

INSTRUCTIONS

For Operation

INTRODUCTION

CAUTION: The equipment covered by this publication must be 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.

The S&C Switch Operator—Type CS-2A is a high-speed, high-torque operator expressly designed for power operation of S&C Circuit-Switchers—Mark IV, Center-Break Style, rated 345 kv and 500 kv, with six gaps. It is not intended for operation of any other devices.

High-speed, high-torque power operation of six-gap Center-Break Style Mark IV Circuit-Switchers, by means of S&C Switch Operator—Type CS-2A, is required to provide two-time duty-cycle fault-closing ratings (345-kv Circuit-Switchers only) of 40,000 amperes rms three-phase symmetrical, 102,000 amperes peak; opening and closing without hesitation under 1½-inch ice formation; close interphase simultaneity; long life of fault-closing contacts under normal operating duties; and avoidance of excessive switching transients due to prolonged or unstable prestrike arcing.

SWITCH OPERATORS—Type CS-2A^①

Application		Motor and Control Voltage	Maximum Operating Time, Seconds ^②	Minimum Locked-Rotor Torque at Rated Control Voltage, Inch-Lbs.	Accelerating Current, Amperes	Catalog Number	Schematic Wiring Diagram Drawing Number
High-Voltage Device	Style and Rating of High-Voltage Device						
S&C Mark IV ♦ Circuit-Switcher without Shunt-Trip Device	Center-Break: 345 and 500 kv, 6 gaps	125 v dc	2.0	40 000 ■	104	38841R1-B	CDR-3130R1
S&C Mark IV ♦ Circuit-Switcher with Shunt-Trip Device	Center-Break: 345 and 500 kv, 6 gaps	125 v dc	2.2	40 000 ■	104	38840R1-B	CDR-3129R2

① Type CS-2A Switch Operators rotate clockwise to open (as viewed from the top).

② Based on minimum battery and external control wire size requirements specified in S&C Data Bulletin 719-60; operating time will be less if larger-than-minimum battery size and/or external control wire size is utilized. Maximum blade-travel time is 1.9 seconds for Switch Operator Catalog

Number 38841R1-B, 2.1 seconds for Switch Operator Catalog Number 38840R1-B.

● The Type CS-2A Switch Operator is also suitable for use with equivalent models of Mark II Circuit-Switchers.

■ This minimum torque is at the interphase shaft and includes a 6.25 to 1 gear reduction in the gearbox at the Circuit-Switcher base.



S&C Switch Operators — Type CS-2A

INTRODUCTION — Continued

S&C Switch Operators—Type CS-2A include the following features as standard:

- Built-in internal decoupling mechanism, operable by integral external selector handle, with padlocking provisions. Laminated safety-plate window permits “visible air-gap” verification of complete disengagement of output shaft.
- Open-close control switch, mounted inside the enclosure.
- Removable manual operating handle, stored inside the enclosure door.
- Mechanical position indicators for both switch operator and Circuit-Switcher “open” and “closed” positions.
- Non-reset electric operation counter.
- Laminated safety-plate window for inspection of built-in internal decoupling mechanism and of mechanical position indicators.
- Foolproof recoupling. Impossible with position-indicating drums to couple the switch operator and the Circuit-Switcher “unsynchronized.”
- Fingertip precision adjustment of output-shaft rotation using self-locking spring-biased cams.
- Eight-pole auxiliary switch, coupled to motor, with fingertip precision adjustment of individual contacts using self-locking spring-biased cams.
- Antifriction bearings throughout; tapered roller bearings for all high-torque gear-train shafts.
- Two-pole pull-out fuseholder for space-heater circuit; two-pole pull-out fuseholder and series disconnect for motor-control circuit.
- Weatherproof, dustproof enclosure, equipped with 120/240-volt ac space heater, factory connected for 240-volt ac operation. Can readily be field reconnected for 120-volt ac operation.
- Tamper-resistant design—welded enclosure; baffled louvers; gasketed, flanged door opening; cam-action door latch; provisions for padlocking.
- Foul-weather accessibility to interior of enclosure. Access is by door rather than by removal of entire enclosure.

