INTRODUCTION

The equipment covered by this publication must be selected for a specific application and it must be installed, operated, and maintained by qualified persons who are thoroughly trained and who understand any hazards that may be involved. This publication is written only for such qualified persons and is not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

General

The following instructions are for field replacement of interrupters for S&C Circuit-Switchers—Mark V, Vertical-Break Style rated 34.5 kv through 161 kv and Center-Break Style rated 115 kv through 345 kv, with one, two, or three interrupting gaps per pole-unit.* See Figure 1.

Though the text and illustrations refer to Circuit-Switcher, the instructions are equally applicable to interrupter replacements for S&C Trans-Rupters® and S&C Line-Rupters®.

The Interrupter

The interrupter contains two movable rods: the main-contact operating rod and the interrupting-contact operating rod. During interruption, both rods are driven to the open position by stored energy, with the action controlled and sequenced by the brain. Both rods extend into the brain where they are linked to actuating arms which are spring driven. Motion is transmitted through metal bellows within the interrupters. For purposes of reference, the main-contact operating rod is the one closest to the supporting insulator stack.

Protective Packaging

Interrupters are porcelain-enclosed, hermetically sealed devices containing sulfur hexafluoride gas under pressure. To guard against breakage and possible hazard to personnel, the porcelain section of these interrupters must be encased in a bolted-on container during handling. Replacement interrupters are shipped with this container in place. Do not remove the container until so directed in the following instructions.

* The instructions herein are also applicable to similar models of Mark III and Mark IV Circuit-Switchers.
Tools Required:
- ¾-inch open-end or box wrench for the ½”–13 hex nuts at the brain connection and the ¾”–13×1½” hex-head cap screws at the terminal end of the interrupter.
- 9/16-inch ratchet-type socket or open-end wrench for the ¾”–16×1¾” hex-head cap screws on the brain cover.
- Screwdriver for the 10–32 slotted-head machine screws fastening the shunt cable inside the brain housing.
- Wire brush and suitable compound for aluminum electrical-contact surfaces.
- Holding-device positioning bolt (if applicable). Otherwise, a clamp or wire is required to maintain the open position of the brain and disconnect blade during replacement procedures. See Step 4.

BEFORE STARTING INSTALLATION

CAUTION
Normal system practices must be followed to ensure that Circuit-Switcher is de-energized, isolated from high-voltage sources, and grounded at all six terminals before proceeding with the work described in this instruction sheet.

Figure 1. Views of S&C Circuit-Switcher—Mark V, Vertical-Break (top) and Center-Break (bottom) Styles, with shunt-trip device.
REMOVING THE EXISTING INTERRUPTER

Step 1
After following the user's standard procedures for clearing and tagging equipment on which work is to be performed, operate the Circuit-Switcher to the fully open position. In this position, subsequent steps may be performed without the possibility of tripping the latch which releases the stored energy in the spring-loaded brain mechanism.

Further, to preclude inadvertent electrical operation of the switch operator, remove the motor-circuit and shunt-trip circuit two-pole pull-out fuseholders or—on earlier-model switch operators—open the two-pole control-source disconnect switch and remove the control-source fuses.

Step 2
Install the spare pressure-relief shield, furnished with the replacement interrupter (in a separate box), around the pressure-relief device of the interrupter to be replaced. See Figure 4 (right). Secure the shield by tightening the clamp furnished.

Step 3
Install the spare interrupter container, furnished with the replacement interrupter, around the interrupter to be replaced, using the following procedure:
(a) Remove the two container-halves from the shipping crate. Note that one of the container-halves is furnished with a loosely attached \( \frac{3}{8}'' - 16 \times 2'' \) carriage bolt at each end. Position this container-
(e) If tapped holes are provided in the indicator end casting and coupling end casting: Secure the container-halves to the indicator end casting using four \( \frac{3}{4}" - 16 \times 3/4" \) zinc-plated hex-head cap screws and flat washers, inserted through the innermost holes at the end of the container-halves. See Figure 4 (right). Then secure the container-halves to the coupling end casting in the same manner. See Figure 4 (left). Securely tighten the \( \frac{3}{4}" - 16 \) zinc-plated serrated hex nuts that run the length of the container-halves.

(f) If tapped holes are not provided in the indicator end casting and coupling end casting: Attach the container-halves at the indicator end of the interrupter using one of the cable-and-clamp assemblies furnished. See Figure 4 (right). Thread the cables through the outermost hole at the bolted connection of the container-halves, as shown. Position the cables around the pressure-relief device and the gas-pressure indicator, then thread the cables through the outermost hole at the bolted connection of the container-halves, on the other side. Do not attach the clamp to the cables at this time.

Attach the container-halves at the coupling end of the interrupter in a similar manner, using the other cable-and-clamp assembly furnished. See Figure 4 (left). Slide the container-halves back or forth as necessary to allow the cables to be threaded through the holes.

Pull the cables taut at the indicator end of the interrupter and attach one of the clamps furnished. See Figure 4 (right). Securely tighten the clamp nuts.

Pull the cables taut at the coupling end of the interrupter and attach the other clamp furnished. See Figure 4 (left). Securely tighten the clamp nuts.

