INSTRUCTIONS

For Installation

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INTRODUCTION

⚠ CAUTION

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.

The S&C Switch Operator—Type CS-10 is a high-speed operator, with an operating time of 1.5 seconds maximum. It is expressly designed for power operation of S&C Circuit-Switchers—Type A and Type G, Vertical-Break Style, having reciprocating operating mechanisms, as indicated in the table below.

For S&C Circuit-Switchers having rotating type operating mechanisms, the S&C Switch Operator—Type CS-1A is required, except for 6-gap S&C Circuit-Switchers, for which the S&C Switch Operator—Type CS-2A is required.

For S&C Alduti-Rupter® Switches—Outdoor Distribution and S&C Alduti-Rupter Switches with Power Fuses—Outdoor Distribution, S&C Switch Operators—Type AS-1A and Type AS-10 are offered for use with rotating or reciprocating operating mechanisms, respectively.

SWITCH OPERATORS—Type CS-10

Application		Motor and Control Voltage	Operating Lever		Maximum Operating Time, Seconds②	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		Sector①	Length, Inches					
S&C Circuit-Switcher without Shunt-Trip Device	Type A Vertical-Break, 34.5 thru 138 kv	48 v dc	LH	6 13/16	1.5	21 500	80	38860R4-A	CDR-3112R2
		125 v dc	LH	6 13/16	1.5	21 500	30	38860R4-B	
		115 v 60 hz	LH	6 13/16	1.5	18 000	46	38860R4-D	CDR-3123R2
		230 v 60 hz	LH	6 13/16	1.5	18 000	23	38860R4-E	
	Type G Vertical-Break, 34.5 thru 161 kv	48 v dc	LH	4 5/8	1.5	21 500	80	38861R4-A	CDR-3112R2
		125 v dc	LH	4 5/8	1.5	21 500	30	38861R4-B	
		115 v 60 hz	LH	4 5/8	1.5	18 000	46	38861R4-D	CDR-3123R2
		230 v 60 hz	LH	4 5/8	1.5	18 000	23	38861R4-E	
S&C Circuit-Switcher with Shunt-Trip Device	Type G Vertical-Break, 34.5 thru 161 kv	48 v dc	LH	6 13/16	1 5	21 500	80	38864R5-AHP	CDR-3185
		125 v dc	LH	6 13/16	1.5	21 500	30	38864R5-B	CDR-3186■
		48 v dc	LH	4 5/8	1.5	21 500	80	38865R5-AHP	CDR-3185
		125 v dc	LH	4 5/8	1.5	21 500	30	38865R5-B	CDR-3186■

① Operating lever travels in left-hand sector as indicated, viewed from front (door side) of switch operator. Operating lever in the "Up" position corresponds to the "Closed" position of the Circuit-Switcher.

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.

■ CDR-3185 for Catalog Numbers 38864R5-BHP and 38865R5-BHP.

Supersedes Instruction Sheet 719-520 dated 6-2-86

INTRODUCTION — Continued

For S&C Line-Rupters™, the S&C Switch Operator—Type LS-2 is available.

For switches of other manufacture, the S&C Switch Operator—Type LS-1 is available. The LS-1 is a low-speed operator, with an operating time of 4 to 7 seconds. It is designed for power operation of outdoor high-voltage disconnects and interrupter switches for which this low operating speed is appropriate.

S&C Switch Operators—Type CS-10 include the following features as standard:

- Built-in internal decoupling mechanism, operable by integral external selector handle, with padlocking provisions and automatic mechanical locking of output shaft. Laminated safety-plate window permits "visible air-gap" verification of complete disengagement of output shaft.
- Open-close pushbuttons, externally operable, with padlockable cover.
- Built-in nonremovable, foldaway manual operating handle.
- Mechanical position indicators for switch operator "open" and "closed" positions.
- Non-reset electric operation counter.
- Laminated safety-plate window for inspection of built-in internal decoupling mechanism, mechanical position indicators, and operation counter (and position-indicating lamps, if furnished as accessories).
- Foolproof recoupling. Impossible with position-indexing drums to couple the switch operator and the Circuit-Switcher "unsynchronized."
- Limits of output-shaft rotation factory-adjusted.
- 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 fuseholders for space heater and motor 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 openings; 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 designates the motor and control voltage:

Suffix	Voltage
-A	48 volts dc
-B	125 volts dc
-D■	115 volts 60 hz
-E■	230 volts 60 hz

■ Not applicable to Catalog Number 38864R5 or 38865R5.

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
Shunt-Trip Contactor and Time-Delay Relay, minimize control-current inrush by energizing shunt-trip device and switch operator motor in sequence①	-HP
Deletion of Externally Operable Open-Close Pushbuttons	-J
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 ②	-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)③	-W
Remote-Control Blocking Switch, prevents remote operation of switch operator when the protective cover for the externally mounted open-close pushbuttons is open	-Y
Extra Auxiliary Switch (individually adjustable contacts), 12-PST (coupled to Circuit-Switcher)③	-Z

① Available as an optional accessory only with S&C Switch Operator Catalog Numbers 38864R5-B and 38865R5-B; included as standard equipment with Catalog Numbers 38864R5-AHP and 38865R5-AHP. Permits use of minimum-size control wire. Refer to S&C Data Bulletin 719-60.

② Not available in applications utilizing an S&C Circuit-Switcher Relay and Control Pack.

③ The 8-PST extra auxiliary switch (suffix "-W") cannot be furnished if the 12-PST version (suffix "-Z") is specified, and vice versa.

⚠ IMPORTANT

Before installing the switch operator, it is advisable to determine that its operating lever travels in the sector indicated on the catalog dimensional drawing furnished. Manually operate the switch operator as described in Step 4, making sure that the selector handle is in the coupled position as described in Step 6, and note the sector in which the operating lever moves. As a point of information, the switch operator cannot be modified to produce opposite-hand movement of the operating lever.

Step 1

Before removing the existing switch operator or manual operating handle, place the Circuit-Switcher in the fully open position. Then remove the existing switch operator or manual operating handle.

Mount the switch operator as indicated on the erection drawing. Do not install the vertical shaft to the clevis fitting at this time.

Step 2

Mark the conduit-entrance location for the control-circuit wiring on the conduit-entrance plate in the bottom of the switch operator enclosure. See Figure 2.

