

INSTRUCTIONS

For Replacement of Live Parts

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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.

General

The following instructions are for replacement and adjustment of live parts for S&C Alduti-Rupter Switches—Outdoor Distribution, Three-Pole Vertical-Break Style, in ratings of 7.2 kv through 34.5 kv; and Three-Pole Vertical-Break Integer Style, in ratings of 25/34.5 kv and 34.5 kv.

Because the construction of switches rated 7.2 kv through 25 kv is quite unlike that of switches rated 25/34.5 kv and 34.5 kv, instructions for replacement of their respective live parts are treated separately, under the appropriate section headings that follow.

These instructions apply only to live part replacement. For adjustments to the switch itself and to its operating mechanism, refer to the instruction sheet and the erection drawing that were furnished with the switch. Additional copies of the instruction sheet and erection drawing, for the applicable switch style, rating, and mounting configuration, may be obtained from the nearest S&C Sales Office.

NOTE: If *only* the blade assembly or *only* the jaw-contact assembly is to be replaced (i.e., not the complete set of live parts), disregard any of the following instructions that obviously do not apply. However, it is generally expected that if either the blade assembly or jaw-contact assembly requires replacement, both assemblies should be changed out.

Indicated herein are the critical dimensional relationships which must be maintained to ensure proper sequencing of the interrupter with respect to its associated blade. Such relationships include those between the blade shunt contact and the interrupter housing, between the blade closing cam and interrupter closing lever, and between the blade opening cam and interrupter opening lever; the importance of these relationships to proper switch performance is as follows.

Blade Shunt-Contact and Interrupter-Housing Clearance

When the switch is in the fully closed position, there must be adequate clearance between the blade shunt contact and the interrupter housing to prevent load current from being carried continuously by the interrupter.

During switch opening, the blade shunt contact must engage the interrupter housing (or the contact rivets in the case of Cyproxylated™▲ interrupters—used with switches rated 25/34.5 kv and 34.5 kv) before the blade disengages from the jaw contact, to ensure proper current transfer.

▲ *Cyproxylated* is the S&C trademark for devices employing the S&C Cypoxy® cycloaliphatic epoxy resin system for multipurpose use as an assembly, encapsulation, and insulation medium.

INTRODUCTION — Continued

**Blade Closing-Cam and
Interrupter Closing-Lever Clearance**

When the switch is in the fully closed position, the clearance between the blade closing cam and the interrupter closing lever must be sufficiently close to prevent any tendency of the interrupter to inadvertently open. There must, however, be physical clearance between the blade closing cam and the interrupter closing lever when the switch is in the fully closed position to prevent load current from being carried continuously by the interrupter.

**Blade Opening-Cam and Interrupter
Opening-Lever Clearance**

During switch opening, as the blade opening cam passes the opening lever on the (already opened) interrupter, the cam-to-lever clearance must be sufficiently close to prevent any tendency of the interrupters to inadvertently close.

During switch closing, there must be sufficient clearance between the blade opening cam and the interrupter opening lever to prevent mechanical interference.

If any of the specified dimensional relationships cannot be attained, contact the nearest S&C Sales Office.



BEFORE STARTING

The following procedures♦ should be observed before attempting any work on S&C Alduti-Rupter Switches:

1. At all times adhere to the prescribed safety rules which are applicable to such devices as circuit breakers, fuses, interrupter switches, power switching equipment, and their mechanisms.
2. Make certain that any such device is disconnected from all power sources and all control sources before being inspected or serviced.
3. Always assume both sets of power terminals on any device to be energized unless proved otherwise by visual evidence of open-circuit conditions on both terminal ends or by test using appropriate high-voltage test equipment.
4. Test for voltage. Qualified persons should be certain that they have, and know how to operate, the correct test equipment for determining the voltage on both sets of power terminals in any circuit breaker, power fuse, or interrupter-switch equipment.
5. After the switch has been completely disconnected from all sources of power, properly connect grounding leads to both sides of the equipment—that is, to the source- and load-side power terminals or contacts of each phase of the equipment to be maintained.

♦ These procedures may differ from the standard operating and safety procedures of certain electric utility companies. Where a discrepancy exists, the operating procedures of the electric utility apply.



LIVE PARTS REPLACEMENT FOR SWITCHES RATED 7.2 KV THROUGH 25 KV

Step 1

Place the switch in the open position and, for each switch pole applicable, remove the existing live parts as follows. See Figure 1.

Step 2

Disconnect the switch pole from the operating mechanism by removing the attachment pin from the switch-pole operating lever. Retain the 3/8-inch spacer, if used. (If two interphase couplings are attached to the operating lever no spacer is included.)

Step 3

Disconnect the blade assembly from the toggle-link assembly by removing the link pin, which is held in place by retaining clips. Then detach the blade assembly from the hinge casting by removing the 1/2"-20 self-locking nut and loading springs, and withdrawing the 1/2"-20 x 4 7/16" hex-head stainless-steel bolt. Discard this mounting hardware.

Detach the jaw-contact-and-interrupter assembly by removing the two 1/2"-13 x 1 1/4" hex-head galvanized steel bolts, lockwashers, and flat washers that fasten it to its insulator. Discard this mounting hardware.

Then—if the interrupter is to be reused—detach it from the jaw contact by removing the 1/2"-13 x 7/8" hex-head stainless-steel screw and internal-tooth lockwasher. Discard this mounting hardware.

Step 4

If necessary, use steel wool to clean the hinge- and jaw-contact surfaces. Then wipe with a dry cloth and apply a thin coat of the contact lubricant furnished.

