S&C Alduti-Rupter® Switches
Outdoor Distribution

Three-Pole Double-Break Style
Modernization Kits
34.5 kV and 46 kV

Instructions for Installation

TABLE OF CONTENTS

S&C ELECTRIC COMPANY
Specialists in Electric Power Switching and Protection

Instruction Sheet 761-609
July 26, 2004

Supersedes Instruction Sheet 761-609 dated 8-30-99

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 S&C Alduti-Rupter Switch. Familiarize yourself with "SAFETY INFORMATION" on pages 3 and 4.

Also, thoroughly and carefully read the instructions for checking switch alignment and operation contained in S&C Instruction Sheet 761-500, "S&C Alduti-Rupter Switches: Double-Break Style, Rotating Operating Mechanism" or S&C Instruction Sheet 761-505, "S&C Alduti-Rupter Switches: Double-Break Style, Reciprocating Operating Mechanism," as appropriate.

Retain this Instruction Sheet

This instruction sheet is a permanent part of your S&C Alduti-Rupter Switch. Designate a location where you can easily retrieve and refer to this publication.

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. Refer to "PROPER APPLICATION" on page 5 for complete application information.

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 Alduti-Rupter Switch covered in this instruction sheet except when it is power operated using a switch operator of other than S&C manufacture.

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 Alduti-Rupter Switch. Familiarize yourself with these types of messages and the importance of the various signal words, as explained below.

⚠ DANGER

"DANGER" 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.

⚠ WARNING

"WARNING" identifies hazards or unsafe practices which *can* result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ CAUTION

"CAUTION" 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.

NOTICE

"NOTICE" identifies important procedures or requirements that, if not followed, *can* result in product or property damage if instructions are not followed.

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.)

NOTICE

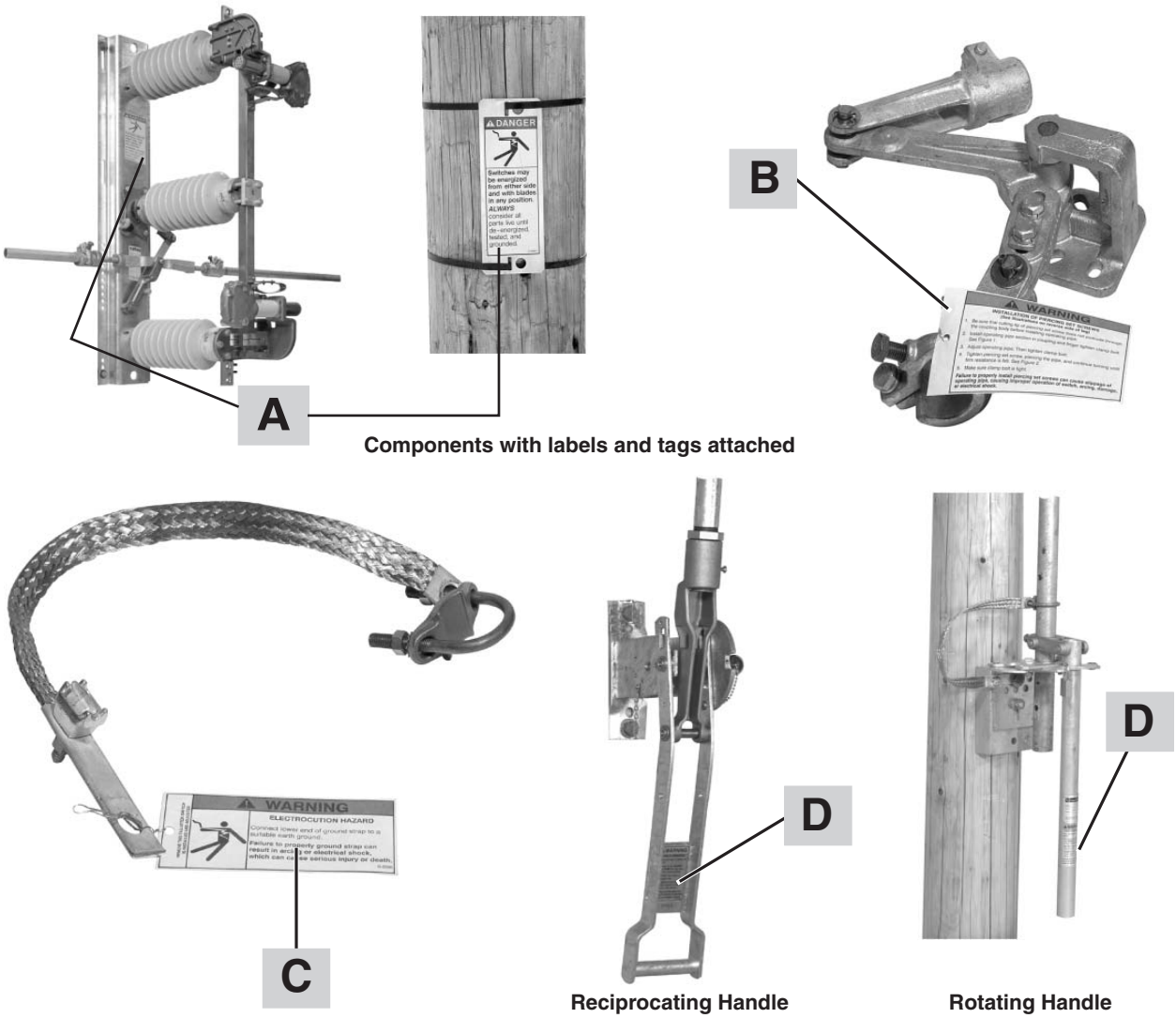
Thoroughly and carefully read this instruction sheet before operating your S&C Alduti-Rupter Switch.

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.

Location of Safety Labels and Tags



Components with labels and tags attached

Reciprocating Handle

Rotating Handle

Reorder Information for Safety Labels			
Location	**Safety-Alert Message**	**Description**	**Part Number**
A	⚠ DANGER	Electrocution Hazard	G-6580-1
B	⚠ WARNING	Piercing Set Screws	G-3176R1▲
C	⚠ WARNING	Electrocution Hazard – Grounding Strap	G-6596▲
D	⚠ WARNING	Handle Operation	G-4400R5

▲ This part is a tag which is to be removed and discarded after the switch is installed and adjusted.

Switching Ratings

⚠ CAUTION

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

In most applications, Alduti-Rupter Switches are capable of switching rated continuous load currents at full voltage. The ratings for the particular switch are listed on nameplates attached to the operating handle and the switch. See Figure 1.

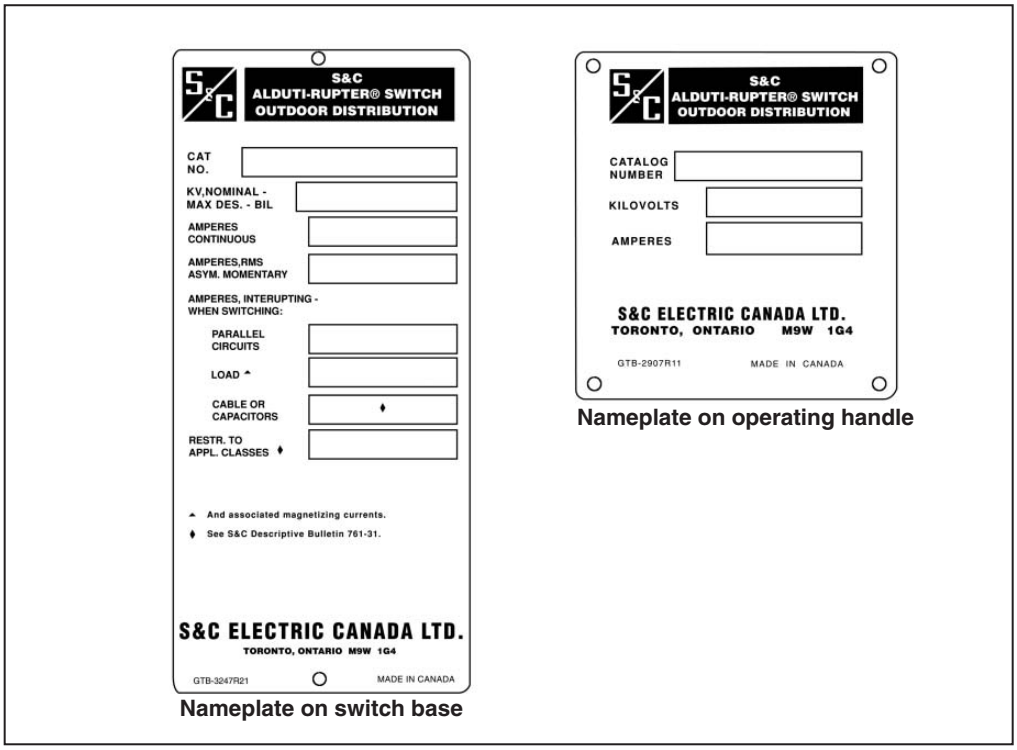


Figure 1. Switch nameplates with ratings.

