# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td></td>
</tr>
<tr>
<td>Qualified Persons</td>
<td>2</td>
</tr>
<tr>
<td>Read this Instruction Sheet</td>
<td>2</td>
</tr>
<tr>
<td>Retain this Instruction Sheet</td>
<td>2</td>
</tr>
<tr>
<td>Proper Application</td>
<td>2</td>
</tr>
<tr>
<td>Warranty</td>
<td>2</td>
</tr>
<tr>
<td>SAFETY INFORMATION</td>
<td></td>
</tr>
<tr>
<td>Understanding Safety-Alert Messages</td>
<td>3</td>
</tr>
<tr>
<td>Following Safety Instructions</td>
<td>3</td>
</tr>
<tr>
<td>Replacement Instructions and Labels</td>
<td>3</td>
</tr>
<tr>
<td>GENERAL</td>
<td></td>
</tr>
<tr>
<td>Interrupters</td>
<td>4</td>
</tr>
<tr>
<td>Operator</td>
<td>4</td>
</tr>
<tr>
<td>Power Train</td>
<td>4</td>
</tr>
<tr>
<td>Mounting Pedestals</td>
<td>5</td>
</tr>
<tr>
<td>Usual Operating Conditions</td>
<td>5</td>
</tr>
<tr>
<td>Inspection Schedule and Procedures</td>
<td>5</td>
</tr>
<tr>
<td>Catalog Number Description</td>
<td>5</td>
</tr>
<tr>
<td>Standard Features</td>
<td>6</td>
</tr>
<tr>
<td>Optional Features</td>
<td>7</td>
</tr>
<tr>
<td>BEFORE STARTING INSTALLATION</td>
<td></td>
</tr>
<tr>
<td>Checking the Shipment</td>
<td>9</td>
</tr>
<tr>
<td>Gas-Pressure Indicator</td>
<td>9</td>
</tr>
<tr>
<td>Storage</td>
<td>9</td>
</tr>
<tr>
<td>INSTALLATION</td>
<td>10</td>
</tr>
<tr>
<td>OPERATION</td>
<td></td>
</tr>
<tr>
<td>Electrical Operation</td>
<td>23</td>
</tr>
<tr>
<td>Manual Operation</td>
<td>23</td>
</tr>
<tr>
<td>Decoupling</td>
<td>25</td>
</tr>
<tr>
<td>Adjusting Auxiliary Switch Contacts</td>
<td>26</td>
</tr>
</tbody>
</table>
INTRODUCTION

Qualified Persons

WARNING

The equipment covered by this publication must be installed, operated, and maintained by qualified persons who are knowledgeable in the installation, operation, and maintenance of overhead electric power distribution equipment along with the associated hazards. A qualified person is one who is trained and competent in:

• The skills and techniques necessary to distinguish exposed live parts from non-live 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

Thoroughly and carefully read this instruction sheet before installing or operating your Series 2000 Circuit-Switcher Model 2010. Familiarize yourself with “SAFETY INFORMATION” on page 3.

Retain this Instruction Sheet

This instruction sheet is a permanent part of your S&C Series 2000 Circuit-Switcher. These instructions should be stored inside the Series 2000 operator enclosure using the instruction manual holder.

Proper Application

CAUTION

The equipment in this publication must be selected for a specific application. The application must be within the ratings furnished for the equipment.

Warranty

The standard warranty contained in S&C’s standard conditions of sale, as set forth in Price Sheet 150, is applicable to the S&C Series 2000 Circuit-Switcher covered in this instruction sheet, except that the first paragraph of said warranty is replaced by the following:

(1) General: Seller warrants to purchaser for a period of 5 years from the date of shipment that the equipment delivered will be of the kind and quality specified in the contract description and will be free of defects of workmanship and material. Should any failure to conform to this warranty appear under proper and normal use within five years after the date of shipment the seller agrees, upon prompt notification thereof and confirmation that the equipment has been stored, installed, operated, inspected, and maintained in accordance with recommendations of the seller and standard industry practice, to correct the nonconformity either by repairing any damaged or defective parts of the equipment or (at seller's option) by shipment of necessary replacement parts.

Replacement parts provided by seller under the warranty for the original equipment will be covered by the original-equipment warranty for its duration. Replacement parts purchased separately will be covered by the warranty contained in seller’s standard conditions of sale, as set forth in Price Sheet 150.
### Understanding Safety-Alert Messages

There are several types of safety-alert messages which may appear throughout this instruction sheet as well as on labels and tags attached to the Series 2000 Circuit-Switcher. Familiarize yourself with these types of messages and the importance of the various signal words, as explained below.

<table>
<thead>
<tr>
<th><strong>Signal Word</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DANGER</strong></td>
<td>&quot;DANGER&quot; identifies the most serious and immediate hazards which will likely result in serious personal injury or death if instructions, including recommended precautions, are not followed.</td>
</tr>
<tr>
<td><strong>WARNING</strong></td>
<td>&quot;WARNING&quot; identifies hazards or unsafe practices which can result in serious personal injury or death if instructions, including recommended precautions, are not followed.</td>
</tr>
<tr>
<td><strong>CAUTION</strong></td>
<td>&quot;CAUTION&quot; identifies hazards or unsafe practices which can result in minor personal injury or product or property damage if instructions, including recommended precautions, are not followed.</td>
</tr>
<tr>
<td><strong>NOTICE</strong></td>
<td>&quot;NOTICE&quot; identifies important procedures or requirements that, if not followed, can result in product or property damage if instructions are not followed.</td>
</tr>
</tbody>
</table>

### Following Safety Instructions

If you do not understand any portion of this instruction sheet and need assistance, contact your nearest S&C Sales Office or S&C Authorized Distributor, or call S&C Headquarters at (773) 338-1000, Monday through Friday between 8:30 AM and 5:00 PM Central Standard Time. (In Canada, call S&C Electric Canada Ltd. at (416) 249-9171, Monday through Friday between 8:00 AM and 5:00 PM Eastern Standard Time.)