Switch-operator catalog numbers are suffixed with one or more letters. The first letter following the catalog number, -B, designates the motor and control voltage, 125 volts dc. Other suffix letters which may be added to the switch-operator catalog number indicate the inclusion of optional accessories as follows:

ACCESSORIES

Item	Suffix Added to Switch-Operator Catalog Number
Space Heater Thermostat	-K
Key Interlock with Switch, locks Circuit-Switcher open and disconnects motor-control circuit	-L
Position-Indicating Lamps (one red, one green), mounted inside the enclosure	-M
Extra Auxiliary Switch (individually adjustable contacts), 4-PST (coupled to motor)	-Q
Duplex Receptacle and Convenience-Light Lampholder with Switch	-V
Extra Auxiliary Switch (individually adjustable contacts), 8-PST (coupled to Circuit-Switcher)	-W



OPERATION

The instructions that follow are based on the assumption that the switch-operator output shaft has been connected to the Circuit-Switcher power train, that electrical connections to the control source have been completed, and that the switch operator has been correctly adjusted in accordance with S&C Instruction Sheet 719-510.

Do not assume that the switch-operator position necessarily indicates the open or closed position of the Circuit-Switcher. Upon completion of an opening or closing operation (electrical or manual), check to be sure that the following conditions exist:

- The mechanical position-indicating drums for both Circuit-Switcher and switch operator show a matched pair of green alignment arrows for a Circuit-Switcher open position, or a matched pair of red alignment arrows for a Circuit-Switcher closed position. See Figure 3. Also note the position-indicating lamps, Figure 1, if furnished.
- The Circuit-Switcher disconnect blades on each pole-unit are fully open or fully closed.

Then tag and padlock the switch operator in accordance with standard system operating procedures. In all cases, make certain that the switch operator is padlocked before "walking away."

Correct operation of the Circuit-Switcher depends on charging and latching the stored-energy source within each brain as the disconnect blades move to the fully open position and the interrupters close. The interrupter target located on the side of each brain housing appears yellow when the interrupters are open. The target appears gray (normal) when the interrupters are closed.

Because the interrupters are closed as the Circuit-Switcher blades move to the fully open position, the target appears yellow only briefly during the opening operation. The target should not appear yellow when

the Circuit-Switcher is in the fully open or fully closed position.

CAUTION: Interrupters should *never* be in the open (unlatched) position when the disconnect blades are in the closed position. To close the interrupters, Circuit-Switcher must be completely opened and then reclosed. For this reason, the switch operator incorporates a control circuit that causes it to return automatically to the open position whenever power is restored while the switch operator is at any position between fully open and fully closed. Such action takes place regardless of the direction in which the switch operator was operating prior to loss of voltage. This control circuit is a built-in safety feature to prevent Circuit-Switcher from being closed from a partially open position after the interrupters have tripped open.

Electrical Operation

The control switch for electrically opening or closing the Circuit-Switcher is located inside the switch-operator enclosure. See Figure 1.

Alternatively, the switch operator may be activated by operating associated, remotely located control switches. (No instructions are included for activating the switch operator by means of remotely located control switches because control schemes vary with different installations. With any given installation, however, it may be possible and desirable to effect such operation. Instructions presented herein cover operation at the switch operator only.)

Decoupling

To permit electrical operation, testing or exercising of the switch operator without affecting the position of the Circuit-Switcher, or to permit manual operation of the Circuit-Switcher, an internal decoupling mechanism is provided.



