Installation and Operation

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Qualified Persons

⚠ WARNING

Only qualified persons knowledgeable in the installation, operation, and maintenance of overhead and underground electric 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 a Model 2030 Series 2000 Circuit-Switcher. Become familiar with the Safety Information on pages 3 through 5 and Safety Precautions on page 6. 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 Model 2030 Series 2000 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 a specific application. The application must be within the ratings furnished for the equipment. Ratings for the Model 2030 Series 2000 Circuit-Switcher are listed in the ratings table in Specification Bulletin 716-31. The ratings are also on the nameplate affixed to the product.

Usual Operating Conditions

Series 2000 Circuit-Switchers will perform as intended at temperatures within the range of –40°C (-40°F) to +40°C (+104°F) (–35°C [–31°F] to +40°C {+104°F } for 161-kV and 230-kV models), at altitudes of up to 5000 feet (1524 m), and at wind loadings of up to 90 miles (145 km) per hour. Further, Series 2000 Circuit-Switchers, when installed with the recommended S&C anchor bolts and with flexible-conductor connections at all six terminal pads, are capable of withstanding seismic loading of 0.2g ground acceleration in any direction and performing as intended during such loading and afterward. For applications at temperatures not within the specified range, at higher altitudes, at higher wind loadings, or where higher seismic-withstand capabilities are required, refer to the nearest S&C Sales Office.

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

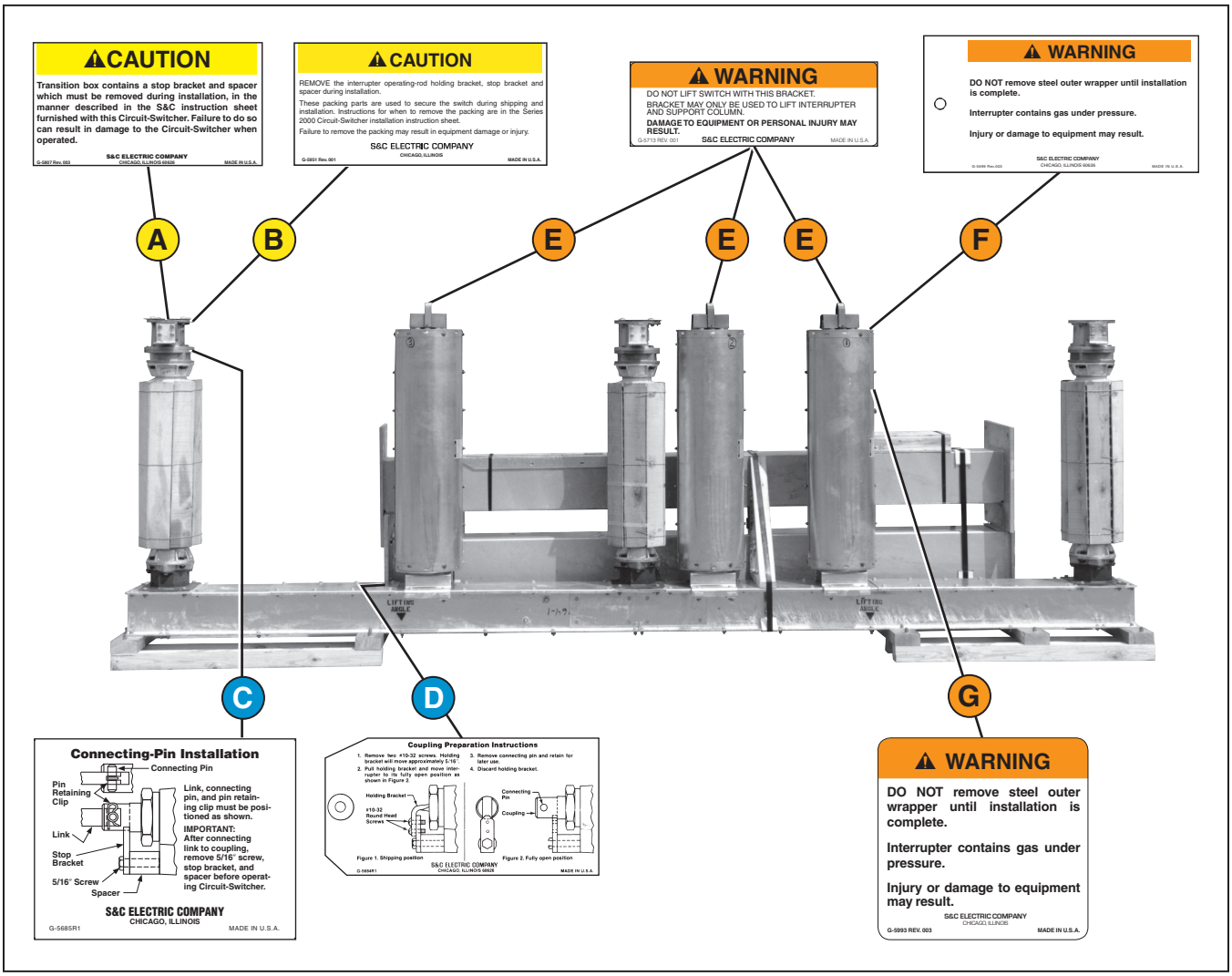
Read this instruction sheet thoroughly and carefully before installing a Model 2030 Series 2000 Circuit-Switcher.

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 that 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.

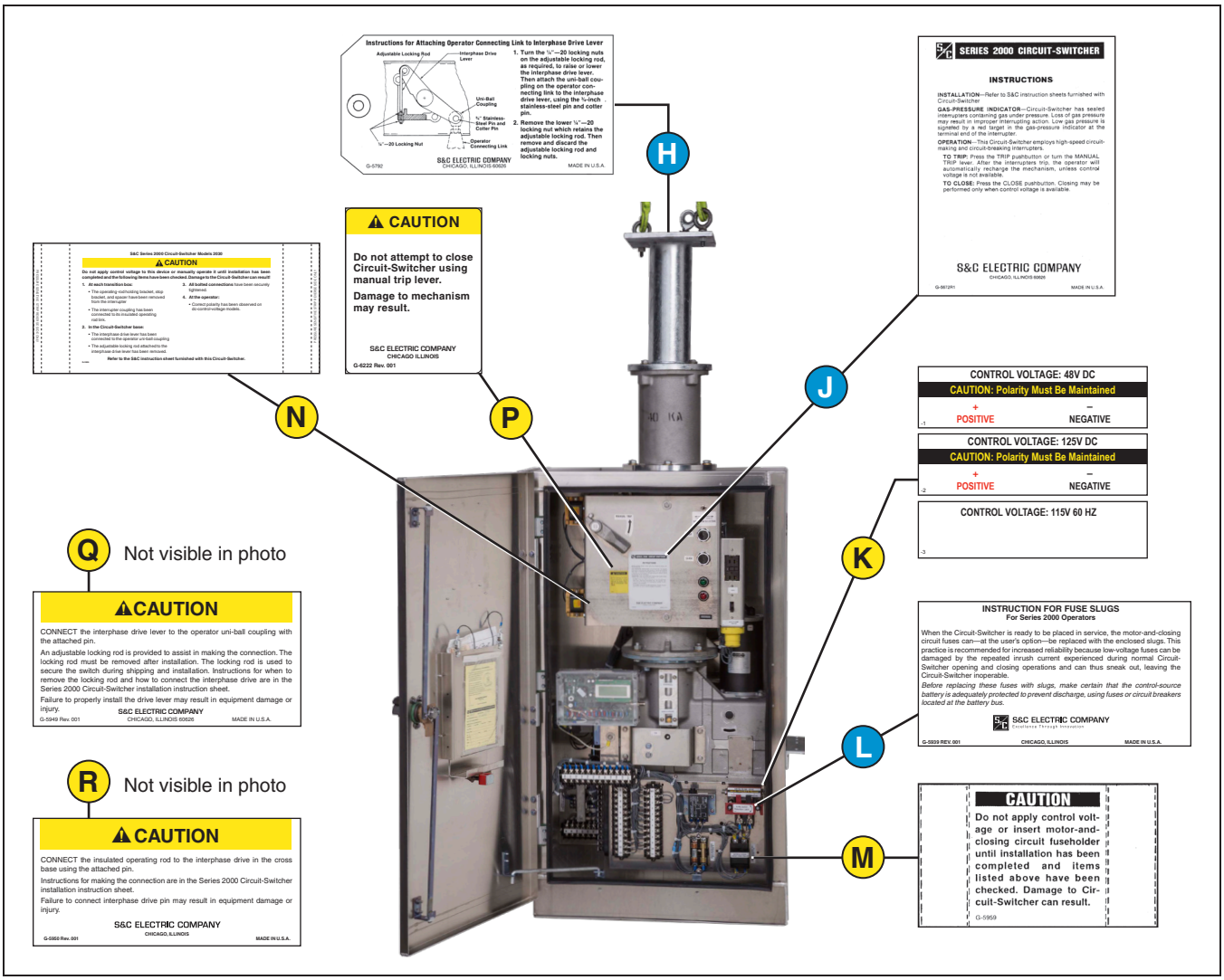
Location of Safety Labels



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Part Number
A	⚠ CAUTION	Transition box contains a stop bracket and spacer . . .	G-5807●
B	⚠ CAUTION	Remove the interrupter operating-rod holding bracket and spacer . . .	G-5951
C	NOTICE	Connecting-Pin Installation	G-5685
D	NOTICE	Coupling Preparation	G-5684■
E	⚠ WARNING	Do not lift switch with this bracket . . .	G-5713▲
F	⚠ WARNING	Do not remove steel over wrapper until installation is complete . . .	G-5699▲
G	⚠ WARNING	Do not remove . . .	G-5993▲

● This label contains important instructions and should be promptly replaced if illegible or missing.
■ This tag is to be removed and discarded after the switch is installed and adjusted.
▲ This label is affixed to the shipping package and will be removed and discarded after the switch is installed and adjusted.



Reorder Information for Safety Labels

Location	Safety Alert Message	Description		Part Number
H	NOTICE	Attaching Operator Connecting Link		G-5792●
J	NOTICE	Instruction—Operation, Gas Pressure Indicator, and Manual Handle		G-5672■
K	⚠ CAUTION	Control Voltage	48 Vdc	G-5948-1
			125 Vdc	G-5948-2
			115 V 60 Hz	G-5948-3
L	NOTICE	Coupling Preparation		G-5939●
M	⚠ CAUTION	Do not apply control voltage or insert motor-and-closing circuit fuseholder. . . .		G-5959■
N	⚠ CAUTION	Do not apply control voltage to this device . . .		G-5946▲
P	⚠ CAUTION	Do not attempt to close Circuit-Switcher using manual trip lever . . .		G-6222
Q	⚠ CAUTION	Connect the interphase drive lever . . .		G-5949●
R	⚠ CAUTION	Connect the insulated operating rod . . .		G-5950●

● This tag is to be removed and discarded after the switch is installed and adjusted.

■ This label contains important instructions and should be promptly replaced if illegible or missing.

▲ This label is affixed to the shipping package and will be removed and discarded after the switch is installed and adjusted.

⚠ DANGER

Model 2030 Series 2000 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 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 AND TAGS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels and tags. Remove tags only if instructed to do so.
5. **ENERGIZED COMPONENTS.** Always consider all parts live until de-energized, tested, and grounded.
6. **CIRCUIT-SWITCHER POSITION.** Always confirm the **Open/Close** position of a circuit-switcher by visually observing the position of the SWITCH POSITION indicator located on the high-speed base. Switches may be energized from either side.
7. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.
8. **OPERATION.** Circuit-making and circuit-breaking are is involved in the normal operation of this interrupter switch. To operate, follow the operating procedure as outlined in the "Operation" section on page 27.

Inspection

Examine the shipment for 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, 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 the condition of the shipment on all copies of the delivery receipt.
4. File a claim with the carrier.
5. If concealed damage is discovered:
6. Notify the delivering carrier within 15 days of receipt of shipment.
7. Ask for a carrier inspection.
8. File a claim with the carrier.

