Installation and Operation

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Qualified Persons

⚠ WARNING

The equipment covered by this publication must be installed, operated, and maintained by qualified persons knowledgeable in the installation, operation, and maintenance of substation and overhead electric power transmission and distribution equipment along with the associated hazards. 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 the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment

These instructions are intended only for such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Read this Instruction Sheet

NOTICE

Thoroughly and carefully read this instruction sheet and all materials included in the product's instruction handbook before installing or operating the Model 2040 Series 2000 Circuit-Switcher. Become familiar with the Safety Information on pages 3 through page 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 2040 Series 2000 Circuit-Switcher. These instructions should be stored in the Series 2000 Switch Operator using the instruction manual holder. The latest version is available online in PDF format at **sandc.com/en/support/product-literature**.

Proper Application

⚠ WARNING

The equipment in this publication must be selected for a specific application. The application must be within the ratings furnished for the equipment. The ratings for this circuit-switcher are listed on the nameplate on the switch operator. Additional application information can be found in S&C Specification Bulletin 716-31.

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 (1524m), and at wind loadings of up to 90 miles per hour (145 kmph). Also, 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 0.2 g 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 as well as on labels and tags attached to the S&C Model 2040 Series 2000 Circuit-Switcher. 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

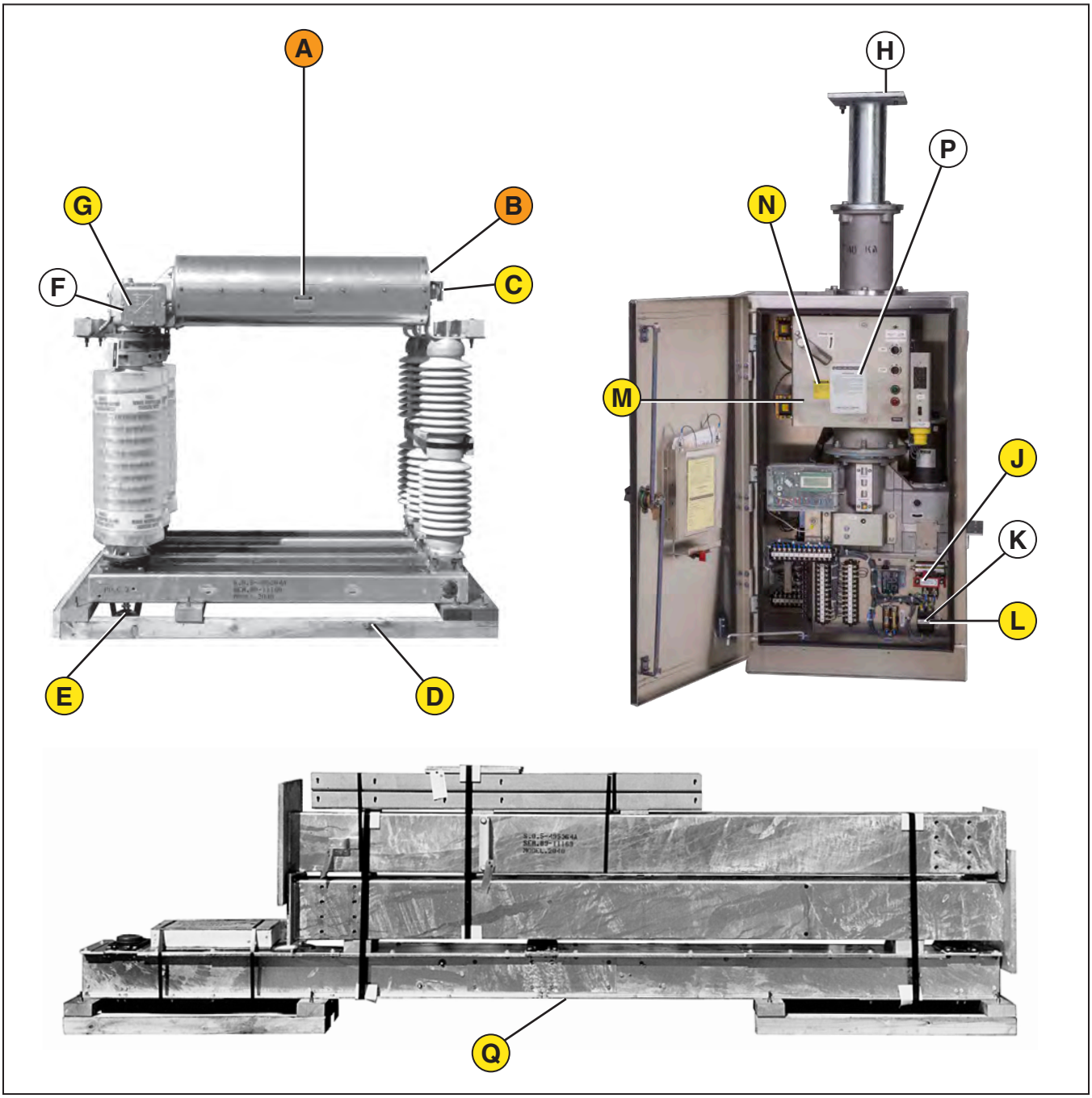
Read this instruction sheet thoroughly and carefully before installing or operating a Model 2040 Series 2000 Circuit-Switcher.

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	⚠ WARNING	Do not remove steel outer wrapper...		G-5993●
B	⚠ WARNING	Do not remove steel over wrapper until installation is complete...		G-5699■
C	⚠ CAUTION	This shield must be removed during installation...		G-6043●
D	⚠ CAUTION	Lifting instructions…	161 kV	G-5995■
			230 kV	G-5994■
E	⚠ CAUTION	Connect the insulated operating rod…		G-5950■
F	INSTRUCTION	Connecting-Pin Installation…		G-5952
G	⚠ CAUTION	Transition box contains a stop bracket and spacer…		G-5807■
H	INSTRUCTION	Instructions for attaching operator connecting link…		G-5792■
J	⚠ CAUTION	Control Voltage	48 Vdc	G-5948-1
			125 Vdc	G-5948-2
			115 V 60 Hz	G-5948-3
K	INSTRUCTION	Instructions for Fuse Slugs		G-5939■
L	⚠ CAUTION	Do not apply control voltage to this device or insert…		G-5959■
M	⚠ CAUTION	Do not apply control voltage to this device or manually...		G-5945■
N	⚠ CAUTION	Do not attempt to close the circuit-switcher using manual trip lever		G-6222▲
P	INSTRUCTION	Instructions — Operation, Gas-Pressure Indicator		G-5672▲
Q	⚠ CAUTION	Connect the interphase drive lever to the operator uni-ball coupling with the attached pin.		G-5949■

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

⚠ DANGER

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, fall protection, 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 circuit-switcher **Open/Close** position 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 breaking is involved in the normal operation of this interrupter switch. To operate, follow the operating procedure as outlined in this instruction sheet starting on page 25.

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 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 and damage.

Packing

An S&C catalog drawing will 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 materials to verify all parts are at hand. The Model 2040 Series 2000 Circuit-Switcher shipment should include the following items, as shown in Figure 1 on page 9 and Figure 2 on page 10.

NOTICE

DO NOT mix components from different installations.

The Series 2000 Circuit-Switcher is completely factory-assembled and thoroughly tested. To speed installation and maintain the proper adjustment of the circuit-switcher and switch operator made in the factory, components belonging to a specific circuit-switcher installation must not be intermixed with components belonging to a different installation.

Each Series 2000 Circuit-Switcher is serially numbered. This serial number appears on the circuit-switcher high-speed base, pole units, 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, which could cause personal injury.

S&C maintains a 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 an invaluable reference for future maintenance, modifications, or replacements.

The shipment contains:

- Three pole-units each consisting of an interrupter, an insulating support column, a support insulator, and a base, all factory-assembled and adjusted
- A single high-speed base enclosing the high-speed power train that drives the interrupters
- The appropriate number of mounting pedestals, complete with support arms and channels:
  - Single-pedestal: 69 kV (with 48-inch (1219-mm) phase spacing)
  - Two-pedestals: 69 kV (with 84-inch [2134-mm] phase spacing); 115 kV and 138 kV and can be specified on 161 kV
  - Three-pedestals: Can be specified on 161 kV and standard on 230 kV
- A Series 2000 Circuit-Switcher switch operator
- A container of operating-mechanism components and hardware, all individually identified
- Any optional features or accessories specified, such as a grounding switch

⚠ WARNING

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

Storage

NOTICE

Connect control power to the switch operator when storing it outdoors. The switch operator is equipped with a space heater that must be energized during storage to prevent condensation and corrosion within the operator enclosure. Alternatively, store the operator in a climate controlled area.

If the Series 2000 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 or in a non-climate-controlled area, connect control power to the space heater inside the Series 2000 Switch Operator per the wiring diagram. 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 may result.**

NOTICE

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

Cut the steel straps binding the mounting pedestals to the high-speed base. Cut the straps binding the container of operating mechanism components and hardware and the straps binding the pole-units. Remove any wood bracing between the terminal pads. See Figure 2 on page 10.

For circuit-switchers rated 161 kV and 230 kV: Remove and discard the lifting angles attached to the pole-unit bases.