Step 5

Attach the replacement jaw-contact casting to its insulator, using the new 1/2"-13 x 1 1/4" hex-head galvanized steel bolts, lockwashers, and flat washers furnished—but leave the bolts loose enough to allow later adjustment. Then attach the interrupter to the jaw-contact casting, using the new 1/2"-13 x 7/8" hex-head stainless-steel screw and internal-tooth lockwasher furnished.

Step 6

Attach the replacement blade assembly to the hinge casting, using the new loading springs, 1/2"-20 x 4 7/16" hex-head stainless-steel bolt, and self-locking nut furnished. For 600-ampere switches, tighten the nut to the limit of the bolt thread. For 1200-ampere switches, tighten the nut to compress the springs only to the extent necessary so that the blade assembly, when placed at 45 degrees from the horizontal, remains stationary. Blade-hinge contact should be positive and the blade should move freely without binding.

Do not connect the blade to the toggle-link assembly at this time.

Step 7

Close and open the blade assembly several times and check the critical dimensional relationships which must be attained to ensure proper sequencing of the blade assembly with respect to its associated interrupter. Refer to Figure 2. The following conditions must be met.

- The interrupter must lie in a plane parallel to the sweep of the blades, and the blades must pass over the interrupter with approximately equal clearance on both sides.
- As the blade moves in the *closing* direction, clearance between the blade opening cam and the interrupter opening lever must be within the limit shown. (For switches rated 600 amperes, see Step 8.)
- The blade-contact spacer must enter the slot in the jaw-contact casting and be centered in the slot when the blade is fully closed, and the blade must engage the jaw contact on-center.
- Also, in the fully closed position, clearance between the blade closing cam and the interrupter closing lever must be within the limit shown.

If adjustment is required, loosen the bolts that fasten the jaw-contact casting to its insulator and slightly rotate the entire contact-and-interrupter assembly to achieve the necessary clearances. Then securely tighten the bolts.



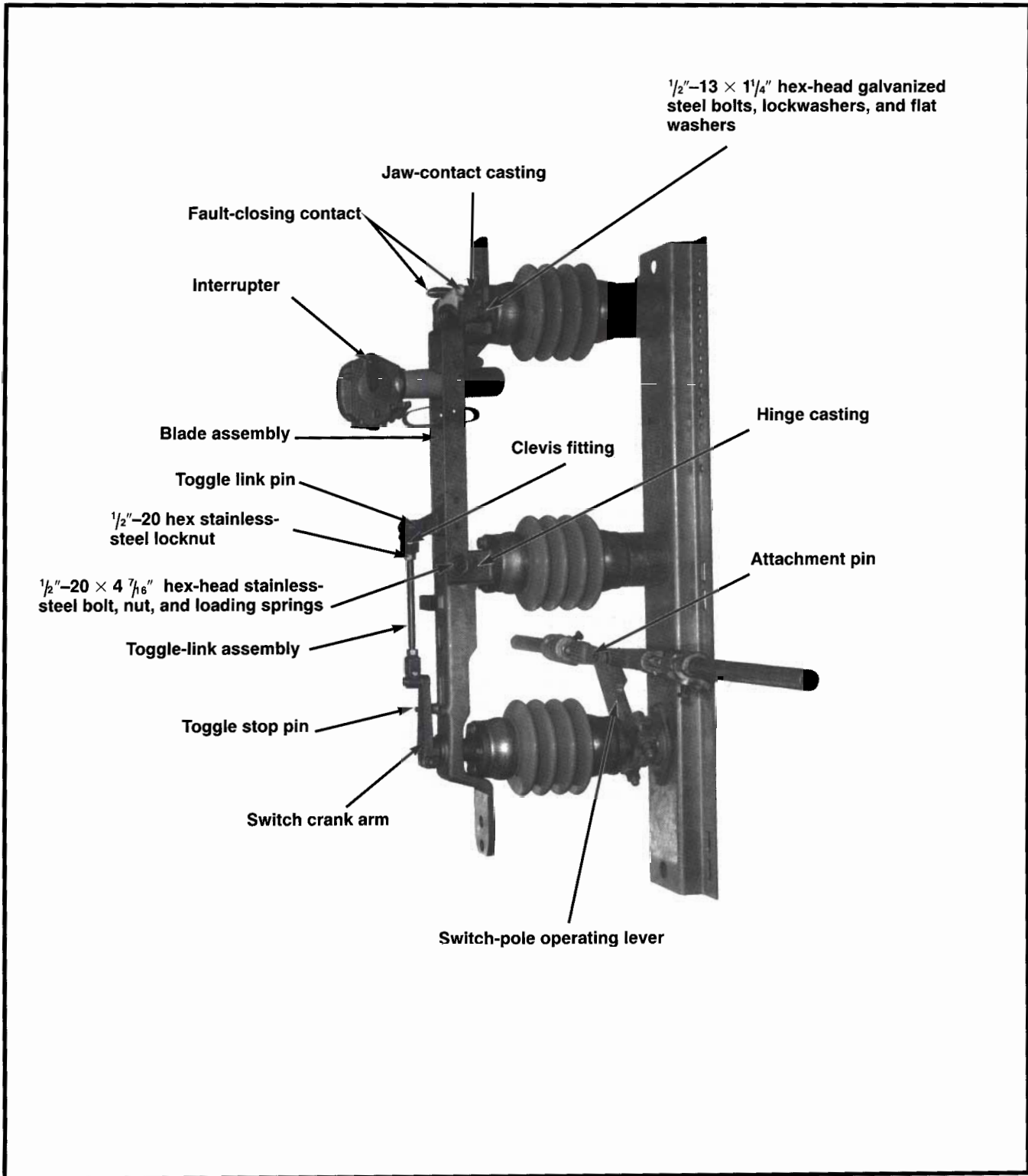


Figure 1. One switch pole of Three-Pole Vertical-Break Style Alduti-Rupter Switch. Typical for switches rated 7.2 kv through 25 kv, 600 amperes and 1200 amperes (600-ampere rating shown).