S&C Switch Operators — Type CS-2A

OPERATION — Continued

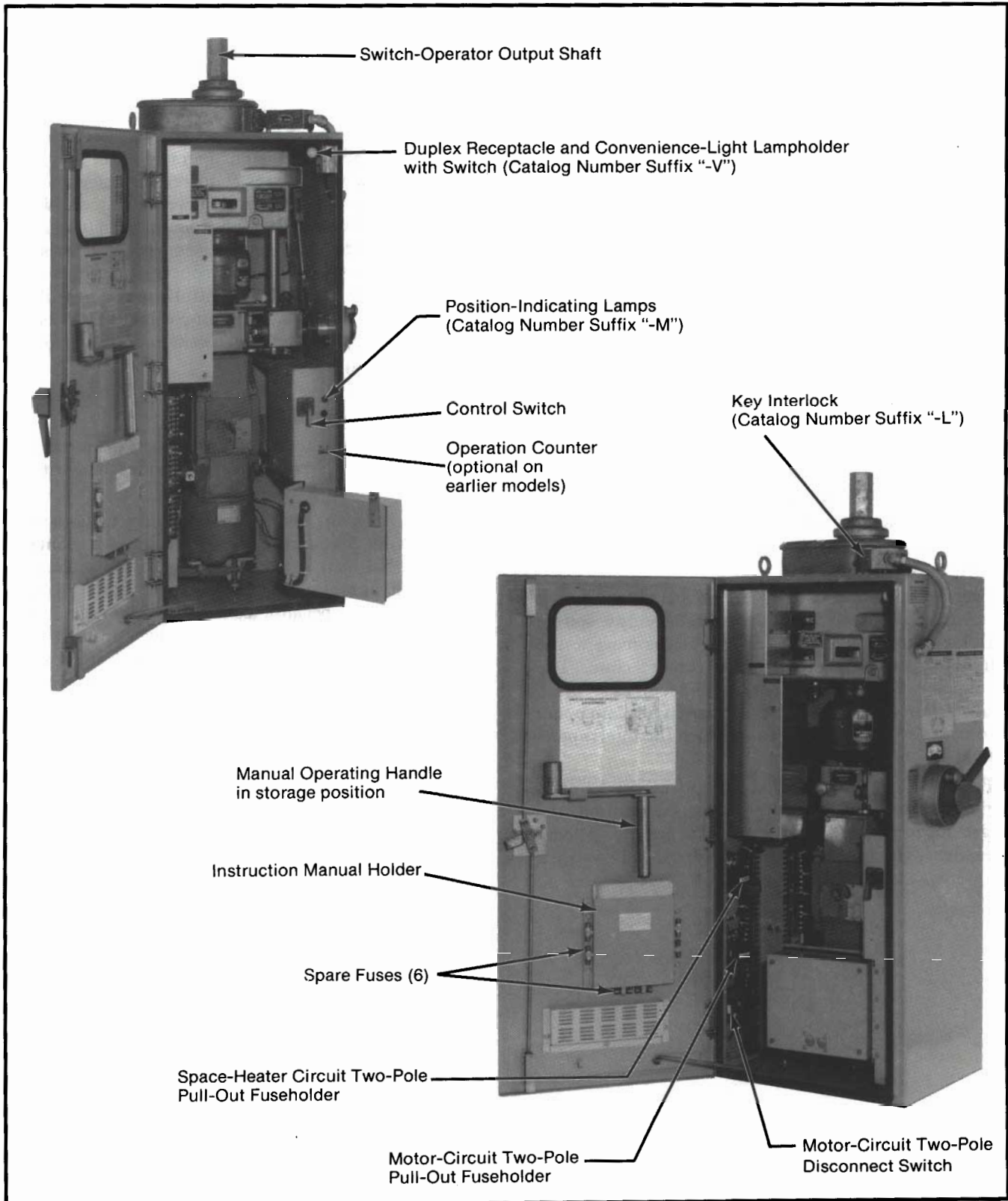


Figure 1. Internal views of switch operator.

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The selector handle, for external operation of the built-in internal decoupling mechanism, is located on the right-hand side of the switch-operator enclosure. See Figure 2. Pull the latch knob to release the selector handle and rotate it counterclockwise approximately 100 degrees to the decoupled position. Release the latch knob to lock the selector handle in position. Moving the selector handle to its decoupled position releases the switch-operator motor and gear train from the switch-operator output shaft, and connects the manual-operating-handle shaft to the output shaft. When the selector handle is in the decoupled position, the shunt-trip device (when this option is provided) is rendered inoperative.* Electrical testing of the operator may be performed in its decoupled position.

