

# Installation

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★ The pre-insertion inductor assemblies discussed in the document can also be used with equivalent models of S&C Mark IV Circuit-Switchers. Contact the local S&C Sales Office for information on installing pre-insertion inductors on Mark III Circuit-Switchers.



# Introduction

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## Qualified Persons

### **WARNING**

Only qualified persons knowledgeable in the installation, operation, and maintenance of overhead and underground electric distribution and transmission equipment, along with all associated hazards, may install, operate, and maintain the equipment covered by this publication. A qualified person is someone trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from nonlive 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 special precautionary techniques, personal protective equipment, insulated 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

### **NOTICE**

Thoroughly and carefully read this instruction sheet and all materials included in the product's instruction handbook before installing pre-insertion inductors. Become familiar with the Safety Information on page 3 and Safety Precautions on page 4. The latest version of this publication is available online in PDF format at [sandc.com/en/contact-us/product-literature/](http://sandc.com/en/contact-us/product-literature/).

## Retain This Instruction Sheet

This instruction sheet is a permanent part of the Mark V Circuit-Switcher. Designate a location where users can easily retrieve and refer to this publication.

## Proper Application

### **WARNING**

The equipment in this publication is only intended for retrofit to already installed Mark IV or Mark V Circuit-Switchers. The application must be within the ratings furnished for the equipment. Ratings for the Mark V Circuit-Switcher are listed in the ratings table in Specification Bulletin 711-31. The ratings are also on the nameplate affixed to the side of the S&C Type CS-1A Switch Operator.

**Understanding Safety-Alert Messages**

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to the product. Become familiar with these types of messages and the importance of these signal words:

<b>⚠ DANGER</b>
“DANGER” identifies the most serious and immediate hazards that will likely result in serious personal injury or death if instructions, including recommended precautions, are not followed.


<b>⚠ WARNING</b>
“WARNING” identifies hazards or unsafe practices that can result in serious personal injury or death if instructions, including recommended precautions, are not followed.

<b>⚠ CAUTION</b>
“CAUTION” identifies hazards or unsafe practices that can result in minor personal injury if instructions, including recommended precautions, are not followed.

<b>NOTICE</b>
“NOTICE” identifies important procedures or requirements that can result in product or property damage if instructions are not followed.

**Following Safety Instructions**

If any portion of this instruction sheet is unclear and assistance is needed, contact the nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C’s website [sandc.com](http://sandc.com), or call the S&C Global Support and Monitoring Center at 1-888-762-1100.

<b>NOTICE</b>	
Read this instruction sheet thoroughly and carefully before installing pre-insertion inductors on already-installed circuit-switchers.	

**Replacement Instructions and Labels**

If additional copies of this instruction sheet are required, contact the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

It is important any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

### DANGER



**Mark V Circuit-Switchers operate at high voltage. Failure to observe the precautions below will result in serious personal injury or death.**

Some of these precautions may differ from your company's operating procedures and rules. Where a discrepancy exists, follow your company's operating procedures and rules.

1. **QUALIFIED PERSONS.** Access to Mark V Circuit-Switchers must be restricted only to qualified persons. See the "Qualified Persons" section on page 2
2. **SAFETY PROCEDURES.** Always follow safe operating procedures and rules.
3. **PERSONAL PROTECTIVE EQUIPMENT.** Always use suitable protective equipment, such as rubber gloves, rubber mats, hard hats, safety glasses, and flash clothing, in accordance with safe operating procedures and rules.
4. **SAFETY LABELS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels.
5. **OPERATING MECHANISM AND BASE.** Mark V Circuit-Switchers contain fast-moving parts that can severely injure fingers. Do not remove or disassemble operating mechanisms or remove access panels unless directed by S&C Electric Company.
6. **ENERGIZED COMPONENTS.** Always consider all parts live until de-energized, tested, and grounded. Voltage levels can be as high as the peak line-to-ground voltage last applied to the unit. Units that have been energized or installed near energized lines should be considered live until tested and grounded.
7. **GROUNDING.** The Mark V Circuit-Switcher must be connected to a suitable earth ground at the base of the utility pole, or to a suitable building ground for testing, before energizing the switch and at all times when energized.  
The ground wire(s) must be bonded to the system neutral, if present. If the system neutral is not present, proper precautions must be taken to ensure the local earth ground, or building ground, cannot be severed or removed.
8. **SWITCH POSITION.** Always confirm the **Open/Close** position of each switch.
  - Switches and terminal pads may be energized from either side.
  - Switches and terminal pads may be energized with the switches in any position.
9. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.