Securely tighten the \( \frac{3}{4}" - 16 \) zinc-plated serrated hex nuts that run the length of the container-halves.

**Step 4**

To assure that Circuit-Switcher remains in the fully open position, particularly while the interrupter is separated from the pole-unit, the holding device, *if there are provisions for it*, must be used and kept in place until Step 15.

The holding device (incorporated in later Mark III and all Mark IV and Mark V Circuit-Switchers) consists of a stop bushing, factory-set in the bracket attached to the underside of the brain, plus a tab on the brain operating shaft. Insert a \( \frac{3}{4}" - 13 \times 2\frac{1}{4}" \) positioning bolt through the tab and stop bushing and secure it with a flat washer and nut, as shown in Figure 5.
If a holding device is not present on the brain, clamp or wire the crank arm at the top of the brain to its crank-arm stop. See Figure 6. The clamp or wire is to remain in position until Step 15. (For Center-Break Style Circuit-Switchers, first remove the linkage cover at the top of the brain to permit access to the crank arm and crank-arm stop. See Figure 1.)

Step 5
For Circuit-Switchers equipped with the S&C Shunt-Trip Device, the silicone-rubber weather-sealing boot should be pulled downward to expose the tongue-and-groove coupling. See Figure 5.

Remove the four 3/8”-16x1 1/4” hex-head cap screws (of which two may be shoulder bolts) from the brain cover on the side of the brain opposite from that of the interrupter target. See Figure 5. Retain the cap screws. Use a small screwdriver, if necessary, to pry the cover loose, but use care not to damage the internal O-ring seal. Remove the brain cover. If the Circuit-Switcher is equipped with the S&C Shunt-Trip Device, the tongue-and-groove coupling will simultaneously disengage as the cover is removed.

Caution
Do not attempt to remove the opposite-side brain cover on which the interrupter target is located. It is not removable.

Step 6
Disconnect the shunt-cable assembly from the interrupting-contact operating rod by removing the two 10-32 slotted-head machine screws fastening it to the rod. See Figure 7. Discard these screws.
Step 7

**WARNING**

Gas pressure within the interrupter can force the operating rods to extend rapidly—approximately 6 inches from the coupling-pin connection—when the coupling pins are removed. Keep hands and tools away from the line of travel of the rods before removing the coupling pins!

Lift the coupling-pin retainers on both operating-rod actuating arms and swing the retainers toward the interrupter. Avoid excessive deflection which would overstress the retainers and cause distortion. Remove and discard the coupling pins. See Figure 8. A small screwdriver may be used to pry at the head of the pin.

Step 8

Remove the four ⅛"—13 hex nuts and lockwashers from the studs which fasten the interrupter to the brain. Then remove the four ⅛"—13x1½" hex-head cap screws, lockwashers and flat washers (or toothed washers) at the terminal end. See Figure 9. Retain this hardware.

Step 9

With a moderate strain on the lifting slings, carefully slide the interrupter away from the brain. See Figure 10. As the unit is lowered, use care to avoid damaging the exposed operating rods.

Step 10

Open the replacement interrupter shipping crate. Attach two suitable lifting slings to the replacement interrupter (the center of gravity is at approximately the center of the unit). Do not use the gas pressure indicator for lifting. Then carefully remove the interrupter from the shipping crate and place it on the ground. Retain the shipping crate.

**CAUTION**

Do not remove the replacement interrupter bolted-on container or pressure-relief shield until the installation has been completed.

Step 11

Remove the cast-aluminum protective cover which is bolted to the coupling end of the replacement interrupter. Retain the protective cover for use on the replaced interrupter during shipment.
Step 12
Hoist the replacement interrupter into position. Use extreme care to avoid damaging the exposed operating rods.

Step 13
Apply Penetrox® A (available from Burndy Corporation) or other suitable aluminum connector compound to the brain and terminal mating surfaces and wire-brush thoroughly.

Step 14
Align the interrupter with the brain. This is the reverse of the procedure shown in Figure 10. Carefully guide the operating-rod ends into the clevises of the actuating arms in the brain and, at the same time, guide the interrupter flange holes over the fastening studs in the brain. Replace the 1/2–13 hex nuts and lockwashers. Thread the nuts only far enough to secure the interrupter to the brain.

Step 15
Align the mounting holes at the terminal connection and replace the 1/2–13X1 1/2 hex-head cap screws, lockwashers and flat washers (or toothed washers)—but do not tighten the cap screws. Torque to final tightness the hex nuts at the brain connection; then snug the cap screws at the terminal connection but do not torque to final tightness.

Step 16
Couple both operating rods to their respective actuating arms, using the new coupling pins furnished. Swing the coupling-pin retainers over the ends of the coupling pins.

To facilitate insertion of the coupling pins, it may be necessary to partially close the Circuit-Switcher, by means of the manual operating handle of the S&C Switch Operator, just enough to "break" the overtoggle stance of the power-train linkage at the Circuit-Switcher base. Return the Circuit-Switcher to the fully open position after the coupling pins have been inserted.

Step 17
Remove the temporary operating rod retaining bracket and keep it for use in Step 23. See Figure 11.