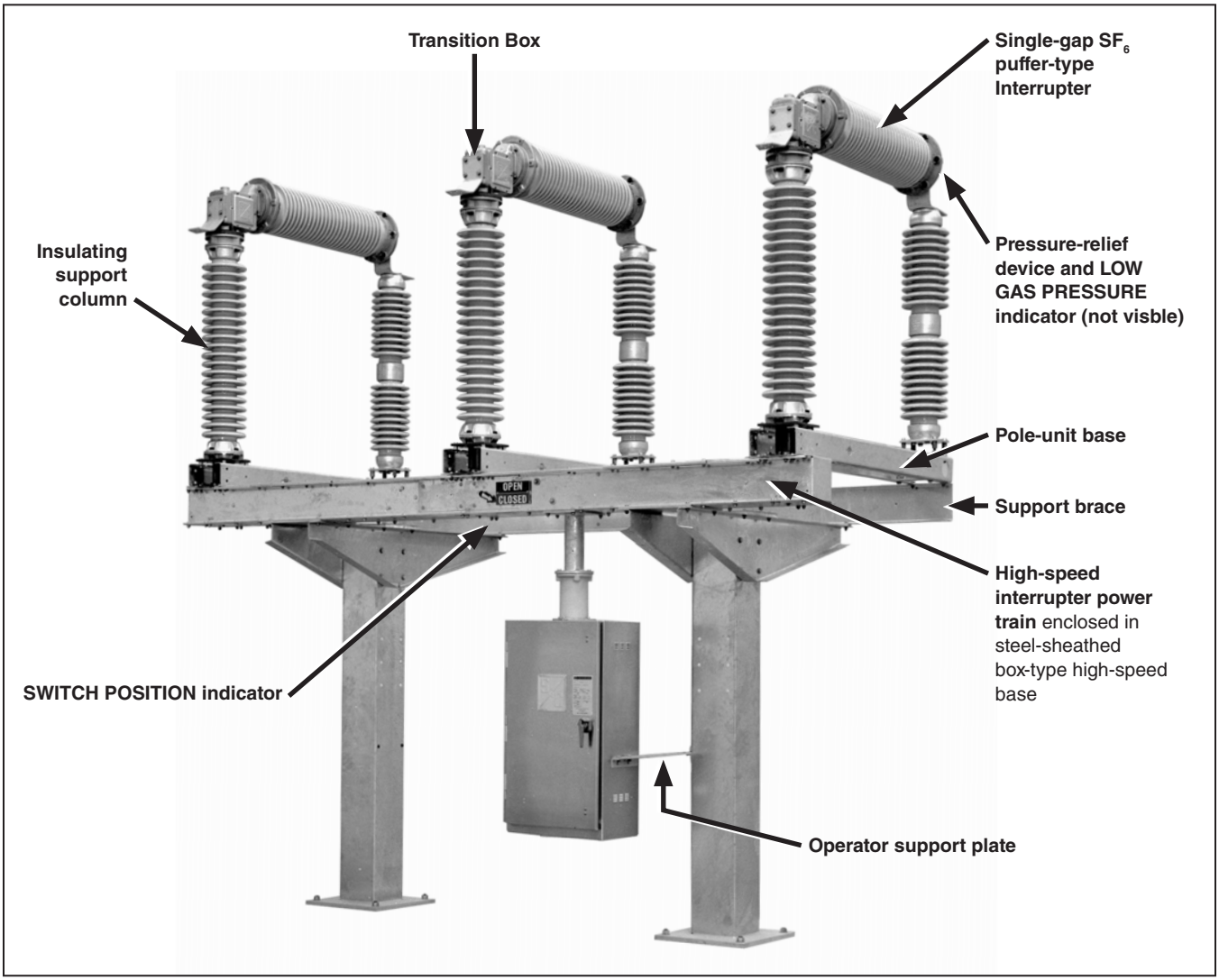


Figure 1. Model 2040 Series 2000 Circuit-Switcher rated 138 kV.

Installing the Mounting Pedestals and High-Speed Base

Complete the following steps to install a Model 2040 Series 2000 Circuit-Switcher:

⚠ 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 or equipment damage.**

STEP 1. Install each pedestal as follows:

(a) Install the lower set of anchor-bolt nuts and flat washers onto the pre-installed anchor bolts. Level all anchor bolts at the same height, leaving space below and above for leveling. See Figure 3 on page 11.

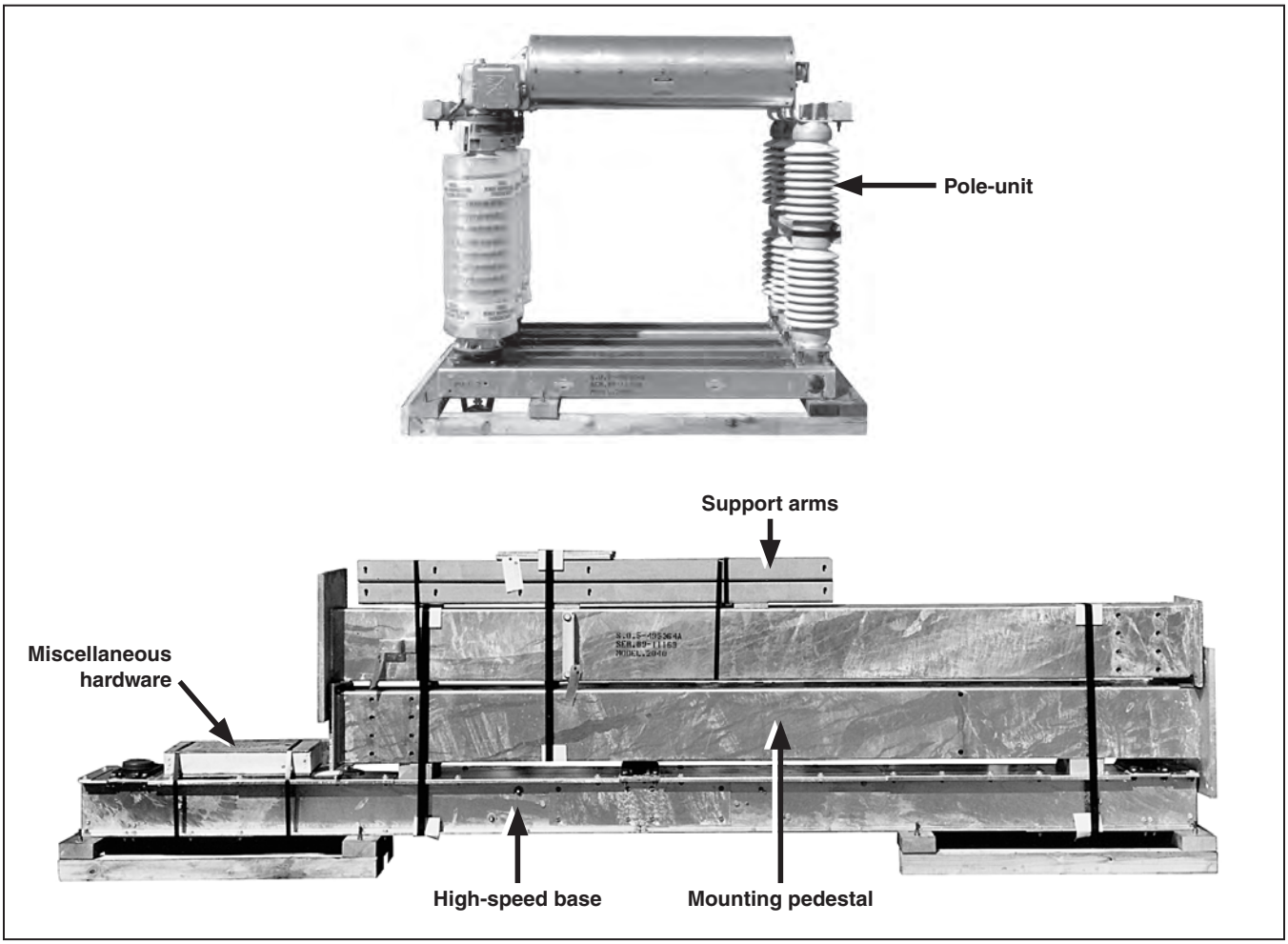


Figure 2. Typical shipment of a Model 2040 Series 2000 Circuit-Switcher. The operator is shipped on a separate skid.

(b) Install the temporary eyebolts into the holes provided at the top of the mounting pedestal. Attach lifting slings to the eyebolts. See Figure 4.

(c) Lift the pedestal over the anchor bolts. Before lowering, make sure the grounding pad is positioned properly for the installation. See Figure 4. Refer to the accompanying catalog drawing for details.

(d) Lower the pedestal onto the anchor-bolt nuts and flat washers. Loosely secure a flat washer and nut to each anchor bolt above the pedestal base. See Figure 3. Remove the lifting slings and eyebolts.

(e) 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 3.

STEP 2. Attach the support arms to the mounting pedestals, as shown on the catalog drawing, using the $\frac{5}{8}$–11 × 1¼-inch hex-head galvanized steel cap screws and flat washers furnished. See Figure 1 on page 9. Lubricate the nuts to facilitate tightening

Securely tighten the cap screws. Also install the covers on top of the mounting pedestals, as shown on the catalog drawing, using the ½–13 × 2-inch hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. Lubricate the cap screws to facilitate tightening. Securely tighten the cap screws.