<table>
<thead>
<tr>
<th><strong>NOTICE</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Read this instruction sheet thoroughly and carefully before installing or operating your S&amp;C Series 2000 Circuit-Switcher.</td>
</tr>
</tbody>
</table>

### Replacement Instructions and Labels

If you need additional copies of this instruction sheet, contact your 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 your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.
Interrupters
Series 2000 Circuit-Switchers employ single-gap SF₆ puffer-type interrupters designed to close the circuit in 6 cycles, interrupt the circuit in 6 cycles, and maintain rated dielectric strength when open. These dual-function interrupters are factory-filled to full pressure under controlled conditions and then permanently sealed. Field filling is neither necessary nor possible, thus eliminating the risk of contaminating the interrupting medium.

Operator
The interrupters are driven by a single stored-energy mechanism located at ground level in a 48-volt dc, 125-volt dc, or 115-volt 60-hertz operator furnished with the Circuit-Switcher. Refer to the “STANDARD FEATURES” table on page 6, and also Figures 15 and 17. This operator includes the following features:

• Trip and close push buttons located inside operator enclosure.
• Manual trip lever, for tripping interrupters in the event control voltage has been lost.
• Manual charging handle, for opening disconnect after interrupters have been manually tripped open—in the event control voltage has been lost.
• Charged and discharged indicators for stored-energy mechanism.
• Non-reset electric operation counter.
• Eight nonadjustable single-pole double-throw auxiliary-switch contacts which follow the interrupters.
• Weatherproof, dustproof enclosure.
• Decoupling mechanism which allows decoupling and locking of disconnect-blade power train in the open position, permitting operational checkout of interrupters, stored-energy mechanism, and relaying equipment without closing the high-voltage circuit.
• Two individually adjustable auxiliary-switch contacts which follow the disconnect-blade power train and operator when coupled, operator only when decoupled.

The mechanism in the operator has an instantaneous trip-free capability: should the Series 2000 Circuit-Switcher be inadvertently closed into a fault sensed by user-furnished relaying, the mechanism will trip immediately. To accomplish trip-free operation, the mechanism utilizes two spring assemblies: one for closing, one for opening. Both springs are charged by the operator motor before the Series 2000 Circuit-Switcher can be closed. Recharging time after a trip operation is approximately 5 seconds for Circuit-Switchers rated 69 kV through 138 kV, and approximately 10 seconds for Circuit-Switchers rated 161 kV and 230 kV.

Power Train
The operator directs 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, to reciprocating-action insulated operating rods which pass through the center of insulating support columns. The disconnect on the operator also drives the disconnect open and closed through a low-speed power train which rotates the insulating support columns. The disconnect on models rated 69 kV through 138 kV is capable of opening and closing with hesitation under ¾-inch ice formation. The disconnect on models rated 161 kV and 230 kV is capable of opening without hesitation under ¾-inch ice formation and of closing without hesitation under ½-inch ice formation. A decoupling mechanism allows decoupling and locking of the disconnect-blade power train in the open position, permitting operational checkout of the interrupters, the stored-energy mechanism, and the relaying equipment without closing the high-voltage circuit.

Permanently lubricated bearings are used throughout both the high-speed and low-speed power trains. The insulating support columns are filled with a lubricated dielectric filler which prevents contamination from affecting the dielectric integrity of the column or the insulated operating rod. An aerator is utilized at the upper end of each insulating support column to eliminate water being pumped-in due to pressure differentials caused by temperature cycling.
### Mounting Pedestals

Series 2000 Circuit-Switchers are furnished with mounting pedestals. Refer to the “STANDARD FEATURES” table on page 6. Anchor bolts are furnished when specified separately.

### Usual Operating Conditions

Series 2000 Circuit-Switchers will perform as intended at temperatures within the range of –40°C to +40°C (–30°C to +40°C for 161-kV and 230-kV models), at altitudes of up to 5000 feet, and at wind loadings of up to 80 miles 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 0.2 g ground acceleration in any direction, as well as 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.

### Inspection Schedule and Procedures

To assure Series 2000 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 716-590.

### Catalog Number Description

The following table lists the basic catalog numbers and ratings of Model 2010 Series 2000 Circuit-Switchers. The catalog number and ratings of the Circuit-Switcher furnished are stamped on the nameplate located on the door of the operator.

### MODEL 2010—With Horizontal Interrupters and Vertical-Break Power-Operated Disconnect

<table>
<thead>
<tr>
<th>kV</th>
<th>Amperes, RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nom.</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>72.5</td>
</tr>
<tr>
<td>115</td>
<td>121</td>
</tr>
<tr>
<td>138</td>
<td>145</td>
</tr>
<tr>
<td>161</td>
<td>169</td>
</tr>
<tr>
<td>230</td>
<td>242</td>
</tr>
</tbody>
</table>

<sup>①</sup> The one-time duty-cycle fault-closing rating expressed in amperes RMS asymmetrical is 1.6 times the symmetrical value listed (or 64,000 amperes).
Suffixes to the basic catalog number specify operator control voltage, space-heater voltage, and mounting pedestal height, in accordance with the following standard features table:

### STANDARD FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Suffix Added to Circuit-Switcher Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator Control Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator Space-Heater Voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting Pedestal Height</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular Wattage</td>
<td>120 V 60 Hz</td>
<td>-H1</td>
</tr>
<tr>
<td>Reduced Wattage</td>
<td>120 V 60 Hz</td>
<td>-H3</td>
</tr>
</tbody>
</table>