LIVE PARTS REPLACEMENT FOR SWITCHES RATED 7.2 KV THROUGH 25 KV — Continued

Step 8

This step applies only to 600-ampere switches, for which the blade opening cams must be attached and positioned to conform to the limit shown in Figure 2.

Place both the blade assembly and the interrupter in their open positions—the interrupter operating levers may be actuated by hand.

Position the opening cam (shipped unattached) against the inside of the blade such that, when two of the four holes in the cam are aligned with two of the eight holes in the blade, the clearance between the cam and the interrupter opening lever at their closest point is as shown in Figure 2. Then fasten the cam to the blade with the #10-32 × 5/8" binding-head stainless-steel screws, nuts, and lock-washers furnished. Tighten securely.

Step 9

With the blade assembly in the fully closed position, verify the minimum clearance between the blade shunt contact and the interrupter housing, as shown in Figure 2. Then move the blade assembly in the opening direction and verify that the blade shunt contact firmly engages the interrupter housing before the blade disengages from the jaw contact. (The shunt contact may be bent as required to conform to these conditions.)

Step 10

With the blade assembly in the fully closed position, use the .0015-inch feeler gauge (the 1/2" × 2" section of steel stock furnished) to check blade-contact engagement at both the hinge and jaw ends of each of the two blade members. *For switches rated 600 amperes*, the gauge *must not* pass between the blade-contact surface and the hinge- and jaw-contact surfaces. *For switches rated 1200 amperes*, the gauge *must not* pass between the blade-contact surface and at least three of the four blade-contact buttons at the hinge and jaw (i.e., there must be a minimum of six buttons in contact at the hinge end and a minimum of six buttons in contact at the jaw end).

If necessary, bias the blade member in the appropriate direction to satisfy this requirement.

Step 11

Perform several opening and closing operations. Then verify that the critical dimensions have been retained.

Step 12

When satisfactory operation has been attained, place the blade assembly in the closed position and (with the

switch crank arm *away* from the toggle stop pin) connect the blade assembly to the toggle-link assembly, using the new link pin furnished. Before securing the link pin with the second retaining clip, check for positive toggle. This condition is attained when, with the blade assembly in the fully closed position, a moderate pressure against the switch crank arm causes the arm to snap against the toggle stop pin. Adjust the toggle link—by removing the link pin and turning the clevis fitting in half-turn increments♦—to a length sufficient to achieve a positive-toggle condition, i.e., no play in the toggle linkage but not excessive toggle pressure.

When satisfactory toggle has been achieved, secure the link pin with the retaining clip furnished. Then tighten the 1/2"-20 hex locknut against the clevis fitting.

Step 13

Place the blade assembly in the open position and reconnect the switch-pole operating lever to the interphase operating mechanism, using the attachment pin and, if applicable, the 3/8-inch spacer which were removed in Step 2. Secure with the cotter pin furnished.

Step 14

When replacement of the live parts has been completed for all applicable switch poles, use the switch operating handle to slowly close and open the switch a number of times and check for full closure of all three poles.

For switches having rotating operating mechanisms, also verify that all play in the operating-pipe linkage has been taken up *before* the handle can be lowered into the closed-position stop-plate and, further, that substantial pressure is required to force the handle into the closed-position slot; attainment of this "windup" tension in the operating linkage is essential to ensure positive switch closure. *For switches having reciprocating operating mechanisms*, also verify that when the handle is moved to its fully closed position, a definite resistance is felt at the end of the stroke; this indicates that all slack in the operating linkage has been taken up—which is essential to ensure positive switch closure. If adjustment of the operating mechanism is required, refer to the section headed "CHECKING OPERATION" in the instruction sheet furnished with the switch.

♦ For 1200-ampere switches, it is not necessary to remove the link pin. Merely loosen the 1/2"-20 hex locknut at the *crank-arm end* of the toggle link, the link may then be freely turned as required. Retighten the locknut