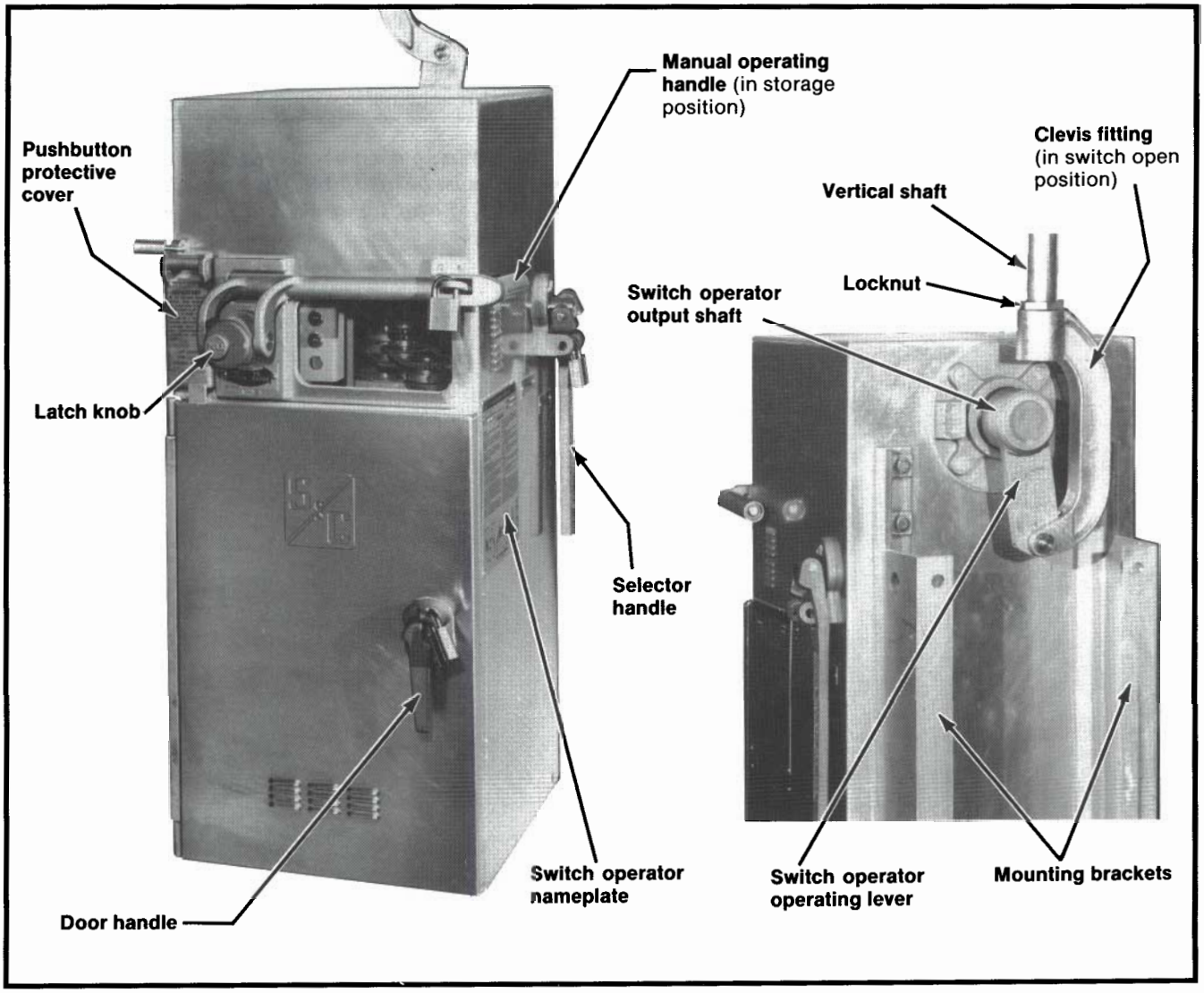


Figure 1. Exterior views of switch operator.

Remove the conduit-entrance plate and cut out the necessary opening. (If Circuit-Switcher is equipped with optional S&C Shunt-Trip Device, an entrance cutout for an additional one-inch-diameter conduit should also be made at this time.)

Replace the conduit-entrance plate and make up the entrance fittings. Apply sealing compound (provided with each switch operator) when replacing the conduit-entrance plate. Verify that the entrance fittings are properly sealed to prevent water ingress.

Step 3

⚠ CAUTION

To avoid accidental energizing of the operator after the external connections have been made, remove the two-pole pull-out fuseholders for the motor circuit and space-heater circuit. See Figure 2. Reinsert the fuseholders only when indicated in the steps which follow.

Remove the blocking from the motor contactors.

Connect the external control-circuit wiring (including space-heater source leads) to the terminal blocks of the switch operator in accordance with the wiring diagram furnished. *Note: Direct-current switch operators are furnished with polarity-sensitive motors. Therefore, external control-circuit connections must be made observing the polarities indicated on the wiring diagram.*

⚠ CAUTION

Unauthorized changes should not be made in the wiring of this switch 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.

⚠ IMPORTANT

Observe recommended minimum wire size requirements for the control-circuit wiring, and the shunt-trip device wiring where applicable, as shown in S&C Data Bulletin 719-60 and on the switch-operator schematic wiring diagram furnished.

Note: Wiring must be complete and adequate control voltage must be available at the switch operator before checkout, if any, by an S&C factory service specialist.