These interrupter switches are *not* intended for breaking fault currents.

COMPONENTS

Contents of the Kit

This kit contains components for modernizing one pole of a Three-Pole Double-Break Style Alduti-Rupter Switch rated 34.5 kV or 46 kV, bearing catalog number supplement "-R9" (for example, 320304R9). Such switches were manufactured between 1966 and 1997.

The kit includes:

- Two interrupters;
- One blade assembly;
- Two stationary contact assemblies, each comprised of a current-carrying contact assembly and an arcing contact assembly; and
- Two terminal base castings.

The modernized switch pole is equivalent to that furnished on a current-production switch bearing catalog number supplement "-R10".

NOTICE

To obtain the improved interrupting ratings and fault-closing capabilities of a switch bearing catalog number supplement "-R10," all three poles of the switch must be modernized.

NOTICE

The blade assembly of a modernized switch pole is approximately 10 inches longer than the original blade assembly. The minimum-required phase-to-phase spacing (centerline-to-centerline) that will permit 90-degree blade rotation is therefore greater for a modernized switch.

If the existing phase-to-phase spacing is less than 42 inches (for 34.5-kV switches) or 48 inches (for 46-kV switches), it will be necessary to either:

- Adjust blade travel for 80-degree rotation or
- Modify the switch installation to attain the minimum-required phase-to-phase spacing.

Refer to page 20 of this instruction sheet.

BEFORE STARTING

⚠ DANGER

Make sure that the Alduti-Rupter Switch is de-energized, isolated from all power sources, and grounded at all six terminals before starting. **Working on an energized switch can result in severe personal injury or death.**

Removing Existing Live Parts

Step 1

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

Disconnect the switch pole by removing the ½″ stainless-steel attachment pin from the toggle mechanism. See Figure 2

Retain the pin, flat washer, spacer(s) and, cotter pin for reassembly later.

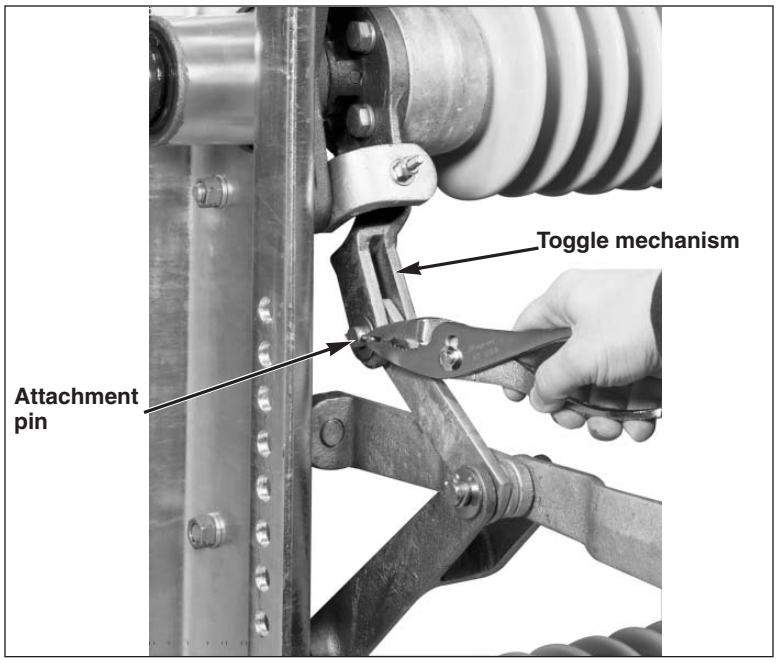


Figure 2. Disconnecting switch pole.

Step 2

Detach the blade assembly by removing the four ½″—13 × 2½″ hex-head galvanized steel cap screws and ½″ galvanized steel lockwashers which secure the blade clamp assembly to the rotating insulator. See Figure 3.

Discard the blade assembly, upper and lower blade clamp, and associated hardware.

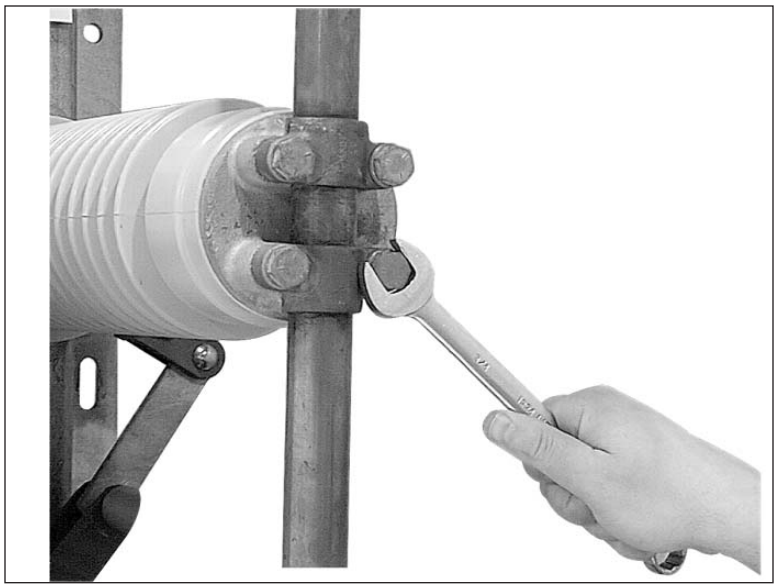


Figure 3. Detaching blade assembly.

Step 3

Detach each of the two terminal base castings by removing the four ½″—13 × 1¼″ hex-head galvanized steel cap screws, ½″ galvanized steel lockwashers, and ½″ galvanized steel flat washers which secure it to its respective stationary insulator. See Figure 4.

Discard the castings (along with the attached interrupters and stationary contact assemblies) and associated hardware.

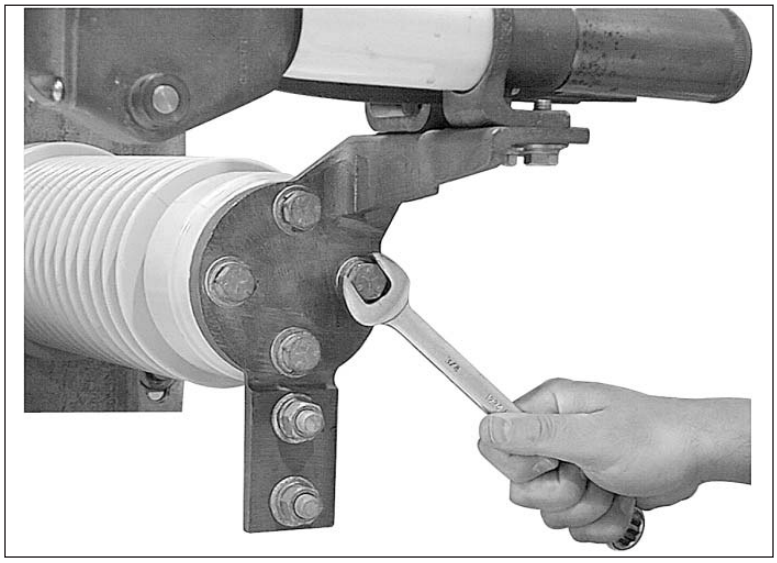


Figure 4. Detaching terminal base casting.

Installing Replacement Live Parts

Step 4

Apply a light coating of No-Ox-Id "A Special" oxidation-inhibiting grease (available from Sanchem Incorporated) to the replacement blade at the surfaces that are in contact with the blade clamp and insulator. See Figure 5.

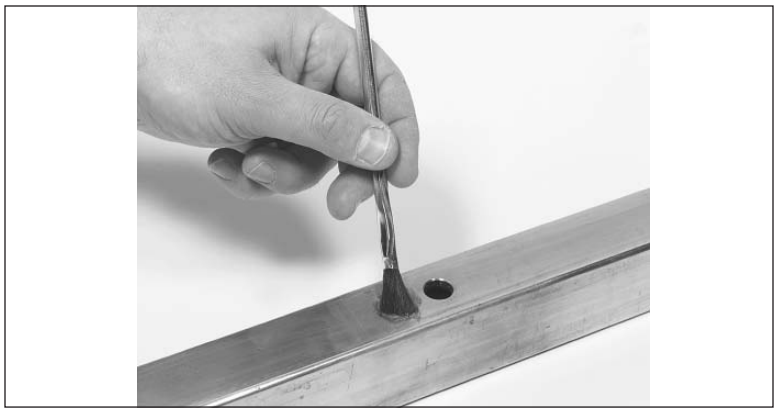


Figure 5. Applying oxidation-inhibiting grease to replacement blade.