Visual inspection, through the observation window, will verify whether the internal decoupling mechanism is in the coupled or decoupled position. See Figure 3. The selector handle may be padlocked in either position.

* Only the shunt-trip device is rendered inoperative. The switch operator can still be opened through the user's protective-relay circuit. Thus "elective" checkout of the system protective scheme is possible at any time.

Manual Operation

The switch operator can be operated manually to open or close the Circuit-Switcher.

CAUTION: Manual closing of an energized Circuit-Switcher is not recommended because of the possibility of closing into a fault. Manual opening of an energized Circuit-Switcher is permissible. Once the opening operation has been initiated, however, it should be completed with dispatch. Cranking should continue until the Circuit-Switcher is fully open, as indicated by resistance which will be felt as the Circuit-Switcher power train progresses to its stops. As the Circuit-Switcher moves toward the open position, the interrupters will close and the stored-energy source within the brains will charge and latch. The Circuit-Switcher disconnect blades should *never* be in the closed position when the interrupters are in the open position.

To open or close the Circuit-Switcher manually, move the selector handle to the decoupled position. Then remove the manual operating handle from its storage position inside the enclosure door. Open the cover, located at the pivot point of the selector handle,

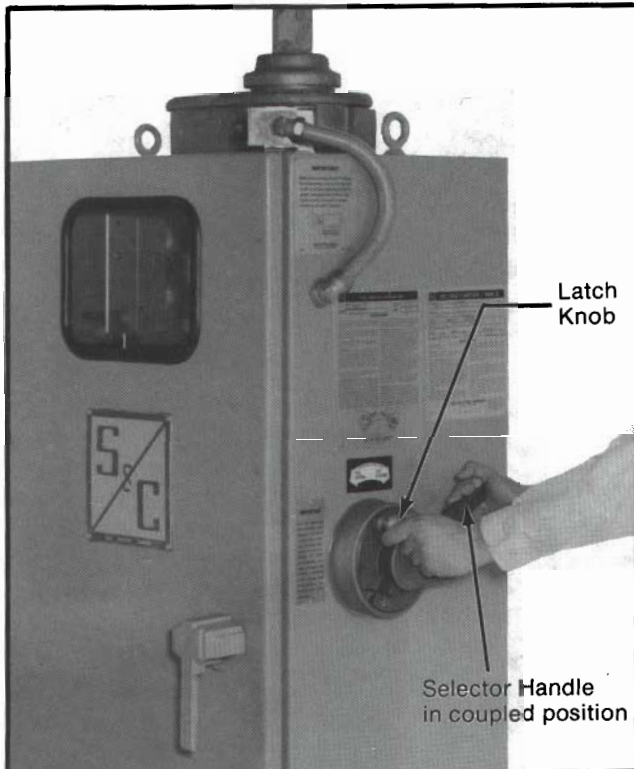


Figure 2. Selector handle operation.