LIVE PARTS REPLACEMENT FOR SWITCHES RATED 7.2 KV THROUGH 25 KV — Continued

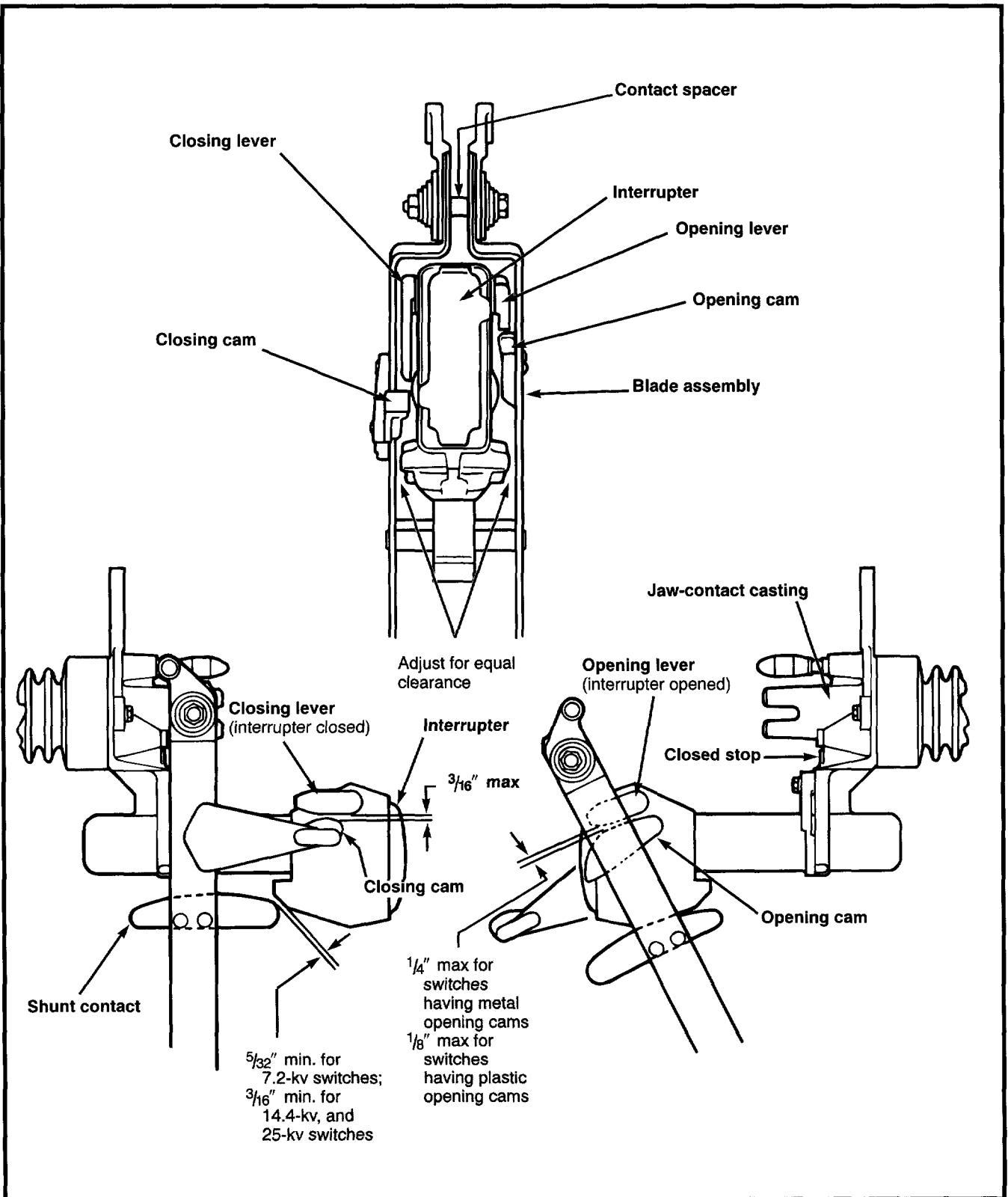


Figure 2. Operation checkpoints for interrupter-to-blade alignment on Three-Pole Vertical-Break Style Alduti-Rupter Switches rated 7.2 kv through 25 kv, 600 amperes and 1200 amperes.

INSTRUCTION SHEET **761-606**



LIVE PARTS REPLACEMENT FOR SWITCHES RATED 25/34.5 KV AND 34.5 KV

Step 1

Place the switch in the open position and, for each switch pole applicable, remove the existing live parts as follows. See Figure 3.

Step 2

Remove the insulated blade-operating rod by first unpinning it from the drive lever at the interphase shaft. Then loosen the $\frac{5}{8}$ "-18 hex jam nut at the blade-linkage tie bar (the nut which is secured by a lockwasher) and unscrew the insulated rod from the tie bar. Discard the jam nut and lockwasher. Do not attempt to remove the threaded stud from the operating rod.

Step 3

Detach the blade linkage members from the hinge adapter by removing the two $\frac{3}{8}$ "-16 \times $1\frac{1}{4}$ " hex-head stainless-steel bolts, nuts, and lockwashers, and the Teflon flat washers. Discard this mounting hardware.

Step 4

Detach the complete blade, hinge, and terminal-pad assembly by removing the two $\frac{1}{2}$ "-13 \times $1\frac{1}{2}$ " hex-head galvanized steel bolts, nuts, lockwashers, and flat washers that fasten it to the hinge adapter. Discard this mounting hardware.

Step 5

Detach the jaw-contact assembly by loosening the two $\frac{1}{2}$ "-13 \times 2" hex-head galvanized steel bolts from the $\frac{1}{2}$ -inch-thick nut plate that fastens it to the jaw-contact adapter. (The bolts, and their associated lockwashers and flat washers, will be held captive by the bumper pad but need not be saved—substitutes are included with the replacement jaw-contact assembly. The nut plate must be retained, however.)

Step 6

Then—if the interrupter is to be reused—detach it from the jaw-contact assembly by removing the two $\frac{3}{8}$ "-16 stainless-steel nuts and lockwashers and the $1\frac{1}{4}$ " \times 2" \times $\frac{1}{16}$ " tinned plate. See Figure 5. The tinned plate serves as an interface between the aluminum mounting surface of the interrupter and the copper mounting surface of the jaw contact, to inhibit galvanic corrosion. Discard the nuts *but retain the tinned plate*.

If the Alduti-Rupter Switch catalog number includes an "R" supplement number (e.g., 135614R1), omit Step 7.