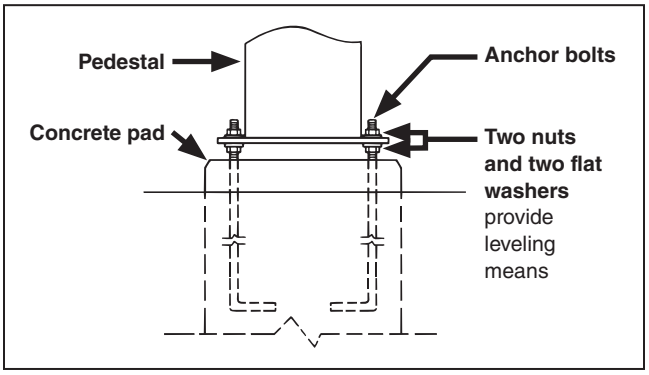


Figure 3. Pedestal mounting detail.

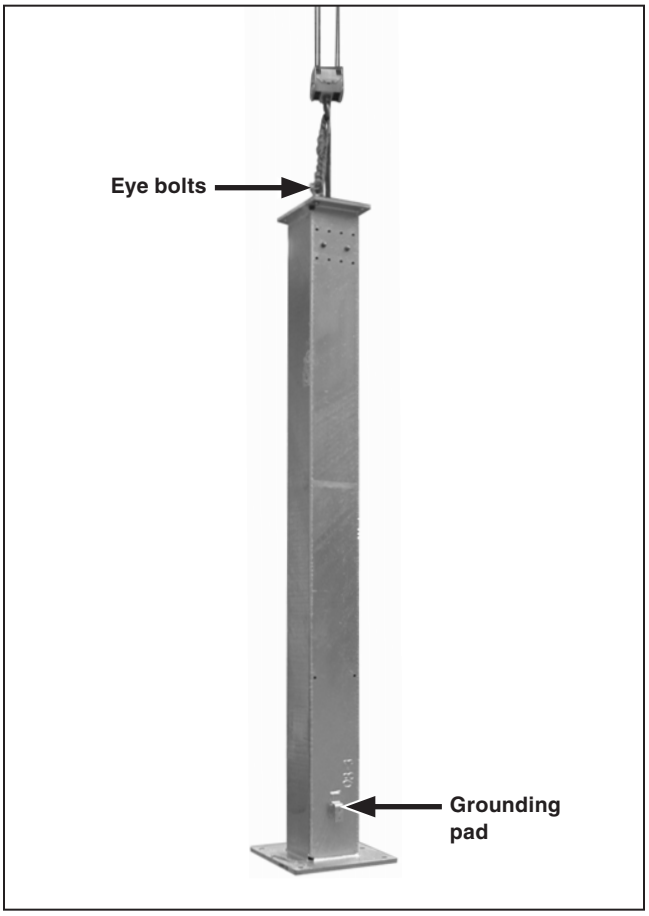


Figure 4. Lifting the pedestal into position.

STEP 3. Attach four suitable lifting slings to the high-speed base. See Figure 5. Unbolt the high-speed base from the shipping skid and lift the base on top of the support arms, as shown on the catalog drawing. 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.

⚠ WARNING

The operator directly drives the interrupters open and closed through a simple high-speed power train leading from the top of the operator, through a horizontal interphase linkage enclosed in a steel-sheathed box-type base, and to the reciprocating-action insulated operating rods passing 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.**

STEP 4. Loosely bolt the high-speed base to the support arms using the ½–13 × 2-inch hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. Lubricate the bolts to facilitate tightening.

Use a level to 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. Refer to the catalog drawing for details. See Figure 3 on page 11 for anchor-bolt nut detail.

STEP 5. Attach the support brace to the support arms using the ½–13 × 2-inch hex-head galvanized steel cap screws, flat washers, and self-locking hex-nuts furnished. See Figure 1 on page 9 and the catalog drawing. Lubricate the hardware to facilitate tightening.

STEP 6. 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. See Figure 3 on page 11. Hand-tighten the lower anchor-bolt nuts as necessary. Then, securely tighten the upper set of anchor-bolt nuts at each mounting pedestal.

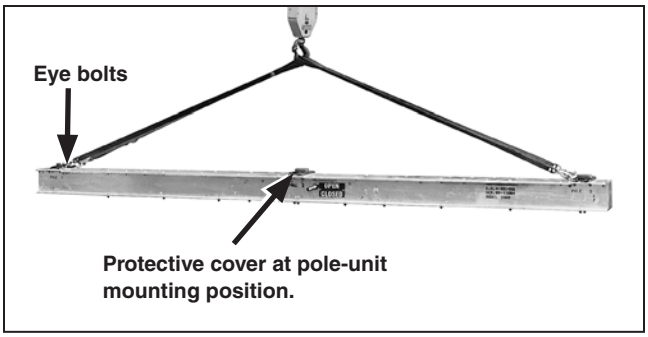


Figure 5. Hoisting the high-speed base.

Installing the Switch Operator

Complete the following steps to install the switch operator:

STEP 1. Loosen the ½–13 × 1¼-inch galvanized steel cap screws, flat washers, and nuts attaching the bottom plates to the underside of the high-speed base. Remove the plates and place them and their hardware aside on a clean surface. See Figure 6.

Remove the ¾-inch stainless steel pin and cotter pin from the interphase drive lever enclosed in the high-speed base. See Figure 7. Retain the pin and cotter pin for re-use in Step 1 on page 18.

⚠ 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 2. Wrap a lifting sling around the stored-energy housing of the operator, as shown in Figure 8 (left).Carefully raise the operator to the upright position so it rests on its base skid, as shown in Figure 8 (right).

⚠ CAUTION

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

Remove the skid and bracing running the length of the operator, the stored-energy housing, and the operator support tube. See Figure 8. Also remove the protective cover and packing on top of the operator support tube as well as the packing on the operator enclosure louvers. See Figure 8 and Figure 9 on page 14.

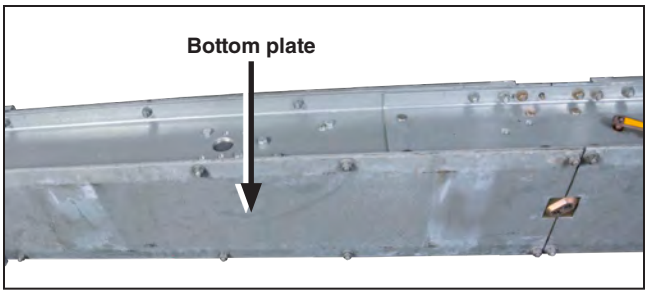


Figure 6. Removing the bottom plates from the high-speed base.

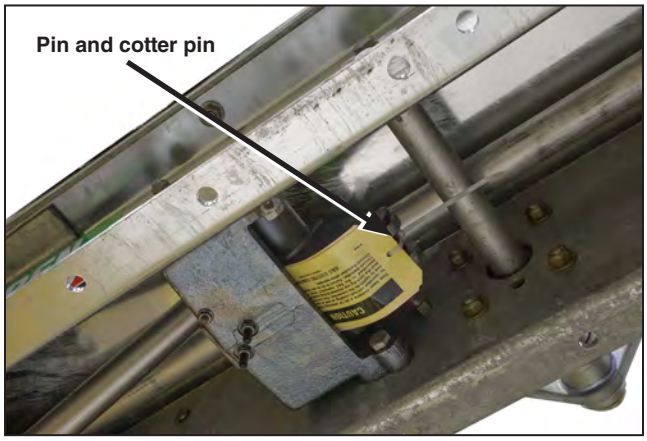


Figure 7. Remove the ¾-inch stainless steel pin and cotter pin from the interphase drive lever inside the high-speed base

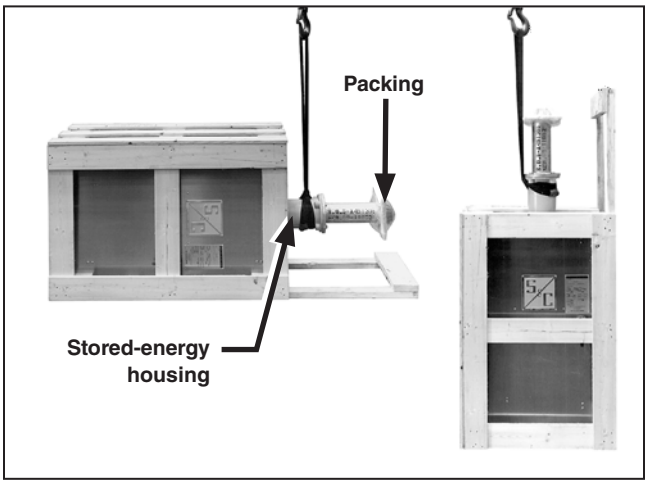


Figure 8. Raising the operator up on the base of the skid.

STEP 3. Lift and install the operator as follows:

NOTICE

Do not 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.**

(a) 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 9. Make sure the operator door faces the same way as the SWITCH POSITION indicator on the high-speed base.

(b) Carefully hoist the operator into place. Be careful not to damage the uni-ball coupling on the operator connecting link during hoisting and installation of the operator to the high-speed base.

(c) Attach the operator support tube mounting plate to the underside of the high-speed base using four ½–13 × 1¼ hex-head galvanized-steel cap screws, flat washers, and self-locking hex nuts. Lubricate the bolts to facilitate tightening. Tighten all four screws securely.

STEP 4. Attach the operator-support angle to the mounting pedestal using the ⅝–11 × 1¼-inch hex-head galvanized steel cap screws, four flat washers, and two self-locking hex nuts. Refer to the catalog drawing for exact placement.

STEP 5. Attach the operator-support plate to the angle on the side of the operator enclosure and to the operator support angle on the mounting pedestal using the four ½–13 × 1¼-inch hex-head galvanized-steel cap screws, flat washers, and self-locking hex nuts furnished. Lubricate the bolts to facilitate tightening. Securely tighten the screws. See Figure 1 on page 9 and Figure 9.