Step 5

Align the blade clamp pin with the hole in the center of the replacement blade. Attach the blade and blade clamp assembly to the center insulator in the blade-closed position, using four ½″—13 × 2½″ hex-head galvanized steel cap screws and ½″ galvanized steel lockwashers furnished. See Figure 6.

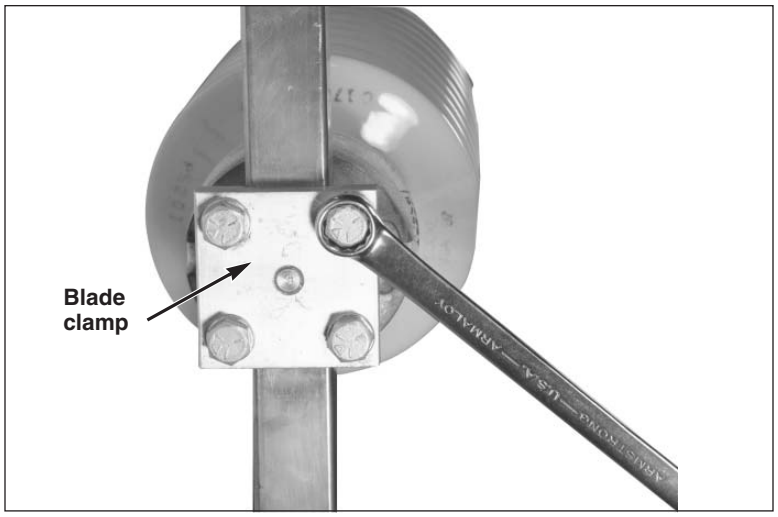


Figure 6. Attaching blade and blade clamp assembly.

Step 6

Check that the blade parallels the switch-pole base, then torque—in a diagonal pattern—the blade assembly cap screws to final tightness (35 ft.-lbs.). See Figure 7.

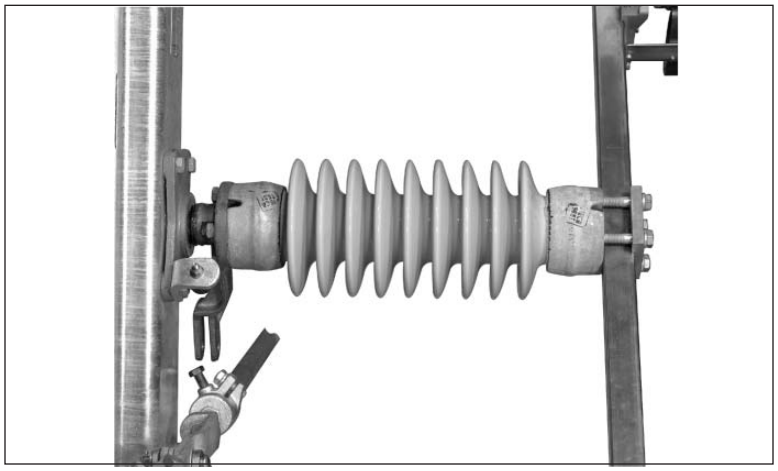


Figure 7. Checking that blade parallels switch-pole base.

Step 7

Attach the replacement terminal base casting to its stationary insulator, using four ½″—13 × 1¼″ hex-head galvanized steel cap screws and ½″ galvanized steel lockwashers furnished. See Figure 8.

Tighten the bolts snugly, but loose enough to permit later adjustment.

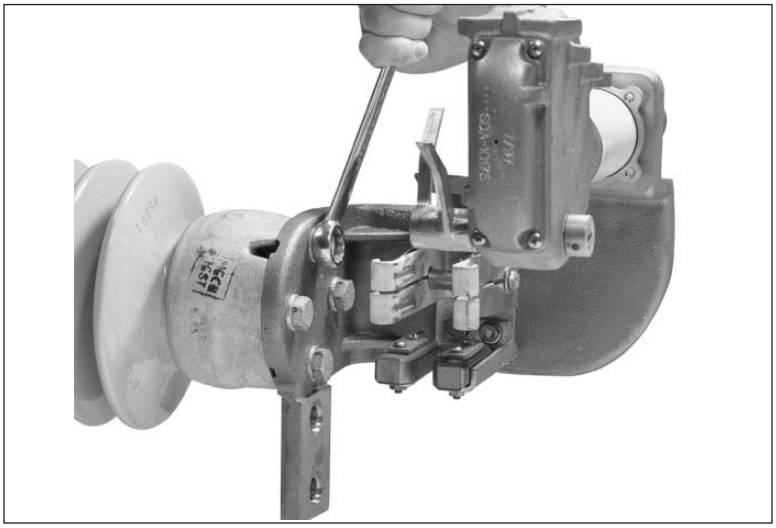


Figure 8. Attaching replacement terminal base casting.

Step 8

Make certain that the interrupter is in the open position. The interrupter operating lever can be actuated by hand.

Move the blade assembly to the open position and attach the interrupter to the terminal base casting using four ¼″—20 × 1″ hex-head stainless-steel cap screws and ¼″ stainless-steel lockwashers. Securely tighten the cap screws. See Figure 9.

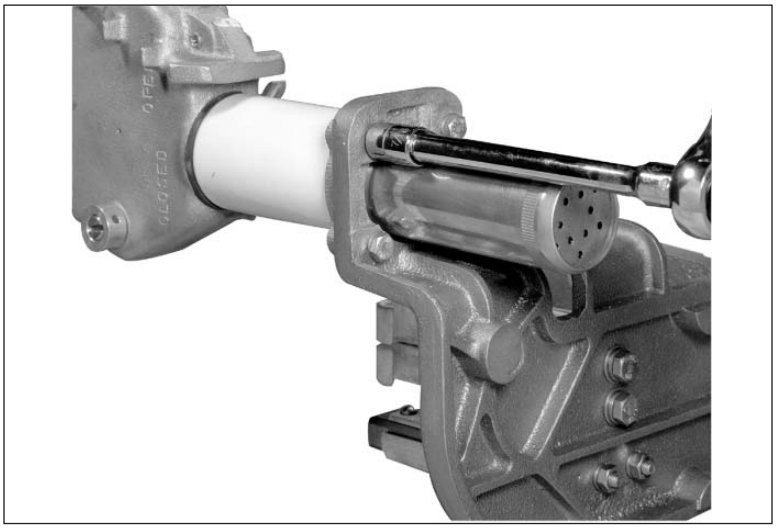


Figure 9. Attaching replacement interrupter.

Step 9

Move the blade assembly *slowly* towards the closed position until the blade assembly is under the interrupter lever shaft. Verify that, for each interrupter, the gap between the end of the interrupter lever shaft and the blade assembly is between 3⁄16″ and 9⁄32″. See Figure 10.

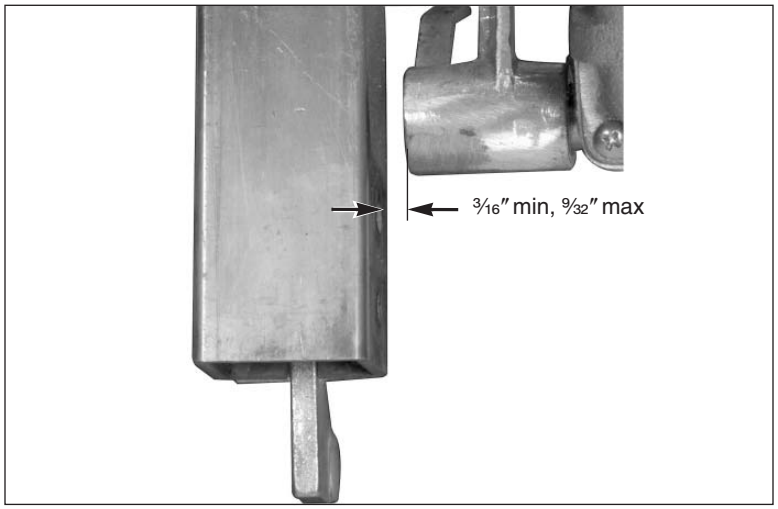


Figure 10. Verifying gap between end of interrupter lever shaft and blade assembly.

Step 10

If one gap measurement is much larger than the other, loosen the four ½″—13 × 2½″ hex-head galvanized steel cap screws used to attach the blade assembly to the center insulator. Install 0.30″ shims as required, between the blade assembly and the center insulator cap, on the side with the larger gap. Retorque —in a diagonal pattern—the blade assembly cap screws to final tightness (35 ft.-lbs.). See Figure 11.