Step 7

If the Alduti-Rupter Switch catalog number *does not* include an "R" supplement number (e.g., 135614), it is

mandatory that both the blade assembly and the jaw-contact assembly—as well as the jaw-contact adapter—be replaced simultaneously. See Figure 4 and proceed as follows.

- (a) Detach the jaw-contact adapter by removing the $\frac{1}{2}$ "-13 \times 1" galvanized screws, lockwashers, and flat washers which fasten the adapter to its associated insulator. Discard this mounting hardware.
- (b) Using the new $\frac{1}{2}$ "-13 \times 1" galvanized screws, lockwashers, and flat washers furnished, attach the replacement jaw-contact adapter. Select the set of mounting holes that provide 24 $\frac{1}{2}$ -inch distance between the centerlines of the mounting-hole pairs for the hinge and the jaw contact. Make sure that the jaw-contact adapter is aligned on-center with the hinge adapter. Then securely tighten the $\frac{1}{2}$ "-13 \times 1" screws.

Step 8

If necessary, use steel wool to clean the hinge- and jaw-contact surfaces. Then wipe with a dry cloth and apply a thin coat of the contact lubricant furnished.

Step 9

Locate the closing cam on the *blade assembly being replaced*. See Figure 5. If it is a present-design closing cam as shown in Figure 6, proceed to Step 10. If it is a previous-design closing cam, it must be transferred to the replacement blade assembly. To do so, remove and discard the four #10-32 hex stainless-steel self-locking nuts that fasten the closing-cam support arm to the *blade assembly being replaced*. Also remove and discard the nuts that fasten the closing-cam support arm to the *replacement blade assembly*. Attach the *previous-design* closing cam support arm to the *replacement* blade assembly using the four #10-32 hex stainless-steel self-locking nuts furnished.

NOTE: If the closing cam from the blade assembly being replaced is in such condition that the clearances in Figure 5 cannot be attained, the closing cam provided on the replacement blade can be used but only if the interrupter is replaced as well.

Step 10

Attach the replacement blade, hinge, and terminal-pad assembly to the hinge adapter, using the new $\frac{1}{2}$ "-13 \times $1\frac{1}{2}$ " hex-head galvanized steel bolts, nuts, lockwashers, and flat washers furnished. The bolts should be approximately centered in the mounting slots. Also attach the blade linkage members to the hinge adapter, using the new $\frac{3}{8}$ "-16 \times $1\frac{1}{4}$ " hex-head stainless-steel bolts, nuts, and lockwashers, and Teflon flat washers furnished. Refer to Figure 3. Do not attach the insulated blade-operating rod until so directed in Step 15.