Also, notify S&C Electric Company in all instances of loss and/or damage.

Packing

An S&C catalog drawing can be found in a water-resistant envelope attached to the wrapper around one of the insulating support columns. Study this drawing carefully and check the bill of material to verify all parts are at hand. The Model 2030 Series 2000 Circuit-Switcher shipment should include the following items, as shown in Figure 1 on page 9, Figure 2 on page 9, and Figure 3 on page 10.

NOTICE

Do not intermingle components from different installations. Series 2000 Circuit-Switchers are completely factory-assembled and thoroughly tested. To speed installation and maintain proper adjustment of the circuit-switcher and its operator, it is imperative components belonging to a specific circuit-switcher installation not be mixed with components belonging to a different installation. For this reason, each Series 2000 Circuit-Switcher is serially numbered. This serial number appears on the circuit-switcher base, the mounting pedestals, and the operator.

Mixing parts from different circuit-switchers will result in significant damage to the switch operator and misoperation of the circuit-switcher.

S&C maintains an historical record by serial number of every circuit-switcher it produces. 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 an invaluable reference for future maintenance, modifications, or replacements.

The shipment contains:

- Three interrupters, mounted to the high-speed base for shipping along with their associated insulating support columns
- A single high-speed base enclosing the high-speed power train
- The appropriate number of mounting pedestals (A single pedestal is used for circuit-switchers rated 69 kV (with 48-inch [122-cm] phase spacing); a set of two pedestals is used for circuit-switchers rated 69 kV (with 84-inch [213-cm] phase spacing) and for 115 kV and 138 kV; a set of three pedestals is used for circuit-switchers rated 161 kV and 230 kV.)
- A Series 2000 Circuit-Switcher Operator
- A container of miscellaneous operating-mechanism components and hardware, all individually identified
- Any optional features specified, such as a grounding switch

⚠ WARNING

DO NOT disassemble or modify the interrupters. The interrupters are pressurized at 75 PSIG. **Serious injury can result.**

Storage

NOTICE

Connect control power to the switch operator when storing it outdoors. The Series 2000 Switch Operator is equipped with a space heater that must be energized during storage to prevent condensation and corrosion within the operator enclosure.

If the circuit-switcher must be stored before installation, keep it in a clean, dry, corrosion-free area to protect it from damage. Make sure each skid rests firmly on the ground and is reasonably level. Shoring under the skids may be necessary if the ground is uneven. If storing outdoors, connect control power to the space heater inside the Series 2000 Switch Operator per the wiring diagram furnished. Inspect the circuit-switcher regularly when storing for prolonged periods.

Before Starting

⚠ WARNING

Do not remove the containers from the interrupters or the plastic bubble wrap from the insulating support columns until the installation is complete.

Equipment damage or personal injury can result.

NOTICE

Bolted and Pinned Connections: A typical bolted connection for field-assembly requires one flat washer under the cap screw and one under the nut. When self-locking hex nuts are specified, the threads of the associated cap screws must be lubricated with a general purpose grease to facilitate tightening. All pins used in the field-assembly should also be lubricated to facilitate insertion.

For circuit-switchers rated 69 kV through 138 kV: Cut the steel straps that bind the mounting pedestals to the high-speed base and the straps that bind the container of operating mechanism components and hardware and the straps that bind the pole-units using a steel strapping cutter. See Figure 2.

For circuit-switchers rated 161 kV and 230 kV: Cut the steel straps binding the container of miscellaneous operating mechanism components and hardware. See Figure 3 on page 10.

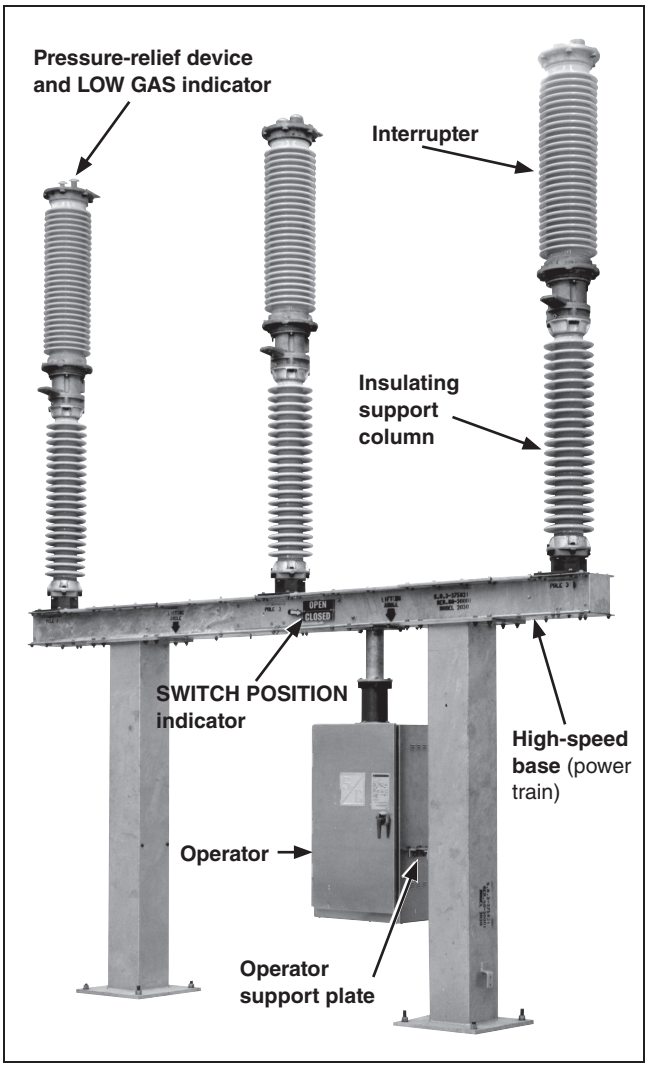


Figure 1. A Model 2030 circuit-switcher rated 138 kV.

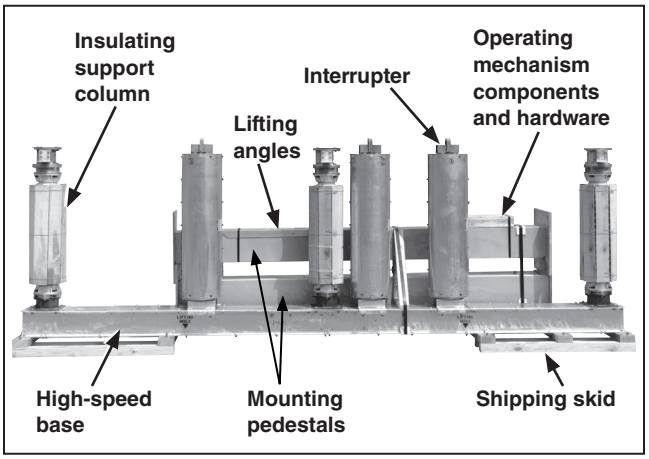


Figure 2. Typical shipment of a Model 2030 circuit-switcher rated 69 through 138 kV. The operator is shipped on a separate skid.

Installing the Mounting Pedestals and High-Speed Base

Install each pedestal as follows:

⚠ CAUTION

The foundations and anchor bolts for S&C Mounting Pedestals must be designed to meet the loading limits specified in S&C Data Bulletin 716-61.

Failure to meet these loading limits can result in personal injury and equipment damage.

STEP 1. Install the lower set of anchor-bolt nuts and flat washers onto the pre-installed anchor bolts. Level all anchor bolts to the same height, leaving space below and above the bolt for leveling. See Figure 4.

STEP 2. Install the temporary eyebolts into the holes provided at the top of the mounting pedestal. Attach the lifting slings to the eyebolts. See Figure 5.

STEP 3. Lift the pedestal over the anchor bolts. Before lowering, make sure the grounding pad is positioned properly for the installation. Refer to the accompanying catalog drawing for details. See Figure 5.

STEP 4. Lower the pedestal onto the anchor-bolt nuts and flat washers. Loosely secure a flat washer and nut to each anchor bolt. See Figure 4. Remove lifting slings and eyebolts.

STEP 5. Adjust the lower set of anchor-bolt nuts to plumb and level the pedestal. The upper set of anchor-bolt nuts should remain loosely attached. See Figure 4.

STEP 6. ***For circuit-switchers rated 69 kV through 138 kV:*** Attach the lifting angles to the circuit-switcher base using ½–3 × 1¼-inch hex-head galvanized steel cap screws, flat washers, and nuts furnished. See Figure 6 on page 11.

Securely tighten the cap screws, and then attach four suitable lifting slings to the lifting angles. Unbolt the base from the shipping skids and lift the base—with interrupters and insulating support columns attached—on top of the mounting pedestals as shown on the catalog drawing. Avoid sudden starts and stops.

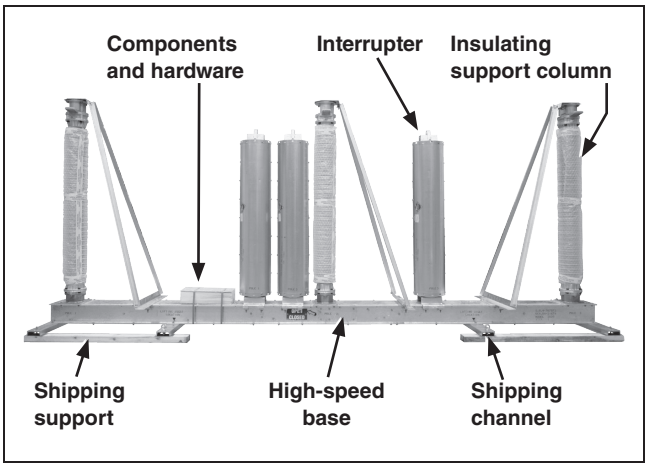


Figure 3. Typical shipment of a Model 2030 circuit-switcher rated 161 through 230 kV. The operator is shipped on a separate skid.

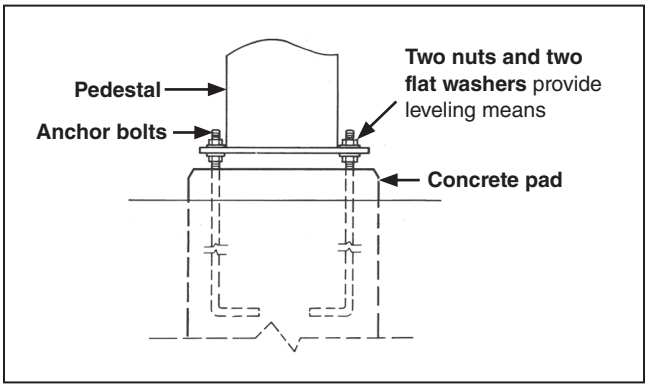


Figure 4. Pedestal anchor-bolt mounting detail.

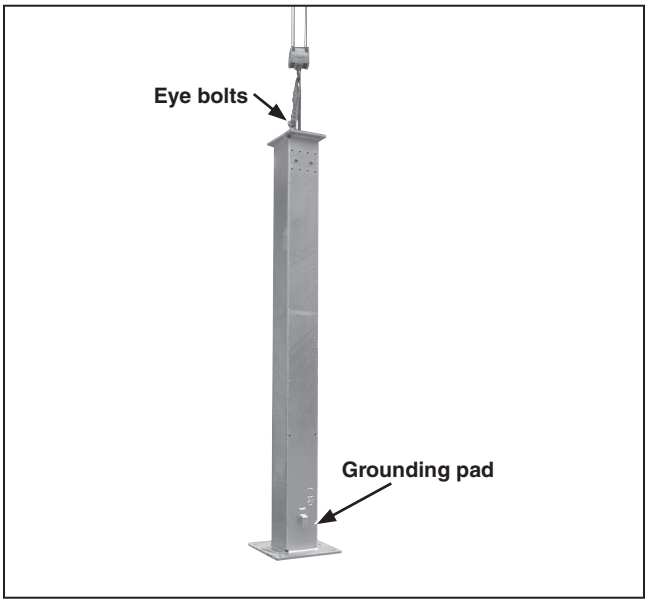


Figure 5. Lifting the pedestal into position.