STEP 6. On circuit-switchers with two or three mounting pedestals, insert the hole-plugs furnished into all unused holes in the pedestal.

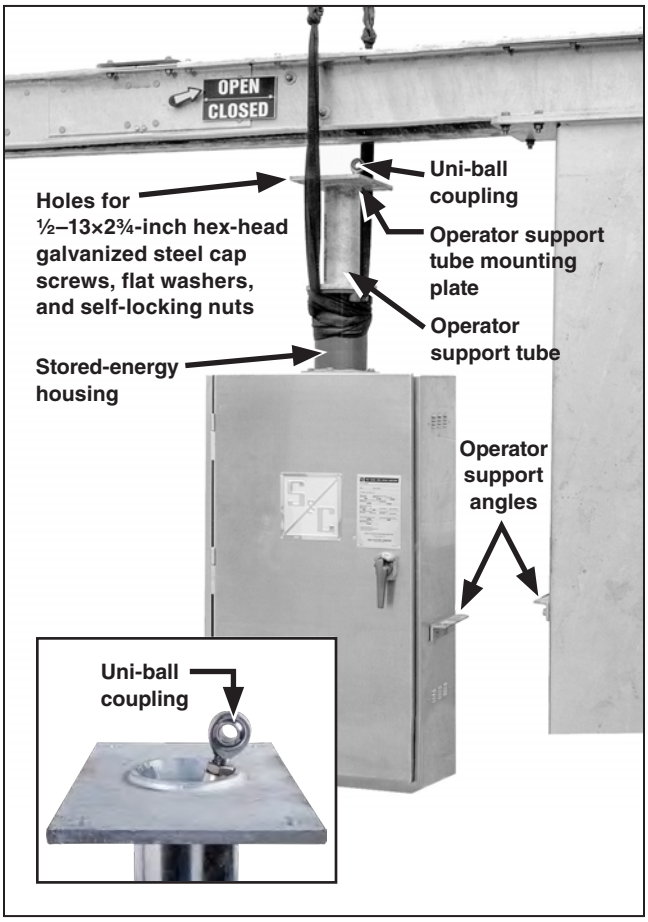


Figure 9. Hoisting the operator into position.

Installing the Pole-Units

NOTICE

The pole-units are numbered "Pole 1," "Pole 2," and "Pole 3." Make sure to install the pole-units in the order marked on the catalog drawing. The pole numbers do not have to correspond with the system's phase designations.

NOTICE

Do not disassemble the insulating support columns. The insulating support columns are filled with lubricated dielectric filler that prevents contamination from affecting the dielectric integrity of the column or the insulated operating rod. An aerator is used at the upper end of each support column to prevent water from being pumped in because of pressure differentials caused by temperature cycling. **Disassembling the insulating support column will cause the lubricated filler to evacuate.**

⚠ WARNING

Lift the pole-unit by the pole-unit base only. Do not attempt to lift the pole-unit by the interrupter or other live parts. **Lifting the pole-unit by any other means can cause damage to the pole-unit or personal injury.**

Complete the following steps to install the pole-units:

STEP 1. Lift and install the pole-units as follows:

(a) Install four eyebolts on each pole-unit base. See Figure 10.

(b) Attach four suitable lifting slings to the eyebolts on the pole-unit to be mounted at the center of the high-speed base—marked "Pole 2"— as shown in Figure 10.

(c) Make sure the rigging does not stress the pole-unit. Unbolt the base from the skid. Raise the pole-unit a few feet, then remove the two ½–13 × 1¾-inch hex-head galvanized steel cap screws, flat washers, and hex nuts that attach the shipping bracket to the bottom of the pole-unit base. The shipping bracket protects the insulated operating rod. Discard the shipping bracket and associated hardware. See Figure 10.

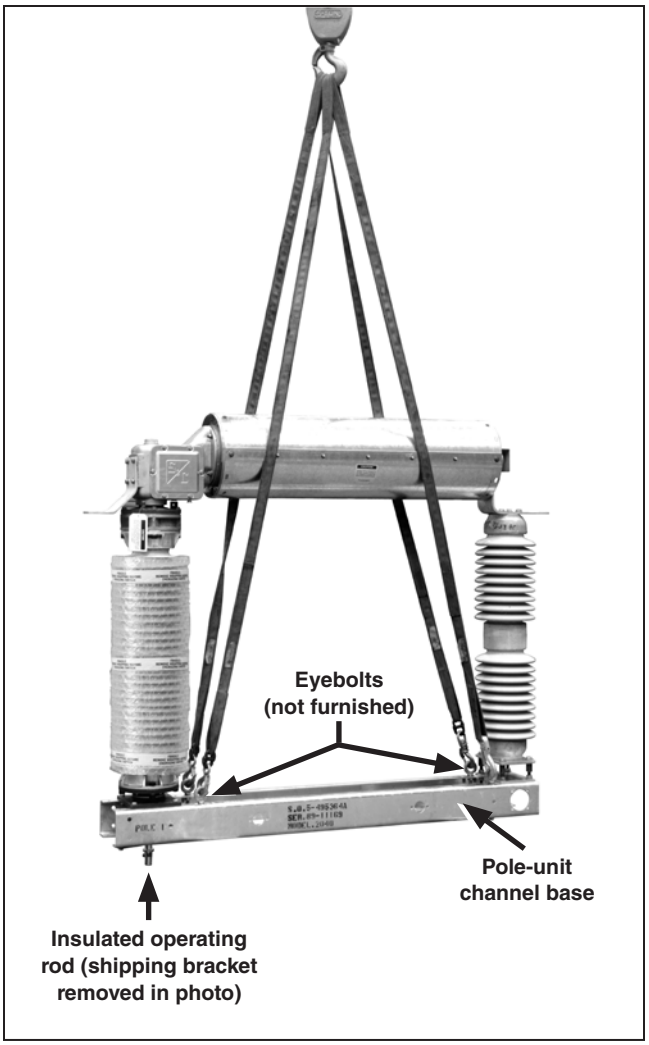


Figure 10. Hoisting the pole-unit.

⚠ CAUTION

The insulated operating rod is under pressure. Removal of the shipping bracket can result in the operating rod quickly moving down approximately ⅜-inch (9.5 mm). **Keep hands clear of the operating rod when removing the shipping bracket to avoid injury.**

(d) Remove the ½-inch silicon-bronze pin and cotter pin from the insulated operating rod. Retain these pins for re-use in Step 1(d) on page 18.

(e) Remove the protective cover on the high-speed base at the pole-unit mounting location. See Figure 5 on page 12. Raise the pole-unit to its mounting location at the center of the high-speed base, as shown on the catalog drawing. Carefully guide the pole-unit to avoid damaging the insulated operating rod.

(f) Attach the pole-unit base to the high-speed base using the ½–13 × 1¾-inch hex-head galvanized-steel cap screws, flat washers, and self-locking hex nuts furnished. Lubricate the cap screws to facilitate tightening. Securely tighten all cap screws.

(g) Attach the pole-unit base to the support brace, using the ½–13 × 1¾-inch hex-head galvanized-steel cap screws, flat washers, and self-locking hex nuts furnished. Lubricate the cap screws to facilitate tightening. Securely tighten all cap screws.

(h) Install shims as necessary between the pole-unit base and the support brace to compensate for any irregularities between the mating surfaces.

STEP 2. Repeat Step 1 for the pole-units, marked "Pole 1" and "Pole 3."

Connecting the Pole-Units to the High-Speed Power Train

Complete the following steps to connect the pole-units to the high-speed power train:

STEP 1. Prepare the insulated operating rod of each pole-unit for attachment to the interphase drive in the high-speed base as follows:

(a) Remove the six 5/16–18 × 3/4-inch hex-head stainless steel cap screws used to attach the access cover to the side of the transition box. See Figure 11. Remove the cover and place it and the hardware on a clean surface.

(b) Make sure the transition lever is in the **Open** position. The lever should be turned fully counterclockwise. See Figure 11 and Figure 12. If the lever is not in the **Open** position, carefully turn the transition lever to the **Open** position.

If the transition lever cannot be freely rotated to its fully **Counterclockwise** position, misalignment of the interphase drive is occurring in the high-speed base. Swing the insulated operating rod end links up, away from the interphase drive linkage lever, and try rotating the transition lever to its fully **Counterclockwise** position.

> **⚠ CAUTION**
>
> Keep fingers clear of the transition lever's travel. The transition lever is under pressure and could quickly rotate counterclockwise. **Injury to the fingers can result.**

(c) Remove the 3/8-inch stainless steel connecting pin used to attach the transition lever to the operating rod link. See Figure 12. The pin is locked in place by a retainer. Lift and turn the retainer to remove the pin. Keep the pin for re-use in Step 1(e) on page 18.