LIVE PARTS REPLACEMENT FOR SWITCHES RATED 25/34.5 KV AND 34.5 KV — Continued

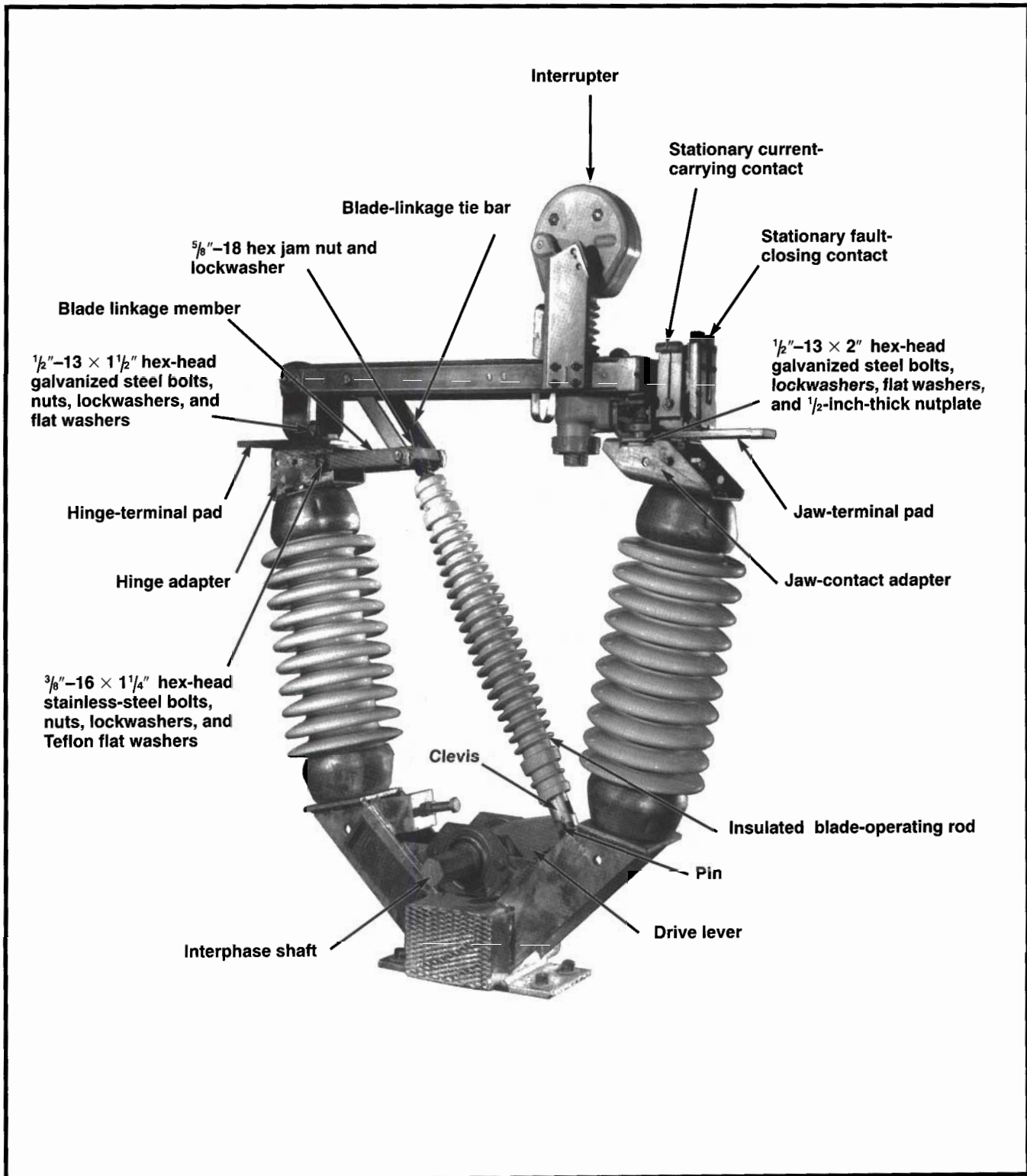


Figure 3. One switch pole of Three-Pole Vertical-Break Style Alduti-Rupter Switch. Typical for switches rated 25/34.5 kv and 34.5 kv, 600 amperes and 1200 amperes (600-ampere rating shown).

INSTRUCTION SHEET **761-606**



LIVE PARTS REPLACEMENT FOR SWITCHES RATED 25/34.5 KV AND 34.5 KV — Continued

Step 11

Attach the replacement jaw-contact assembly to the jaw-contact adapter, using the 1/2-inch-thick nut plate previously removed. Leave the bolts loose enough to permit adjustment.

Step 12

Place the blade assembly in the open position and attach the interrupter to the jaw-contact assembly, using the new 3/8"-16 stainless-steel nuts and lockwashers furnished. Be sure that the 1 1/4" x 2" x 1/16" tinned interface plate is placed between the interrupter and copper jaw-contact-assembly mounting surfaces. Also make sure that the interrupter is in the open position to correspond with the position of the blade assembly—the interrupter operating levers may be actuated by hand.

Step 13

Loosen, sufficiently to permit adjustment, the two 1/2"-13 x 2" hex-head galvanized steel bolts that fasten the jaw-contact assembly to the jaw-contact adapter. Then close and open the blade assembly several times and check the critical dimensional relationships which must be attained to ensure proper sequencing of the blade assembly with respect to its associated interrupter. Refer to Figure 5 and adjust the complete assembly to attain the following conditions.

- The interrupter must lie in a plane parallel to the sweep of the blades, and the blades must pass over the interrupter with approximately equal clearance on both sides. It may be necessary to loosen the 3/8"-16 stainless-steel nuts that fasten the interrupter to the jaw-contact assembly and shift the interrupter, within the limits of its mounting holes, to achieve this clearance. It also may be necessary to loosen the 1/2"-13 x 1 1/2" hex-head galvanized steel bolts that fasten the hinge to the hinge adapter and, within the confines of the hinge mounting holes, to shift the blade assembly.
- As the blade moves in the *closing* direction, clearance between the blade opening cam and the interrupter opening lever must be within the limit shown.
- With the blade assembly in the fully closed position, the clearances between the blade shunt contact and the interrupter—measured to the interrupter housing as well as to the interrupter skirts—must be at least the minimums shown.

Then securely tighten the 1/2"-13 x 2" hex-head galvanized steel bolts that fasten the jaw-contact assembly to the jaw-contact adapter. Make sure the 3/8"-16 stainless-steel interrupter mounting nuts are also tightened.

Step 14

With the blade assembly in the fully closed position, loosen the four #10-32 hex stainless-steel self-locking nuts that fasten the closing-cam support arm to the blade assembly, and adjust the closing-cam support arm so that the clearance between the blade closing cam and the interrupter closing lever is within the limit shown in Figure 5. The closing-cam support arm has slotted holes, and detents are provided on the blade-assembly mounting surface, thus allowing for incremental positioning of the support arm. Tighten the four #10-32 hex stainless-steel self-locking nuts.

Step 15

Move the blade assembly in the opening direction and verify that the blade shunt contact firmly engages the interrupter contact rivets before the blade disengages from the jaw contact. (The shunt contact may be bent to conform to this condition.)

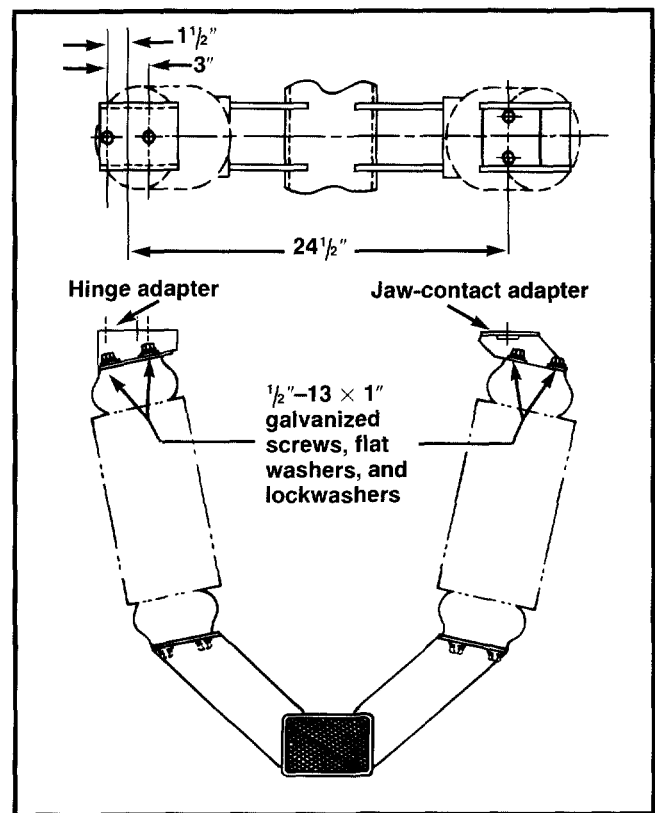


Figure 4. Hinge and jaw-contact adapter alignment detail. Typical for switches rated 25/34.5 kv and 34.5 kv, 600 amperes and 1200 amperes.