Verify the SWITCH-POSITION indicator on the base is visible on the desired side. (This is also the side on which the operator door will open.) See Figure 6.

For Circuit-Switchers rated 161 kV and 230 kV: Attach four suitable lifting slings to the eyebolts connected to the two inboard shipping channels. Unbolt all four shipping channels from the shipping supports. Also unbolt and discard the two outboard shipping channels from the circuit-switcher base, as shown in Figure 7, but retain the associated ½–13 × 1¾-inch galvanized steel cap screws, flat washers, and nuts.

Do not unbolt the two inboard shipping channels from the circuit-switcher base. Lift the base—with interrupters and insulating support columns attached (including the support angles and support braces for the insulating support columns)—on top of the mounting pedestals, as shown on the catalog drawing. Avoid sudden starts and stops. Verify the SWITCH POSITION indicator on the base is visible on the desired side. (This is also the side on which the operator door will open.) See Figure 7.

Remove and discard the three sets of support angles and their associated hardware. Also remove and discard the three support braces and their associated hardware. Leave the shipping covers on top of the insulating support column transition boxes.

⚠ WARNING

The operator directly drives the interrupters open and closed through a high-speed power train leading from the top of the operator, through a horizontal interphase linkage enclosed in a steel-sheathed box-type base, to reciprocating-action insulated operating rods that pass through the center of the insulating support columns. Permanently lubricated bearings are used throughout the power train. The high-speed base has been fully pre-assembled and adjusted at the factory. DO NOT disassemble the high-speed base or high-speed power train. **Damage to the high-speed base and personal injury can result.**

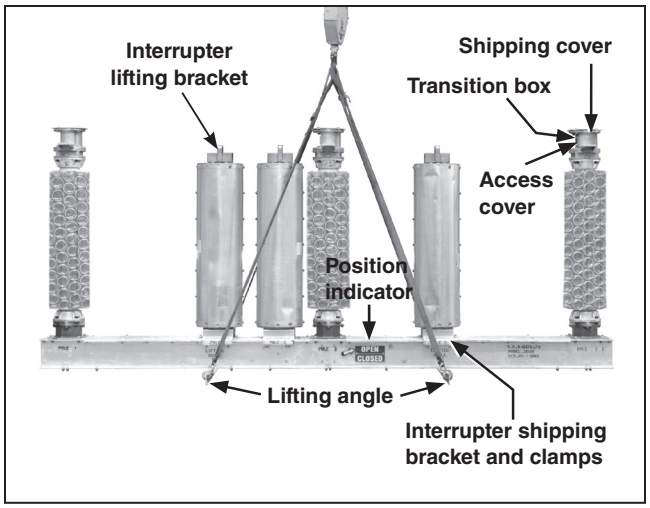


Figure 6. Hoisting the high-speed base using a crane for circuit-switchers rated 69 kV through 138 kV.

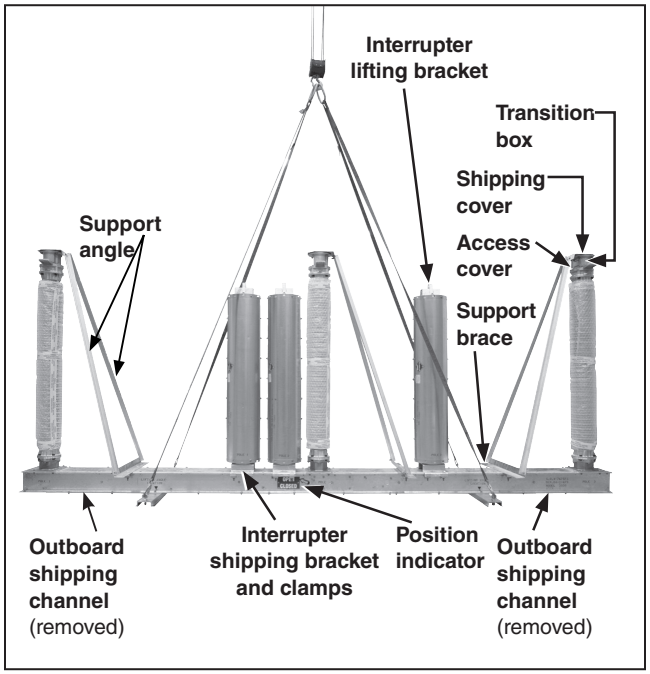


Figure 7. Hoisting the high-speed base using a crane for circuit-switchers rated 161 kV.

STEP 7. Loosely bolt the high-speed base to the mounting pedestals using the ⅝–11 × 2¼-inch hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. Lubricate the bolts to facilitate tightening and then, using a level, verify the high-speed base is horizontal, both lengthwise and sideways. Adjust the lower set of anchor-bolt nuts at the pedestals to achieve level.

STEP 8. Securely bolt the high-speed base to the mounting pedestals. If necessary, install shims between the high-speed base and the pedestals to compensate for any gaps greater than ⅛-inch (3 mm) between the mating surfaces. See Figure 8.

Tighten the bolts on the high-speed base to 75 ft./lbs.

STEP 9. Check the lower set of anchor-bolt nuts at each mounting pedestal to verify all nuts are in contact with the bottom of the pedestal. Hand-tighten the anchor-bolt nuts as necessary, and then securely tighten the upper set of anchor-bolt nuts at each mounting pedestal. See Figure 4 on page 10.

STEP 10. ***For circuit-switchers rated 69 kV through 138 kV:*** Remove and discard the lifting angles, but retain the associated ½–13 × 1¼-inch galvanized steel cap screws, flat washers, and nuts. See Figure 7 on page 11.

For circuit-switchers rated 161 kV and 230 kV: Remove and discard the inboard shipping channels, but retain the associated ½–13 × 1¾-inch galvanized steel cap screws, flat washers, and nuts. See Figure 7 on page 11.

Remove the remaining hardware used to attach the bottom plates adjacent to the operator support tube mounting plate. See Figure 9. Put the bottom plates and hardware aside on a clean surface. Also remove the ¾-inch (19-mm) stainless steel pin and cotter pin from the interphase drive lever enclosed in the high-speed base. See Figure 10. Retain these pins for re-use in Step 1 on page 19.

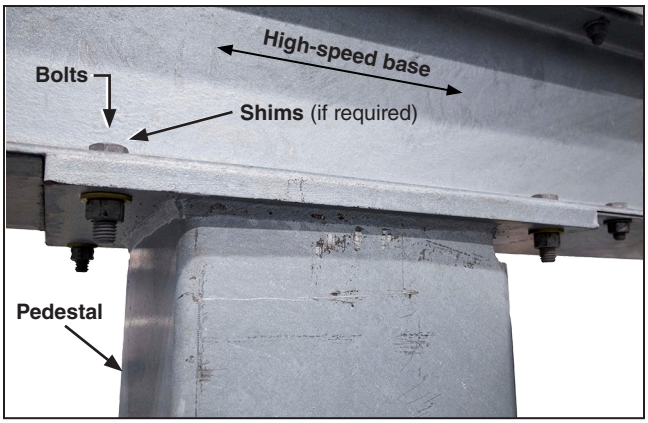


Figure 8. Shim the high-speed base for gaps of more than ⅛-inch (3 mm).

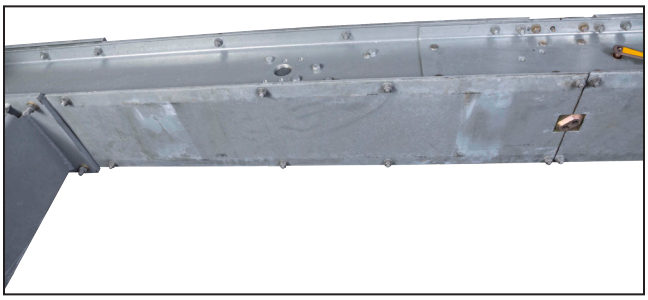


Figure 9. Removing the bottom plates from the high-speed base.

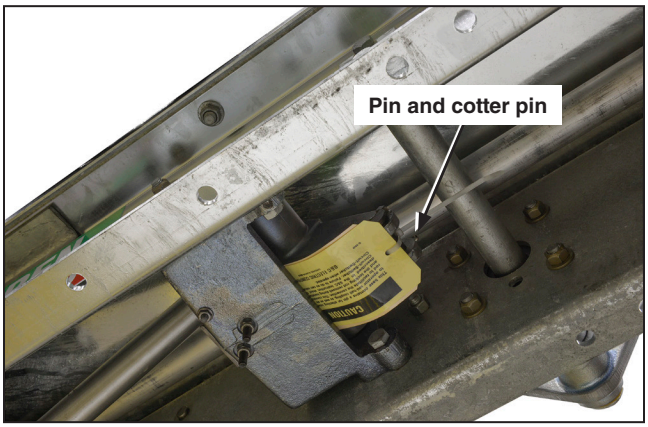


Figure 10. Removing the ¾-inch (19-mm) stainless steel pin and cotter pin from the interphase drive lever inside the high-speed base.

STEP 11. Note the direction of the lower terminal pad on each insulating support column. See the catalog drawing. See Figure 11. If the alternate terminal pad position is desired, remove the ½–13 × 1½-inch hex-head stainless steel cap screws and flat washers used to attach the transition box to the insulating support column. Turn the transition box 180 degrees and then replace and securely tighten the ½–13 × 1½-inch cap screws.

Installing the Interrupters

NOTICE

Interrupters are numbered "Pole1," "Pole 2," and "Pole 3." Make sure to install the interrupter to its corresponding insulating support column. The pole numbers do not have to correspond with your system's phase designations.

STEP 1. Attach a lifting sling to the lifting bracket on one of the interrupters. See Figure 12. Remove and discard the clamps and associated ½-inch galvanized steel hardware fastening the interrupter shipping bracket to the high-speed base. See Figure 13 on page 14.

Carefully lift the interrupter somewhat higher than the top of the transition box of its associated insulating support column. Remove the four ½–13-inch stainless steel hex nuts and Belleville washers used to attach the interrupter shipping bracket to the threaded studs on the interrupter. Discard the shipping bracket, but retain the Belleville washers and nuts for re-use in Step 3(e) on page 15.

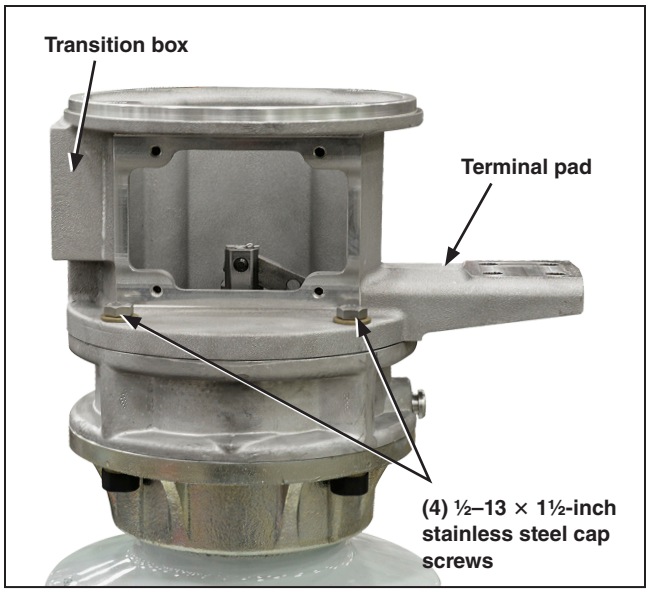


Figure 11. Terminal pad orientation can be rotated 180 degrees.