---

① Anchor bolts are specified separately.
② For applications in temperate climates.
### OPTIONAL FEATURES

<table>
<thead>
<tr>
<th>Item</th>
<th>Suffix Added to Circuit-Switcher Catalog Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass Accessory, single-pole, stick-operated, set of three, 1200 amperes continuous, 61,000 amperes momentary rating. Permits operational checkout of Circuit-Switcher and relaying equipment without opening high-voltage circuit</td>
<td>-F</td>
</tr>
<tr>
<td>Grounding Switch, manual, three-pole, group-operated, 64,000 amperes momentary rating, with flexible straps for current transfer at hinge end of grounding-switch blades; blades parallel to pole-unit bases when in open position. Grounds jaw-contact terminal pads</td>
<td>-G2</td>
</tr>
<tr>
<td>Grounding Switch, manual, three-pole, group-operated, 64,000 amperes momentary rating, with flexible straps for current transfer at hinge end of grounding-switch blades; blades parallel to pole-unit bases when in open position. Grounds interrupter-end terminal pads</td>
<td>-G4</td>
</tr>
<tr>
<td>Deletion of Trip and Close Push Buttons located inside operator enclosure</td>
<td>-J</td>
</tr>
<tr>
<td>Space Heater Thermostat for operator</td>
<td>-K</td>
</tr>
<tr>
<td>Key Interlock located inside operator enclosure. Key may be removed when interrupters are tripped—thereby locking the interrupters open and disconnecting the control circuit. Key may then be used in interlock associated with grounding switch (such as Key Interlock Option Suffix “-L4”), or other device</td>
<td>-L1</td>
</tr>
<tr>
<td>Key Interlock mounted on grounding-switch manual operating handle. Works in conjunction with Key Interlock Option Suffix “-L1” to guard against operating grounding switch with disconnect blades closed or with interrupters closed</td>
<td>-L4</td>
</tr>
<tr>
<td>Position-Indicating Lamps (one red, one green) located inside operator enclosure. Lamps are wired in series with trip coil, for local indication of Circuit-Switcher position and operator trip-circuit continuity</td>
<td>-M</td>
</tr>
<tr>
<td>Anti-Pump Circuit. For applications where user’s control scheme utilizes closing contact which is maintained longer than 6 seconds. Prevents alternating opening and closing attempts in the event Circuit-Switcher is closed into a fault, by causing Circuit-Switcher to remain open</td>
<td>-P</td>
</tr>
<tr>
<td>Remote Gas-Density Monitor. Provides a system to monitor the SF6 gas density in each interrupter. System outputs include two alarm relays that actuate at pre-set gas densities, a system status alarm relay, 0 to 1 mA analog outputs for each interrupter, and a liquid crystal display inside the operator enclosure</td>
<td>-R</td>
</tr>
<tr>
<td>Trip-Circuit-Monitoring Relay wired in series with operator trip coil. Monitors continuity of trip circuit. Includes one normally open and one normally closed contact suitable for use with remotely located indicating lamps or alarms</td>
<td>-T</td>
</tr>
<tr>
<td>Disconnect/Interrupter Simultaneous-Opening Circuit. For applications where user’s protective-relay contact closure is to initiate disconnect blade opening simultaneously with interrupter tripping</td>
<td>-U</td>
</tr>
<tr>
<td>Duplex Receptacle with Ground-Fault Circuit Interrupter and Convenience-Light Lampholder with Switch located inside operator enclosure</td>
<td>-V</td>
</tr>
<tr>
<td>Eight Additional Nonadjustable Single-Pole Double-Throw Auxiliary-Switch Contacts in Operator which follow the interrupters</td>
<td>-W1</td>
</tr>
<tr>
<td>Local-Remote Selector Switch. Prevents remote operation of operator when selector switch is placed in “local” mode as, for example, during inspection</td>
<td>-Y</td>
</tr>
</tbody>
</table>

1 Suffix “-J” cannot be furnished if suffix “-Y” is specified, and vice versa.
Figure 1. Model 2010 Series 2000 Circuit-Switcher rated 138 kV.
BEFORE STARTING INSTALLATION

Checking the Shipment
An S&C catalog drawing will be found in a water-resistant envelope attached to the plastic bubble-wrap around one of the insulating support columns. Study this drawing carefully and check the bill of material to verify that all parts are at hand.

The Model 2010 Series 2000 Circuit-Switcher shipment should include the following items, as shown in Figures 2 and 5:

1. Three pole-units, each consisting of an interrupter, integral disconnect blade, insulating support column, support insulator, and channel base—all factory-assembled and adjusted.
2. A single cross base, enclosing the high-speed interphase power train which drives the interrupters.
3. The appropriate number of mounting pedestals, complete with support arms and channels. A single pedestal is used for Circuit-Switchers rated 69 kV (with 48-inch phase spacing); a set of two pedestals is used for Circuit-Switchers rated 69 kV (with 84-inch phase spacing), 115 kV, and 138 kV; and a set of three pedestals is used for Circuit-Switchers rated 161 kV and 230 kV.
5. A low-speed interphase power train which drives the disconnect blades.
6. A container of miscellaneous operating-mechanism components and hardware—all individually identified.
7. Any optional features specified, such as a grounding switch.

Gas-Pressure Indicator
Series 2000 Circuit-Switchers have sealed interrupters containing gas under pressure. Low gas pressure is signaled by a red target in the gas-pressure indicator at the terminal end of the interrupter.