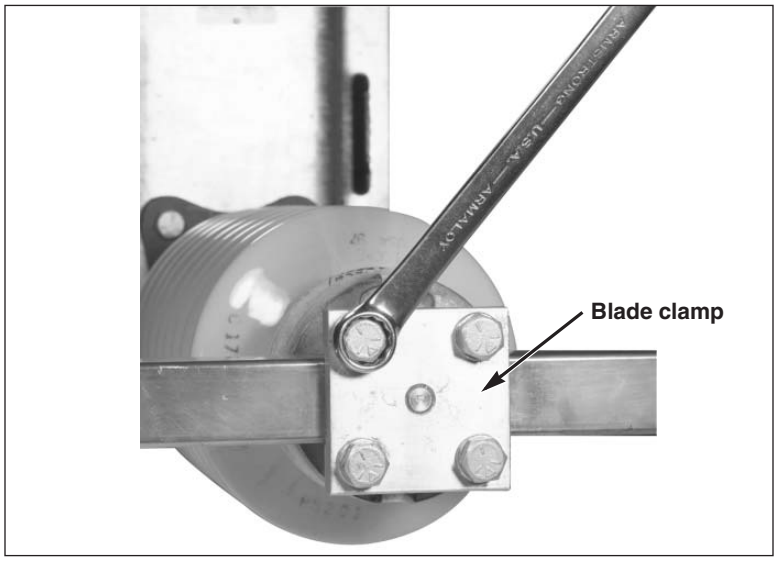


Figure 11. Retorquing blade assembly cap screws with shims installed.

Step 11

If the two gap measurements are nearly the same and only minor adjustment is needed, loosen the four ½″—13 × 1¼″ hex-head galvanized steel cap screws used to attach each terminal base casting to its stationary insulator. Install 0.30″ shims as required, between the terminal base casting and the stationary insulator cap, on the side with the larger gap. See Figure 12.

Retighten the bolts snugly, but loose enough to permit later adjustment.

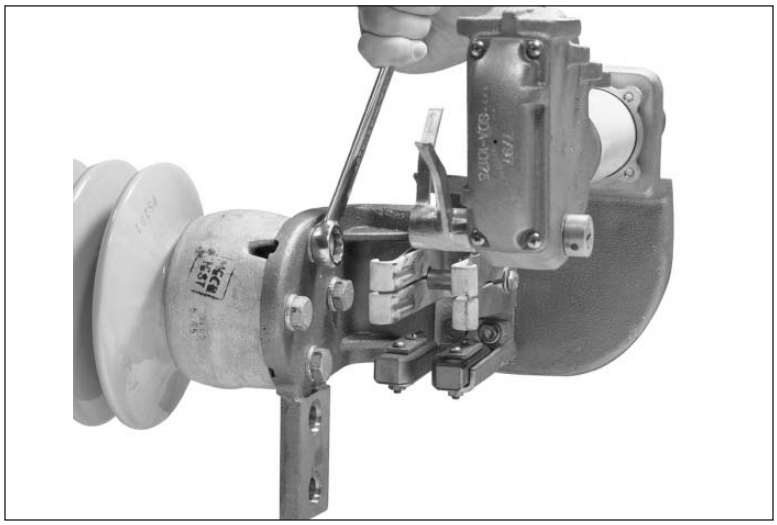


Figure 12. Attaching replacement terminal base casting with shims installed.

Step 12

Open and close the blade assembly *slowly* several times.

⚠ CAUTION

The switch should be opened and closed slowly only when checking for alignment and complete closure.

When opening or closing the switch in service, *do not* slow down or stop part way. Arcing can occur if the switch is partially open or partially closed.

Check to be sure that the following conditions exist:

The interrupters must lie in a plane parallel to the sweep of the blade. See Figure 13.

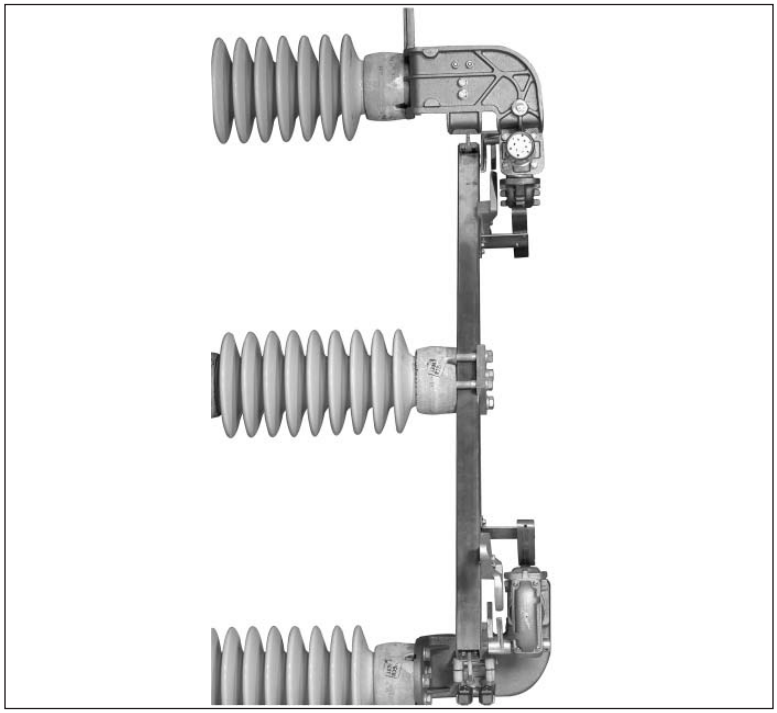


Figure 13. Checking interrupter alignment.

As the blade assembly moves in the *closing* direction, each blade closing cam must make positive engagement with its respective interrupter closing lever. See Figure 14.

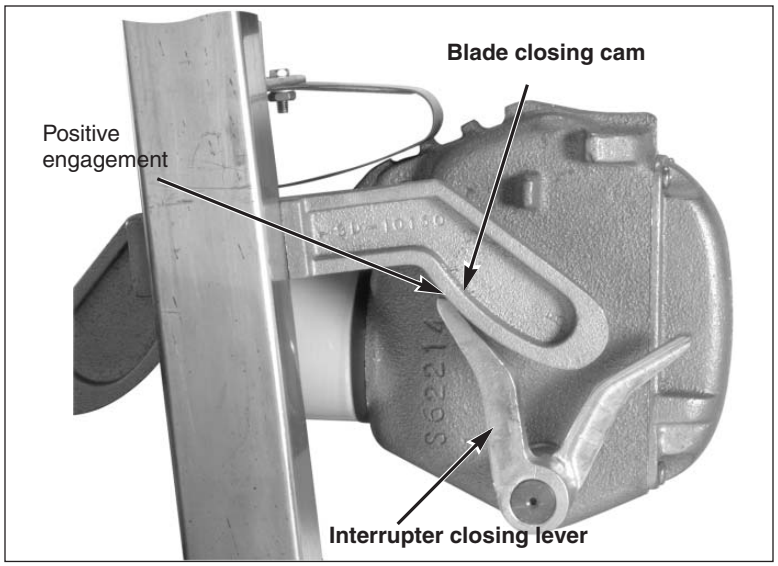


Figure 14. Verifying blade closing cam engages interrupter closing lever.

When the blade is in the fully closed position, each blade closing cam must overlap its respective interrupter closing lever to prevent inadvertent opening of the interrupter, and clearance between the blade closing cam and its respective interrupter closing lever must be within the limit shown in Figure 15.

Adjust the terminal base casting position to obtain the required gap.

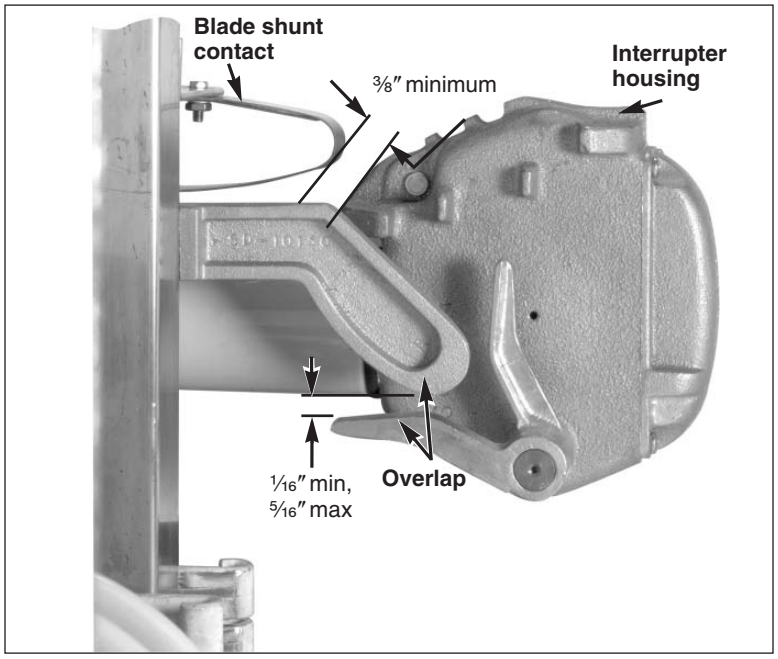


Figure 15. Verifying blade closing cam overlaps interrupter closing lever.