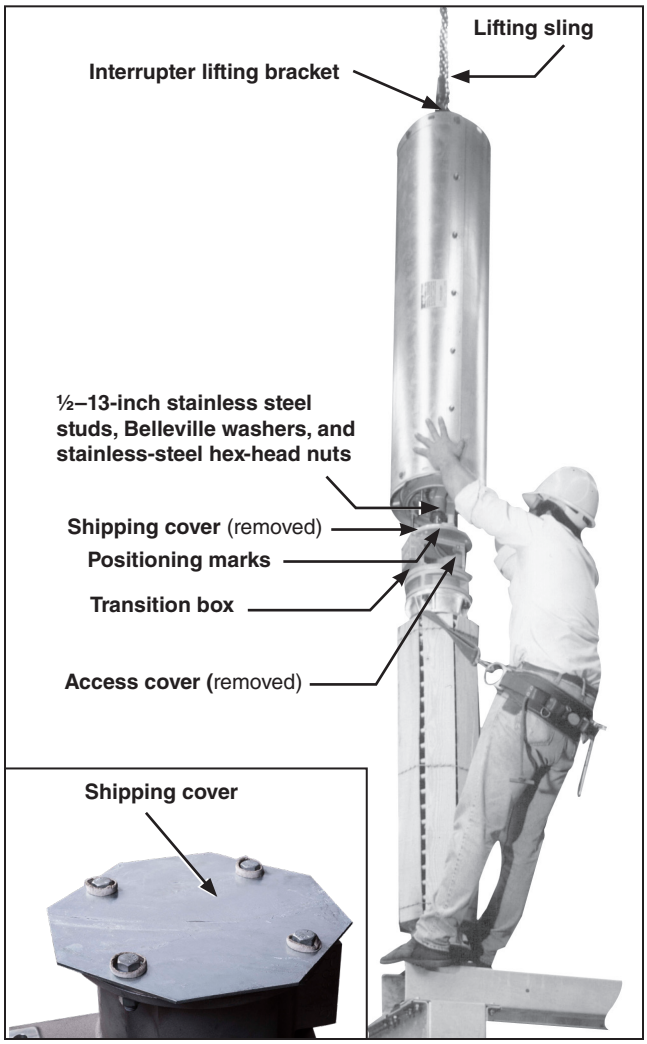


Figure 12. Lifting the interrupter over the insulating support column.

STEP 2. Prepare the interrupter for attachment to its insulating support column as follows:

(a) Remove and discard the two #10–32 screws that connect the operating rod holding bracket (marked with a black/yellow-striped label) for shipment. See Figure 14.

> **⚠ CAUTION**
>
> Keep hands clear of the operating rod when removing the shipping bracket. The insulated operating rod is under pressure. Removal of the bracket may result in the operating rod quickly moving down approximately ⅜-inch (10 mm). **Injury to the hands can result.**

(b) Pull the holding bracket to move the operating rod to its fully **Open** position. See Figure 14.

(c) Remove the connecting pin used to attach the holding bracket to the coupling. Retain the connecting pin for re-use in Step 3(f) on page 15. See Figure 14. Discard the holding brackets.

STEP 3. Attach the interrupter to its insulating support column as follows:

(a) Remove and discard the shipping cover on top of the transition box. See Figure 12 on page 13, inset.

(b) Thoroughly wire-brush the top of the transition box and mating surface on the interrupter, and immediately apply a liberal coating of Burndy Penetrox® A or equivalent aluminum-connector compound to the brushed surfaces.

(c) Remove the four 5⁄16–18 × ¾-inch hex-head stainless steel cap screws used to attach the access cover to the side of the transition box. Remove the cover and place it and the hardware on a clean surface. See Figure 12 on page 13 . Also remove the cloth bag containing the hardware that will be used for connecting the interrupter coupling to the operating rod link in on page 15.

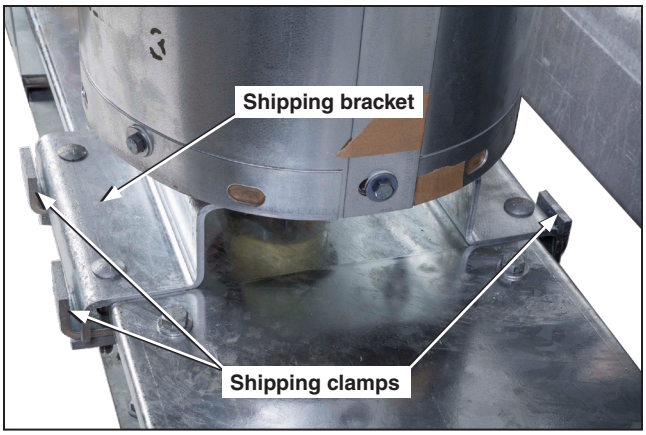


Figure 13. Remove the shipping clamps before attaching a lifting sling to the interrupter.

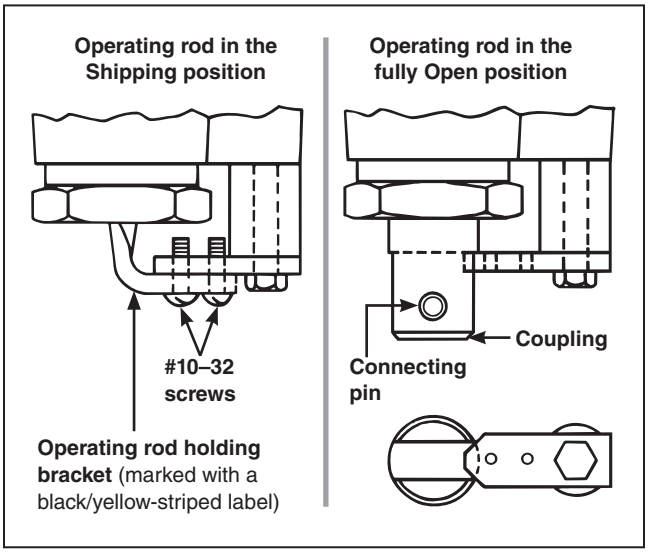


Figure 14. Preparing the interrupter for attachment to the insulating support column.

(d) Make sure the positioning mark stamped on the bottom of the interrupter is aligned with the position mark stamped on the top of the transition box. See Figure 15.

(e) Lower the interrupter onto the transition box. One of the ½–13-inch stainless steel studs on the interrupter is longer than the other three to aid in aligning the interrupter with the transition box. Reattach a ½-inch Belleville washer and a ½–12-inch stainless steel hex nut, retained from Step 1 on page 13, to each of the four studs. Lubricate the nuts to facilitate tightening. Tighten each nut securely.

(f) ***For circuit-switchers rated 69 kV through 138 kV:*** Insert the connecting pin retained from Step 2(c) on page 14 into the coupling and operating rod link. See Figure 16. It will be necessary to loosen the 5⁄16–18 × 2¼-inch hex-head stainless steel screw indicated in Figure 16 and withdraw it approximately ⅛-inch (3 mm) so the connecting pin can be inserted. Do not remove the screw at this time. Insert the pin retaining clip as indicated in Figure 16. Make sure the clip is positioned as shown.

For circuit-switchers rated 161 kV through 230 kV: Insert the connecting pin retained from Step 2(c) on page 14 into the coupling and operating rod link. See Figure 17. It will be necessary to loosen the 5⁄16–18 × 2¼-inch hex-head stainless steel screw indicated in Figure 17 and withdraw it approximately ⅛-inch (3 mm), so the connecting pin can be inserted.

Do not remove the screw at this time. Use a flat-head screwdriver blade in the slot at the end of the connecting pin to align with the cross-hole in the operating rod link. Now, insert the pin retaining clip as indicated in Figure 17. Make sure the clip is positioned as shown.

(g) Remove and discard the 5⁄16–18 × 2¼-inch hex head stainless steel screw, stop bracket (marked with a black/yellow-striped label), and spacer (marked with a black/yellow-striped label) illustrated in Figure 16 and Figure 17.

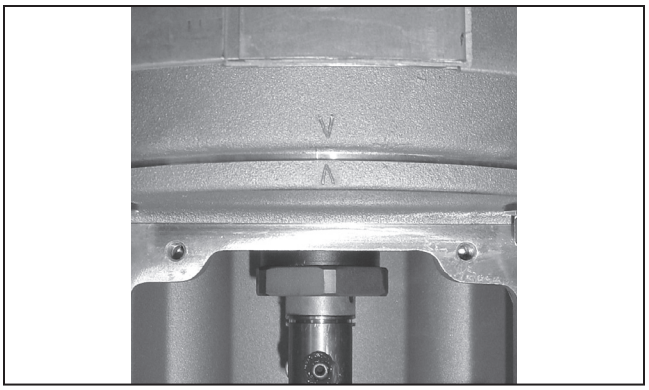


Figure 15. Aligning the positioning mark on the interrupter with the mark on the transition box.

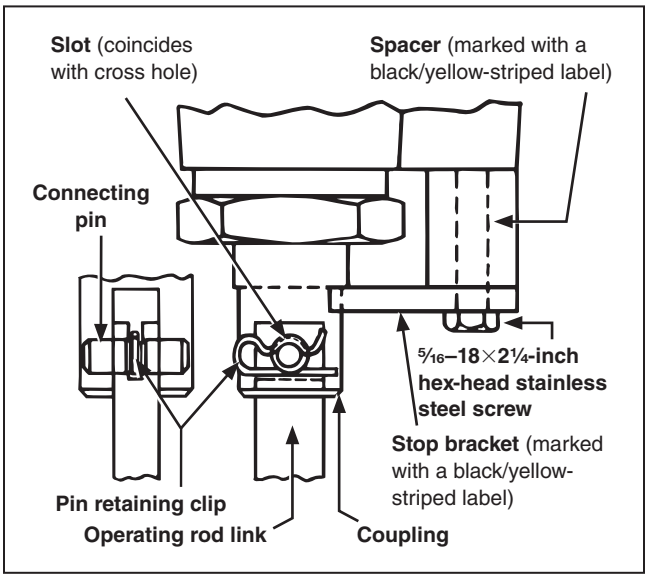


Figure 16. Connecting the interrupter to the operating rod link for circuit-switchers rated 69 through 138 kV.

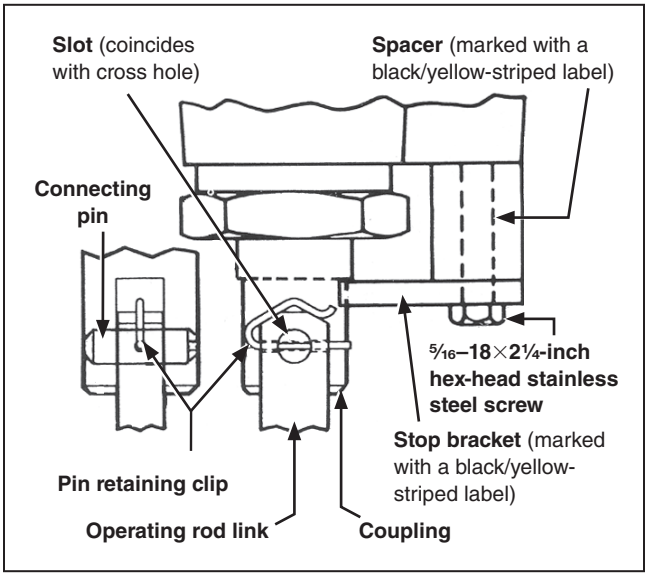


Figure 17. Connecting the interrupter to the operating rod link for circuit-switchers rated 161 kV through 230 kV.

STEP 4. Attach the upper terminal pad as follows:

(a) Remove the interrupter lifting bracket and associated ½-inch stainless steel hardware from on top of the interrupter. See Figure 18. Discard the lifting bracket but retain the hardware.

(b) Thoroughly wire-brush the indicator end-casting where the upper terminal pad is to be attached as well as the mating surface on the upper terminal pad, and immediately apply a liberal coating of Penetrox A or other suitable aluminum-connector compound. See Figure 19.

(c) Attach the upper terminal pad using three ½–13 × 1¼-inch hex-head stainless steel cap screws and Belleville washers. See Figure 20.

NOTICE

The terminal pad may be positioned in either of two ways, 180 degrees apart. See the catalog drawing for details.

STEP 5. Repeat Steps 1 through 4 for the other two interrupters.