NOTICE
Loss of gas pressure may result in improper interrupting action. The red target should not be visible. If the red target is visible, stop the installation and notify S&C Electric Company.

DO NOT INTERMIX 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 that components belonging to a specific Circuit-Switcher installation not be intermixed with components belonging to a different installation. For this reason, each Series 2000 Circuit-Switcher is serially numbered. This serial number appears on the individual pole-units, the cross base, the mounting pedestals, and the operator.

It is further important that components from different installations not be intermixed in that S&C maintains an historical record—by serial number—of every Circuit-Switcher produced. This record lists information pertinent to each installation, such as application, date of shipment, and any service performed by S&C field service specialists. This record is invaluable when questions arise relative to modifications or replacements.

Please complete and mail the Circuit-Switcher registration card (enclosed in a vinyl envelope located inside the operator) after the Circuit-Switcher has been installed. The information requested on this card is vital to ensure prompt notification in the event field modifications are needed.

Storage
If the Circuit-Switcher must be stored before installation, keep it in a clean, dry, corrosion-free area to protect it from damage. If storing outside or in a non-climate controlled area, connect control power to the space heater inside the Circuit-Switcher Operator per wiring diagram. Inspect the Circuit-Switcher regularly when stored for prolonged periods.

NOTICE
The Series 2000 Circuit-Switcher Operator is equipped with a space heater that must be energized during storage to prevent condensation and corrosion within the operator enclosure.

INSTRUCTION SHEET 716-501
S&C ELECTRIC COMPANY
Page 9 of 26
August 12, 2002
**CAUTION**

Do not remove the containers from the interrupters, or the plastic bubble-wrap from the insulating support columns, until the installation has been completed.

**BOLTED AND PINNED CONNECTIONS**

A typical bolted connection for field assembly requires a flat washer under the cap screw and one under the nut. In instances where self-locking hex nuts are specified, it is essential that the threads of the associated cap screws be lubricated with a general-purpose grease, to facilitate tightening. All pins used in the field assembly should also be lubricated to facilitate insertion.

---

**Step 1**

Cut the steel straps that bind the mounting pedestals to the cross base, the straps that bind the container of miscellaneous operating-mechanism components and hardware, and the straps that bind the pole-units. Also remove the wood bracing between the pole-unit terminal pads. See Figure 2. For Circuit-Switchers rated 161 kV and 230 kV: Remove the lifting angles attached to the pole-unit channel bases; retain these lifting angles and associated hardware for re-use in Step 13.

---

*Figure 2. Typical shipment of Model 2010 Series 2000 Circuit-Switcher. Operator is shipped on a separate skid; see Figure 5.*
INSTALLATION — Continued

Step 2
Install the mounting pedestals. See Figure 3. Make certain that the grounding pad on each mounting pedestal is properly positioned for this particular installation.

Adjust the lower set of anchor-bolt nuts at each pedestal to generally plumb and level the pedestal. The upper set of anchor-bolt nuts should be only loosely attached at this time.

Step 3
Attach four suitable lifting slings to the cross base. See Figure 4. Unbolt the base from the shipping skid and lift the base atop the mounting pedestals, as shown on the catalog drawing. Avoid sudden starts and stops. Verify that 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).

Step 4
Loosely bolt the cross base to the mounting pedestals using the \( \frac{5}{8}'' \times 11 \times 2\frac{3}{4}'' \) hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. Then—using a level—verify that the cross base is horizontal, both lengthwise and side-to-side; adjust the lower set of anchor-bolt nuts at the pedestals to achieve this condition.

Step 5
Securely bolt the cross base to the mounting pedestals. Shims are furnished and should be installed as necessary between the cross base and the mounting pedestals, to compensate for any irregularities greater than \( \frac{1}{8}'' \) inch between the mating surfaces.

Step 6
Check the lower set of anchor-bolt nuts at each mounting pedestal to verify that all nuts are in contact with the bottom of the pedestal. Hand-tighten these anchor-bolt nuts as necessary. Then securely tighten the upper set of anchor-bolt nuts at each mounting pedestal.

Figure 3. Pedestal mounting detail.

Figure 4. Hoisting the cross base.
S&C Electric Company

S&C Series 2000 Circuit-Switchers
Outdoor Transmission (69 kV through 230 kV)

Model 2010 — With Horizontal Interrupters and Vertical-Break Power-Operated Disconnect

INSTALLATION — Continued

Step 7
Loosen the \( \frac{1}{2}'' - 13 \times 1\frac{1}{4}'' \) galvanized steel cap screws, flat washers, and nuts which are used to attach the bottom plates to the underside of the cross base. Remove the plates and place them and their hardware aside on a clean surface.

Also remove the \( \frac{3}{4}'' \) stainless-steel pin and cotter pin from the interphase drive lever enclosed in the cross base. See Figure 10. Retain these pins for re-use in Step 17.

Step 8
Wrap a lifting sling around the stored-energy housing of the operator, as shown in Figure 5 (left). Now carefully raise the operator to the upright position so that it rests on its base skid, as shown in Figure 5 (right). Do not remove the lifting sling around the stored-energy housing, as the operator is top-heavy and must be adequately supported until it is attached to the Circuit-Switcher.

Remove the skid and bracing which 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.

Step 9
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 6. Make certain that the operator door faces the same way as the switch-position indicator on the cross base. Then carefully hoist the operator into place. Be careful not to damage the uni-ball coupling on the operator connecting link during hoisting and attachment of the operator. Attach the operator support tube mounting plate to the underside of the cross base using four \( \frac{1}{2}'' - 13 \times 1\frac{1}{4}'' \) hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts. Tighten all four screws securely.