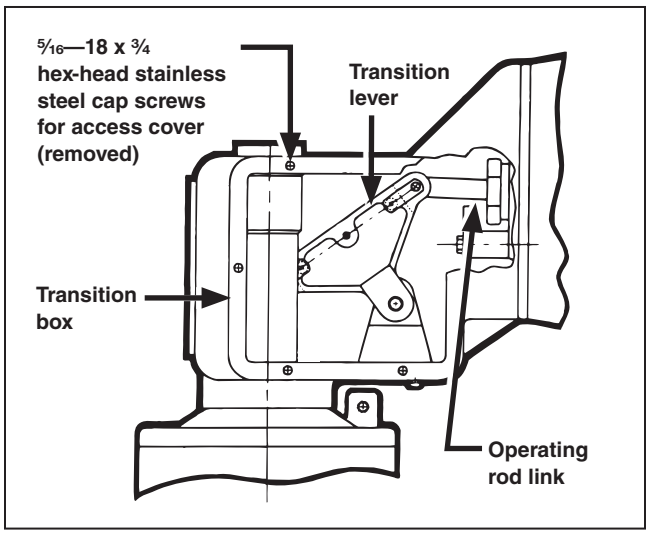


Figure 11. The transition lever in the Shipping position.

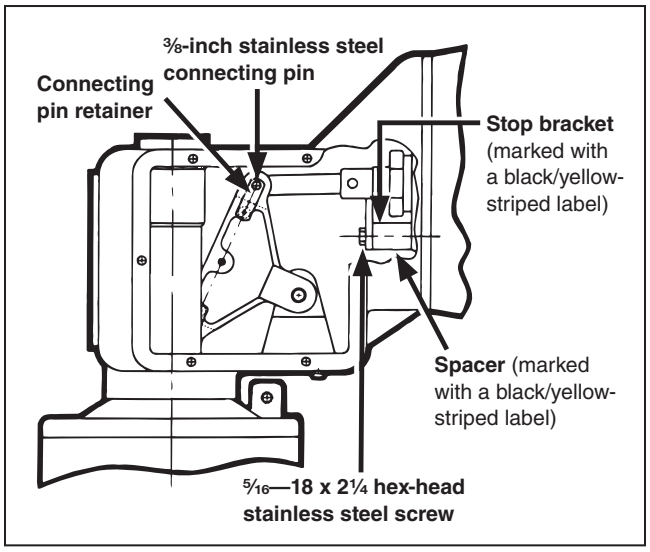


Figure 12. Transition lever in the Open position.

(d) Attach the insulated operating rod end links to the interphase drive linkage lever in the high-speed base using the ½-inch silicon-bronze pin and cotter pin retained from Step 1(d) on page 16. See Figure 13. The insulated operating rod may be moved up or down, as required, to make the connection.

(e) Replace the ⅜-inch stainless steel connecting pin retained from Step 1(c) on page 17. See Figure 12 on page 17. It will be necessary to loosen the 5⁄16–18 × 2¼-inch hex-head stainless steel screw holding the spacer in place and withdraw it approximately ⅛-inch so the connecting pin can be inserted. Do not remove the screw at this time.

(f) After the connecting pin has been inserted, lock it in place with its retainer.

(g) Remove and discard the 5⁄16–18 x 2¼-inch hex-head stainless steel screw, spacer, and stop bracket (marked with a black/yellow-striped label) shown in Figure 12 on page 17

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 1 on page 13. See Figure 14. 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 enough to facilitate insertion of the stainless steel pin.

STEP 2. After the pin is installed, remove the lower ¼–20-inch locknut retaining the adjustable locking rod, and remove and discard the adjustable locking rod and locknuts. See Figure 14.

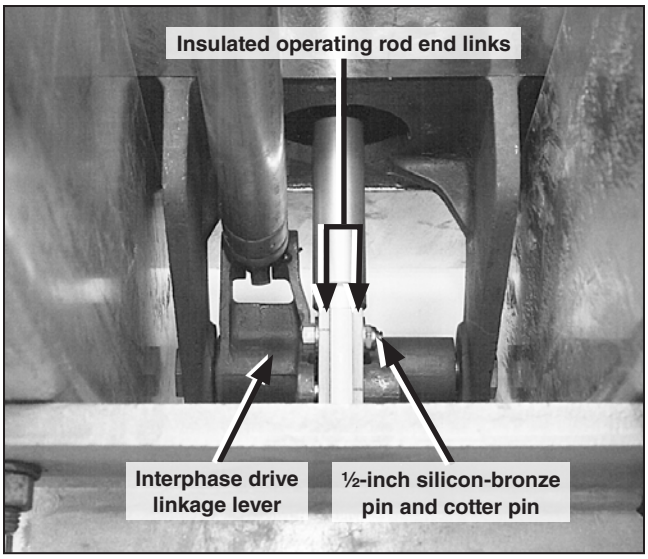


Figure 13. Attaching the insulated operating rod to the interphase drive.

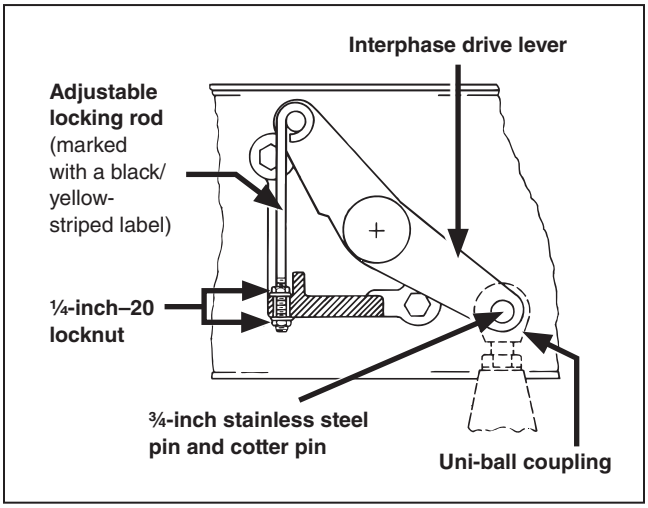


Figure 14. Attaching the Uni-ball coupling to the interphase drive lever.

Connecting 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.**

Complete the following steps to connect the conductors:

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 attaching the conductors:

(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 terminal pad and apply a coating of aluminum connector compound. 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 zinc-plated serrated hex nuts that run the length of the container.

(b) Remove and discard the ⅜–16 × ⅞-inch and two ⅜–16 × 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 ⅜–16 × ⅞-inch and two ⅜–16 × 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.

(c) Pry the container halves apart with a flat-head screwdriver or other sturdy pry tool. 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 more safely lowered to the ground.

(d) Remove and discard the ⅜–16 × ⅞-inch hex-head cap screw and flat washer that attach the lower container half to the coupling-end casting of the interrupter and the ⅜–16 × ⅞-inch hex-head cap screw and flat washer that attach the lower container half to the indicator-end casting of the interrupter. Then, discard this container half.

(e) Remove and discard the foam-core inner liner wrapped around the interrupter.

(f) Remove the shield for the pressure-relief device. See Figure 15 on page 20.

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

Setting 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 16 on page 20 and Figures 17 and 18 on page 21.

(a) To avoid accidentally energizing the operator after the external connections have been completed, open the control power KNIFE switch, and 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 17 on page 21.

(b) Mark the conduit-entrance location for the control-circuit wiring on the conduit-entrance plate in the bottom of the operator enclosure. See Figure 16. Remove the plate and cut out the necessary opening.

(c) Apply sealant and replace the plate. Make up and connect the entrance fittings. Verify the 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.**

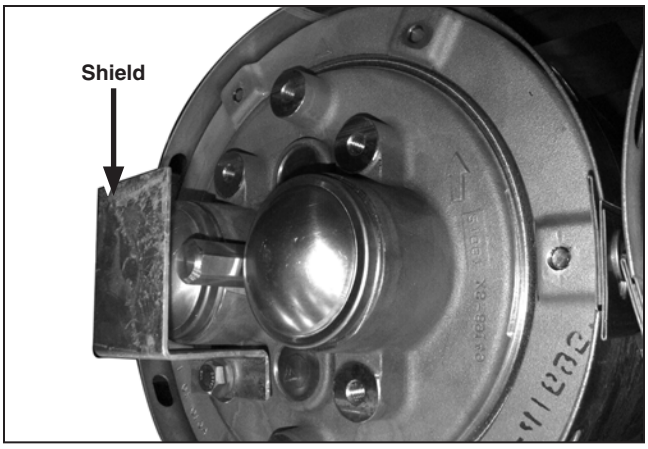


Figure 15. Removing the shield for the pressure-relief device.