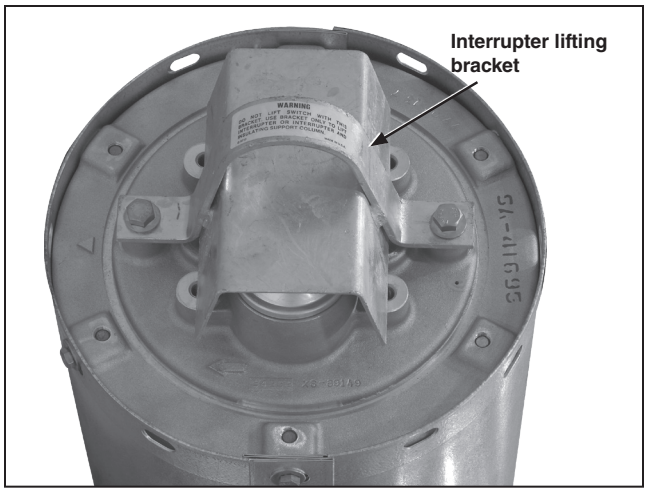


Figure 18. Removing the interrupter lifting bracket.

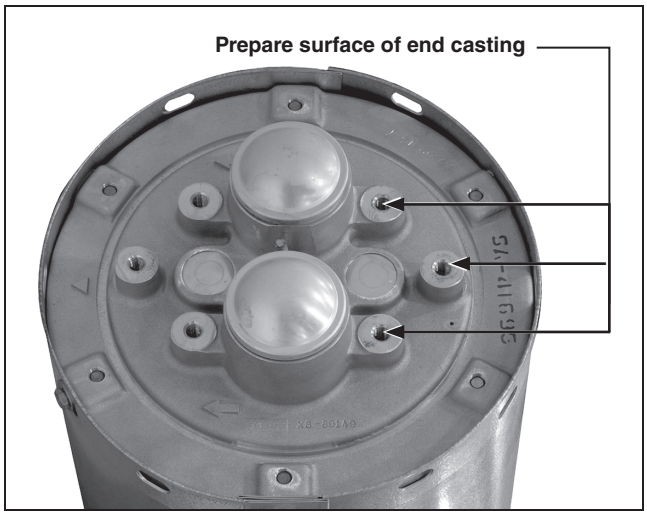


Figure 19. Wire-brushing the surface of the end casting and preparing with aluminum connector compound.

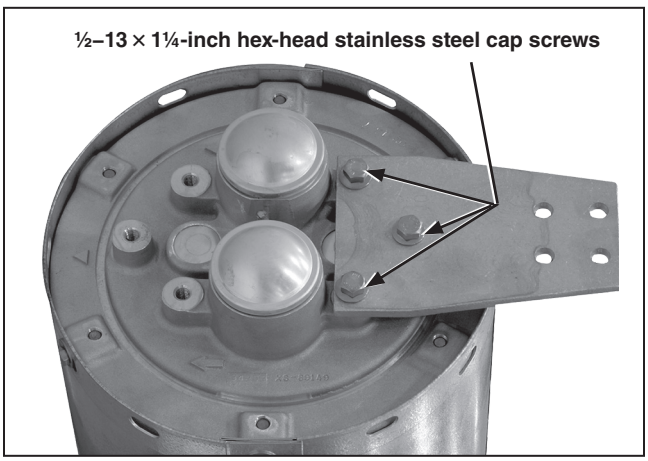


Figure 20. Attaching the terminal pad.

Installing the Operator

⚠ CAUTION

Do not attempt to set the operator upright by slinging to the skid. The skid is not designed to carry the weight of the switch operator. **Damage to the operator and minor personal injury can result.**

STEP 1. Wrap a lifting sling around the stored-energy housing of the operator, as shown in Figure 21. Carefully raise the operator to the upright position so it rests on its skid.

⚠ CAUTION

Do not remove the lifting sling around the stored-energy housing. The operator is top-heavy and must be adequately supported until it is attached to the circuit-switcher. **Damage to the operator and minor personal injury can result.**

STEP 2. Remove the skid and bracing that runs the length of the operator, stored energy housing, and operator support tube. Also remove the protective cover atop the operator support tube as well as the protective covers on the operator enclosure louvers. See Figure 21 and Figure 22 on page 18.

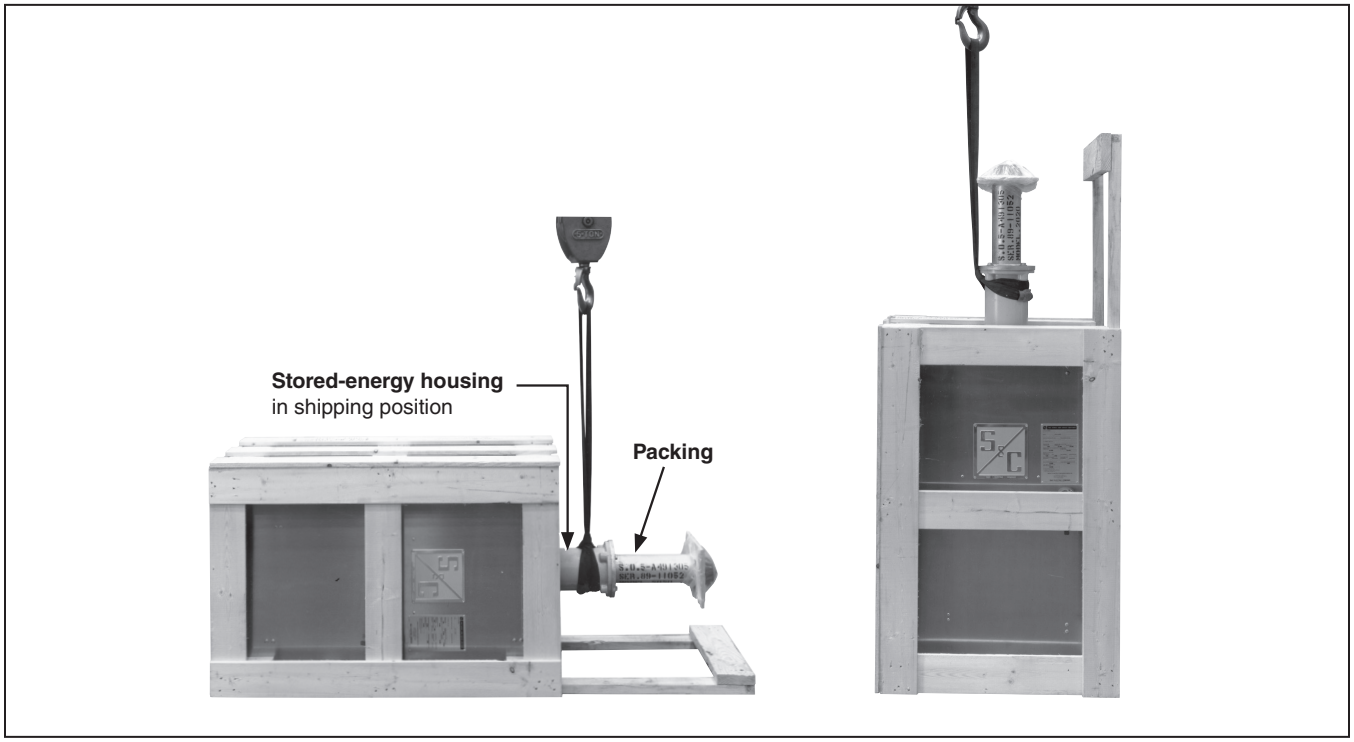


Figure 21. A typical shipment of a Series 2000 operator. Wrap lifting slings around the stored-energy housing to raise the operator to the Upright position.

STEP 3. Reposition the lifting sling around the front of the stored-energy housing and wrap another lifting sling around the back of the stored-energy housing, as shown in Figure 22. Face the operator door the same direction as the SWITCH POSITION indicator on the high-speed base. Hoist the operator into place.

> ***NOTICE***
>
> Do not to damage the uni-ball coupling on the operator connecting link during hoisting and attachment of the operator. The uni-ball coupling cannot be replaced in the field. **Damage will necessitate returning the operator for replacement.**

STEP 4. Attach the operator support tube mounting plate to the underside of the high-speed base using four ½–13 × 1¾-inch hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts. Lubricate the screws to facilitate tightening. Tighten all four screws securely.

STEP 5. Attach the operator support angle to the appropriate mounting pedestal using two ⅝–11 × 14-inch hex-head galvanized steel cap screws, four flat washers, and two self-locking hex nuts. Refer to the catalog drawing for exact placement. See Figure 22.

Attach the operator support plate to the angle on the operator and the angle on the mounting pedestal using four ½–13 × 1½-inch hex-head galvanized steel cap screws, flat washers, and self-locking nuts furnished. Lubricate the bolts to facilitate tightening. Securely tighten the screws. On circuit-switchers with two or three mounting pedestals, insert the hole plugs furnished into all unused holes in the pedestals.

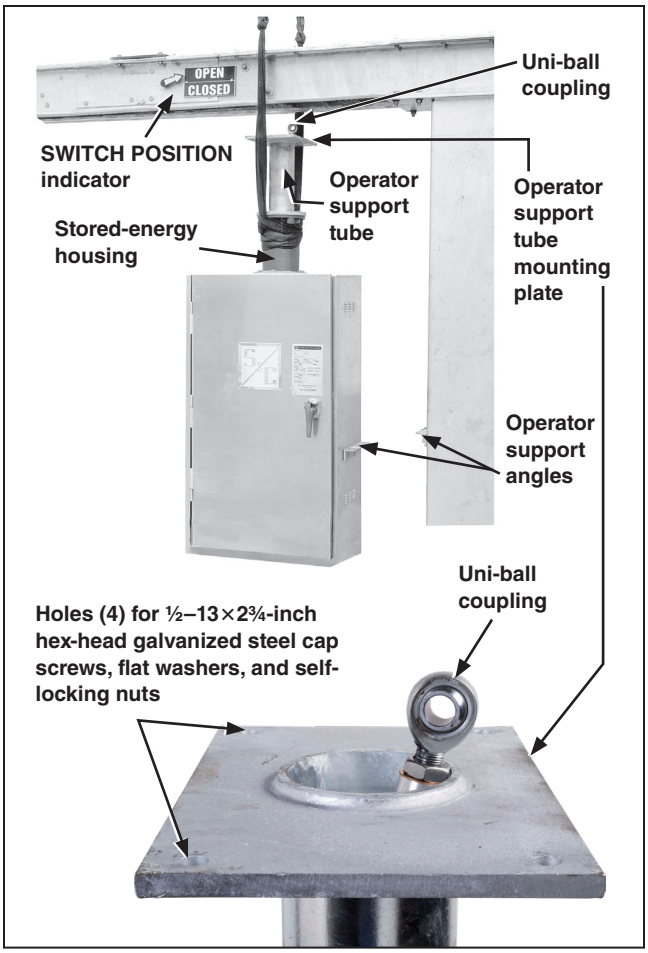


Figure 22. Hoisting the operator into position below the high-speed base using a lifting crane.

Connecting the Operator to the High-Speed Power Train

Complete the following steps to connect the operator to the high-speed power train.

STEP 1. Attach the uni-ball coupling on the operator connecting link to the interphase drive lever in the high-speed base using the ¾-inch stainless steel pin and cotter pin retained from Step 10 on page 12. See Figure 23. An adjustable locking rod (marked with a black/yellow striped label) is furnished, factory connected to the interphase drive lever; turn the associated ¼–20-inch locknuts as required to raise or lower the interphase drive lever to facilitate insertion of the stainless steel pin.

STEP 2. After the pin is installed, remove the lower ¼–20-inch locknut that retains the adjustable locking rod, and then remove and discard the adjustable locking rod and locknuts. See Figure 23.