Figure 5. Raising operator upon base skid.
**Step 10**
Attach the operator support angle to the appropriate mounting pedestal using two \( \frac{5}{8} \)–\( 11 \times 14 \) inch hex-head galvanized steel cap screws, four flat washers, and two self-locking hex nuts furnished. Refer to the catalog drawing and Figure 6. Then 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 four \( \frac{1}{2} \)–\( 13 \times 1 \frac{1}{2} \) inch hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. Securely tighten the screws. See Figures 1 and 6. On Circuit-Switchers utilizing two or three mounting pedestals, insert the hole plugs furnished into all unused holes in the pedestals.

**Step 11**
Attach the support arms to the mounting pedestals as shown on the catalog drawing, using \( \frac{5}{8} \)–\( 11 \times 1 \frac{1}{2} \) inch hex-head galvanized steel cap screws and flat washers furnished. The screws should only be loosely attached at this time.

**Step 12**
For Circuit-Switchers rated 69 kV through 138 kV: Refer to the catalog drawing and attach the interrupter-end and disconnect-end support arm channel assemblies to the support arms, using clip angles, \( \frac{1}{2} \)–\( 13 \times 1 \frac{1}{4} \) inch hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished.

For Circuit-Switchers rated 161 kV and 230 kV: Refer to the catalog drawing and attach the interrupter-end and disconnect-end support arm channel assemblies to the support arms, using clip angles, \( \frac{1}{2} \)–\( 13 \times 2 \) inch hex-head galvanized steel cap screws (at the outboard pole-units), \( \frac{5}{8} \)–\( 11 \times 14 \) inch hex-head galvanized steel cap screws (at the center pole-unit), flat washers, and self-locking hex nuts furnished.

Level the support arm channel assemblies to the same elevation as the cross base, then tighten the associated cap screws securely. Now securely tighten the \( \frac{5}{8} \)–\( 11 \times 1 \frac{1}{2} \) inch hex-head galvanized steel cap screws which attach the support arms to the mounting pedestals. Torque the cap screws to 160 foot-pounds.

★ A single support arm and support arm channel assembly are used on 69-kV Circuit-Switchers with 48-inch phase spacing, for attachment at the interrupter end. Further, a disconnect-end support arm angle is furnished in lieu of a disconnect-end support arm channel assembly.

---

**Figure 6. Hoisting operator into position.**
Step 13
For Circuit-Switchers rated 69 kV through 138 kV: Attach four suitable lifting slings to the channel base of the pole-unit that will be mounted at the center of the cross base—marked “Pole 2”—as shown in Figure 7 (left). (“Pole 2” is positioned outboard on the shipping skid for ease in handling.)

For Circuit-Switchers rated 161 kV and 230 kV: Attach the lifting angles retained from Step 1 to the channel base of the pole-unit that will be mounted at the center of the cross base—marked “Pole 2,” using \( \frac{1}{2} - 13 \times 13/4 \) hex-head galvanized steel cap screws, flat washers, and hex nuts furnished. See Figure 7 (right). Securely tighten the cap screws. (“Pole 2” is positioned outboard on the shipping skid for ease in handling.) Then attach four suitable lifting slings (10 to 12 feet long for Circuit-Switchers rated 161 kV, 12 to 14 feet long for Circuit-Switchers rated 230 kV) to the lifting angles.

Make certain that the rigging does not stress the interrupter, transition box, or disconnect. Unbolt the base from the skid. Raise the pole-unit a few feet, then remove the two \( \frac{1}{2} - 13 \times 13/4 \) hex-head galvanized steel cap screws, flat washers, and hex nuts which attach the shipping bracket to the bottom of the pole-unit channel base. Note: The insulated operating rod is under pressure; removal of the two screws may result in the operating rod quickly moving down approximately \( 3/8 \) inch. Remove the \( 1/2 \)-inch silicon-bronze pin and cotter pin from the insulated operating rod and retain these for re-use in Step 16(d). Discard the shipping bracket and associated hardware.

Remove the protective cover on the cross base at the pole-unit mounting position. See Figure 4. Now continue to raise the pole-unit to its mounting position at the center of the cross base, as shown on the catalog drawing. Carefully guide the pole-unit to avoid damaging the insulated operating rod. Do not attempt to lift the pole-unit by the interrupter or disconnect.

Attach the pole-unit channel base to the cross base, using \( \frac{1}{2} - 13 \times 13/4 \) hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. Securely tighten the cap screws.
Next, attach the pole-unit channel base to the interrupter-end support arm channel assembly. For Circuit-Switchers rated 69 kV through 138 kV: Use ½"—13×1½” hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. For Circuit-Switchers rated 161 kV and 230 kV: Use ½"—13×2” hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. Securely tighten the cap screws.

Finally, attach the pole-unit channel base to the disconnect-end support arm channel assembly. For Circuit-Switchers rated 69 kV through 138 kV: Use ½"—13×1½” hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. For Circuit-Switchers rated 161 kV and 230 kV: Use ½"—13×2” hex-head galvanized steel cap screws, flat washers, and self-locking hex nuts furnished. Securely tighten the cap screws. Shims are furnished and should be installed as necessary between the pole-unit channel base and the disconnect-end support arm channel assembly, to compensate for any irregularities between the mating surfaces.

**Step 14**

Repeat Step 13 for the two outboard pole-units—marked “Pole 1” and “Pole 3.”

**Step 15**

For 69-kV Circuit-Switchers with 48-inch phase spacing:
Relevel the interrupter-end support arm channel assembly and disconnect-end support arm angle to the same elevation as the cross base. If necessary, loosen the cap screws used to attach the outboard pole-unit channel bases to the cross base, interrupter-end support arm channel assembly, and disconnect-end support arm angle, and shift the pole-units in order to level the channel assembly and support arm angle. Then securely tighten the cap screws.