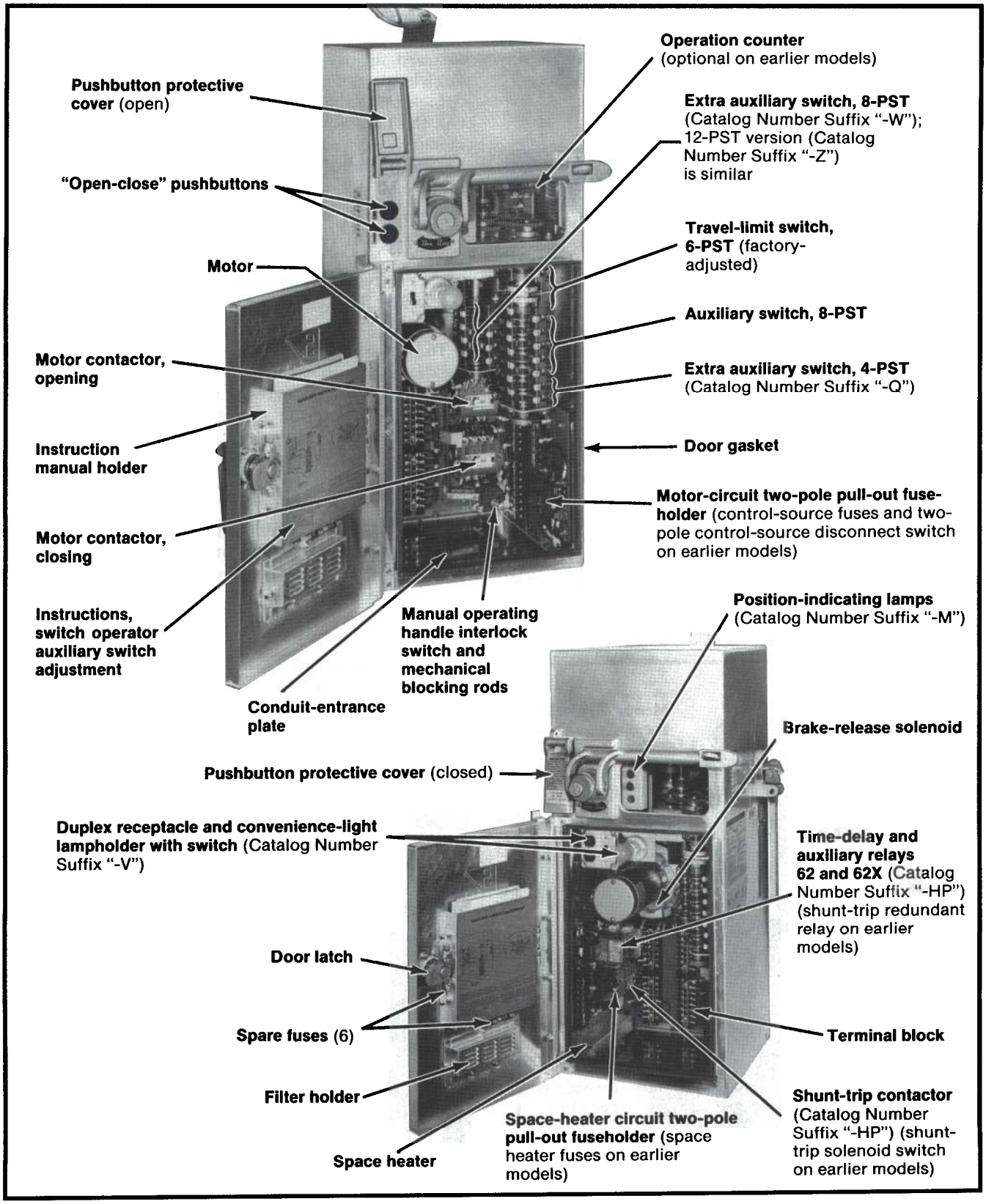


Figure 2. Interior views of switch operator.

MANUAL OPERATION

Before proceeding further, the user should become familiar with the operation of the manual operating handle and the selector handle, as described on the switch-operator nameplate on the right-hand side of the enclosure and in Steps 4, 5, and 6. See Figures 3 and 4.

⚠ 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. If the Circuit-Switcher is equipped with a control unit, it will not be possible to close the Circuit-Switcher without first moving it to the fully open position.

Step 4

To operate manually: Pull the latch knob on the hub of the manual operating handle and pivot the handle forward slightly from its storage position. Release the latch knob while continuing to pivot the handle forward to lock it into the cranking position. See Figures 1 and 3. (As the handle is pivoted forward the motor brake is mechanically released, both leads of the control source are automatically disconnected, and both the "opening" and "closing" motor contactors are mechanically blocked in the open position.)

If desired, during manual operation, the switch operator may also be disconnected from the control source by removing the motor-circuit two-pole pull-out fuseholder, located on the right-hand inside wall of the enclosure.

To return the manual operating handle to its storage position, pull the latch knob and pivot the handle approximately 90 degrees. The handle will then be disengaged from the switch operator and may be rotated freely in either direction to its storage position. Complete the handle storage by pivoting the operating handle backward approximately 90 degrees until it latches in the storage position.

Note that the manual operating handle may be disengaged from the switch operator mechanism at any position of the handle. However, if the switch operator

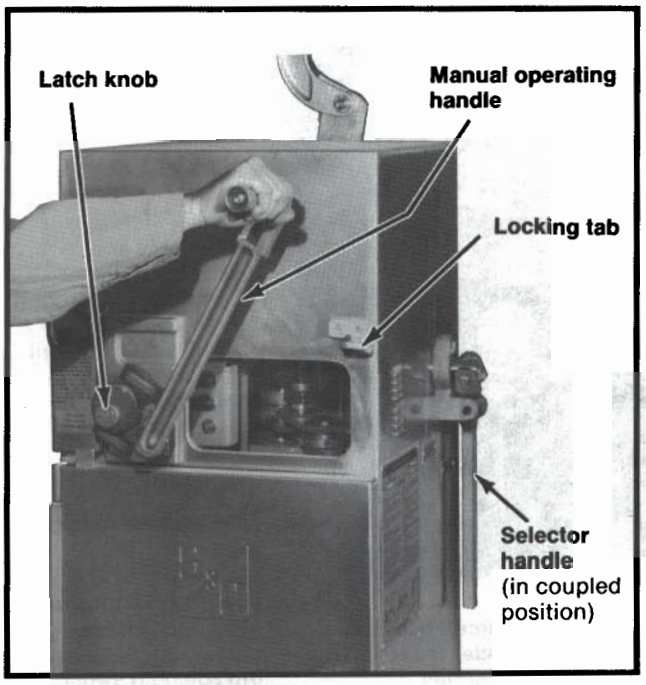


Figure 3. Manual operation.

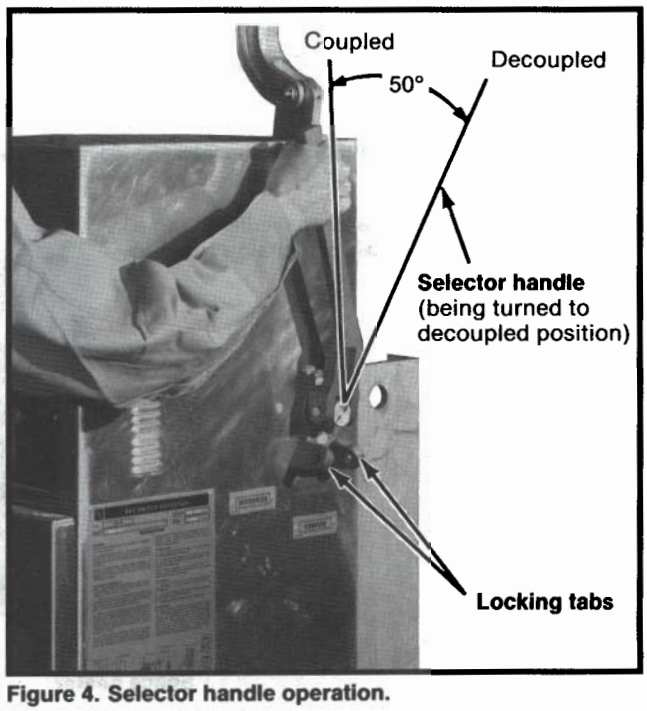


Figure 4. Selector handle operation.

and Circuit-Switcher are at any position between fully open and fully closed when the manual operating handle is placed in the storage position, and the motor-circuit fuseholder is inserted, the switch operator will automatically move to the open position (because the switch operator control circuit is designed to allow an electrical closing only from the fully open position of Circuit-Switcher).

The handle may be padlocked in its storage position.

Step 5

To decouple: The integral external selector handle, for operation of the built-in internal decoupling mechanism, is located on the right-hand side of the switch operator enclosure. See Figure 3. Swing the selector handle upright and *slowly* rotate it clockwise 50 degrees to the decoupled position. See Figure 4. This decouples the switch operator mechanism from the switch operator operating lever. Then lower the selector handle to engage the locking tab. When thus decoupled, the switch operator may be operated either manually or electrically without operating the Circuit-Switcher. When the selector handle is in the decoupled position, the shunt-trip device (when this option is provided) is rendered inoperative.★ Moreover, in the decoupled position, the switch operator's operating lever is prevented from moving by a mechanical locking device located within the switch operator enclosure. During the intermediate segment of the selector handle travel, which includes the position at which actual disengagement (or engagement) of the internal decoupling mechanism occurs, the motor-circuit source leads are momentarily disconnected and both the "opening" and "closing" motor contactors are mechanically blocked in the open position. Visual inspection, through the observation window, will verify whether the internal decoupling mechanism is in the coupled or decoupled position. See Figure 5. The selector handle may be padlocked in either position.