## Removal of Existing Pre-Insertion Resistors

Remove the components indicated:

**⚠ DANGER**

De-energize and ground the circuit-switcher at all six terminals before removing pre-insertion resistors. **Failure to fully de-energize the circuit-switcher before performing work will cause serious personal injury or death.**

*For pre-insertion resistors on 34.5-kV through 69-kV vertical-break style and integer-style circuit-switchers, refer to Figure 1*

*For pre-insertion resistors on 115-kV and 138-kV vertical-break style circuit-switchers, refer to Figure 2 on page 6.*

*For pre-insertion resistors on 230-kV and 345-kV Center-Break Style circuit-switchers, refer to Figure 3 on page 6.*

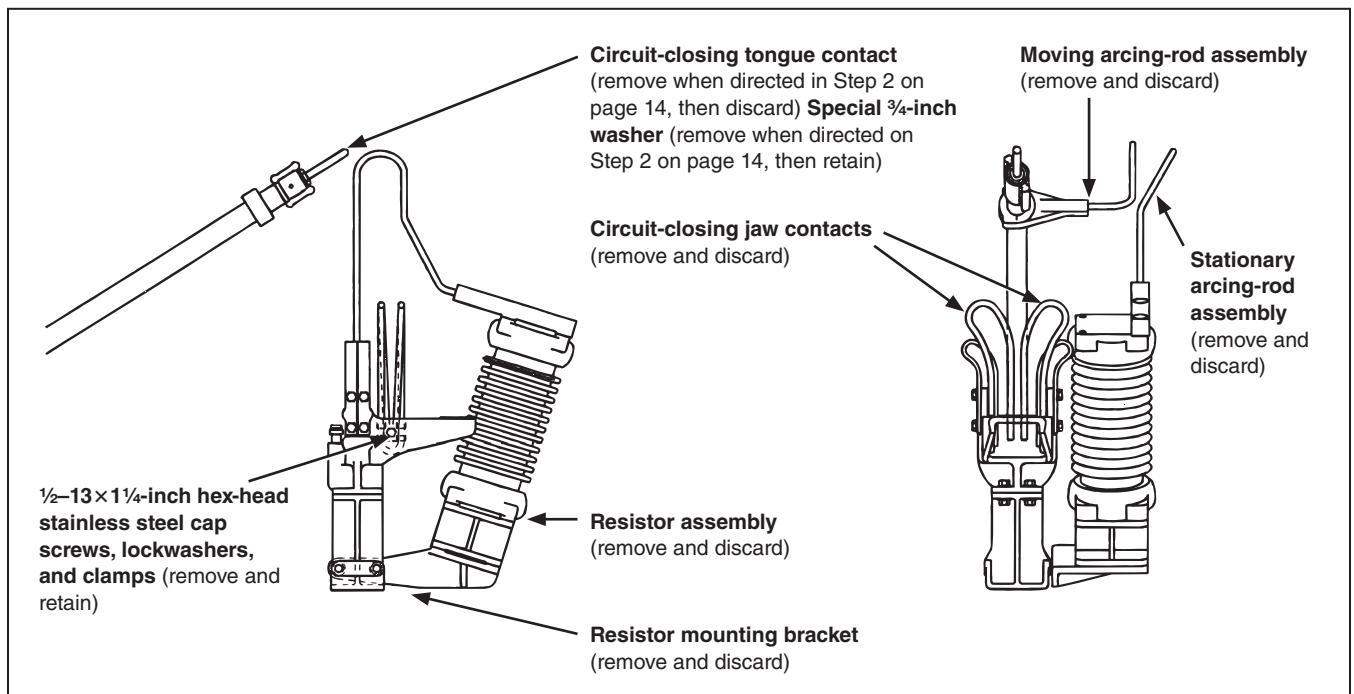


Figure 1. Removal of existing pre-insertion resistors on 34.5-kV through 69-kV vertical-break and integer-style circuit-switchers.