▲ Disconnect-end support arm angle on 69-kV Circuit-Switchers with 48-inch phase spacing.
**Step 16**

Prepare the insulated operating rod of each pole-unit for attachment to the interphase drive in the cross base as follows:

(a) Remove the six \(\frac{5}{16} - 18 \times \frac{3}{4} \) hex-head stainless-steel cap screws used to attach the access cover to the side of the transition box. See Figure 8 (left). Remove the cover and place it and the hardware on a clean surface.

(b) Check that the transition lever is in the open position. The lever should be turned fully counterclockwise. See Figure 8 (right). If the lever is not in the open position, complete the following steps:

| **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 could result. |

Carefully turn the transition lever to this position. If the transition lever cannot be freely rotated to its fully counterclockwise position, misalignment of the interphase drive is occurring in the cross base. Temporarily swing the insulated operating rod end links up, away from the interphase drive linkage lever, and again try rotating the transition lever to its fully counterclockwise position; see Figure 9.

(c) Remove the \(\frac{5}{8} \) -inch stainless-steel connecting pin used to attach the transition lever to the operating rod link. See Figure 8 (right). 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 16(e).

(d) Attach the insulated operating rod end links to the interphase drive linkage lever in the cross base, using the \(\frac{1}{2} \) -inch silicon-bronze pin and cotter pin retained from Step 13; see Figure 9. The insulated operating rod may be moved up or down, as required, to make the connection.

(e) Replace the \(\frac{5}{8} \) -inch stainless-steel connecting pin retained from Step 16(c). See Figure 8 (right). It will be necessary to loosen the \(\frac{5}{16} - 18 \times 2\frac{3}{4} \) hex-head stainless-steel screw indicated in Figure 8 (right) and withdraw it approximately \(\frac{1}{8} \) inch, so that the connecting pin can be inserted. Do not remove the screw at this time.

(f) After the connecting pin has been inserted and locked in place by its retainer, remove and discard the \(\frac{5}{8} - 18 \times 2\frac{3}{4} \) hex-head stainless-steel screw and stop bracket (marked with a black/yellow striped label) illustrated in Figure 8 (right).

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**Figure 8. Preparing insulated operating rod for attachment.**
**Step 17**
Attach the uni-ball coupling on the operator connecting link to the interphase drive lever in the cross base, using the ¾-inch stainless-steel pin and cotter pin retained from Step 7. See Figure 10. 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 locknuts as required to raise or lower the inter-phase drive lever and thus facilitate insertion of the stainless-steel pin.

**Step 18**
Remove the lower ¼”—20 locknut which retains the adjustable locking rod. Then remove and discard the adjustable locking rod and locknuts.

Figure 9. Attaching insulated operating rod to interphase drive.

Figure 10. Attaching connecting link to interphase drive lever.
Figure 11. Connecting interphase pipe assembly and vertical operating-pipe assembly. Attachment of interphase drive link to interphase pipe assembly is different on Circuit-Switchers rated 69 kV (with 48-inch phase spacing), 161 kV, and 230 kV; refer to the catalog drawing.
Step 19
Make certain that the insulating support column drive lever at each pole-unit is turned completely in the blade-closing direction. Connect the factory-adjusted interphase pipe assembly to the center pole-unit insulating support column drive lever using a \( \frac{1}{2} \) inch stainless-steel pin, two galvanized steel spacers, and two stainless-steel “X” washers furnished. See Figure 11. Then attach the interphase pipe assembly to the two outboard pole-unit insulating support column drive levers.

In the event that the interphase pipe assembly cannot be connected to an outboard pole-unit insulating support column drive lever, loosen the appropriate locknut at the adjustable coupling and rotate the affected interphase pipe section so that the connection can be made; then tighten the locknut. See Figure 11.

Verify, at each outboard pole-unit insulating support column, that the clearance between the rotating-spindle closed-stop bolt and the bumper is \( \frac{1}{16} \) inch or less. See Figure 12 (left). (At the center pole-unit insulating support column, the closed-stop bolt must touch the bumper.) In the event that the clearance between the closed-stop bolt and the bumper exceeds \( \frac{1}{8} \) inch at either outboard pole-unit insulating support column, remove the pin at the appropriate insulating support column drive lever, loosen the appropriate locknut at the adjustable coupling, and rotate the affected interphase pipe section so that the aforementioned clearance is attained. Then replace the pin and tighten the locknut. See Figure 11. Do not adjust the closed-stop bolts.

Step 20
Attach the clevis end of the interphase drive link to the longer of the bell-crank arms on the cross base, using a \( \frac{1}{2} \) -inch stainless-steel pin and cotter pin furnished. See Figure 11.

Step 21
Attach the “C”-shaped clevis at the lower end of the vertical operating-pipe assembly to the take-off shaft on the rear of the operator, using a \( \frac{5}{8} \) -inch stainless-steel pin and stainless-steel “X” washer furnished. See Figure 11 (inset). Then attach the straight clevis at the upper end of the vertical operating-pipe assembly to the shorter of the bell-crank arms on the cross base, using a \( \frac{5}{8} \) -inch stainless-steel pin and cotter pin furnished. See Figure 11. If necessary, loosen the locknuts at the top and bottom of the vertical operating pipe and rotate the pipe so that the connection can be made; then tighten the locknuts.

Figure 12. Clearances at closed and open stops.
**Step 22**

Use the manual charging handle furnished with the operator to check functioning of the low-speed power train, as follows. Refer to Figure 16.

(a) Open the access shutter and place the manual charging handle on the manual charging shaft.