Step 6

To couple: Manually operate the switch operator to bring it to the same position (open or closed) as the Circuit-Switcher. The switch operator position indicator, seen through the observation window, will show when the approximate open or closed position has been attained. See Figure 5. To move the switch operator to the exact position for coupling, turn the manual operating handle slowly until the position-indexing drums are numerically aligned. Then swing the selector handle upright and rotate it counterclockwise to the coupled position. Lower the handle to engage the locking tab. The selector handle is now in the coupled 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.

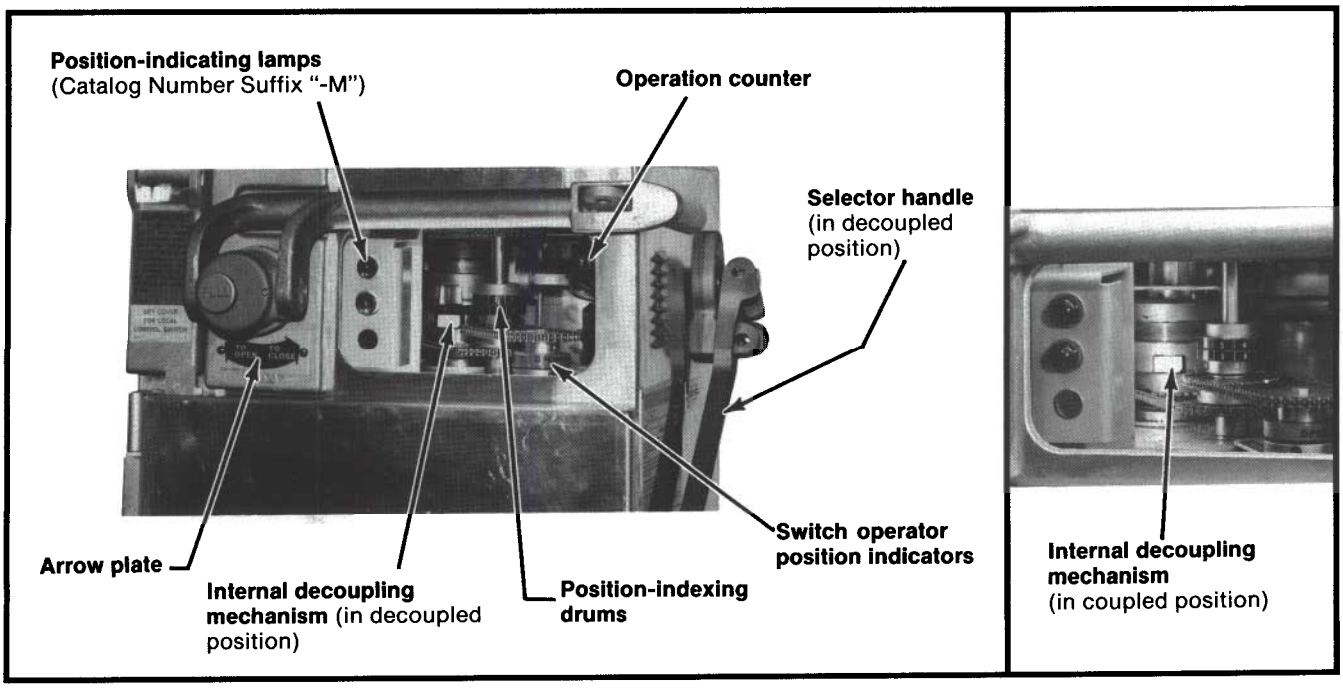


Figure 5. Views of switch operator through observation window.

⚠ CAUTION

To avoid accidental energizing of the operator, remove the two-pole pull-out fuseholders for the motor circuit and space-heater circuit and do not reinsert them until so directed.

Step 7

With the selector handle in the coupled position, manually crank the switch operator to the fully open position. Note that the operating lever travels in the left-hand, as viewed from the front (door side) of the switch operator. Operating lever in the "Down" position corresponds to the open position of the Circuit-Switcher. Conversely, operating lever in the "Up" position corresponds to the closed position of the Circuit-Switcher.

Make certain that the Circuit-Switcher is in the fully open position with the blade crank-arm of each pole-unit resting against the blade-crank stop (located on the top of the brain) and the toggle link against the toggle stop on the pole-unit base. Additionally, the rod-guide lever(s), if rod guides are used, as well as the driving lever of the bell crank (or jack shaft) to the Circuit-Switcher interphase pipe should be 45 degrees below the horizontal. All rod-guide levers, when more than one guide is employed, should be parallel at all times.

Connection of the vertical shaft to the switch operator is made by means of a clevis fitting. See Figure 1. The vertical shaft is to be threaded into the clevis fitting to a thread depth of approximately two inches. Measure and cut the length of vertical shaft required to connect the clevis fitting and the rod-guide coupling (jack-shaft or bell-crank coupling if no rod guide is used). Place a locknut on the threaded end of the vertical shaft. Thread the vertical shaft into the clevis fitting to a thread depth of about two inches. Tighten the locknut securely against the clevis.

Make certain that the cutting tip of the piercing set screw does not protrude through the body of the rod-guide (or bell-crank) coupling clamp. Insert the upper end of the vertical shaft into the coupling. Tighten the clamp bolt securely, but *do not tighten the piercing set screw at this time.*

Step 8

Manually operate the Circuit-Switcher to the fully closed position. Note the position of the rod-guide lever(s), if rod guides are used, and the bell-crank (or jack-shaft) lever. They should now be approximately 45 degrees in an upward position, and a definite resistance should be felt as the switch operator operating lever goes over center, indicating that all slack in the operating linkage has been taken up. All three pole-unit blades should be fully closed with the blade crank-arm, located at the top of each brain, against its closed stop. If these conditions are not met, increase the effective length of the vertical shaft as follows:

(a) Loosen the clamp bolt on the rod-guide coupling (bell crank or jack shaft if no rod guide is used).

(b) Manually operate the switch operator in the opening direction until the operating lever is approximately 10 degrees from the vertical (up) position (approximately one revolution of the manual operating handle). Retighten the coupling clamp bolt.

(c) Manually operate the switch operator to the fully closed position and recheck the Circuit-Switcher to determine if full closure has been attained.

Manually operate the switch operator to the fully open position and check to be sure that all three pole-units are in the fully open position, as indicated by the blade crank-arm at the top of each brain. Each blade crank-arm should be in contact with its respective open stop.

If more travel in the opening direction is required, proceed as follows:

(a) Loosen the clamp bolt on the rod-guide coupling (bell crank or jack shaft if no rod guide is used).