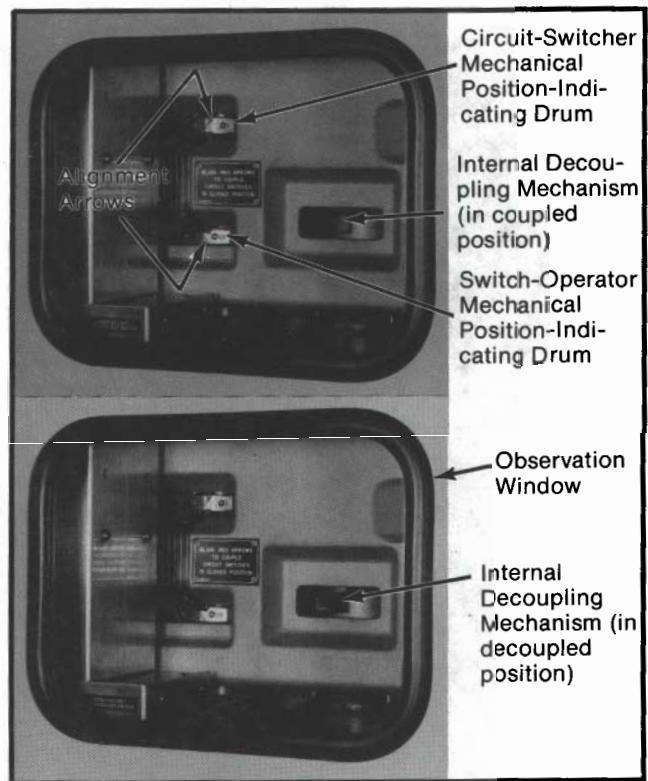


Figure 3. Decoupling mechanism and mechanical position indicators.



S&C Switch Operators — Type CS-2A

OPERATION — Continued

to expose the manual-operating-handle shaft. See Figure 4. Opening the cover will automatically disconnect both leads of the control source to prevent electrical operation. However, during manual operation, the switch operator may also be disconnected from the control source by opening the motor-circuit two-pole disconnect switch. Attach the manual operating handle to the shaft and crank to open or close the Circuit-Switcher. An arrow label above the shaft indicates the cranking direction to close. Since the cover can be opened only when the selector handle is in the decoupled position, the manual operating handle can drive only the output shaft—not the motor and gear train.

Coupling

Determine the position of the switch-operator output shaft, and the switch-operator motor and gear train, by observing the mechanical position-indicating drums which appear in the two openings inside the enclosure at the upper left. See Figure 3. The upper drum is

coupled to the switch-operator output shaft. The green and red arrows on this drum indicate open and closed positions, respectively, of the Circuit-Switcher. The switch-operator motor and gear train can be coupled to the Circuit-Switcher power train when they are in the same relative position as indicated by the matching pairs of green or red arrows.

Approximate alignment of matching pairs of red or green arrows can be accomplished by manual operation of the Circuit-Switcher as explained above, or by electrical operation of the switch operator. When arrows are in approximate alignment, obtain precise alignment by turning the handwheel provided on the motor shaft. See Figure 5. Opening the handwheel access cover automatically releases the motor brake and opens the motor-contactor control circuit.

When the matching pairs of red or green arrows are in precise alignment, pull the latch knob on the selector handle and rotate the handle clockwise. Release the latch knob to lock the selector handle in the coupled position.

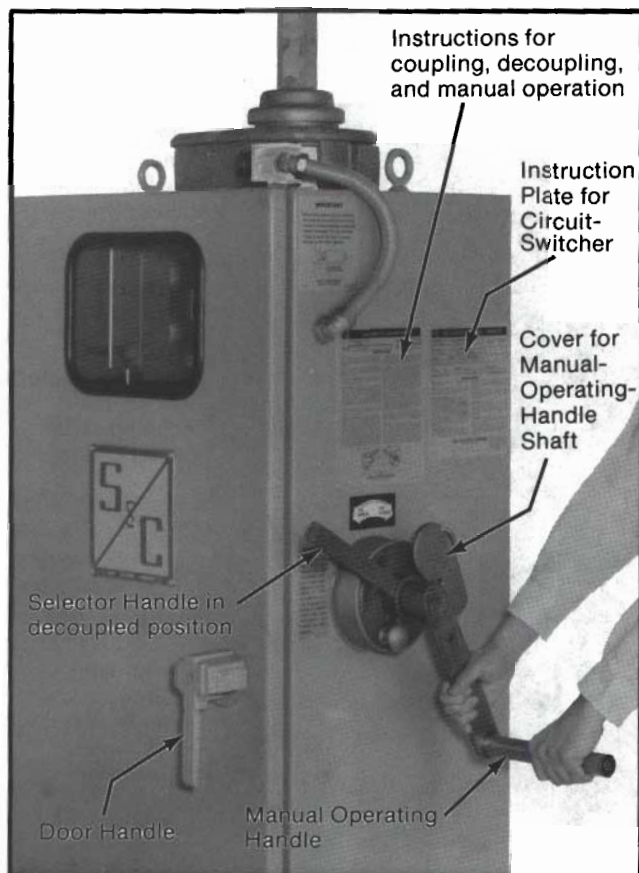


Figure 4. Inserting operating handle.