Step 18
Disconnect the existing shunt-cable assembly by removing the two 10–32 slotted-head machine screws fastening it to the brain housing. See Figure 7. Discard the shunt-cable assembly and the screws.
Connect one end of the new shunt-cable assembly to the interrupting-contact operating rod, using the new self-locking 10—32 slotted-head machine screws furnished. Then apply Penetrox A or other suitable aluminum connector compound to the other end of the new shunt-cable assembly and connect this end to the brain housing, using the new self-locking 10—32 slotted-head machine screws furnished. The new cable must be routed in the same manner the existing cable was routed, as shown in Figure 7.

As a point of information, two extra sets of self-locking 10—32 slotted-head machine screws have been included. Replacement of the existing machine screws used to connect the shunt-cable assemblies in the two other pole-unit brains is highly recommended because of the improved long-term connection the self-locking machine screws provide.

Step 19
Make sure that all loose material is removed from inside the brain housing. Then replace the brain cover. Use care to avoid damage to the O-ring. If a locating pin is present on the brain housing, it is to be used as a guide for positioning the cover.

For Circuit-Switchers equipped with the S&C Shunt-Trip Device, the brain cover should be carefully placed to ensure that the tongue-and-groove coupling of the shunt-trip insulated operating shaft properly engages, while at the same time aligning the cover by means of the locating pin. Push the weather-sealing boot back to its original position.

Secure the brain cover, using the four 3/4"—16X1 1/4" hex-head cap screws removed in Step 5. If two of these are shoulder bolts, their correct positions are in the upper right and lower left holes.

For Center-Break Style Circuit-Switchers, do not replace the linkage cover at this time. This will be done in the next step.

Step 20
Manually operate the Circuit-Switcher to the closed position and then to the fully open, positive-toggle position of the drive-shaft assembly at the pole-unit base. The blade crank-arm at the top of the brain should now rest firmly against its open stop.

To achieve a positive-stop position of the blade crank-arm in the open position, loosen the cap screws which fasten the interrupter at the terminal end and, with the power train held securely to prevent the insulator stack(s) from rotating, move the interrupter sideways until the blade crank-arm stop is firmly against the blade crank-arm.

Performance of this step is necessary to ensure positive latching of the stored-energy source within the brain.

Torque to final tightness the cap screws which fasten the interrupter at the terminal end. For Center-Break Style Circuit-Switchers, replace the linkage cover on the top of the brain.

Take this opportunity to check the alignment and engagement of the disconnect blades. If adjustment is required, follow the procedure as described in the instruction sheet originally furnished for the field assembly and erection of the particular Circuit-Switcher style applicable.

Step 21
Remove the container from the replacement interrupter as follows:

(a) Remove and discard the 3/4"—16 zinc-plated serrated hex nuts which run the length of the container.

(b) Remove and discard the 3/4"—16X3/4" and two 3/4"—16X1" zinc-plated hex-head cap screws and flat washers which attach the upper container-half to the coupling end casting of the interrupter. Also remove and discard the 3/4"—16X3/4" and two 3/4"—16X1" zinc-plated hex-head cap screws and flat washers which attach the upper container-half to the indicator end casting of the interrupter.

(c) Pry the container-halves apart with a screwdriver. The upper container-half can now be removed and discarded—slotted holes are provided so that a rope or lifting sling can be attached and the container-half can be more conveniently lowered to the ground.

(d) Now remove and discard the 3/4"—16X3/4" hex-head cap screw and flat washer which attach the lower container-half to the coupling end casting of the interrupter, and the 3/4"—16X3/4" hex-head cap screw and flat washer which attach the lower container-half to the indicator end casting of the interrupter. Then discard this container-half.

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

Now remove the shield for the interrupter pressure-relief device. Discard the shield and its hardware.
**INSTALLED THE NEW INTERRUPTER — Continued**

**Step 22**
Replace the motor-circuit and shunt-trip circuit two-pole pull-out fuseholders or—on earlier-model switch operators—close the two-pole control-source disconnect switch and replace the control-source fuses.

**Step 23**
Install the temporary operating-rod retaining bracket on the replaced interrupter. This is the reverse of the procedure shown in Figure 11. Then attach the cast-aluminum protective cover to the coupling end of the replaced interrupter, to protect the operating rods.

**Step 24**
Attach lifting slings to the four lifting rings on the replaced interrupter container. *Do not* loop slings from one end of the container to the other. Carefully lift the interrupter into the replacement interrupter shipping crate. Secure the interrupter and close the lid.

**Step 25**
Ship the replaced interrupter, transportation charges prepaid, to S&C Electric Company, Repair Center, 1800 Devon Avenue, Chicago, Illinois 60626. To ensure proper handling, purchasers are asked to obtain from the nearest S&C Sales Office a special serially numbered label to place on the shipping crate. Please enclose a packing slip showing purchase order or requisition number covering the exchange.

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**INSPECTION SCHEDULE AND PROCEDURES**

To assure Circuit-Switcher’s continued proper performance, it should be inspected in accordance with S&C’s recommended schedule and procedures contained in S&C Instruction Sheet 711-590.