(b) Loosen the two bolts on the adjustable driving arm of the bell crank (or jack shaft). Shorten the adjustable driving arm by one "step" (⅛ inch) and retighten the bolts. (Moving the arm *toward* the bell-crank pivot *increases* the amount of switch opening.) Retighten the coupling clamp bolt.

Manually operate the switch operator to open and close the Circuit-Switcher. In each position, make certain that the blade crank-arm of each pole-unit rests against the blade-crank stop on the brain. Additionally, in the open position, the toggle link on each pole-unit should be against the toggle stop on the pole-unit base. If necessary, readjust for full closure of the Circuit-Switcher or for more or less travel in the opening direction as described above.

After satisfactory manual operation of the Circuit-Switcher has been attained, firmly tighten the clamp bolt on the rod-guide coupling (bell crank or jack shaft if no rod guide is used). Tighten the piercing set screw in the coupling clamp, piercing the vertical shaft, and continue turning until a firm resistance is felt.

Note: Avoid forcing the power train beyond the fully open or fully closed Circuit-Switcher stop positions.

Step 9

The travel-limit switch (coupled to the motor), which governs the extent of output-shaft rotation in the opening and closing directions, includes six contacts that are operated by cam-actuated rollers. The cams are permanently set at the factory to produce an output-shaft rotation of 180 degrees and cannot be field adjusted. See Figure 7. Therefore, no travel-limit adjustments are necessary.

Place the selector handle in the *decoupled* position in preparation for electrical operation. Reinsert the motor-circuit fuseholder.

Open the pushbutton protective cover★ and operate the switch operator by means of the externally mounted "Open-Close" pushbuttons. (Where "Open-Close" pushbuttons have not been provided, the switch operator can be electrically opened or closed by temporarily jumpering terminals 1 and 8 to open, and 1 and 9 to close.▼)

If a dc switch operator fails to operate, check the polarity of the external control-source wiring connections.

★ For switch operators with optional remote-control blocking switch (suffix "-Y"), opening the pushbutton protective cover prevents remote operation of the switch operator.

▼ Terminal designations may differ in special wiring diagrams. In such cases, refer to the specific wiring diagram for the correct terminal designations.

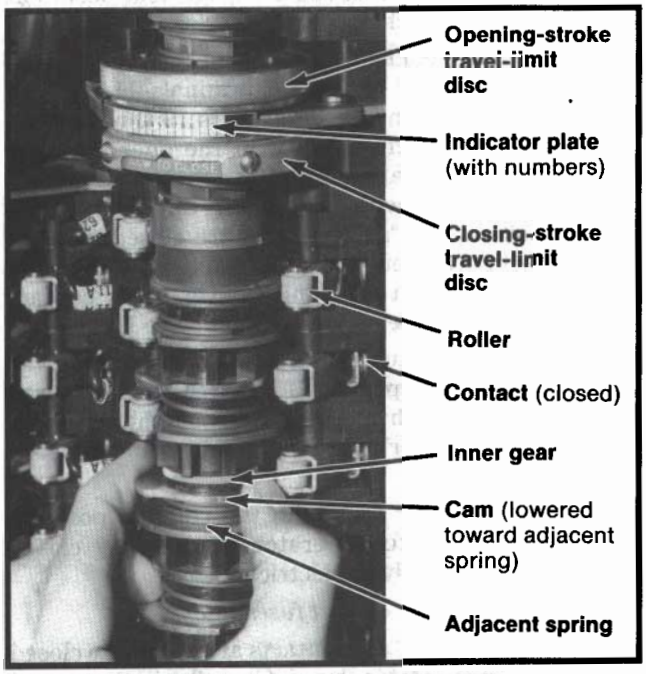


Figure 6. Adjustment of cams on auxiliary switch.

Step 10

Place the selector handle in the *coupled* position and operate the switch operator electrically. In the fully open position and then in the fully closed position, make certain that the blade crank-arm of each pole-unit comes to rest against the blade-crank stop on the brain. Additionally, in the open position, the toggle link on each pole-unit should be against the toggle stop on the pole-unit base.

Step 11

The auxiliary switch, which is permanently coupled to the motor, includes eight contacts (terminals 11 through 26). (If the optional position-indicating lamps are included, six contacts are available: terminals 13—18 and terminals 21—26.) These contacts are provided so that external circuits can be established to monitor switching operations. Each contact is operated by a cam-actuated roller. The cams are individually adjustable in 4.5-degree increments and can be positioned so that roller engagement occurs at the desired point in the operating cycle.

The "standard" configuration for the auxiliary switch consists of four "a1" contacts (terminals 11 through 18) and four "b1" contacts (terminals 19 through 26). Thus, with the switch operator in the open position, the "a1" contacts are open and the "b1" contacts are closed. Conversely, with the switch operator in the closed position, the "a1" contacts are closed and the "b1" contacts are open. 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. See Figure 7.

Any auxiliary-switch contact being used must be checked for proper operation for both open and closed positions of the switch operator. To adjust the auxiliary-switch contacts, refer to Figures 6 and 7 and proceed as follows:

(a) With the selector handle in the coupled position, operate the switch operator to the fully closed position (manually or electrically).

(b) *Remove the motor-circuit fuseholder.*

(c) Determine which "a1" contacts are not in the closed position. 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.

(d) For the "a1" contacts that are not in the closed position, raise (or lower) the corresponding cam toward its adjacent spring until the cam is separated from the teeth of the inner gear. Rotate the cam until it is in a position so that when lowered