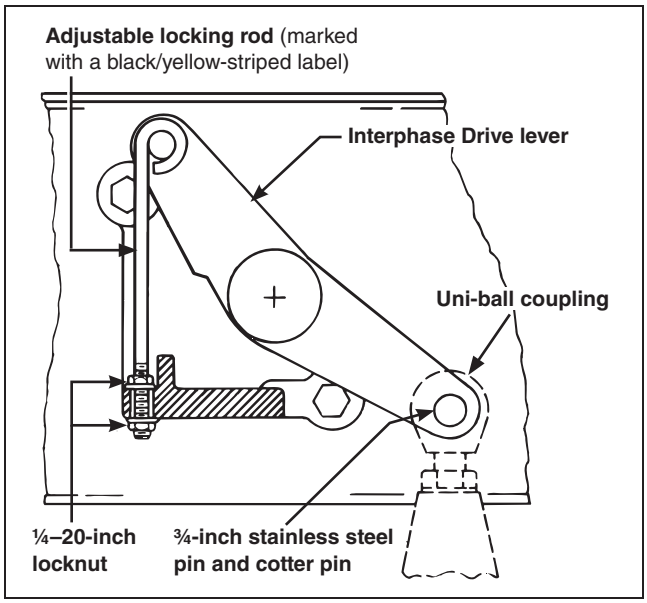


Figure 23. Attaching the uni-ball coupling on the operator-connecting link to the interphase drive lever inside the high-speed base.

Connecting Conductors

Complete the following steps to connect the conductors.

⚠ DANGER

Conductors must be de-energized and grounded in accordance with standard system operating practice. **Failure to do so will result in serious injury or death.**

STEP 1. Attach the high-voltage conductors to their respective circuit-switcher terminal pads using flexible-conductor connections. Observe the terminal-pad loading limits specified on the catalog drawing. Use the following procedure for attachment:

(a) Thoroughly wire-brush the current-transfer surfaces of each connector and immediately apply a liberal coating of Penetrox® A or other suitable aluminum-connector compound to the brushed surfaces.

(b) Wire-brush each circuit-switcher terminal pad and apply a coating of Penetrox A, and then bolt the connectors to the terminal pads.

(c) Prepare the conductors using established procedures and clamp them in their respective connectors.

Removing the Interrupter Containers

Complete the following steps to remove the interrupter containers.

STEP 1. Remove the container from each interrupter as follows:

(a) Remove and discard the ⅜–16-inch zinc-plated serrated hex nuts that run the length of the container.

(b) Remove and discard the two ⅜–16 × 1-inch and two ⅜–16 × ⅞-inch zinc-plated hex-head cap screws and flat washers that attach the two container halves to the coupling end casting of the interrupter.

(c) Remove and discard the two ⅜–16 × 1-inch and one ⅜–16 × ⅞-inch zinc-plated hex-head cap screws and flat washers that attach one of the container halves to the indicator end casting of the interrupter. Do not remove the remaining ⅜–16 × ⅞-inch cap screw, which is needed to temporarily retain the other container half.

(d) Pry the container halves apart with a screwdriver. One of the container halves can now be removed and discarded. Slotted holes are provided so a rope or lifting sling can be attached and the container safely lowered to the ground.

(e) Remove and discard the remaining ⅜–16 × ⅞-inch hex-head cap screw and flat washer that attach the other container half. Then, discard this container half.

(f) Finally, remove and discard the foam-core inner liner wrapped around the interrupter.

STEP 2. Remove and discard the wrappers from each insulating support column.

Setting Up the Operator and Checkout

Complete the following steps to set up the operator and checkout.

⚠ CAUTION

Unauthorized changes should not be made in the wiring of the operator. Should a control-circuit revision appear desirable, it should be made only on the authority of a revised wiring diagram approved by both the user and S&C Electric Company.

Do not apply control voltage to the operator at this time. Unexpected operation of the circuit-switcher can occur, resulting in equipment damage or personal injury.

STEP 1. Perform the following set-up procedure on the operator. See Figure 24 on page 22, Figure 25 on page 23, and Figure 26 on page 24.

(a) To avoid accidentally energizing the operator after the external connections have been completed, open the control power KNIFE switch, and then swing the KNIFE switch retainer arm out of the way by putting pressure on the red insulated retainer and the black nylon retainer nut. The KNIFE switch retainer arm will "pop up" and can then be swung out of the way. See Figure 26 on page 24.

(b) Mark the conduit-entrance location for the control-circuit wiring on the conduit-entrance plate at the bottom of the operator enclosure. Then, remove the plate and cut out the necessary opening. Apply the sealing compound furnished, replace the plate, and create the entrance fittings. Verify the entrance fittings are properly sealed to prevent water ingress.

NOTICE

Make sure the polarity of the control circuit is correct on dc control-voltage models. **Energizing the switch operator with polarity reversed will cause damage to the operator control circuit and will require repair or replacement of the operator.**

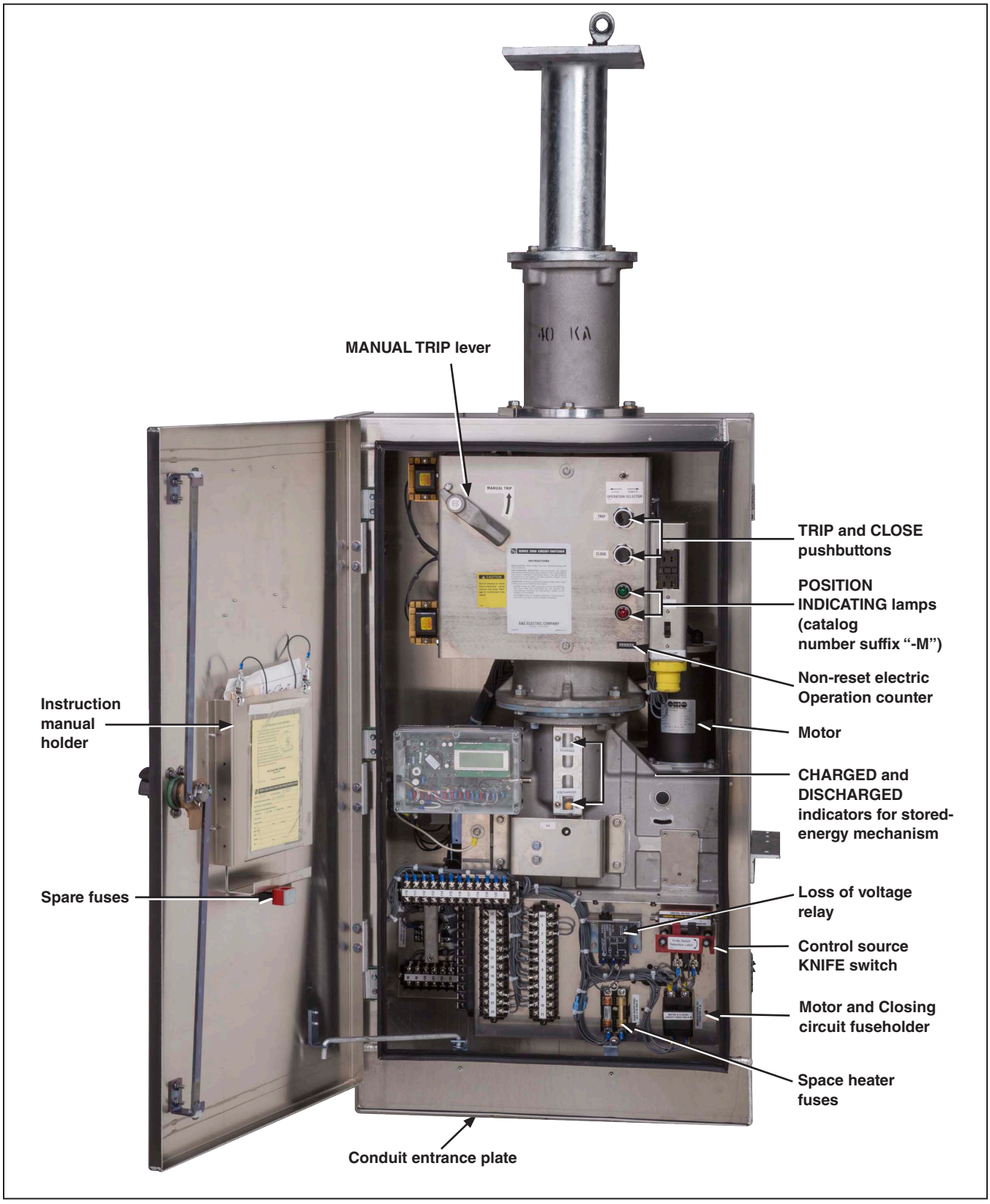


Figure 24. The inside of a Series 2000 switch operator.

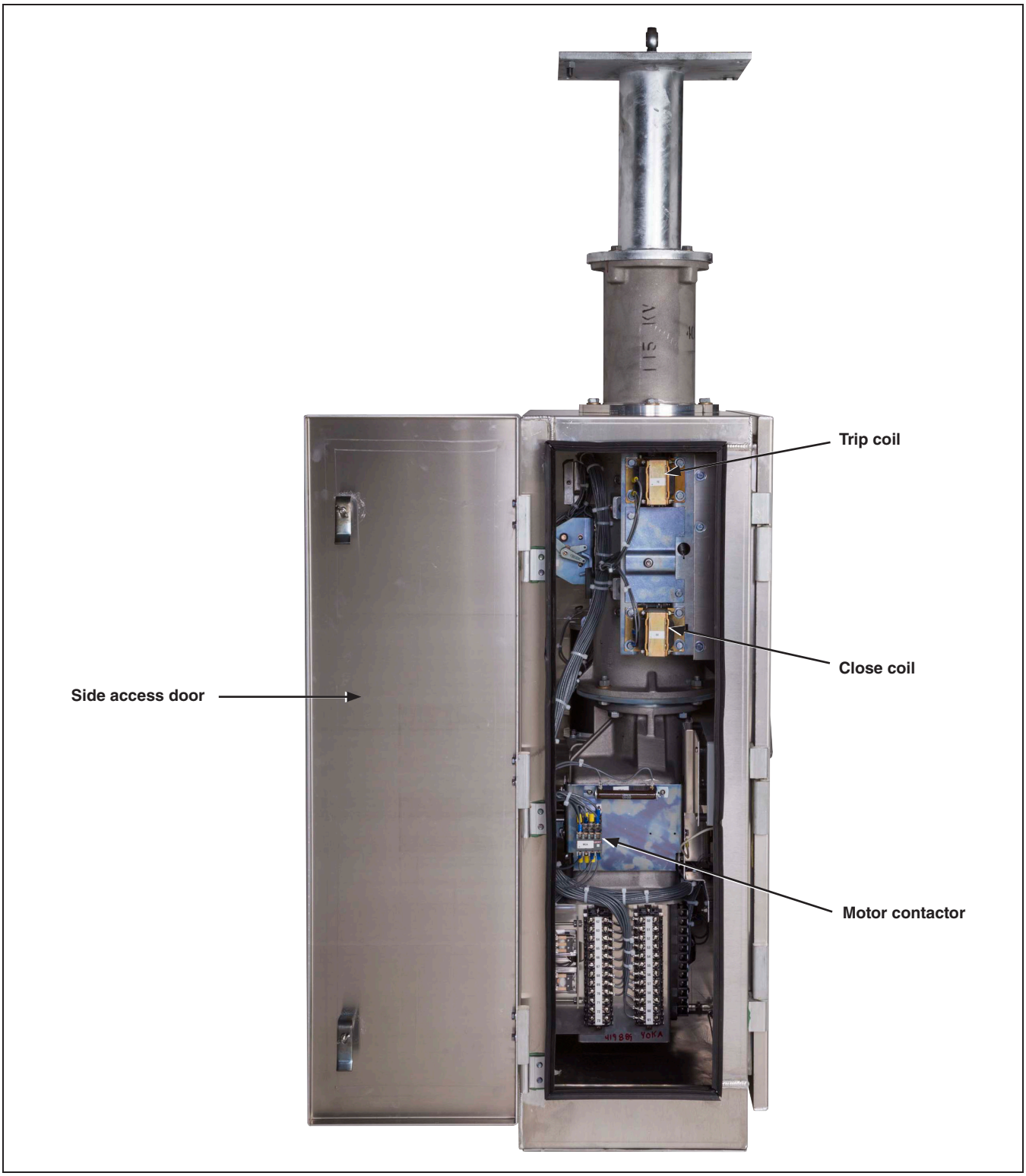


Figure 25. Side-access panel of a Series 2000 switch operator.