As the blade assembly moves in the *opening* direction, the two blade opening cams must simultaneously make positive engagement with their respective interrupter opening levers as shown in Figure 16. Simultaneity is essential to ensure that both interrupters share the interrupting duty. The opening lever on one or both interrupters may be bent slightly to attain opening simultaneity.

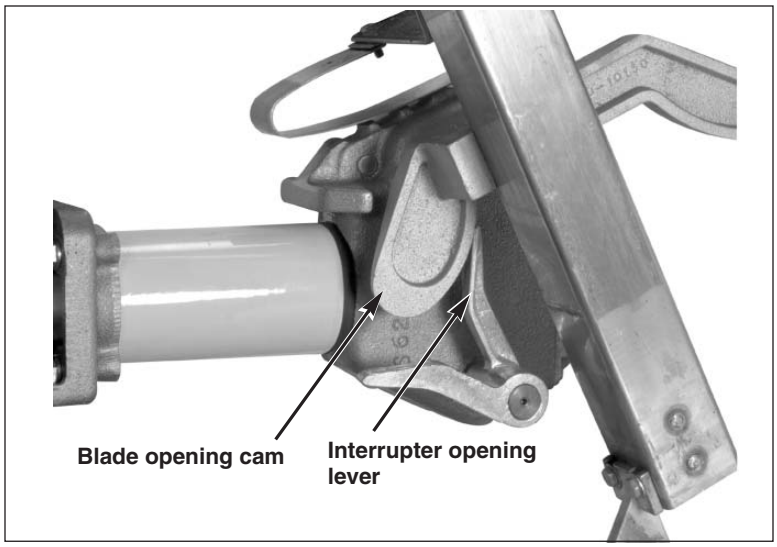


Figure 16. Verifying blade opening cams simultaneously engage interrupter opening levers.

After opening the blade fully, *slowly* close the blade and verify that the two opening cams do not hit the interrupter opening levers. See Figure 17.

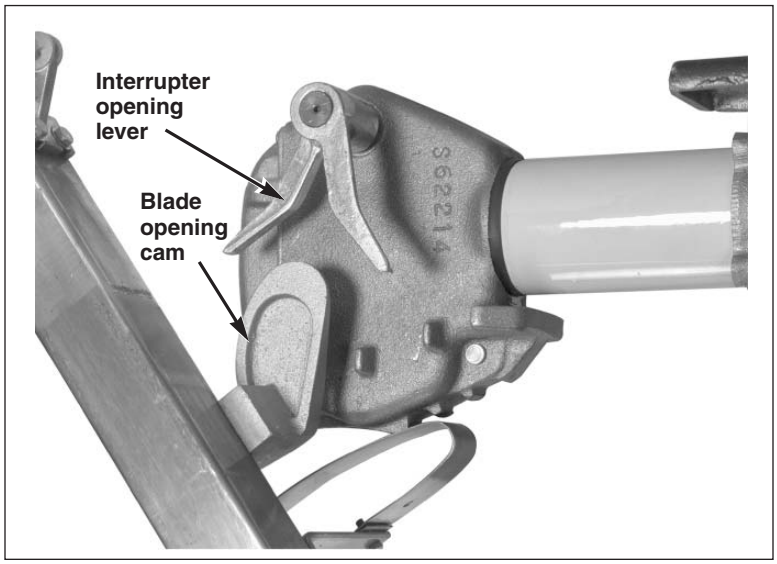


Figure 17. Verifying blade opening cams do not hit interrupter opening levers on closing.

If the conditions described above are not met, adjust as follows. Loosen the four ½″—13 × 1¼″ hex-head galvanized steel cap screws which fasten the terminal base castings to the stationary insulators. See Figure 18. Shift the terminal base castings as required. Tighten the terminal base casting cap screws and recheck for conformance to the conditions outlined above. Readjust if required. Make certain that the terminal base casting cap screws are tightened to final tightness (55 ft.-lbs.)

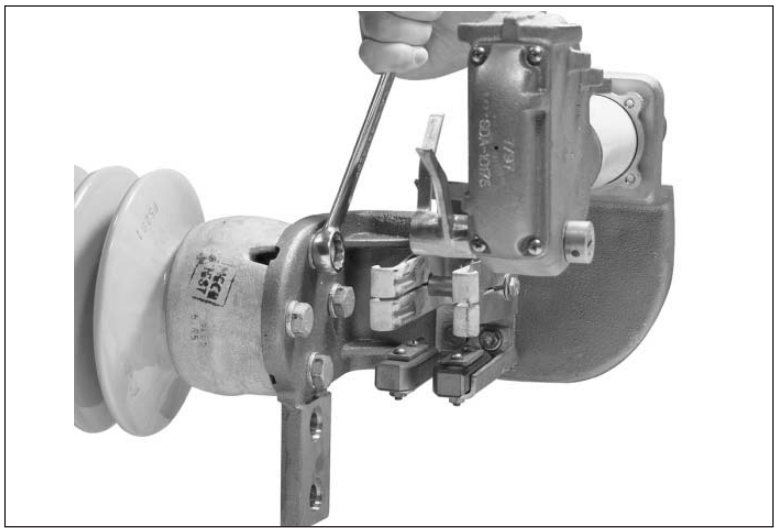


Figure 18. Shifting position of terminal base casting.

Step 13

Attach the current-carrying contact assembly to the terminal base casting using two 5⁄16″—18 × 1″ hex-head stainless-steel cap screws, 5⁄16″ stainless-steel lockwashers, 5⁄16″ stainless-steel flat washers, and nut plate. See Figure 19.

Adjust the current-carrying contact assembly so that the blade assembly enters the contacts on-center ± 1⁄16″.

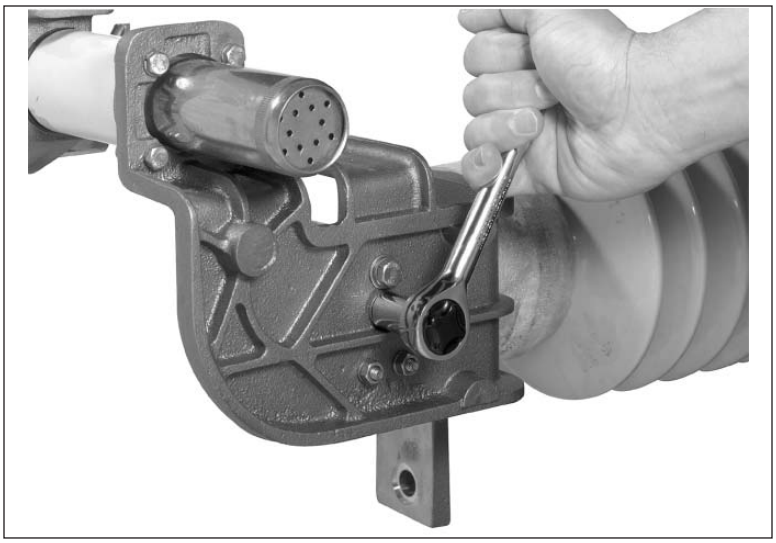


Figure 19. Attaching current-carrying contact assembly.

Step 14

Also adjust the current-carrying contact assembly so that the silver-nickel contact buttons on the blade assembly engage their respective current-carrying contact fingers on-center ± 1⁄16″. See Figure 20.

Then torque the cap screws to final tightness.

NOTICE

Stationary contacts are greaseless and self-lubricating. **DO NOT** apply lubricant to the stationary contacts.