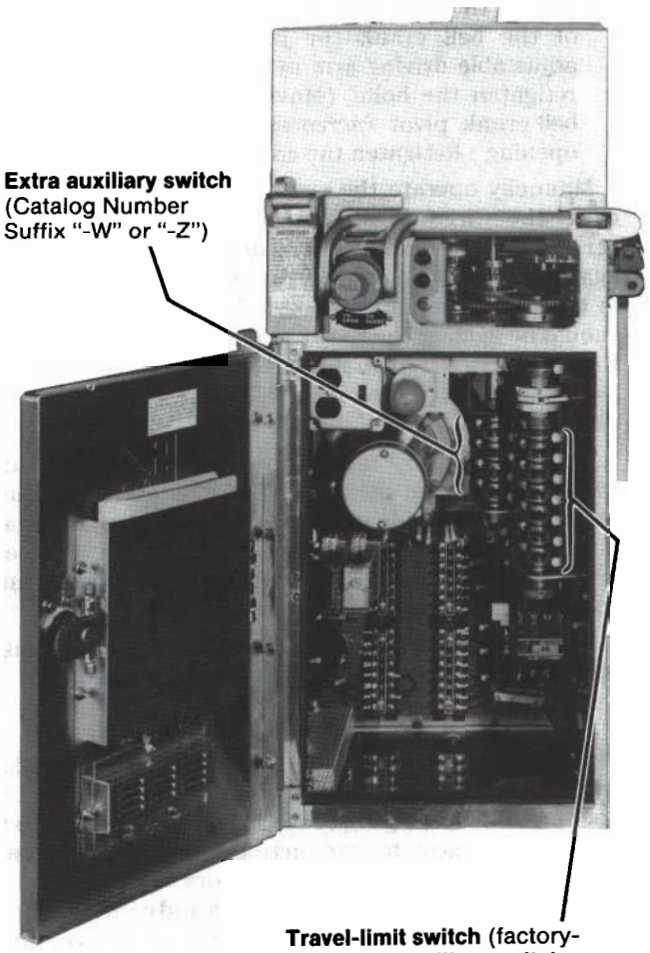
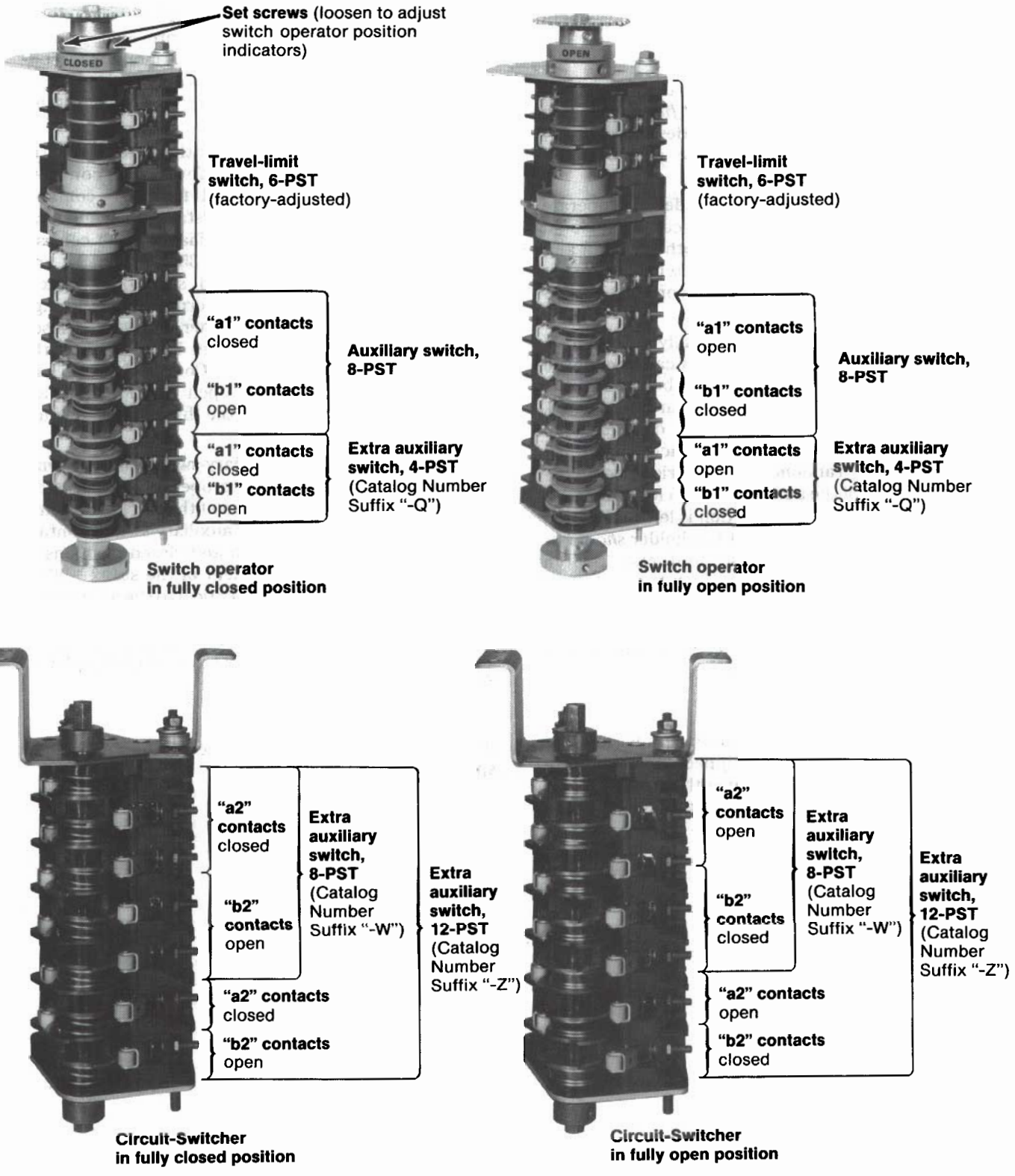


Figure 7. "Standard" contact configurations.


Set screws (loosen to adjust switch operator position indicators)
CLOSED
Travel-limit switch, 6-PST (factory-adjusted)
"a1" contacts closed
"b1" contacts open
Auxiliary switch, 8-PST
"a1" contacts closed
"b1" contacts open
Extra auxiliary switch, 4-PST (Catalog Number Suffix "-Q")
Switch operator in fully closed position
OPEN
Travel-limit switch, 6-PST (factory-adjusted)
"a1" contacts open
"b1" contacts closed
Auxiliary switch, 8-PST
"a1" contacts open
"b1" contacts closed
Extra auxiliary switch, 4-PST (Catalog Number Suffix "-Q")
Switch operator in fully open position
"a2" contacts closed
"b2" contacts open
Extra auxiliary switch, 8-PST (Catalog Number Suffix "-W")
"a2" contacts closed
"b2" contacts open
Extra auxiliary switch, 12-PST (Catalog Number Suffix "-Z")
Circuit-Switcher in fully closed position
"a2" contacts open
"b2" contacts closed
Extra auxiliary switch, 8-PST (Catalog Number Suffix "-W")
"a2" contacts open
"b2" contacts closed
Extra auxiliary switch, 12-PST (Catalog Number Suffix "-Z")
Circuit-Switcher in fully open position

(or raised) it will be disengaged from the roller. Lower (or raise) the cam making sure that the teeth are in mesh with the inner gear and that the cam is disengaged from the roller.

(e) Reinsert the motor-circuit fuseholder.

(f) Operate the switch operator to the fully open position. *Remove the motor-circuit fuseholder* and, if necessary, adjust the cams as described in (d) above until all "b1" contacts are in the closed position.

(g) Reinsert the motor-circuit fuseholder and operate the Circuit-Switcher. Both sets of contacts should now be correctly positioned for both the open and closed positions of the Circuit-Switcher. Sufficient adjustment is available to provide correct positioning of both sets of contacts.

Since each cam can be individually adjusted in 4.5-degree increments, any "a1" contact can be changed to a "b1" contact, or vice versa. Also, because of the many positions to which the cams can be adjusted, the various rollers can be engaged or disengaged to respectively open or close their contacts simultaneously, sequentially, randomly, or in various combinations. Adjustment of the auxiliary switch for other than the "standard" contact configuration is left to the user. Remember that the motor-circuit fuseholder *should be removed* when adjusting these contacts. (Switch operators having catalog numbers with the suffix "-Q" are equipped with an extra auxiliary switch, terminals 27 through 34, having four contacts—two "a1" and two "b1"—which may be adjusted as described in (a) through (g) above. See Figure 7.)