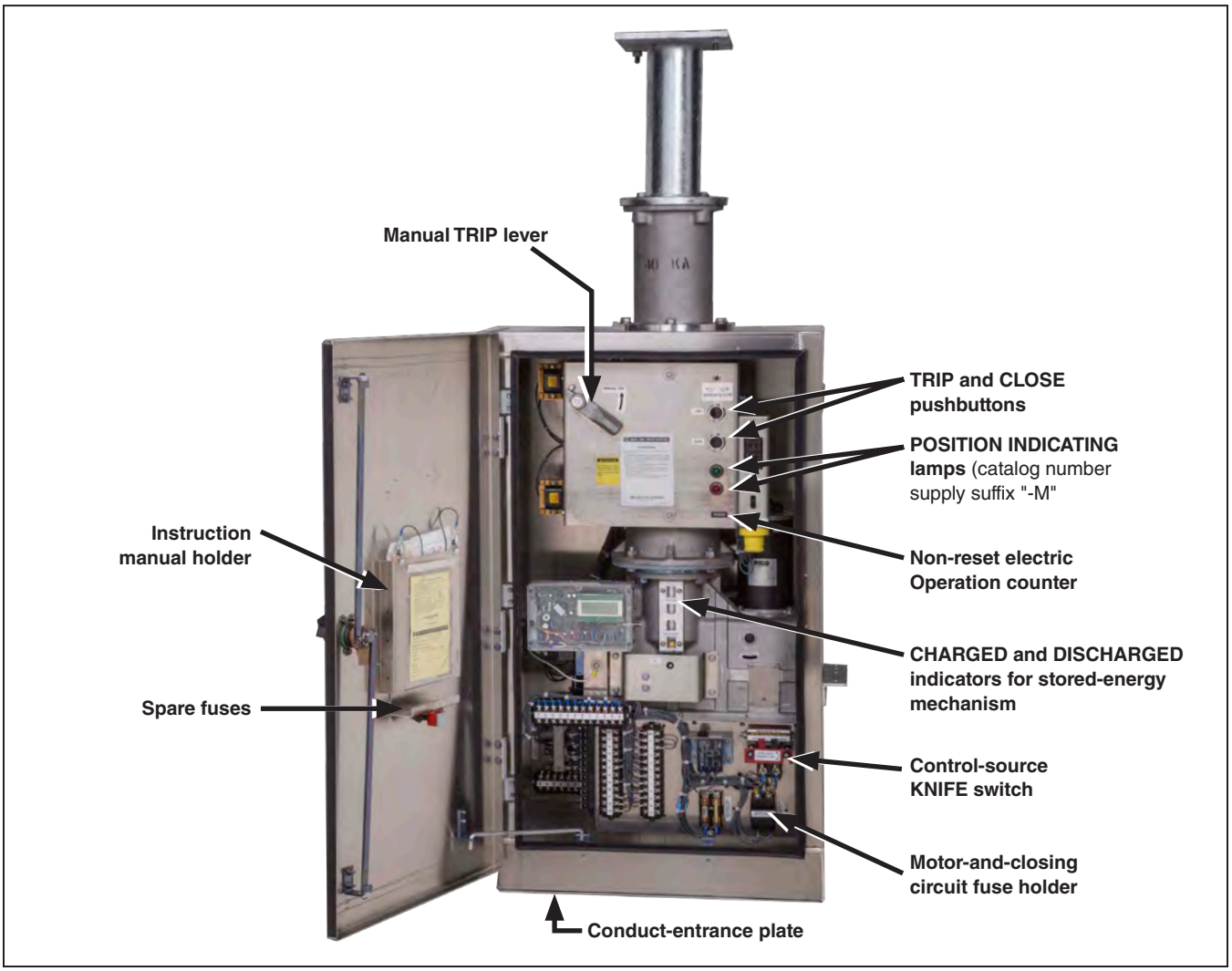


Figure 16. Interior of the switch operator.

(d) Connect the external control-circuit wiring (including the space-heater source leads) to the terminal blocks at the bottom of the enclosure. Refer to the wiring diagram. Observe correct polarity on the dc-control-voltage models. Trip-circuit conductors and motor-closing circuit conductors must be adequately sized for the ampacities indicated on the wiring diagram.

NOTICE

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

Do not apply control voltage to the operator at this time.

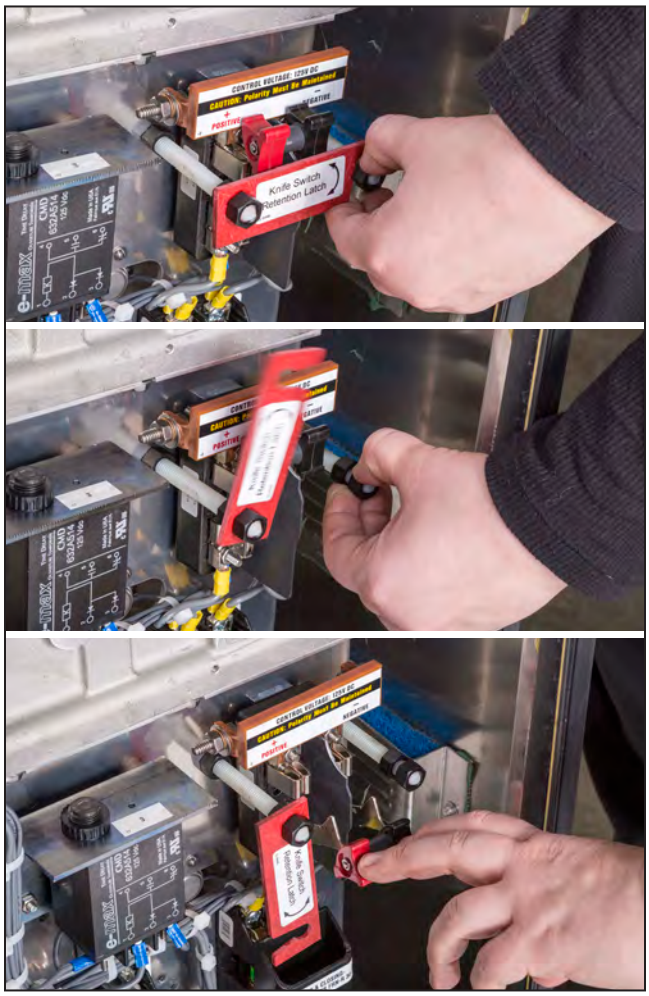


Figure 17. The KNIFE switch retainer and KNIFE switch.

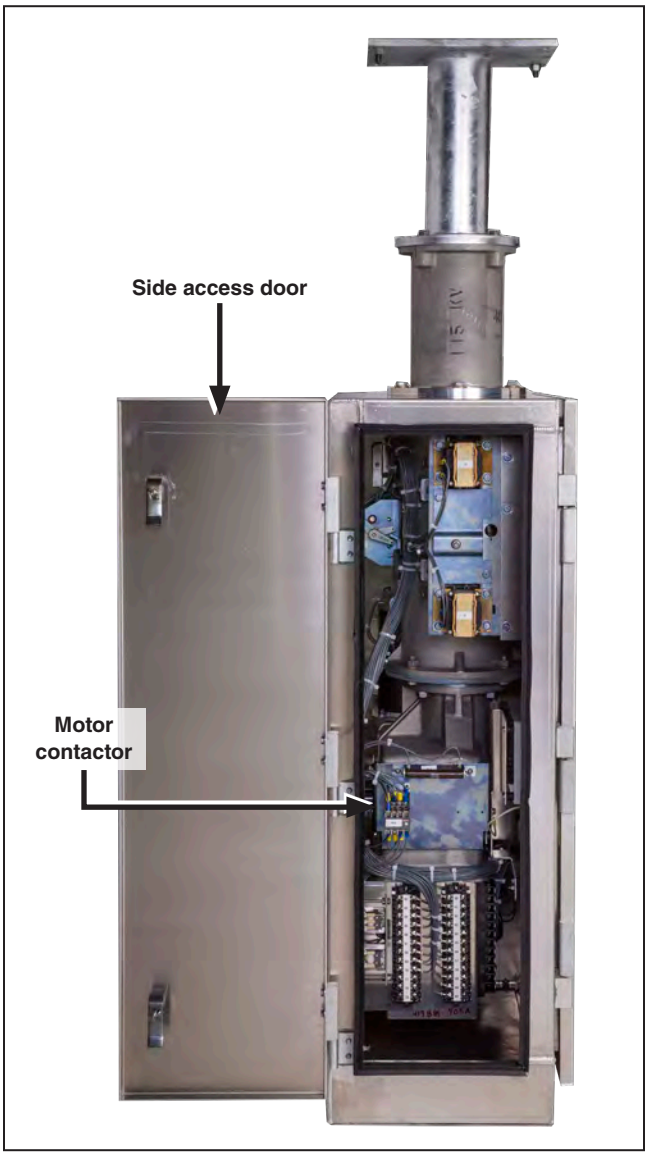


Figure 18. Series 2000 Switch Operator side-access panel.

STEP 2. Perform the final checkout per the following steps:

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 interrupter stop bracket and spacer have been removed (see Figure 19)
- The transition lever has been connected to the operating rod link (see Figure 12 on page 17)
- If the optional remote gas-density monitor is present (catalog number suffix "-R"), make sure connections are made according to S&C Instruction Sheet 716-530

(b) At each interrupter, make sure:

- Both shipping-container halves and all associated packing and hardware have been removed
- The pressure relief shield has been removed from the target-end of the interrupter (See Figure 15 on page 20)

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

- Each insulated operating rod is connected to the interphase drive (see Figure 20 on page 23)
- The interphase drive lever has been connected to the operator uni-ball coupling (see Figure 21 on page 23)
- The adjustable locking rod attached to the interphase drive lever has been removed (see Figure 19 and Figure 21 on page 23)