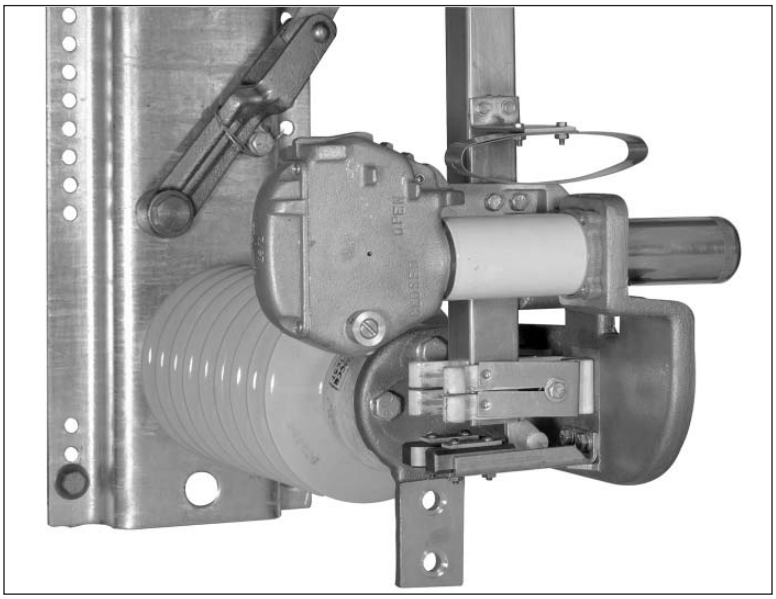


Figure 20. Adjusting current-carrying contact assembly.

Step 15

With the blade assembly in the fully closed position, verify the minimum clearance between each blade shunt contact and its respective interrupter housing, as shown in Figure 21.

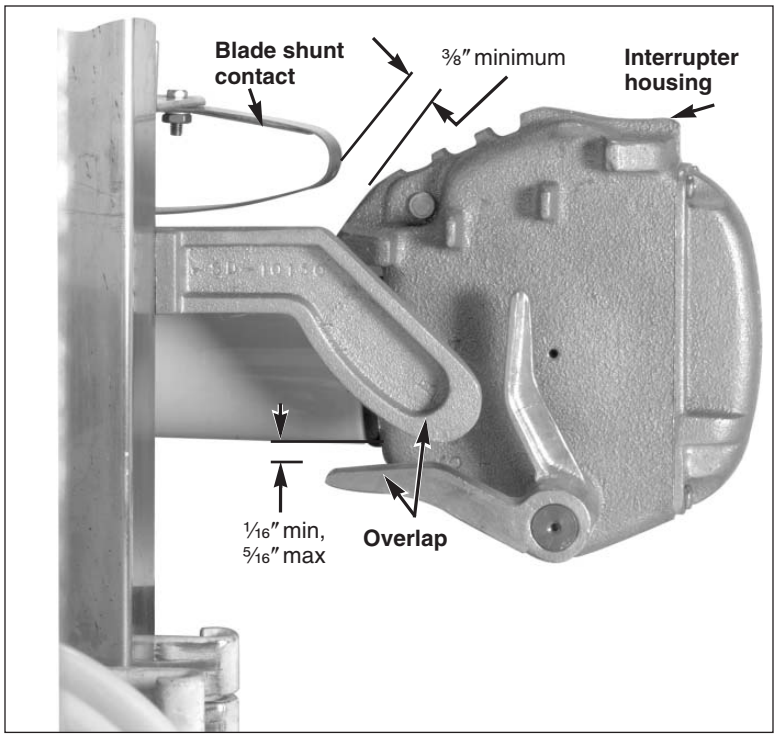


Figure 21. Verifying clearance between blade shunt contact and interrupter housing.

Step 16

Move the blade in the opening direction and verify that each blade shunt contact firmly engages its respective interrupter housing before the blade contacts disengage from the stationary main contact assemblies, as shown in Figure 22. The shunt contacts may be bent as required to conform to these conditions.

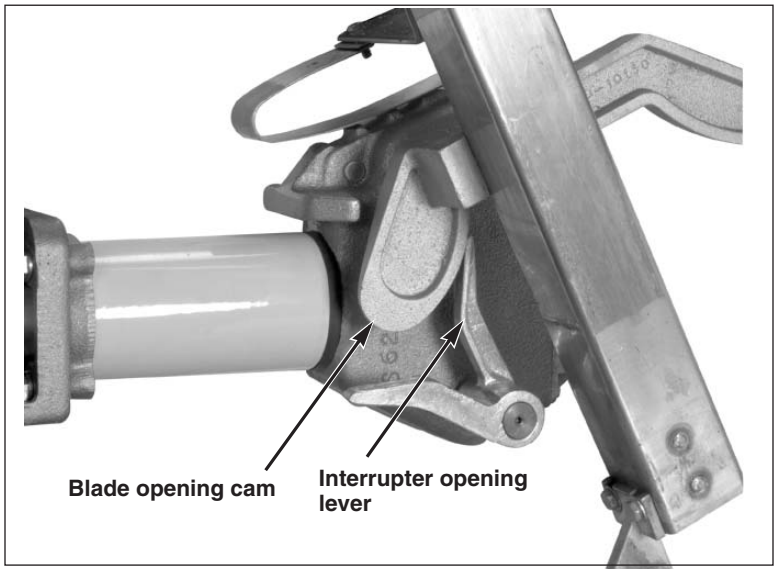


Figure 22. Verifying blade shunt contacts engages interrupter housing.

Step 17

With the blade assembly in the fully closed position, verify that the blade is within ⅛-inch of the stop on the terminal base casting. See Figure 23.

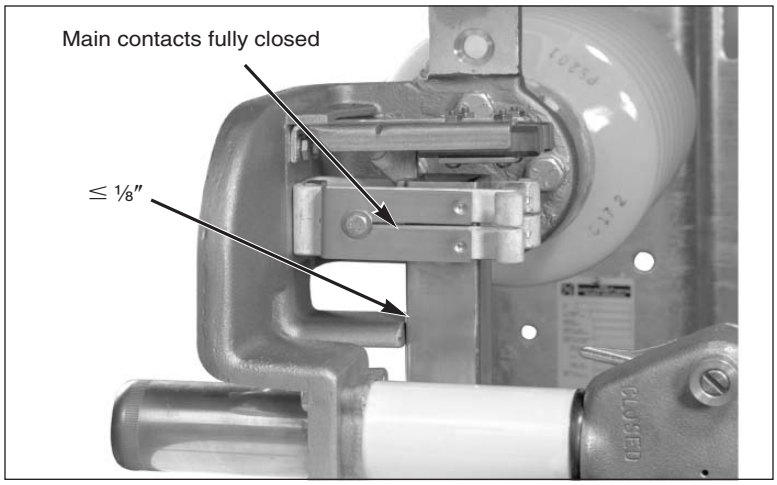


Figure 23. Checking that blade is fully closed and within ⅛″ of the stop on the terminal base casting.

Step 18

Attach the arcing contact assembly to the terminal base casting using two ¼″—20 × ¾″ hex-head stainless-steel cap screws, ¼″ stainless-steel lockwashers, ¼″ stainless-steel flat washers, and ¼″ stainless-steel nuts. See Figure 24.

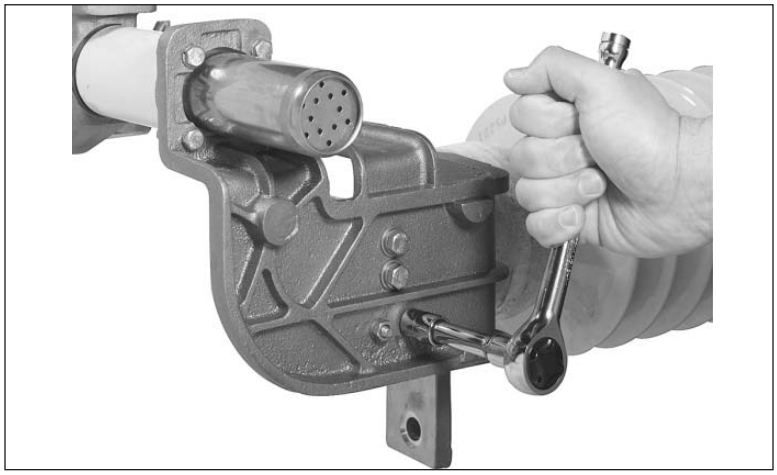


Figure 24. Attaching arcing contact assembly.

Step 19

Adjust the arcing contact assembly so that the blade assembly enters the contacts on-center ± 1/16″. See Figure 25.

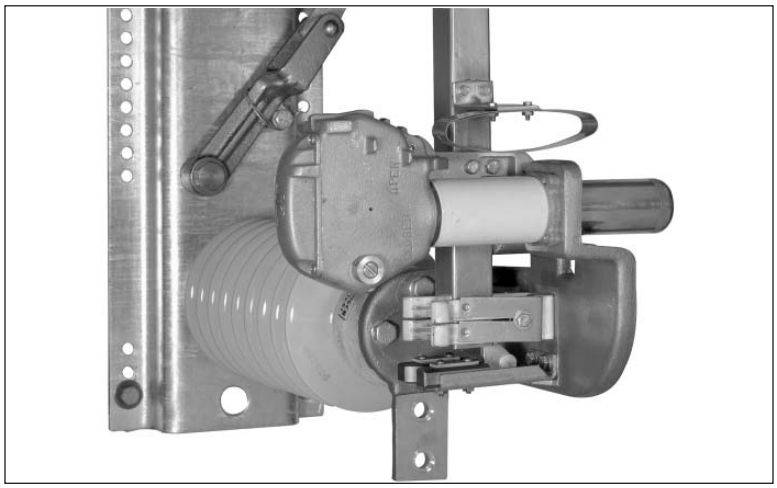


Figure 25. Adjusting arcing contact assembly so contacts enter on-center.