## Removal of Existing Pre-Insertion Resistors or Inductors

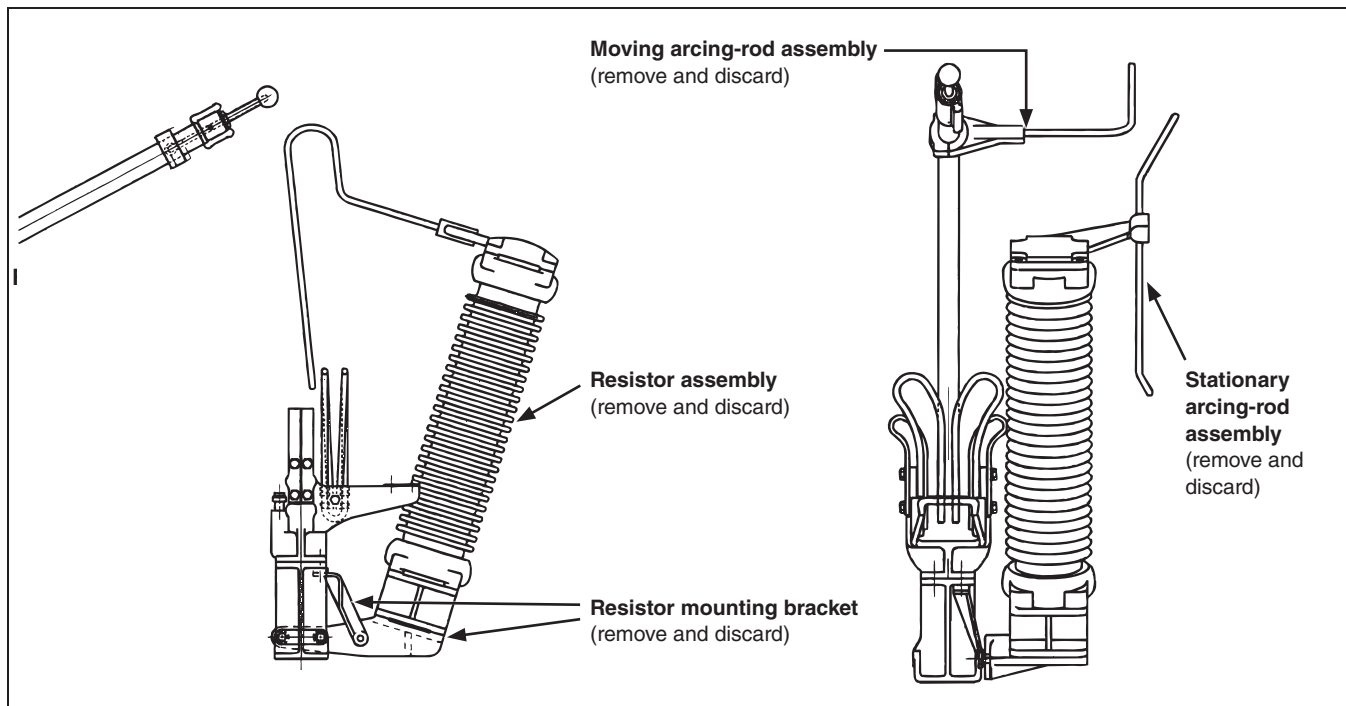


Figure 2. Removal of existing pre-insertion resistors on 115-kV and 138-kV vertical-break style circuit-switchers.