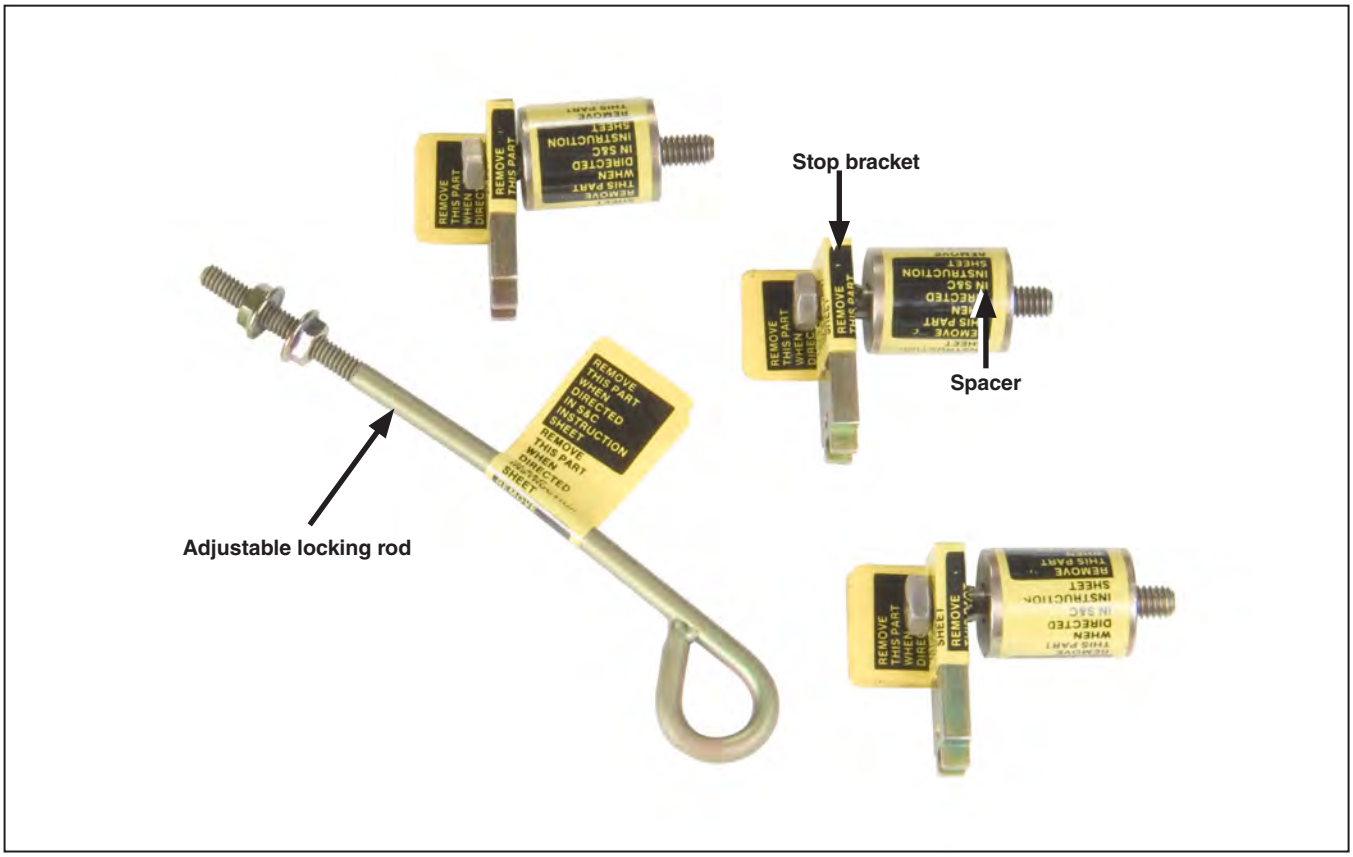


Figure 19. Check the transition box and high-speed base for these.

(d) In the switch operator, make sure:

- Correct polarity has been observed on dc-control-voltage models (See Figure 22)
- The motor contactor and surge suppressor are fully seated in their mounts (See Figure 23 on page 24)
- Any optional "icebox"-style relays (used for catalog number suffix "-P," "-T2" and "-U") are fully seated (See Figure 24 on page 24)

(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. See Figure 11 on page 17.

STEP 4. Replace the bottom plates to the underside of the high-speed base and securely tighten the associated ½–13 × 1¼-inch galvanized-steel cap screws, flat washers, and nuts. See Figure 6 on page 13.

For circuit-switchers rated 161kV and 230 kV: Attach the six 13 × 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.

STEP 5. Insert the motor-and-closing circuit fuse holder. Then, close the control power KNIFE switch. See Figure 22.

STEP 6. Press the CLOSE pushbutton or send a **Close** command to the switch operator. See Figure 16 on page 20. (TRIP and CLOSE pushbuttons are not included on operators specified with catalog number suffix "-J." In such instances, momentarily touch a jumper between terminals 1 and 3 to close the circuit-switcher.)

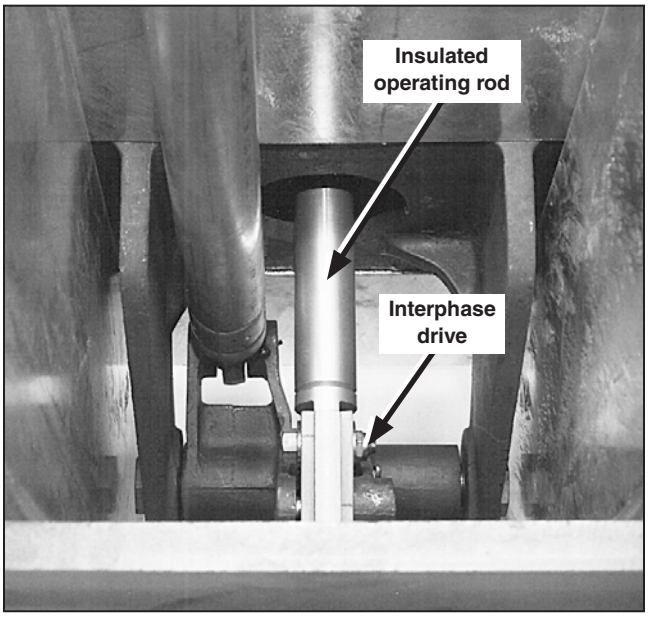


Figure 20. Make sure each insulated operating rod has been connected to the interphase drive.

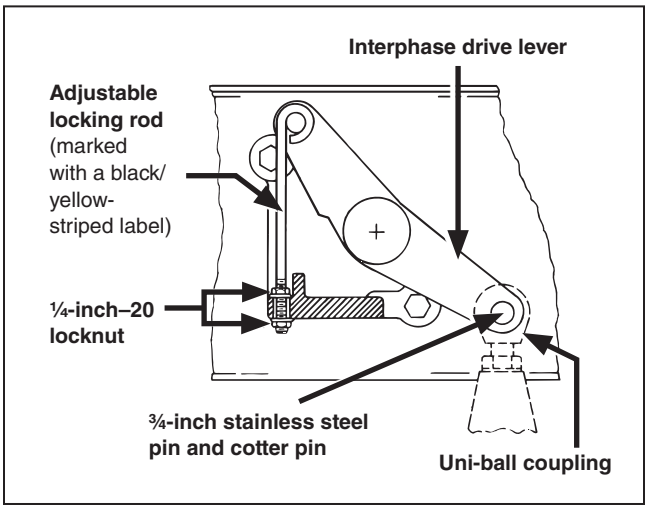


Figure 21. Make sure the interphase drive lever has been connected to the uni-ball coupling and the adjustable locking rod has been removed.

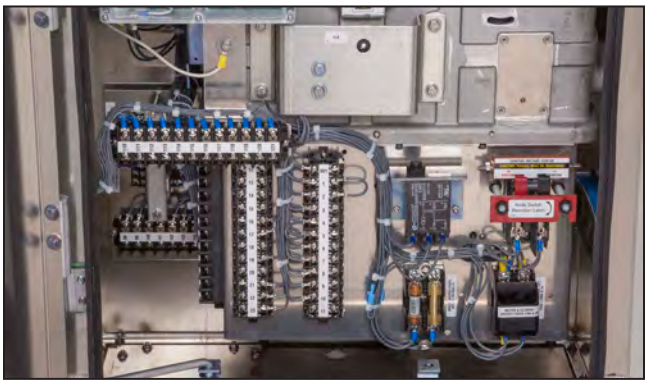


Figure 22. The motor-and-closing circuit fuse holders and the control-source knife switch.

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 25 on page 25. If the POSITION INDICATING lamp option has been specified, the red lamp will light. See Figure 16 on page 20.

STEP 7. When the circuit-switcher is ready to be placed in service, the motor and closing circuit fuses can, at the user's discretion, be replaced with the slugs furnished. S&C recommends this practice for increased reliability because low-voltage fuses can be damaged by the repeated inrush current experienced during normal 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.

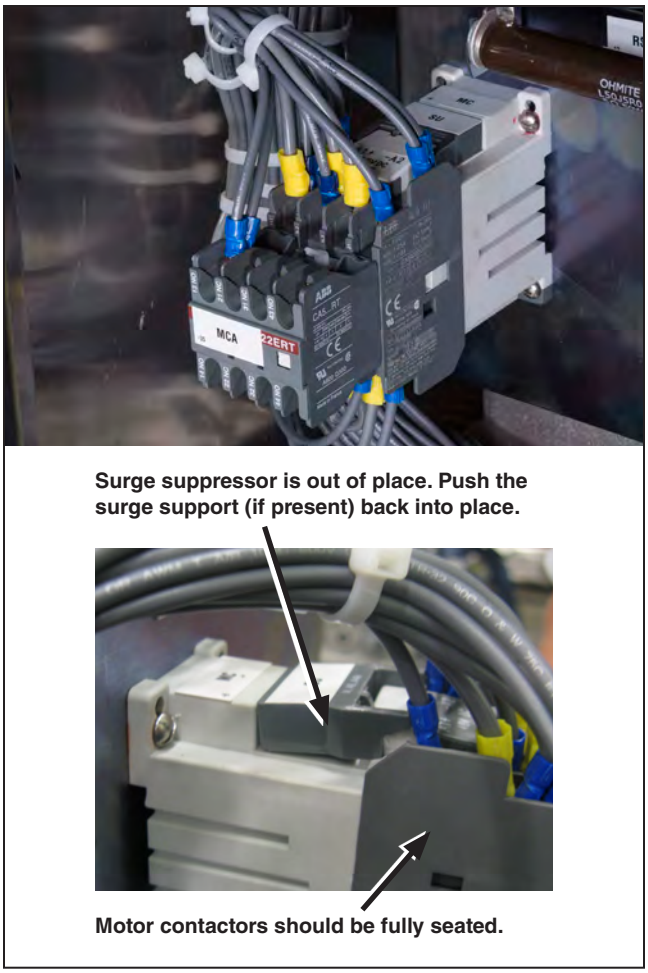


Figure 23. Check the open and close motor contactors, auxiliary contact blocks, and surge suppressors behind the operator side panel.