LIVE PARTS REPLACEMENT FOR SWITCHES RATED 25/34.5 KV AND 34.5 KV — Continued

Step 16

Position the stationary current-carrying contact on the jaw-terminal pad such that the blade-contact buttons are centered on the current-carrying-contact fingers. Tighten the two $\frac{5}{16}$ "-18 \times 1 $\frac{1}{4}$ " hex-head stainless-steel mounting bolts and apply Loctite® 242 (furnished) to the threads.

Position the stationary fault-closing contact such that the blade fault-closing tip enters on-center, with a $\frac{1}{64}$ -inch clearance on each side. Tighten the two $\frac{1}{4}$ "-20 \times $\frac{5}{8}$ " hex-head stainless-steel screws and apply Loctite 242 (furnished) to the threads.

Use care to prevent Loctite from coming in contact with the interrupter or the insulated blade-operating rod. Remove any excess Loctite immediately.

Step 17

Use the .0015-inch feeler gauge (the $\frac{1}{2}$ " \times 2" section of steel stock furnished) to check blade-contact engagement at the hinge. At any point in the blade travel, the gauge *must not* pass between any of the contact buttons on the blade and the contact surfaces of the hinge. If necessary, bias the blade member in the appropriate direction to satisfy this requirement.

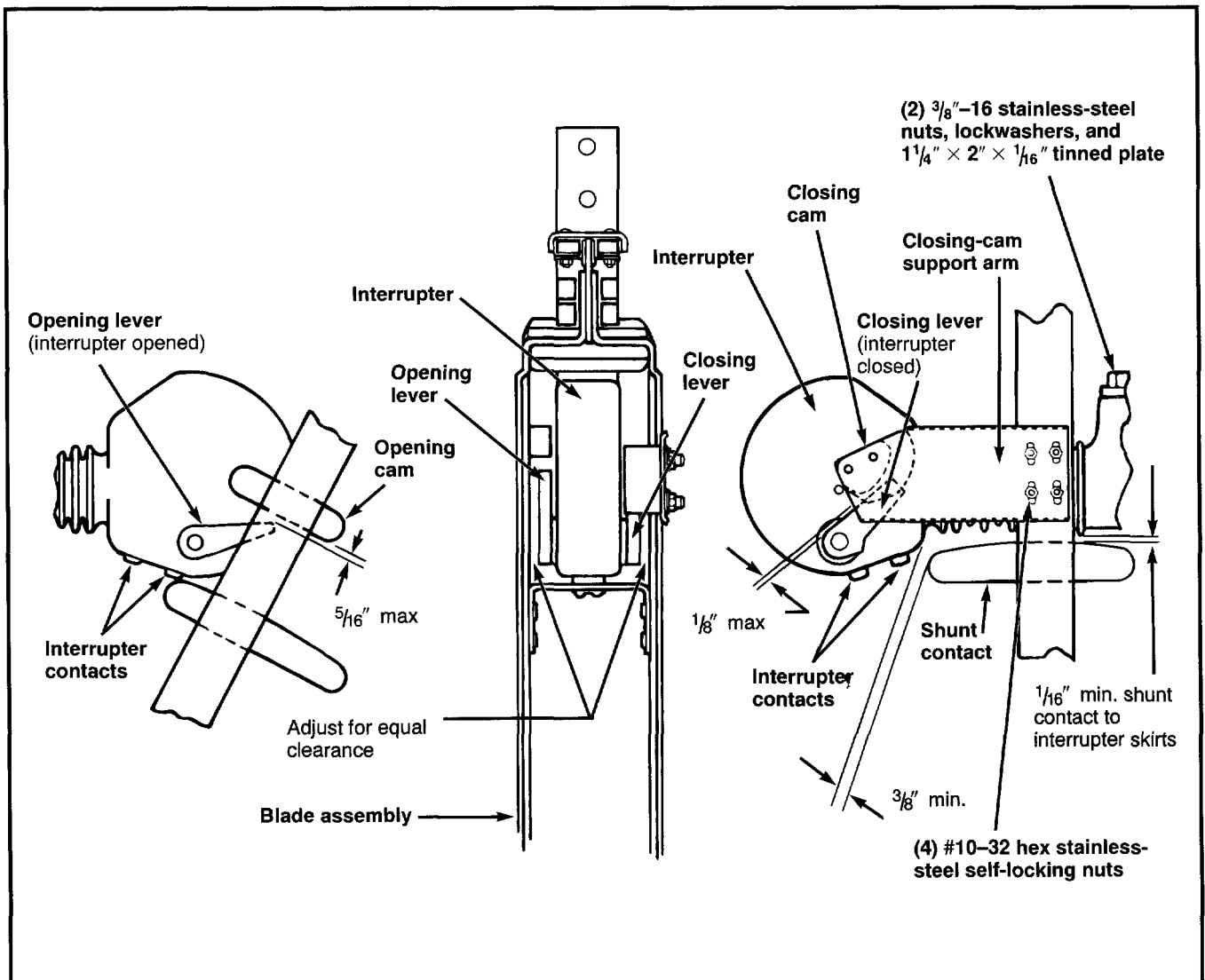


Figure 5. Operation checkpoints for interrupter-to-blade alignment on Three-Pole Vertical-Break Style Alduti-Rupter Switches rated 25/34.5 kv and 34.5 kv, 600 amperes and 1200 amperes.