Step 12

Switch operators having catalog numbers with either the suffix "-W" or "-Z" are equipped with an extra auxiliary switch which is permanently coupled to the Circuit-Switcher. The suffix "-W" auxiliary switch consists of eight contacts (terminals 35 through 50). The suffix "-Z" auxiliary switch consists of twelve contacts (terminals 35 through 50 plus terminals 80 through 87). These contacts are provided so that external circuits can be established to monitor Circuit-Switcher operation. Each contact is operated by a cam-actuated roller and the cams are individually adjustable in 4.5-degree increments.

The "standard" configuration for the suffix "-W" extra auxiliary switch consists of four "a2" contacts (terminals 35 through 42) and four "b2" contacts (terminals 43 through 50). The "standard" configuration for the suffix "-Z" extra auxiliary switch consists of six "a2" contacts (terminals 35 through 42 and terminals 80 through 83) and six "b2" contacts (terminals 43 through 50 and terminals 84 through 87). Thus, with the Circuit-Switcher in the fully closed position, the "a2" contacts should be closed and the "b2" contacts should be open. Conversely, with the Circuit-Switcher in the fully open position, the "a2" contacts should be open and the "b2" contacts should be closed. See Figure 7.

Any suffix "-W" or "-Z" auxiliary-switch contact being used must be checked for proper operation after satisfactory electrical operation of the Circuit-Switcher has been achieved. Check the auxiliary-switch contact engagement for both the open and closed positions of the Circuit-Switcher. Adjustment of the suffix "-W" or "-Z" extra auxiliary switch is identical to the adjustment performed for the auxiliary switch and the suffix "-Q" extra auxiliary switch. Therefore, if adjustment of the suffix "-W" or "-Z" auxiliary switch is needed, refer to Step 11 and Figures 6 and 7.

Step 13

Reinsert the fuseholders for the motor circuit and space-heater circuit.

To optimize performance of the Type G or Type A Circuit-Switcher and associated Type CS-10 Switch Operator, they should be exercised and inspected annually. Refer to S&C Instruction Sheet 711-590 for *recommended inspection procedures.*★ (Note: The recommended inspection *schedule* for Circuit-Switcher components contained in Instruction Sheet 711-590 is intended for Mark II, III, IV, and V models and *does not* apply to Type G and Type A models because these devices have significantly different and less robust construction features than subsequent models. The *recommended inspection procedures* for Circuit-Switcher components contained therein are, however, generally applicable to Type G and Type A models.)

Since the Type CS-10 Switch Operator may be conveniently decoupled from the Circuit-Switcher, elective exercising of the operator may be performed 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, thus permitting checkout of the system protective scheme.

The brake in the Type CS-10 Switch Operator should be inspected every 2500 operations or 5 years, whichever occurs more often. The inspection procedure is as follows. See Figure 8.

1. Place the selector handle in the decoupled position.
2. Remove the two-pole pull-out fuseholders for the motor circuit and space-heater circuit.
3. Disconnect the linkage rod by removing the ¼″—20 × 1¼″ hex-head screw, lockwasher, flat washer, and spacer-bushing from the end of the brake lever, as shown in Detail A. Be careful not to lose these parts. Then raise the brake lever and measure the vertical free play, as shown in Detail B. This dimension should be ⅝″ to ¾″. Should the measurement be outside this range, brake-wear compensation is required; proceed to Step 4. If the measurement is within this range, reattach the linkage rod and tighten the ¼″—20 × 1¼″ hex-head screw securely; proceed to Step 9.
4. Remove the four 5/16″—18 × 1¼″ screws used to attach the motor, withdraw the motor, and carefully rest its shaft on the floor of the enclosure. Be careful not to lose the square key or tubular spacer (if furnished), which may remain on the motor shaft. Note: 115-volt ac and 230-volt ac motors utilize a ¼″—20 socket-head set screw on the side of the brake disc hub, as shown in Detail C. Loosen this set screw approximately one-half turn, using a ⅛″ Allen wrench, before removing the motor.
5. Using a 3/32″ Allen wrench, loosen the pad assembly socket-head set screw on the side of the caliper assembly approximately one-half turn. See Detail A.
6. Then, using a 5/16″ Allen wrench, rotate the pad assembly clockwise until the free play at the end of the brake lever is ⅝″ to ¾″, as shown in Detail B. Now tighten the 3/32″ pad assembly socket-head set screw.
7. Insert the spacer-bushing through the angle bracket and brake lever, and reattach the linkage rod using the ¼″—20 × 1¼″ hex-head screw, lockwasher, and flat washer. Tighten the screw securely.
8. Insert the square key in the keyway, as shown in Detail A. Slip the tubular spacer (if furnished) over the motor shaft and reinstall the motor. Position the motor such that the two weep holes on the side of the housing face downward. Replace the four 5/16″—18 × 1¼″ screws used to attach the motor and tighten them securely. On 115-volt ac and 230-volt ac motors, further, retighten the ¼″—20 socket-head set screw on the side of the brake disc hub.
9. Check the operation of the brake linkage as follows: Pull the latch knob on the hub of the manual operating handle and *slowly* pivot the handle forward from its storage position toward its cranking position until the brake disc can be rotated by hand. *Be careful not to get grease on the brake disc.* Now measure the distance that the end of the brake lever travels from the point of initial brake release to the bottom of its stroke (which occurs when the handle locks into the cranking position). This dimension should be ⅛″ to ¼″. See Detail D. Should the measurement be outside this range, refer to the nearest S&C Sales Office.
10. Finally, to check the functioning of the brake, decouple the operator and then open and close the operator electrically. After each operation, check the position of the indicator on the appropriate travel-limit disc: it should stop between indicator-plate numbers 2 and 8. See Figure 6. Should the indicator on the travel-limit disc stop outside this range, refer to the nearest S&C Sales Office.

★ Superseded-design switch operators, Catalog Numbers 38864 through 38864R3, 38865 through 38865R3, 38866 through 38866R3, and 38867 through 38867R3, equipped with optional shunt-trip solenoid switch and redundant relay (Catalog Number Suffix "-HP"), should also have these components exercised annually. See page 15.