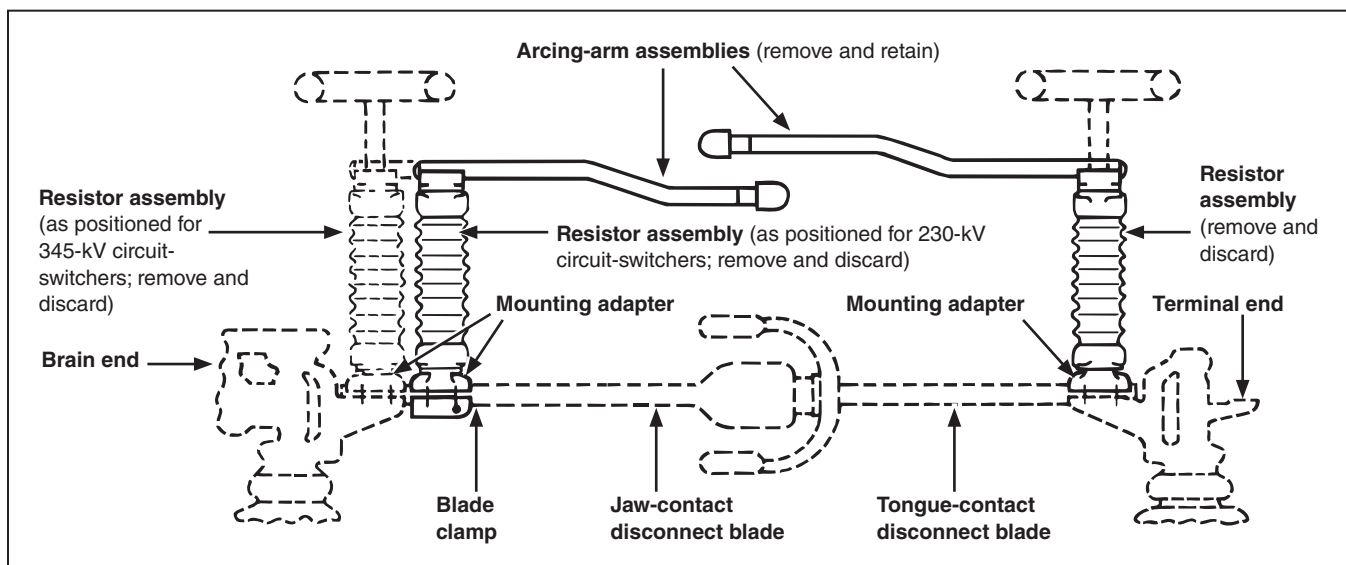


Figure 3. Removal of existing pre-insertion resistors on 230-kV and 345-kV center-break style circuit-switchers.

## Removal of Existing Earlier-Production Pre-Insertion Inductors

Remove the components indicated:

**⚠ DANGER**

De-energize and ground the circuit-switcher at all six terminals before removing earlier production pre-insertion inductors. **Failure to fully de-energize the circuit-switcher before performing work will cause serious personal injury or death.**

*For upgraded earlier-production 5-millihenry pre-insertion inductors (inductors mounted vertically) on 34.5-kV through 69-kV vertical-break style and integer-style circuit-switchers:* Refer to Figure 4.

*For earlier-production 5-millihenry pre-insertion inductors (inductors mounted at an angle) on 34.5-kV through 69-kV vertical-break style and integer-style circuit-switchers:* Refer to Figure 5 on page 8.

*For earlier-production 10-millihenry pre-insertion inductors (inductors mounted vertically) on 34.5-kV through 69-kV vertical-break style and integer-style circuit-switchers:* Refer to Figure 6 on page 8.

*For upgraded earlier-production 10-millihenry pre-insertion inductors (inductors mounted vertically) on 115-kV and 138-kV vertical-break style circuit-switchers:* Refer to Figure 7 on page 9.

*For earlier-production 10-millihenry pre-insertion inductors (inductors mounted at an angle) on 115-kV and 138-kV vertical-break style circuit-switchers:* Refer to Figure 8 on page 9.