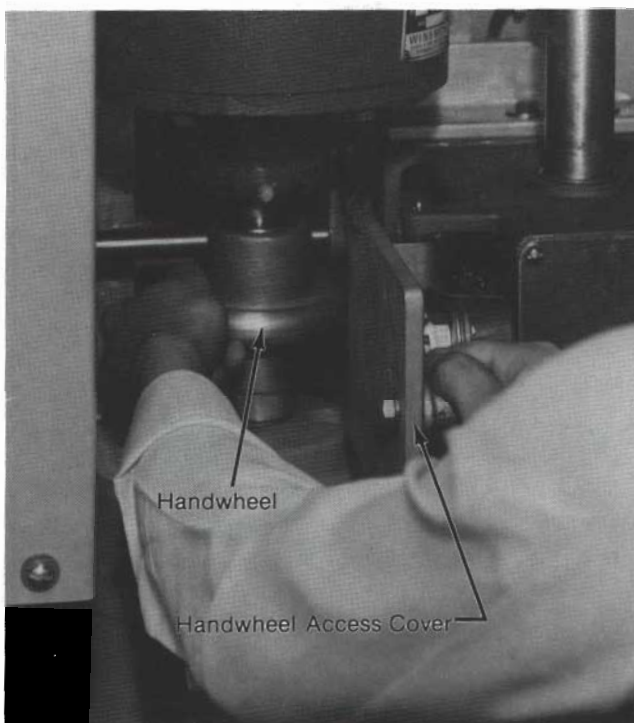


Figure 5. Operating handwheel for precise alignment of matching pairs of arrows as illustrated in Figure 3.

INSPECTION SCHEDULE AND PROCEDURES

To assure continued proper performance of Circuit-Switcher and Type CS-2A Switch Operator, they should be inspected in accordance with S&C's recommended schedule and procedures contained in S&C Instruction Sheet 711-590. (These procedures, incidentally, take the place of the annual exercising which has, up until the October 28, 1985 issuance of Instruction Sheet 711-590, been recommended for Circuit-Switcher and its operator.)

The Type CS-2A Switch Operator may be conveniently decoupled from the Circuit-Switcher, thereby permitting elective exercising of the operator at any time without requiring an outage or switching to an alternate source; when the switch operator is in the decoupled position, the shunt-trip device—if furnished—is rendered inoperative, thereby permitting checkout of the system protective scheme.

CAUTION

Do not assume that the switch-operator position necessarily indicates the open or closed position of the Circuit-Switcher. Upon completion of an opening or closing operation (electrical or manual), check to be sure that the following conditions exist:

- The mechanical position-indicating drums for both Circuit-Switcher and switch operator show a matched pair of green alignment arrows for a Circuit-Switcher open position, or a matched pair of red alignment arrows for a Circuit-Switcher closed position. See Figure 3. Also note the position-indicating lamps, Figure 1, if furnished.
- The Circuit-Switcher disconnect blades on each pole-unit are fully open or fully closed.

Then tag and padlock the switch operator in accordance with standard system operating procedures. In all cases, make certain that the switch operator is padlocked before "walking away."

Correct operation of the Circuit-Switcher depends on charging and latching the stored-energy source within each brain as the disconnect blades move to the fully open position and the interrupters close. The interrupter target located on the side of each brain housing appears yellow when the interrupters are open. The target appears gray (normal) when the interrupters are closed.

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To restore to normal operation

So that the switch operator is ready for normal operation of Circuit-Switcher by remote automatic or supervisory control, be sure that the following conditions exist:

- The selector handle is in the coupled position.
- The motor-circuit two-pole disconnect switch is closed.
- The switch operator is tagged and padlocked in accordance with standard system operating procedures.