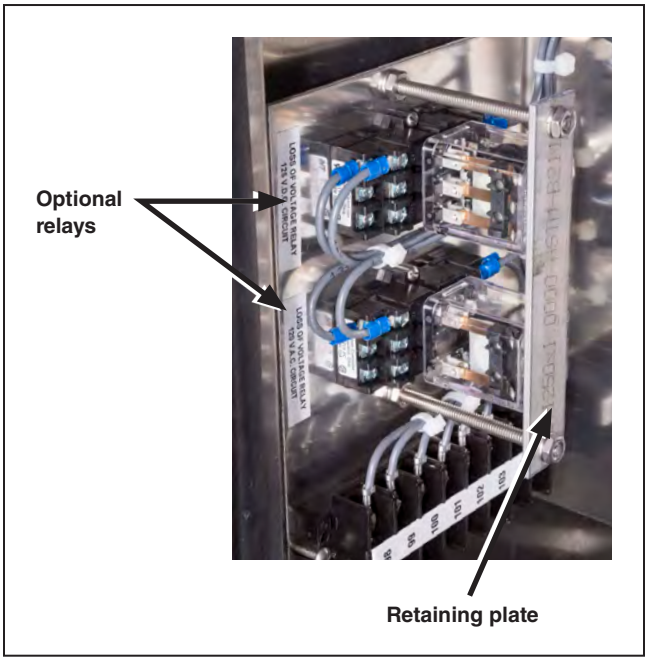


Figure 24. Ice cube-style relays and relay holder.

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 2040 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 16 on page 20.

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 26 on page 26.

The SWITCH POSITION indicator on the high-speed base will move to the **Open** position. See Figure 25. 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 16 on page 20.

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 the **Closed** position. See Figure 25. If the POSITION INDICATING lamp option has been specified, the red lamp will light.

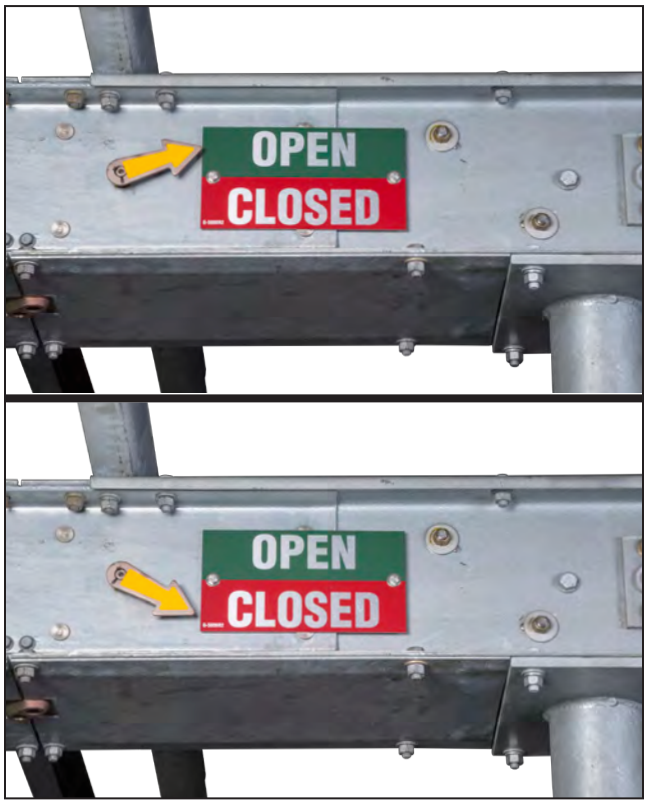


Figure 25. The SWITCH POSITION indicator in the Open position (top). The SWITCH POSITION indicator in the Closed position (bottom).

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.

Manual Operation

To trip the interrupters, push the manual TRIP lever counterclockwise as indicated by the TRIP lever label. See Figure 16 on page 20. 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 denoted by movement of the STORED ENERGY indicator to the **Discharged** window. (See Figure 26.)

The SWITCH POSITION indicator on the high-speed base will move to the **Open** position. (See Figure 25 on page 25.) 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 STORED ENERGY 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.

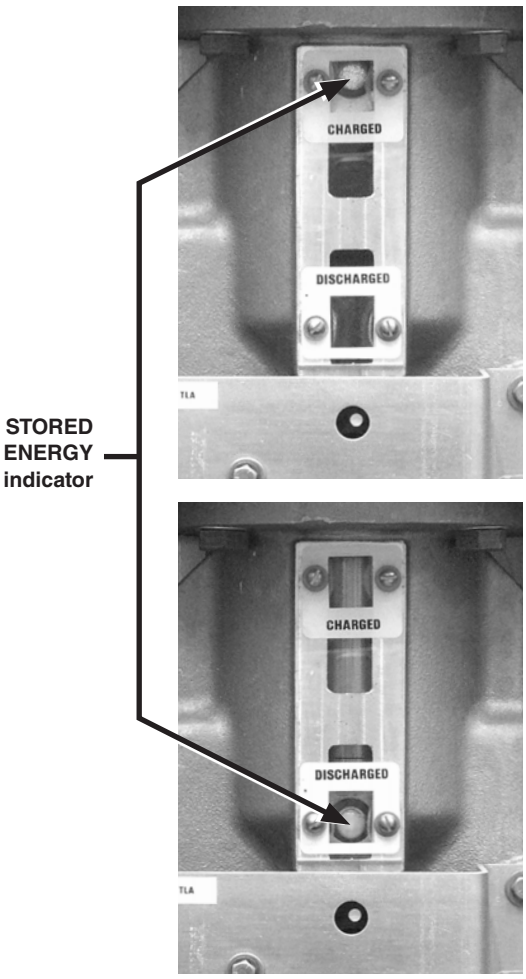


Figure 26. The STORED ENERGY indicator.

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 27 illustrates a GAS PRESSURE indicator with acceptable gas pressure.

Figure 28 illustrates a GAS PRESSURE indicator with a red target, signaling a loss in gas-pressure.

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. 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.
- A **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 over 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.

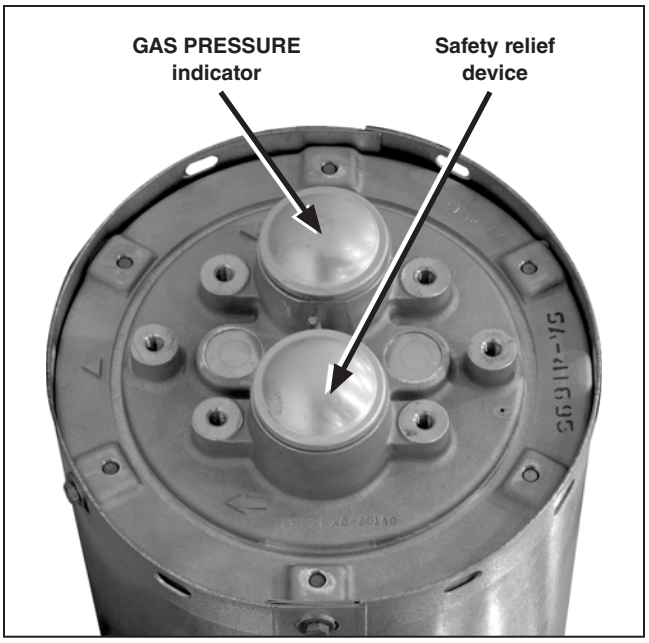


Figure 27. The normal GAS PRESSURE indicator and relief device.

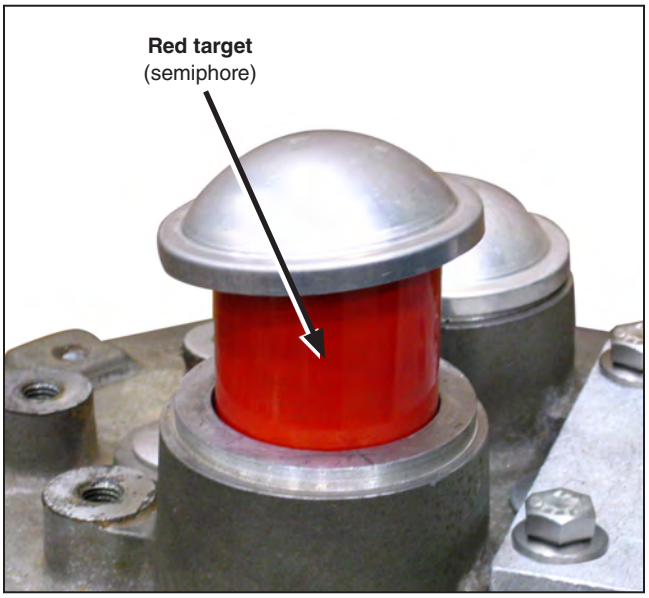


Figure 28. The visible "red target" GAS PRESSURE indicator.

Inspection Recommendations

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