(b) Rotate the shaft, clockwise only, just to the point at which the disconnect-blade tongue contacts clear their respective jaw-contact fingers. See Figure 13.

With the disconnect blades maintained in the position shown in Figure 13, check each blade to verify that its centerline has not shifted left or right by more than ¼ inch—as measured to the centerline of its respective jaw contact. If any blade centerline has shifted by more than ¼ inch, loosen the leveling-screw locknuts located under the associated jaw-contact support insulator. See Figure 14. Adjust the locknuts as necessary to shift the jaw-contact centerline to correspond to that of the blade centerline, ±¼ inch. Then tighten the locknuts. To avoid changing the effective height of the support insulator, do not adjust more than three of the four sets of locknuts.

(c) Continue to rotate the shaft, clockwise only, until a firm resistance is felt. At this point, the disconnect blades should be open past 90 degrees. If the disconnect blades are not open past 90 degrees, loosen the locknuts at the top and bottom of the vertical operating pipe and rotate the pipe clockwise (as viewed from the top) to increase blade travel; then tighten the locknuts. Now verify, at each pole-unit insulating support column, that the rotating-spindle open-stop bolt does not touch the bumper. See Figure 12 (right). If any open-stop bolt does touch the bumper, loosen the locknuts at the top and bottom of the vertical operating pipe and rotate the pipe counterclockwise (as viewed from the top) to decrease blade travel; then tighten the locknuts. Do not adjust the open-stop bolts.

(d) Remove the manual charging handle from the manual charging shaft.

**Step 23**

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.

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**DANGER**

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

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**Step 24**

Remove the container from each interrupter as follows:

(a) Remove and discard the ¾"—16 zinc-plated serrated hex nuts which run the length of the container.

(b) Remove and discard the ½"—16×¾" and two ¾"—16×1" 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 ¾"—16×¾" and two ¾"—16×1" zinc-plated hex-head cap screws and flat washers which attach the upper container-half to the indicator end casting of the interrupter.

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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 (available from Burndy Corporation) 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. Then bolt the connectors to the terminal pads.

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

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**Figure 13. Checking alignment of disconnect blade and jaw contact.**
(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 more conveniently lowered to the ground.

(d) Now remove and discard the $\frac{3}{8}$—$16\times\frac{3}{4}$ hex-head cap screw and flat washer which attach the lower container-half to the coupling end casting of the interrupter, and the $\frac{3}{8}$—$16\times\frac{3}{4}$ 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 pressure-relief device and low-gas-pressure indicator.

**Step 25**

Remove and discard the plastic bubble-wrap from each insulating support column.

**Step 26**

Perform the following set-up procedure on the operator. See Figure 15.

(a) To avoid accidentally energizing the operator after the external connections have been completed, open the control-source disconnect switch.

(b) Loosen the clamps on the inside of the side access door, open the side access door, and remove the blocking from the motor contactors.

(c) Mark the conduit-entrance location for the control-circuit wiring on the conduit entrance plate in 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 make up the entrance fittings. Verify that the entrance fittings are properly sealed to prevent water ingress.

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

**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 which has been approved by both the user and S&C Electric Company.

Do not apply control voltage to the operator at this time!
**Step 27**

**CAUTION**

Check the following... failure to do so can result in damage to the Circuit-Switcher when operated!

(a) At each transition box:
   - The interrupter stop bracket and spacer have been removed (see Figure 8), and
   - The transition lever has been connected to the operating rod link (see Figure 8).

(b) In the cross base
   - Each insulated operating rod has been connected to the interphase drive (see Figure 9),
   - The interphase drive lever has been connected to the operator uni-ball coupling (see Figure 10), and
   - The adjustable locking rod attached to the interphase drive lever has been removed (see Figure 10).

(c) All other pinned connections have been made and all bolted connections have been securely tightened.

(d) At the operator:
   - Blocking has been removed from the motor contactors, and
   - Correct polarity has been observed on dc-control-voltage models.

**Step 28**

Replace the access cover on the side of each transition box and securely tighten the associated 5/32"—18×3/4" hex-head stainless-steel cap screws.

**Step 29**

Replace the bottom plates to the underside of the cross base and securely tighten the associated 1/4"—13×1 1/4" galvanized steel cap screws, flat washers, and nuts. For Circuit-Switchers rated 161 kV and 230 kV: Attach the six 13"×3 1/4" adjustment plates to the underside of the cross base. These plates are used to cover small gaps between the bottom plates, the operator support tube mounting plate, and the mounting pedestals.

**Step 30**

Insert the motor-and-closing circuit fuseholder. Then close the control-source disconnect switch.

**Step 31**

Press the “CLOSE” push button. The motor-driven cam in the stored-energy mechanism will immediately start retracting. Simultaneously, the take-off shaft at the rear of the operator housing will turn to drive the interphase pipe assembly, closing the disconnect. When the disconnect has completely closed, the closing latch will release, discharging the closing spring. This action closes the interrupters. The switch-position indicator on the cross base will move to the “CLOSED” position. Further, if the position-indicating lamp option has been specified, the red lamp will light.

**Step 32**

Verify, at the center pole-unit insulating support column, that the rotating-spindle closed-stop bolt touches the bumper. See Figure 12 (left). In the event that the closed-stop bolt is not touching the bumper, loosen the locknuts at the top and bottom of the vertical operating pipe and turn the pipe counterclockwise (as viewed from the top) to increase blade travel; then tighten the locknuts. Do not adjust the closed-stop bolt.