Step 20

Also adjust the arcing contact assembly so that there is a .015″ gap between the blade arcing tip and the arcing contact—on each side—when the blade assembly is in the closed position. See Figure 26.

Then torque the cap screws to final tightness.

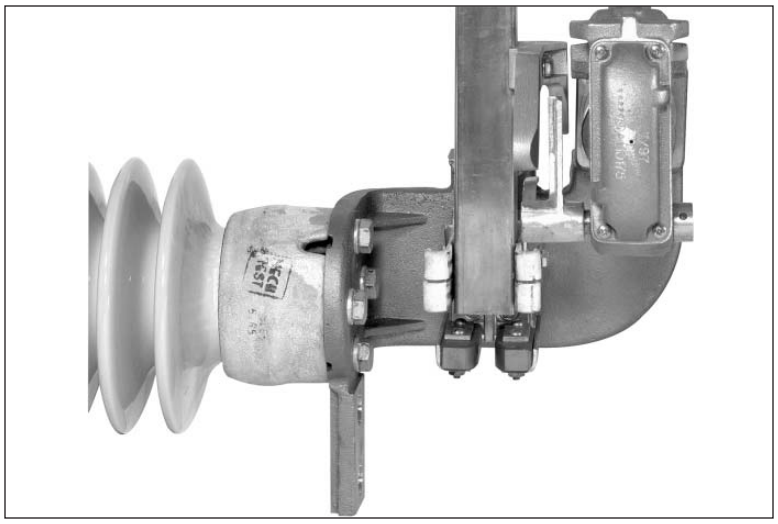


Figure 26. Adjusting arcing contact assembly to achieve gap between blade arcing tip and arcing contact.

Reconnecting Switch Pole

Step 21

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

⚠ CAUTION

The switch should be opened and closed slowly only when checking for alignment and complete closure.

When opening or closing the switch in service, *do not* slow down or stop part way. Arcing can occur if the switch is partially open or partially closed.

Step 22

When satisfactory operation has been attained, place the blade assembly in an intermediate position and reconnect the switch pole using the ½″ stainless-steel attachment pin, flat washer, spacer(s), and cotter pin removed earlier. See Figure 27.

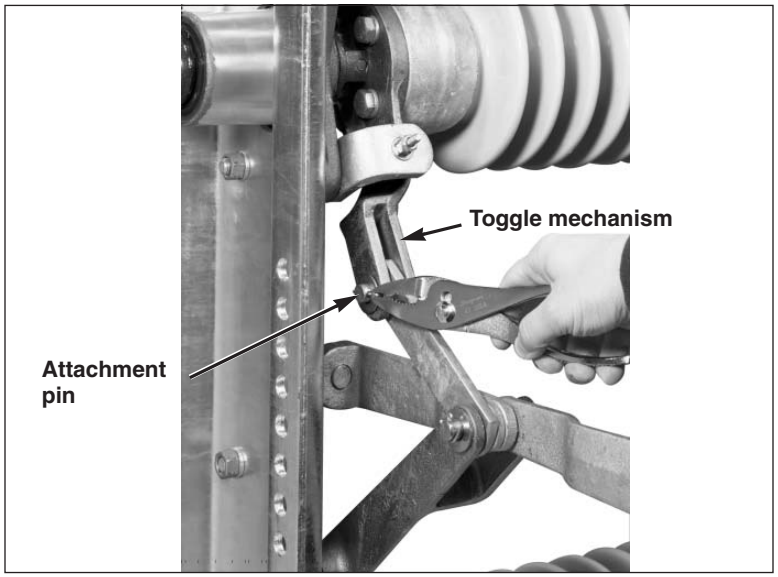


Figure 27. Reconnecting switch pole.

Step 23

Measure the *minimum* phase-to-phase spacing of the switch pole-units, centerline-to-centerline. See Figure 28.

If this dimension is *greater than or equal to* 42 inches (for 34.5 kV switches) or 48 inches (for 46 kV switches), refer to S&C Instruction Sheet 761-500 or 761-505, as appropriate, and complete the procedures described under the "Checking Alignment" and "Checking Operation" sections.

If this dimension is *less than* 42 inches (for 34.5 kV switches) or 48 inches (for 46 kV switches), proceed to "Adjusting Blade Travel for 80-Degree Rotation on Switches with Rotating Operating Mechanism" or "Adjusting Blade Travel for 80-Degree Rotation on Switches with Reciprocating Operating Mechanism," as appropriate.■

■ Alternately, modify the switch installation to attain the minimum-required phase spacing. Longer interphase pipe sections (furnished by others) will be required, and the switch operating mechanism will need to be readjusted. Refer to S&C Instruction Sheet 761-500 or 761-505, as appropriate, and follow the installation instructions in that publication. Be sure to complete the procedures described under the "Checking Alignment" and "Checking Operation" sections.

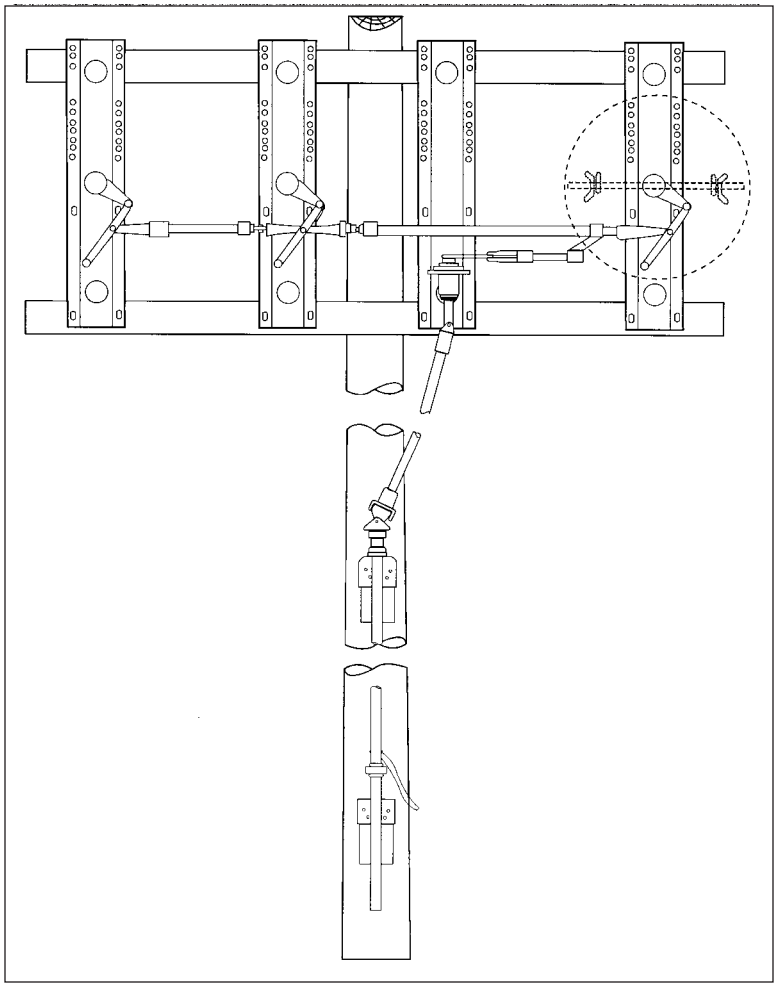


Figure 28. Measuring phase-to-phase spacing.

Adjusting Blade Travel for 80-Degree Rotation on Switches with Rotating Operating Mechanism

Step 24

Locate the open bumper attached to the bearing assembly of the rotating insulator. Remove the bumper and reinstall it with the replacement ¼″—20 × 3½″ galvanized steel cap screw and spacer furnished. See Figure 29.

Place the switch in the fully open position and adjust the bumper so that it rests on the operating lever and the blade assemblies of adjacent phases *do not* touch.

Refer to S&C Instruction Sheet 761-500 and complete the procedures described under the "Checking Alignment" and "Checking Operation" sections.