LIVE PARTS REPLACEMENT FOR SWITCHES RATED 25/34.5 KV AND 34.5 KV — Continued

Step 18

Perform several opening and closing operations and verify the adjustments and clearances attained in Steps 12 through 17. Then connect the insulated blade-operating-rod as follows.

Place the blade assembly in the open position. Then thread the insulated blade-operating-rod stud into the blade-linkage tie bar to a depth sufficient to permit insertion of the coupling pin in the drive lever at the interphase shaft. Before securing the coupling pin with a cotter pin, close the switch slowly with the switch operating handle to verify that complete closure has been attained. If necessary, increase or decrease the effective length of the insulated blade-operating rod by removing the coupling pin and rotating the rod, in half-turn increments, until full closure is attained.

When proper adjustment has been achieved, place Teflon flat washers between the drive lever and each clevis inner surface and secure the coupling pin with the cotter pin. Then—while firmly holding the blade-operating rod so that its clevis fitting remains aligned with the drive lever—tighten the 5/8"-18 hex jam nut against the blade-linkage tie bar. The drive lever must be centered in the clevis slot without touching the slot sides.

Step 19

When replacement of the live parts has been completed for all applicable switch poles, use the switch operating handle to slowly close and open the switch a number of times and check for full closure of all three poles.

For switches having rotating operating mechanisms, also verify that all play in the operating-pipe linkage has been taken up *before* the handle can be lowered into the closed-position stop-plate and, further, that substantial pressure is required to force the handle into the closed-position slot; attainment of this "windup" tension in the operating linkage is essential to ensure positive switch closure. *For switches having reciprocating operating mechanisms,* also verify that when the handle is moved to its fully closed position, a definite resistance is felt at the end of the stroke; this indicates that all slack in the operating linkage has been taken up—which is essential to ensure positive switch closure. If adjustment of the operating mechanism is required, refer to the section headed "CHECKING OPERATION" in the instruction sheet furnished with the switch.

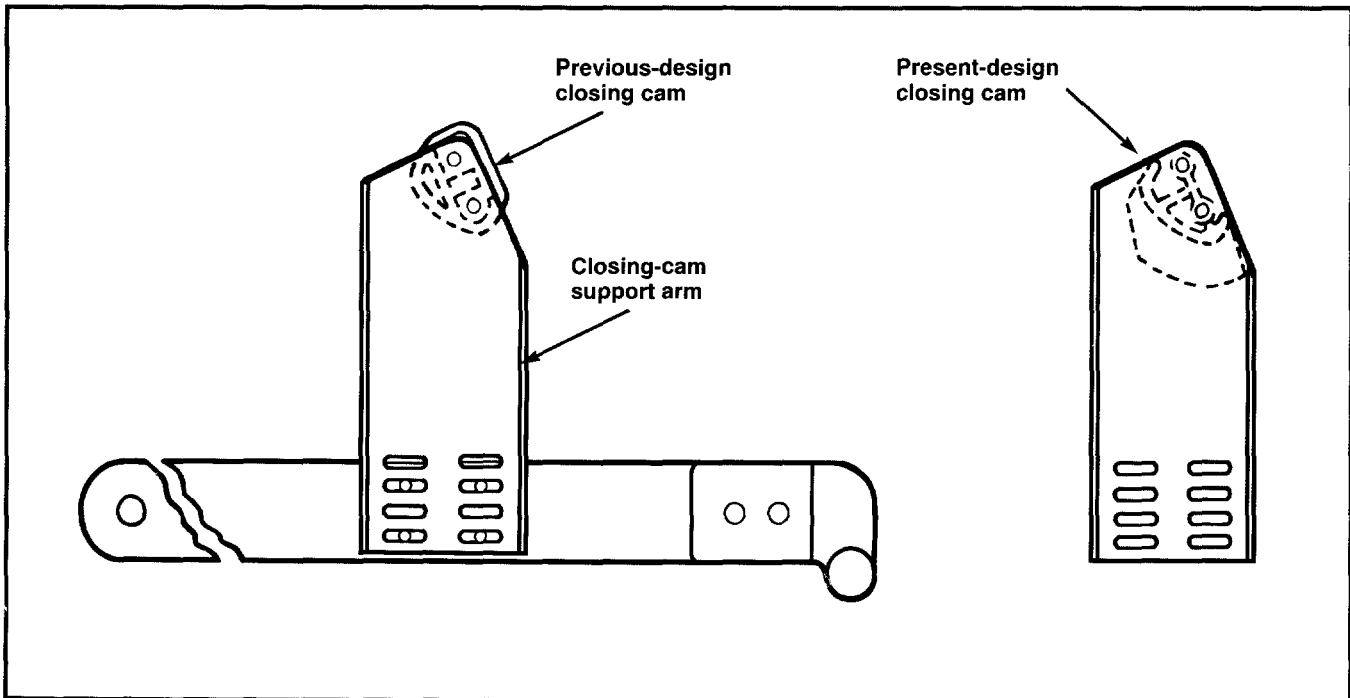


Figure 6. Present-design and previous-design closing cams.