(c) Connect the external control-circuit wiring (including the space heater source leads) to the terminal blocks at the bottom of the enclosure in accordance with the wiring diagram furnished. Observe correct polarity on dc control-voltage models.

NOTICE

Trip-circuit conductors and motor-and-closing circuit conductors must be adequately sized for the ampacities indicated on the wiring diagram.

⚠ CAUTION

Do not apply control voltage to the operator at this time. Unexpected operation of the circuit-switcher can occur, resulting in equipment damage or personal injury.

STEP 2. Perform the final checkout as detailed below:

NOTICE

Check the following. **Failure to do so can result in damage to the circuit-switcher when operated.**

(a) At each transition box, make sure:

- The operating rod holding bracket, stop bracket, and spacer have been removed from the interrupter (see Figure 27)
- The interrupter coupling has been connected to its insulated operating rod link (see Figure 16 on page 15 and Figure 17 on page 15)
- The connections are made according to S&C Instruction Sheet 716-530 when the optional remote gas-density monitor is present (catalog number suffix "-R")

(b) At each interrupter make sure:

- Both interrupter container halves and all associated packing and hardware have been removed

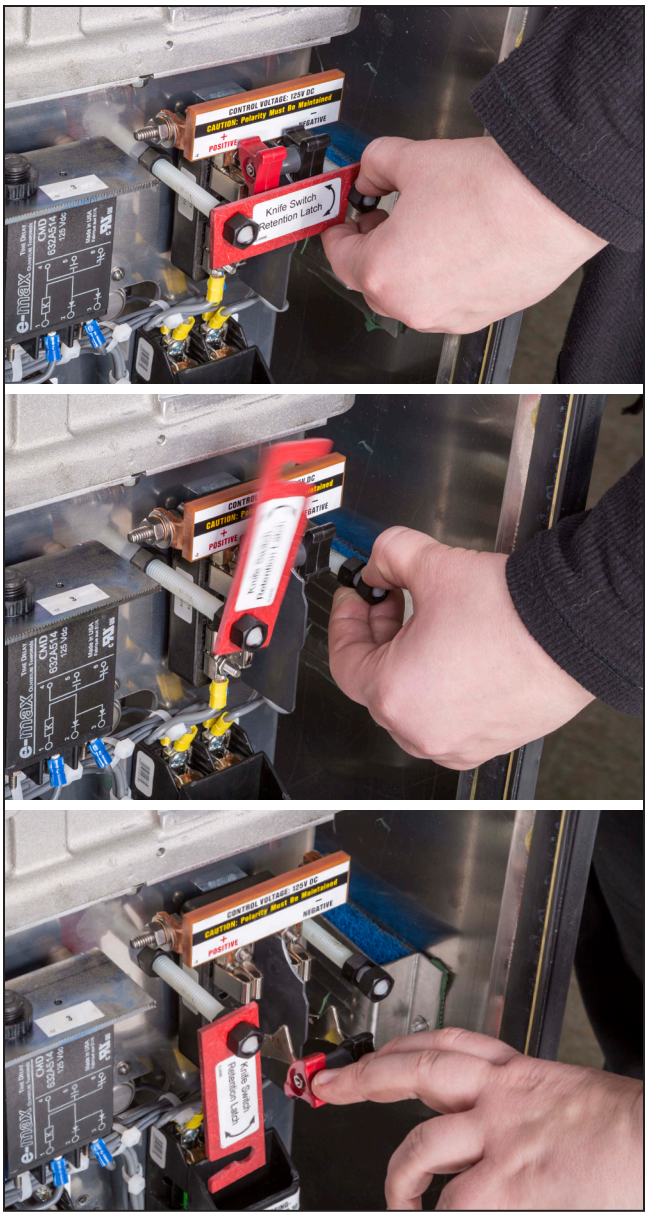


Figure 26. The KNIFE switch retainer and KNIFE switch.

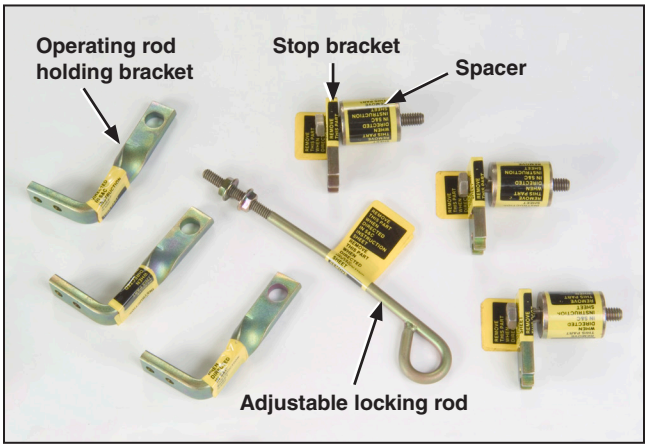


Figure 27. Checking the transition box and high-speed base for these shipping parts.

(c) In the high-speed base, make sure:

- Each insulated operating rod is connected to the interphase drive (see Figure 28)
- The interphase drive lever has been connected to the operator uni-ball coupling (see Figure 29)
- The adjustable locking rod attached to the interphase drive lever has been removed (see Figure 29 and Figure 27 on page 24.)

(d) In the switch operator, make sure:

- Correct polarity has been observed on dc control-voltage models (see Figure 24 on page 22)
- To check the motor contactor and surge suppressor to ensure all electrical connections are secure and the surge suppressor is fully seated in its mount (see Figure 31 on page 26)
- Any optional "ice-cube" style relays (used for catalog option "-P" and "-T2") are fully seated in their mounts (see Figure 32 on page 26)

(e) Make sure all other pinned connections have been made and all bolted connections have been securely tightened.

STEP 3. Replace the access cover on the side of each transition box and securely tighten the associated 5⁄16–18 × ¾-inch hex-head stainless steel cap screws.

STEP 4. Replace the bottom plates, which were removed in Step 10 on page 12, to the underside of the high-speed base and securely tighten the associated ½–13 × 1¼-inch or ½–13 × 1¾-inch galvanized steel cap screws, flat washers, and nuts. See Figure 9 on page 12.

For circuit-switchers rated 161 kV and 230 kV: Attach the six 13-inch × 3¼-inch adjustment plates to the underside of the high-speed base. These plates are used to cover small gaps between the bottom plates, the operator support tube mounting plate, and the mounting pedestal.

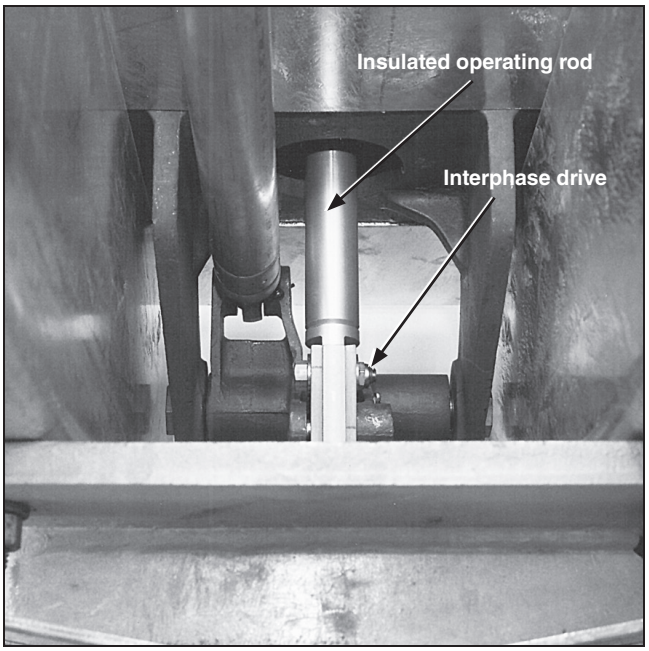


Figure 28. Making sure each insulated operating rod has been connected to the interphase drive.

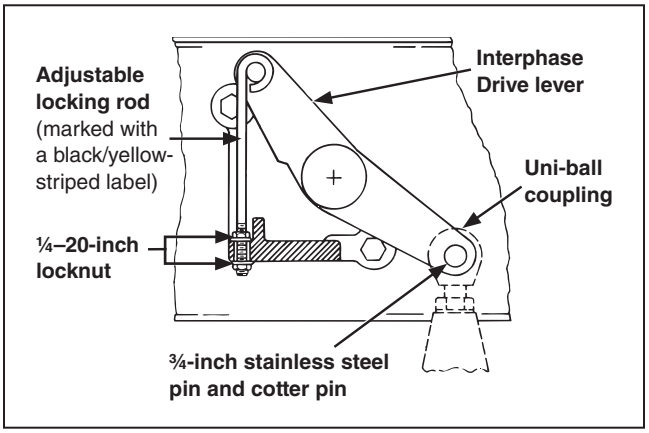


Figure 29. Making sure the interphase drive lever has been connected to the uni-ball coupling and the adjustable locking rod has been removed.

STEP 5. Insert the motor and closing circuit fuseholder, and then close the control-source disconnect KNIFE switch. See Figure 30.

STEP 6. Press the CLOSE pushbutton or send a "Close" signal to the switch operator. See Figure 24 on page 22. The closing latch will release, discharging the closing spring. This action closes the interrupters. The SWITCH POSITION indicator on the high-speed base will move to the **Closed** position. Further, if the POSITION INDICATING lamp option has been specified, the red lamp will light.

STEP 7. When the circuit-switcher is ready to be placed in service, the motor and closing circuit fuses can—at the user's option—be replaced with the slugs furnished. This practice is recommended for increased reliability because low-voltage fuses can be damaged by the repeated inrush current experienced during normal circuit-switcher opening operations and can "sneak out," leaving the circuit-switcher inoperable.

NOTICE

Before replacing these fuses with slugs, make sure the control-source battery is adequately protected to prevent discharge using fuses or circuit breakers located at the battery bus.

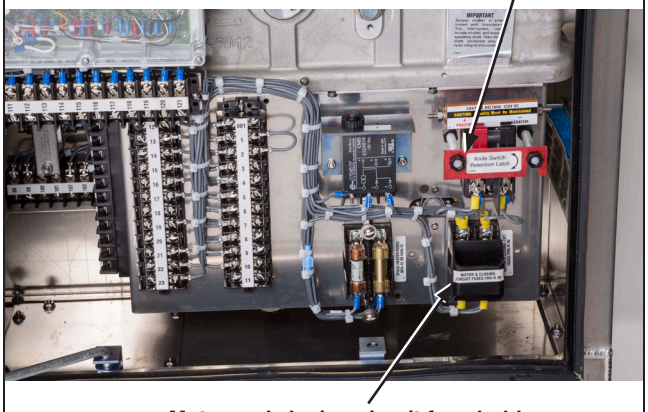


Figure 30. Motor and closing circuit fuse holder and control source KNIFE switch.

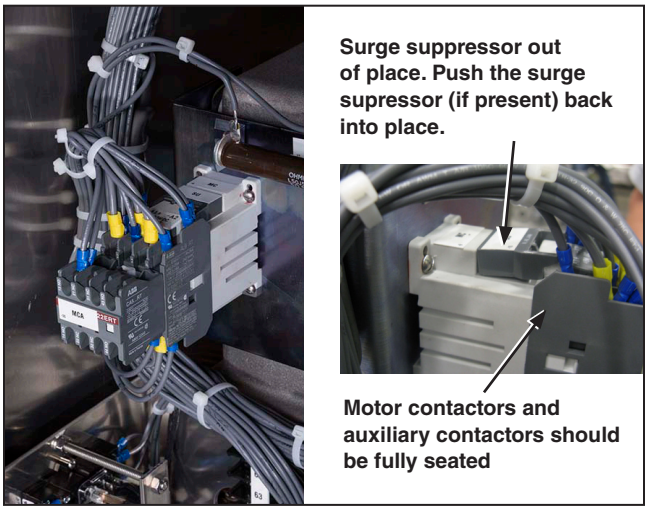


Figure 31. Checking the motor contactor and the surge suppressor behind the operator side panel.