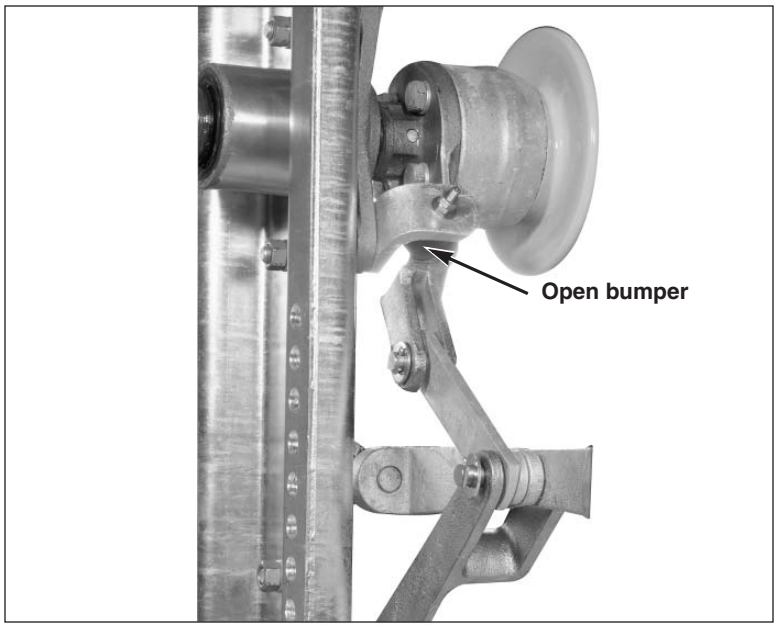


Figure 29. Replacing open bumper.

Adjusting Blade Travel for 80-Degree Rotation on Switches with Reciprocating Operating Mechanism

Step 25

Move the operating handle to mid-position (parallel with the ground) to take tension off of the vertical operating pipe. See Figure 30.

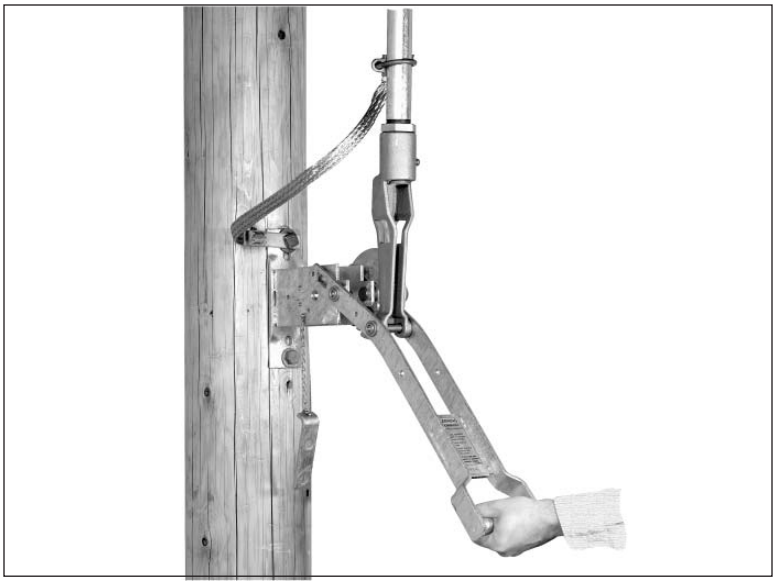


Figure 30. Moving handle to mid-position.

Step 26

While supporting the upper section of vertical operating pipe, disconnect the pipe coupling connecting the pipe to the bell-crank by removing the ½″ stainless-steel attachment pin. See Figure 31.

Retain the pin, flat washer, and cotter pin for reassembly later.

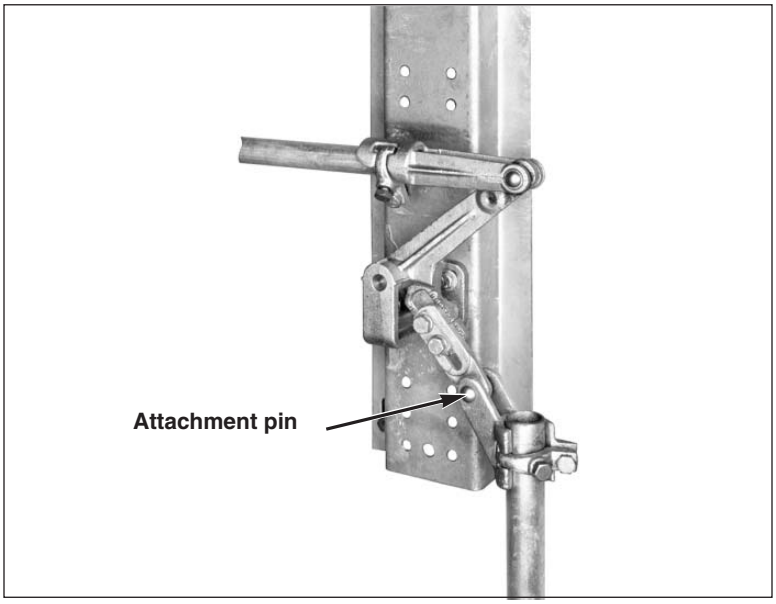


Figure 31. Disconnecting vertical operating pipe at bell-crank.

Step 27

Remove the two ½″—13 × 2″ galvanized steel cap screws, ½″ galvanized steel lockwashers, clamp bar, and nut plate retaining the adjustable lever arm of the bell-crank. See Figure 32.

Discard the adjustable lever arm but retain the hardware.

Install the new adjustable lever arm furnished using the hardware just removed.

Match the index grooves on the replacement adjustable lever arm and bell-crank, then torque the cap screws to final tightness.

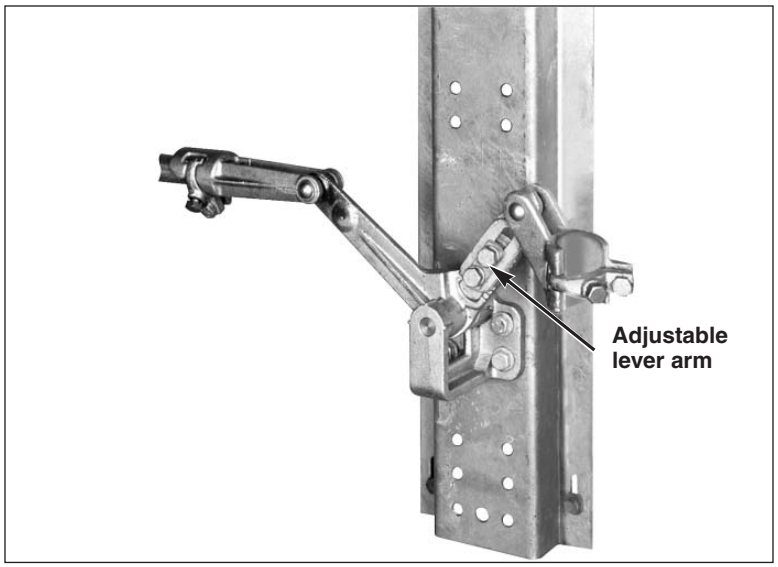


Figure 32. Replacing adjustable lever arm.

Step 28

Locate the open bumper attached to the bearing assembly of the rotating insulator. Remove the bumper and reinstall it with the replacement ¼″—20 × 3½″ galvanized steel cap screw and spacer furnished. See Figure 33.

Place the switch in the fully open position and adjust the open bumper so that it rests on the operating lever and the blade assemblies of adjacent phases *do not* touch.

Refer to S&C Instruction Sheet 761-505 and complete the procedures described under the "Checking Alignment" and "Checking Operation" sections.

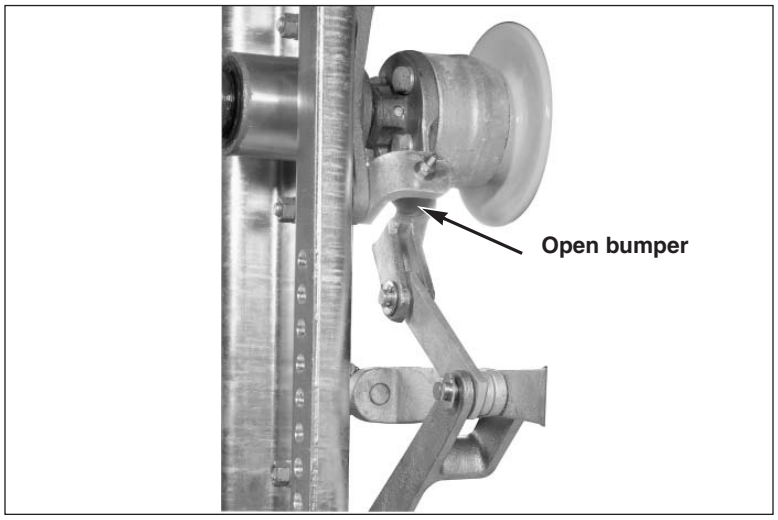


Figure 33. Replacing open bumper.