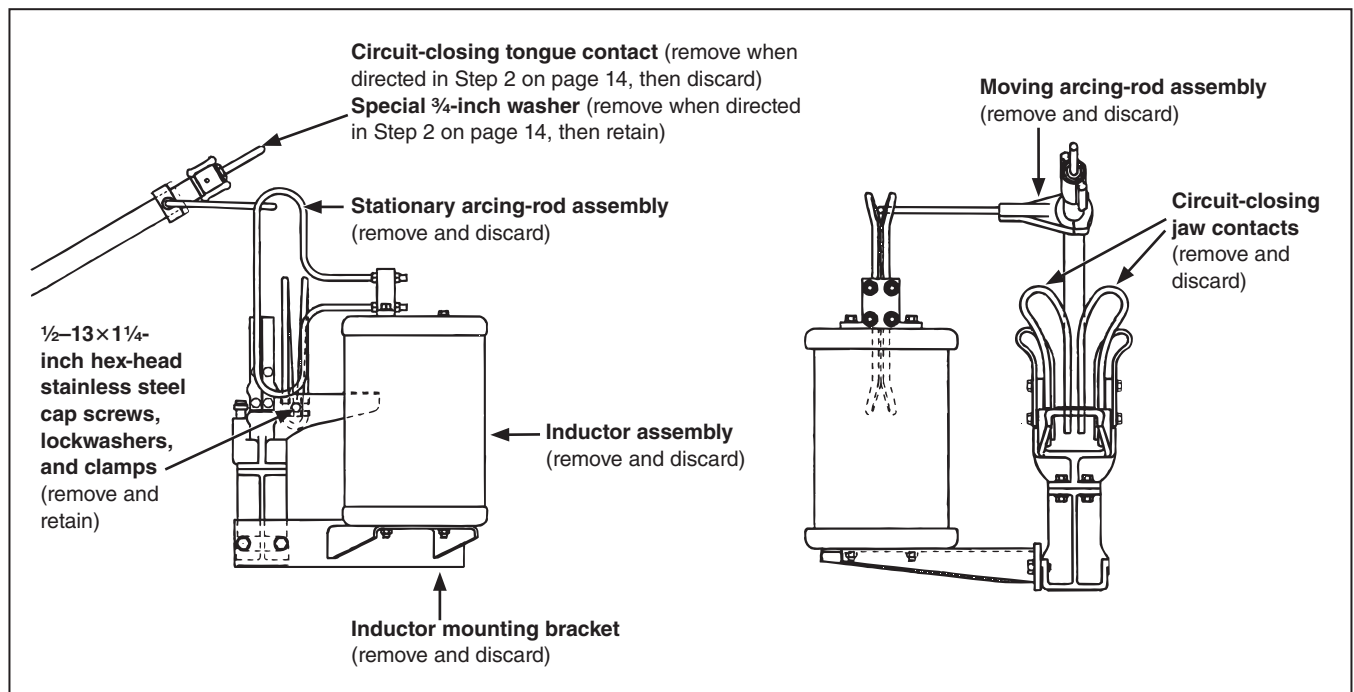


Figure 4. Removal of existing upgraded earlier-production 5-millihenry pre-insertion inductors on 34.5-kV through 69-kV vertical-break style and integer-style circuit-switchers.

## Removal of Existing Pre-Insertion Resistors or Inductors

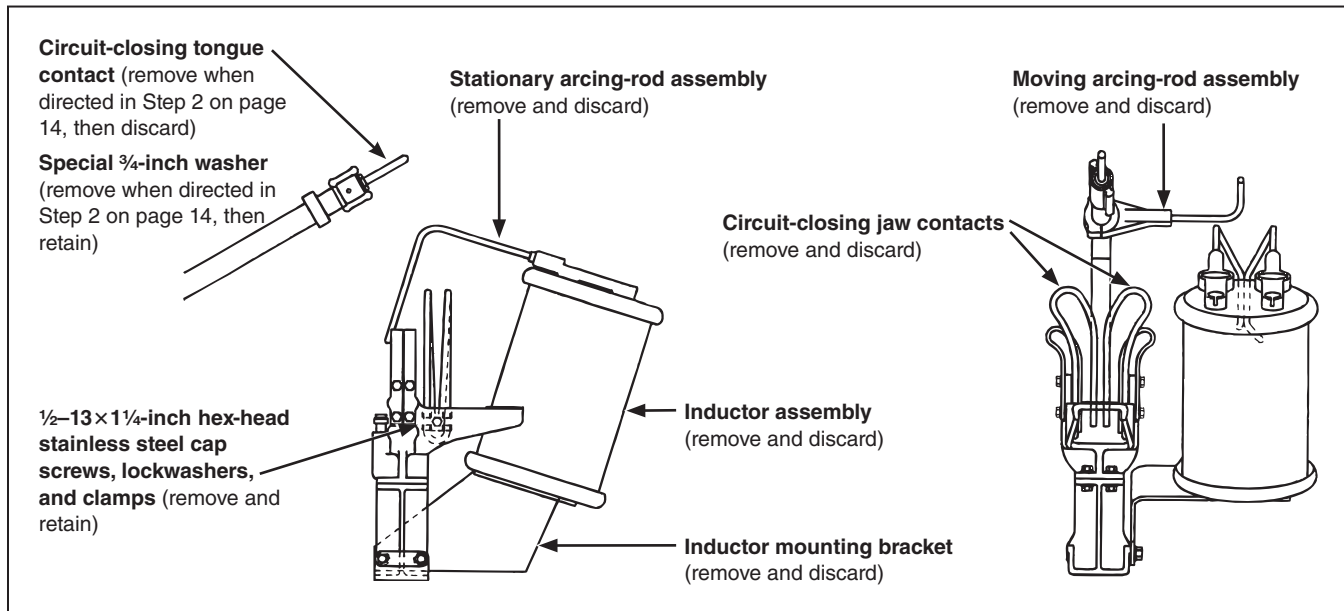


Figure 5. Removal of existing earlier-production 5-millihenry pre-insertion inductors on 34.5-kV through 69-kV vertical-break style and integer-style circuit-switchers.