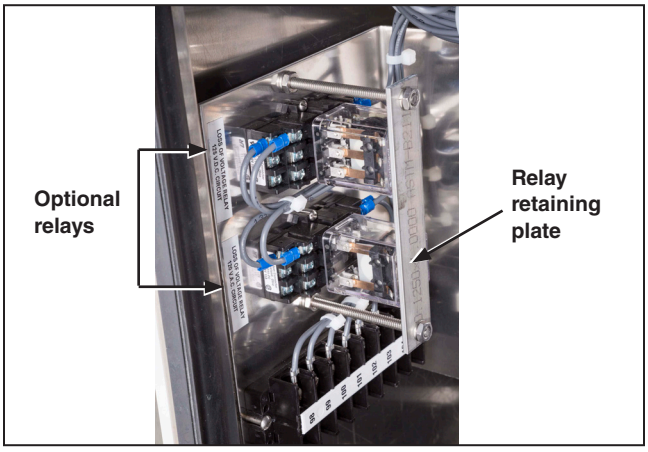


Figure 32. Making sure all optional "ice-cube" style relays are fully seated and the retaining plate is in place.

Understanding Trip-Free Operation

The stored-energy mechanism has an instantaneous trip-free capability. If the Series 2000 Circuit-Switcher is closed into a fault sensed by the user-furnished relaying, the mechanism will immediately trip. To accomplish trip-free operation, the stored-energy mechanism uses two spring assemblies: one for closing and one for opening. Both springs are charged by the operator motor before the circuit-switcher can be closed

Recharging time after a **Trip** operation is approximately 10 seconds for Model 2030 circuit-switchers rated 69 kV through 138 kV and 16 seconds for circuit-switchers rated 161 kV and 230 kV.

Electrical Operation

To open the circuit-switcher, press the TRIP pushbutton or send a remote trip signal to the switch operator. See Figure 24 on page 22.

The opening latch in the stored-energy mechanism will release, discharging the opening spring. This action trips the interrupters and forces the opening and closing pistons in the mechanism downward, which can be seen in the STORED ENERGY indicator's **Discharged** window inside the operator. See Figure 33. The SWITCH POSITION indicator on the high-speed base will move to the **Open** position. See Figure 34 on page 28. Further, if the POSITION INDICATING lamp option (catalog number suffix "-M") has been specified, the green lamp will light.

The motor-driven cam in the stored-energy mechanism will immediately start rising, thereby charging both the opening and closing springs. When the opening spring latches, the STORED ENERGY indicator will again be visible at the **Charged** window.

To close the circuit-switcher: Press the CLOSE pushbutton or send a remote close signal to the switch operator. See Figure 24 on page 22.

The motor-driven cam in the stored-energy mechanism will immediately start retracting. The closing latch will release, discharging the closing spring. This action closes the interrupters. The SWITCH POSITION indicator on the high-speed base will move to the **Closed** position. See Figure 34 on page 28. If the POSITION INDICATING lamp option has been specified, the red lamp will light.

The circuit-switcher may also be electrically operated via remotely located control switches. No instructions are included for remote control because control schemes vary with the installation and specific application of the switch.

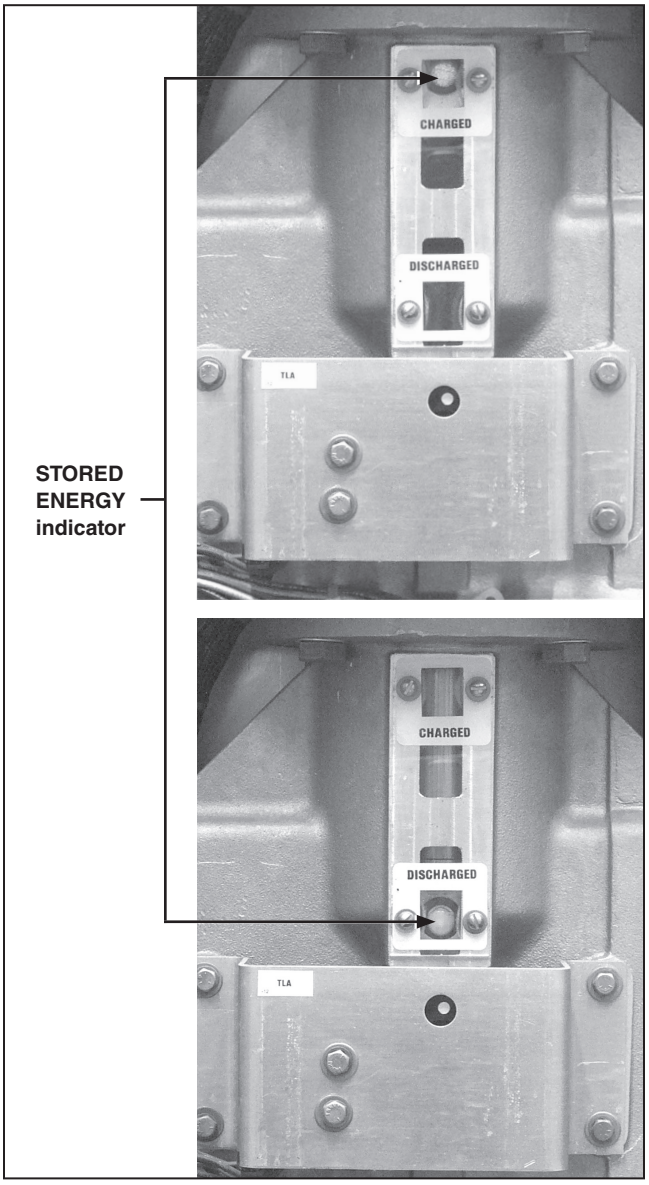


Figure 33. A close up of the stored-energy mechanism CHARGED/DISCHARGED indicator.

Manual Operation

To trip the interrupters: Push the manual TRIP lever counterclockwise as indicated by the TRIP lever label. See Figure 24 on page 22. The opening latch in the stored-energy mechanism will release, discharging the opening spring.

This action trips the interrupters and forces the opening and closing pistons in the mechanism downward, as shown by movement of the indicator to the **Discharged** window. See Figure 33 on page 27. The SWITCH POSITION indicator on the high-speed base will move to the **Open** position. See Figure 34. If the POSITION INDICATING lamp option has been specified—and operator control voltage is available—the green lamp will light.

If operator control voltage is available: The motor-driven cam in the stored-energy mechanism will immediately start rising, charging both the opening and closing springs. When the opening spring latches, the indicator will again be visible at the **Charged** window.

If operator control voltage is not available: The interrupters will open. The motor-driven cam in the stored-energy mechanism will charge the opening and closing springs when control power is restored to the operator.

Manual closing of the circuit-switcher cannot be performed.

Understanding the GAS PRESSURE Indicator and Safety Relief Device

Series 2000 Circuit-Switchers have sealed interrupters containing gas under pressure. Loss of gas pressure may result in improper interrupting action. Low gas pressure is signaled by a red target in the GAS PRESSURE indicator at the upper terminal end of the interrupter.

Figure 35 illustrates a GAS PRESSURE indicator with acceptable gas pressure.

Figure 36 illustrates a GAS PRESSURE indicator with a red target, signaling a loss in gas pressure.

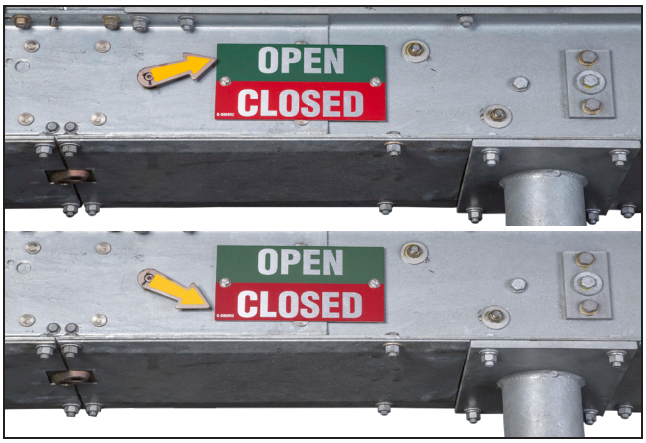


Figure 34. A SWITCH POSITION indicator in the Open position (top). The SWITCH POSITION indicator in the Closed position (bottom).

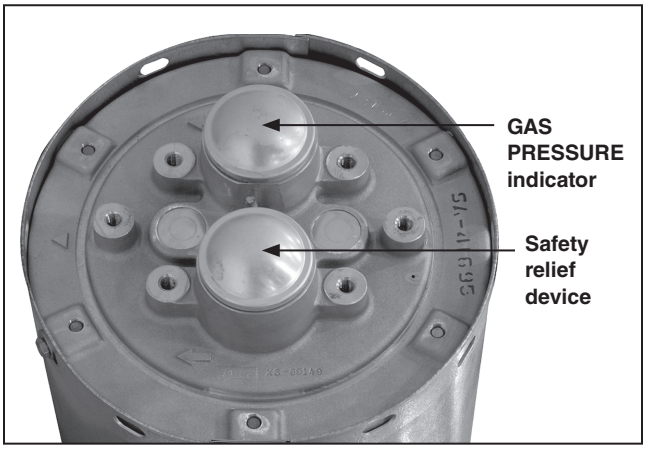


Figure 35. A normal GAS PRESSURE indicator and relief device.

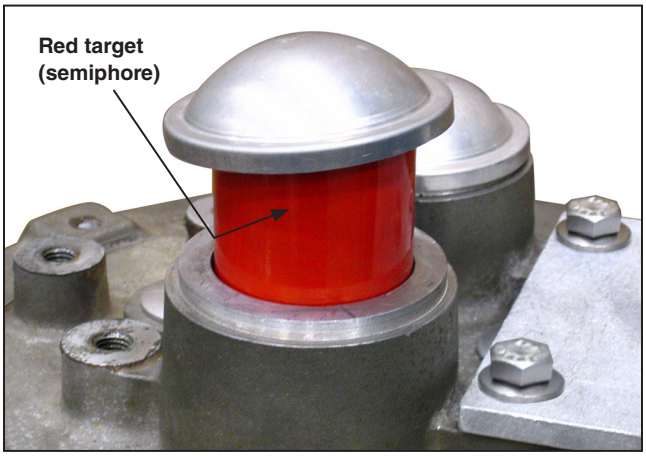


Figure 36. A visible "red target" GAS PRESSURE indicator.

Understanding the Optional Remote Gas-Density Monitor

The remote gas-density monitor provides local and remote indication of the gas density in each interrupter in terms of percent full. The system can be wired to provide remote indication of the gas density of each interrupter via three analog 0- to 1.0-mA dc outputs.

The LCD screen provides indication of gas density and alarms for each interrupter. The remote gas-density monitor transmits updated measurements approximately once per hour.

The remote gas-density monitor has three available alarm contacts, and the system provides both local and remote indication of alarms:

- A **Level 1** alarm indicates an interrupter is leaking. The circuit-switcher can still be operated, but the leaking interrupter should be replaced promptly.
- A **Level 2** alarm indicates an interrupter has lost enough SF_6 gas it can no longer clear faults properly.
- The **System Trouble** alarm indicates a problem with the monitoring system. A **System Trouble** alarm will activate when the receiver fails to receive a signal for more than 24 hours. The **System Trouble** alarm will also activate when there are approximately three months or less of battery life remaining. At first, a **Low-Battery** alarm will appear locally. After the battery has completely discharged, an **Error** message will appear in place of the percent-gas-density information, and the **System Trouble** alarm will signal remotely.

For complete instructions on installing, operating, and troubleshooting the optional remote gas-density monitor, refer to S&C Instruction Sheet 716-530.

Inspection Recommendations

To ensure a Series 2000 Circuit-Switcher's continued proper performance, it should be inspected in accordance with an S&C-recommended schedule and procedures contained in S&C Instruction Sheet 716-590.