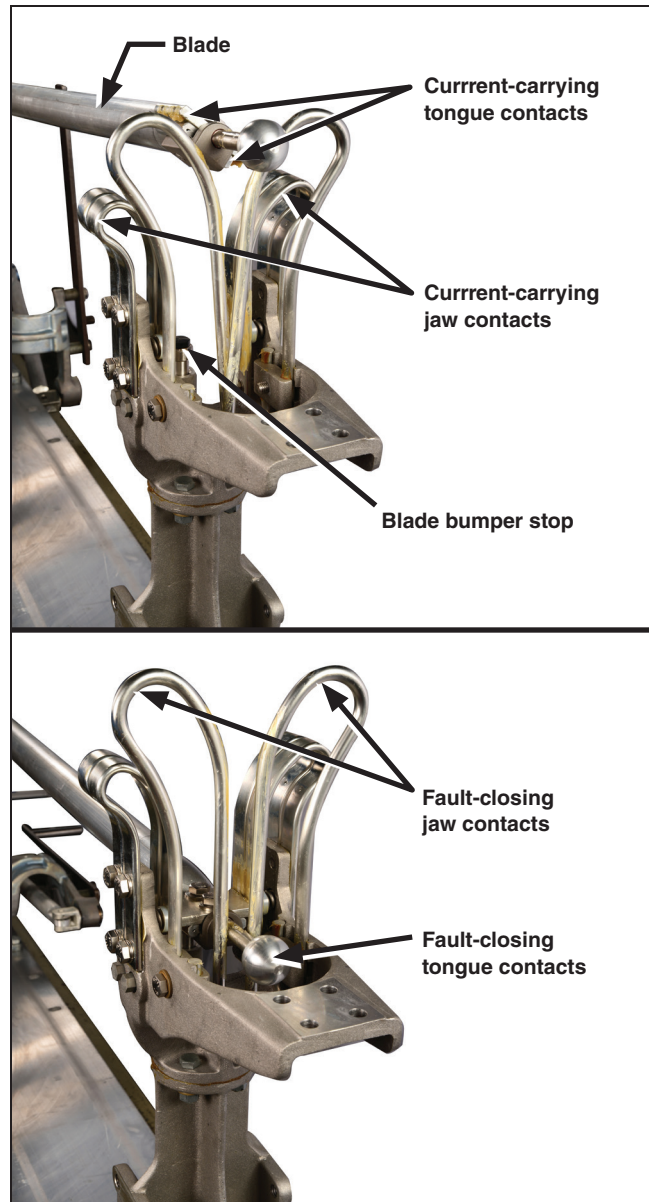


Figure 10. Tongue-contact and jaw-contact assemblies shown in partially Closed and fully Closed positions.

Before Energizing the Circuit-Switcher

Remove the container from each interrupter as follows:

- STEP 1.** Remove and discard the $\frac{3}{8}$ -16 zinc-plated serrated hex nuts that run the length of the container. See Figure 11.
- STEP 2.** Remove and discard the $\frac{3}{8}$ -16 \times $\frac{7}{8}$ -inch and two $\frac{3}{8}$ -16 \times 1-inch zinc-plated hex-head cap screws and flat washers that attach the upper container-half to the coupling-end casting of the interrupter. Also remove and discard the $\frac{3}{8}$ -16 \times $\frac{7}{8}$ -inch and two $\frac{3}{8}$ -16 \times 1-inch zinc-plated hex-head cap screws and flat washers that attach the upper container-half to the indicator-end casting of the interrupter. See Figure 11.
- STEP 3.** Pry the container-halves apart with a screwdriver. The upper container-half can now be removed and discarded. Slotted holes are provided so a rope or lifting sling can be attached and the container-half conveniently lowered to the ground.
- STEP 4.** Remove and discard the $\frac{3}{8}$ -16 \times $\frac{7}{8}$ -inch hex-head cap screw and flat washer that attach the lower container-half to the coupling-end casting of the interrupter, and the $\frac{3}{8}$ -16 \times $\frac{7}{8}$ -inch hex-head cap screw and flat washer that attach the lower container-half to the indicator-end casting of the interrupter, and discard this container-half.
- STEP 5.** Finally, remove and discard the inner packaging wrapped around the interrupter.
- STEP 6.** Remove and discard the shield for the pressure-relief device. See Figure 12.
- STEP 7.** Complete and mail the circuit-switcher registration card. The information requested on this card is vital to ensure prompt notification in the event field modifications are needed.

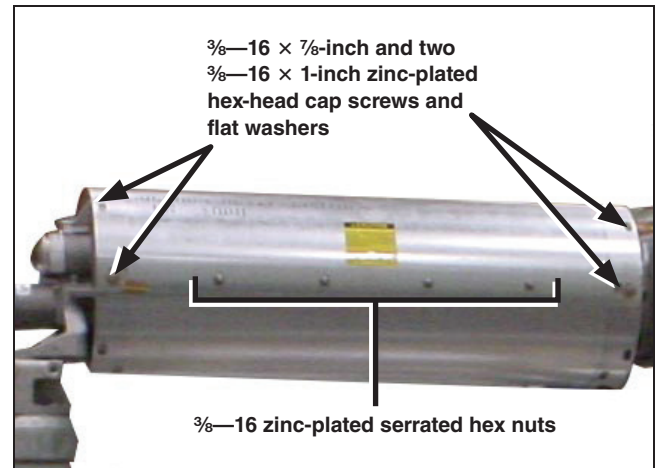


Figure 11. Removing the interrupter container.

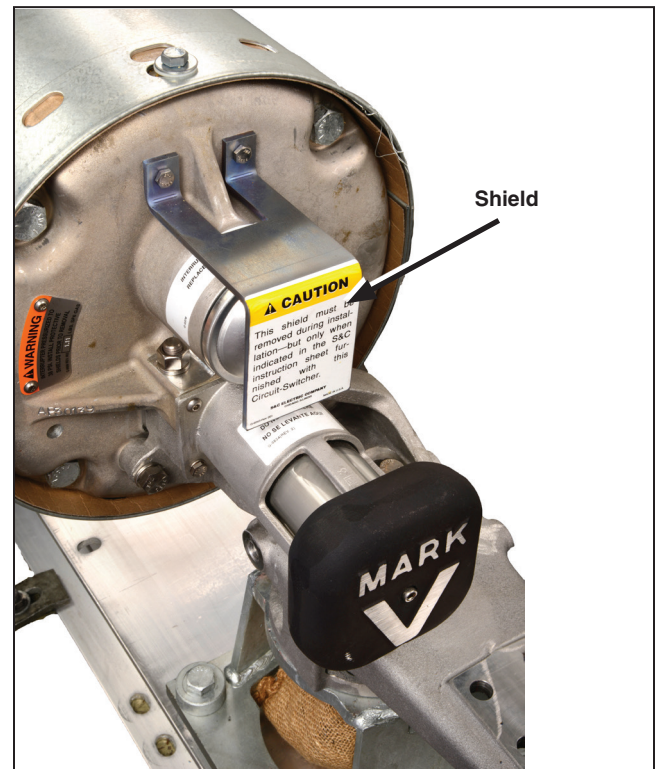


Figure 12. Removing the pressure relief device shield.