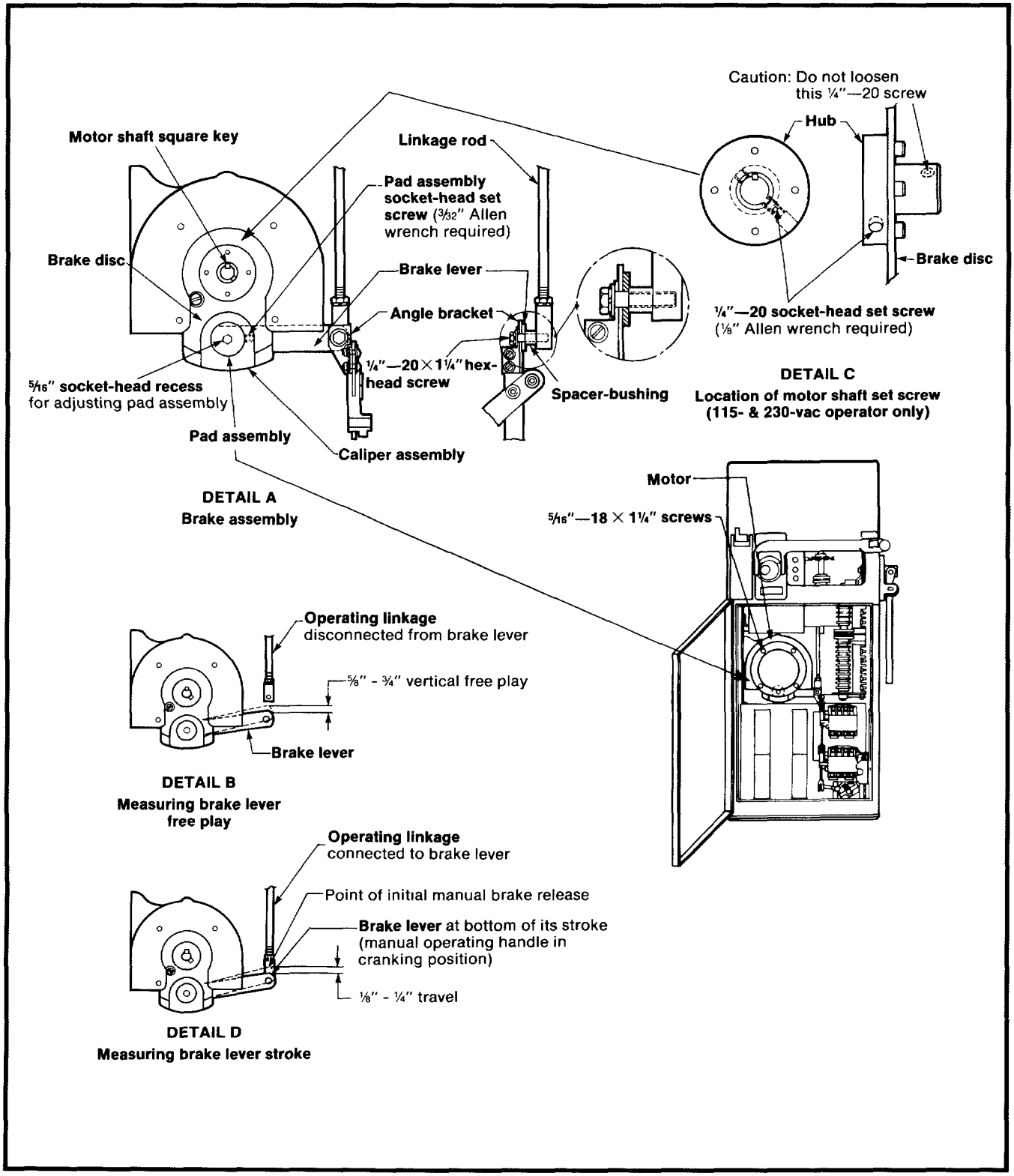


Figure 8. Brake inspection procedure.

Recommended Exercising Procedure for Superseded-Design Switch Operators, Catalog Numbers 38864 through 38864R3, 38865 through 38865R3, 38866 through 38866R3, and 38867 through 38867R3, Equipped with Optional Shunt-Trip Solenoid Switch and Redundant Relay (Catalog Number Suffix "-HP")

In these superseded-design switch operators, a shunt-trip solenoid switch (94) and redundant relay (62) are utilized to minimize control-current inrush by energizing the shunt-trip device and switch operator motor in sequence; the redundant relay provides a backup function, ensuring Circuit-Switcher actuation independent of shunt-trip operation. To verify their proper functioning, it is recommended that the shunt-trip solenoid switch and redundant relay each be exercised separately (preferably through the protective-relay circuit, to check out the external control wiring as well) while the other component is temporarily disabled.

The following annual exercising procedure is recommended. (Note that the wire and terminal designations referenced apply to the standard wiring diagrams for these superseded models—CDR-3116R3-1 and CDR-3116R3-2—and may differ on special wiring diagrams.)

To exercise the shunt-trip solenoid (94) switch:

1. Open the control-source disconnect switch; then place the switch operator selector handle in the *decoupled* position. (When the switch operator is thus decoupled, the shunt-trip solenoids at the Circuit-Switcher pole-units are rendered inoperative.)
2. Disable the opening contactor (OC) by removing wires numbered 8C and 8D from the opening-contactor (OC) coil terminal C7. This will allow the opening operation of the switch operator to be totally controlled by the contacts of the solenoid (94) switch.
3. Close the control-source disconnect switch and energize the solenoid (94) switch (to move the switch operator to the open position) by a simulated shunt-trip operation. Return the switch operator to the closed position by means of the pushbutton control. Repeat four times for exercising purposes.
4. Open the control-source disconnect switch and reconnect wires numbered 8C and 8D to the opening-contactor (OC) coil terminal C7.

To exercise the redundant (62) relay:

1. Make sure that the control-source disconnect switch is opened and the switch operator selector handle is in the *decoupled* position.
2. Disable the solenoid (94) switch by removing wire number 2I from terminal L1 on the redundant (62) relay. This will allow an opening operation of the switch operator to be initiated by the contacts of the redundant (62) relay.
3. Close the control-source disconnect switch and energize the redundant (62) relay (to move the switch operator to the open position) by a simulated shunt-trip operation. Energization should be for a duration of more than ¼ second to allow time for closing of the (62) relay contact. Return the switch operator to the closed position by means of the pushbutton control. Repeat four times for exercising purposes.
4. Open the control-source disconnect switch and reconnect wire number 2I to the redundant (62) relay terminal L1.
5. To return the switch operator to service, bring the switch operator to the same position as the Circuit-Switcher; place the selector handle in the coupled position; and close the control-source disconnect switch.

CHECKING SWITCH OPERATOR AND CIRCUIT-SWITCHER POSITIONS

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 switch operator position indicator, Figure 5, signals "Open" or "Closed" to indicate that the switch operator has moved through a complete operation. Also note the position-indicating lamps, Figure 5, if furnished.
- The operating lever, at the rear of the switch operator, Figure 1, is in the "Up" position for a Circuit-Switcher "Closed" position. Conversely, the operating lever is in the "Down" position for a Circuit-Switcher "Open" position.
- The Circuit-Switcher disconnect blade on each pole-unit is 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 interrupter is open. The target appears gray (normal) when the interrupter is 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 *never* appear yellow when the Circuit-Switcher is in the fully open or fully closed position.

To restore to normal operation

So that the switch operator is ready for normal power 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 manual operating handle is in its storage position.
- The two-pole pull-out fuseholders for the motor circuit and space-heater circuit are inserted.
- The pushbutton protective cover is closed.
- The switch operator is tagged and padlocked in accordance with standard system operating procedures.