**Step 33**

Verify, at each outboard pole-unit insulating support column, that the clearance between the rotating-spindle closed-stop bolt and the bumper does not exceed 1/16 inch. See Figure 12 (left). In the event that the clearance between the closed-stop bolt and the bumper exceeds 1/16 inch at either outboard pole-unit insulating support column, remove the pin at the appropriate insulating support column drive lever, loosen the appropriate locknut at the adjustable coupling, and rotate the affected interphase pipe section so that the aforementioned clearance is obtained. Then replace the pin and tighten the locknut. See Figure 11. Do not adjust the closed-stop bolts.

**Step 34**

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 and closing operations and can thus sneak out, leaving the Circuit-Switcher inoperable.

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

**Step 35**

Please complete and mail the Circuit-Switcher registration card! The information requested on this card is vital to ensure prompt notification in the event field modifications are needed.

▼ Trip and close push buttons are not included on operators specified with Catalog Number Suffix “J.” In such instances, momentarily jumper terminals 1 and 3 to close the Circuit-Switcher.
**Electrical Operation**

Refer to Figure 15.

To open the Circuit-Switcher, press the “TRIP” push button. 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 indicator to the “DISCHARGED” window. The switch-position indicator on the cross base will move to the “OPEN” position. 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 indicator will again be visible at the “CHARGED” window. Simultaneously, the take-off shaft at the rear of the operator housing will turn to drive the interphase pipe assembly, opening the disconnect.

To close the Circuit-Switcher, press the “CLOSE” push button. The motor-driven cam in the stored-energy mechanism will immediately start retracting. Simultaneously, the take-off shaft at the rear of the operator housing will turn to drive the interphase pipe assembly, closing the disconnect. When the disconnect has completely closed, the closing latch will release, discharging the closing spring. This action closes the interrupters. The switch-position indicator on the cross base will move to the “CLOSED” position. Further, 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 such operation because control schemes vary with different installations. With any given installation, however, it may be possible and desirable to effect such operation.

**Manual Operation**

Refer to Figure 15.

To trip the Circuit-Switchers, push the manual trip lever counterclockwise. 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 indicator to the “DISCHARGED” window. The switch-position indicator on the cross base will move to the “OPEN” position. Further, if the position-indicating lamp option has been specified—and operator control voltage is available—the green lamp will light.

The motor-driven cam in the stored-energy mechanism will immediately start rising—if operator control voltage is available—thereby charging both the opening and closing springs; when the opening spring latches, the indicator will again be visible at the “CHARGED” window. Simultaneously, the take-off shaft at the rear of the operator housing will turn to drive the interphase pipe assembly, opening the disconnect.

If operator control voltage is not available, the motor-driven cam in the stored-energy mechanism will charge the opening and closing springs—and the take-off shaft will turn to drive the interphase pipe assembly, opening the disconnect—when control voltage returns. If desired, the opening and closing springs can be charged and the disconnect opened after the interrupters have been...
### Key Features of S&C Series 2000 Circuit-Switchers:

- **Model 2010**
- **Horizontal Interrupters**
- **Vertical-Break Power-Operated Disconnect**

#### Description:

- **Eight nonadjustable single-pole double-throw auxiliary-switch contacts**
  (not visible in photo) which follow the interrupters.

- **Weatherproof,** dustproof enclosure.

- **Trip and close push buttons**

- **Position-indicating lamps** (Catalog Number Suffix “-M”)

- **Duplex receptacle**
  with ground-fault circuit interrupter and convenience-light lamp holder
  with switch (Catalog Number Suffix “-V”)

- **Non-reset electric operation counter**

- **Charged and discharged indicators** for stored-energy mechanism

- **Control-source disconnect switch**

- **Motor-and-closing circuit fuseholder**

- **Motor**

- **Door gasket**

- **Optional remote gas-density monitor** (receiver)

- **Trip and close push buttons**

- **Motor**

- **Access shutter**

- **Manual operating shaft**

- **Control-source disconnect switch**

- **Motor-and-closing circuit fuseholder**

#### Diagram:

- **Figure 15. Interior of operator.**

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**S&C ELECTRIC COMPANY**

**Page 24 of 26**

**August 12, 2002**
tripped, using the manual charging handle furnished. Refer to Figure 16. Use the following procedure:

(a) Open the access shutter and place the manual charging handle on the manual operating shaft.

(b) Rotate the shaft, clockwise only, until the disconnect opens fully and the mechanism reaches its open stop.

Manual closing of the Circuit-Switcher cannot be performed.

**Decoupling**

The disconnect-blade power train may be decoupled in the open position, permitting the interrupters to be tripped and closed for inspection purposes.

To decouple, open the Circuit-Switcher electrically or manually. Then disengage the decoupling handle on the rear of the operator by pivoting it outward. See Figure 17 (bottom). The disconnect-blade power train may now be...
padlocked open. In addition, the interrupters may now be closed and re-tripped as desired, either electrically or manually.

To recouple, open the Circuit-Switcher electrically or manually. Then engage the decoupling handle on the rear of the operator by pivoting it inward. See Figure 17 (top). The disconnect-lade power train may now be padlocked coupled.

**Adjusting Auxiliary-Switch Contacts**

Two individually adjustable auxiliary-switch contacts are furnished in the operator. These contacts follow the position of the disconnect-blade power train and operator when the power train is coupled, and the position of the operator when the power train is decoupled.

Each auxiliary-switch contact is operated by a cam-actuated roller. A contact is closed if its roller is disengaged from a cam and, conversely, a contact is open if its roller is engaged by a cam. The cams are individually adjustable in 4.5-degree increments. Adjustment of the cams is accomplished as follows:

(a) Push the cam toward its adjacent spring until the cam is separated from the teeth of the inner gear. See Figure 18.

(b) Rotate the cam to advance or retard engagement with its roller.

(c) Release the cam, making sure that the teeth are in mesh with the inner gear.