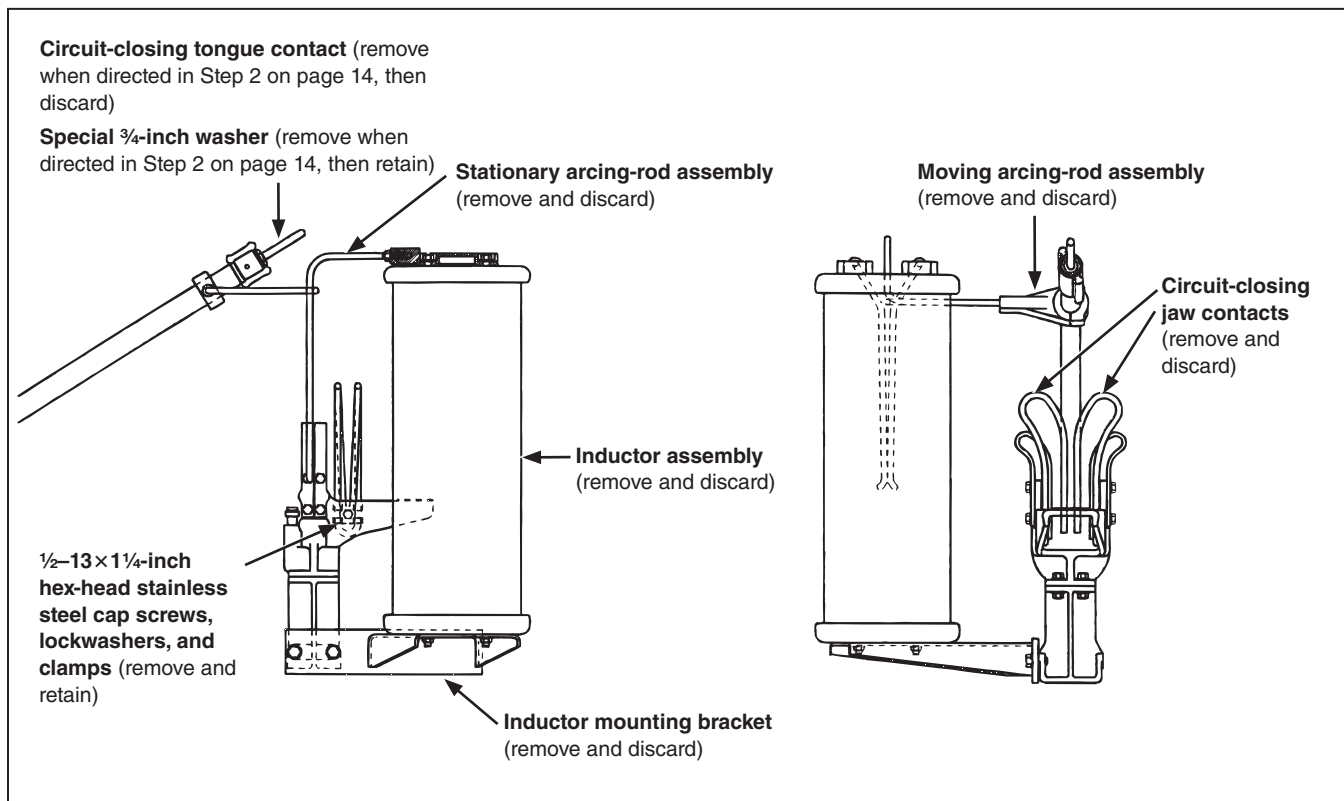


Figure 6. Removal of existing earlier-production 10-millihenry pre-insertion inductors on 34.5-kV through 69-kV vertical-break style and integer-style circuit-switchers.

# Removal of Existing Pre-Insertion Resistors or Inductors

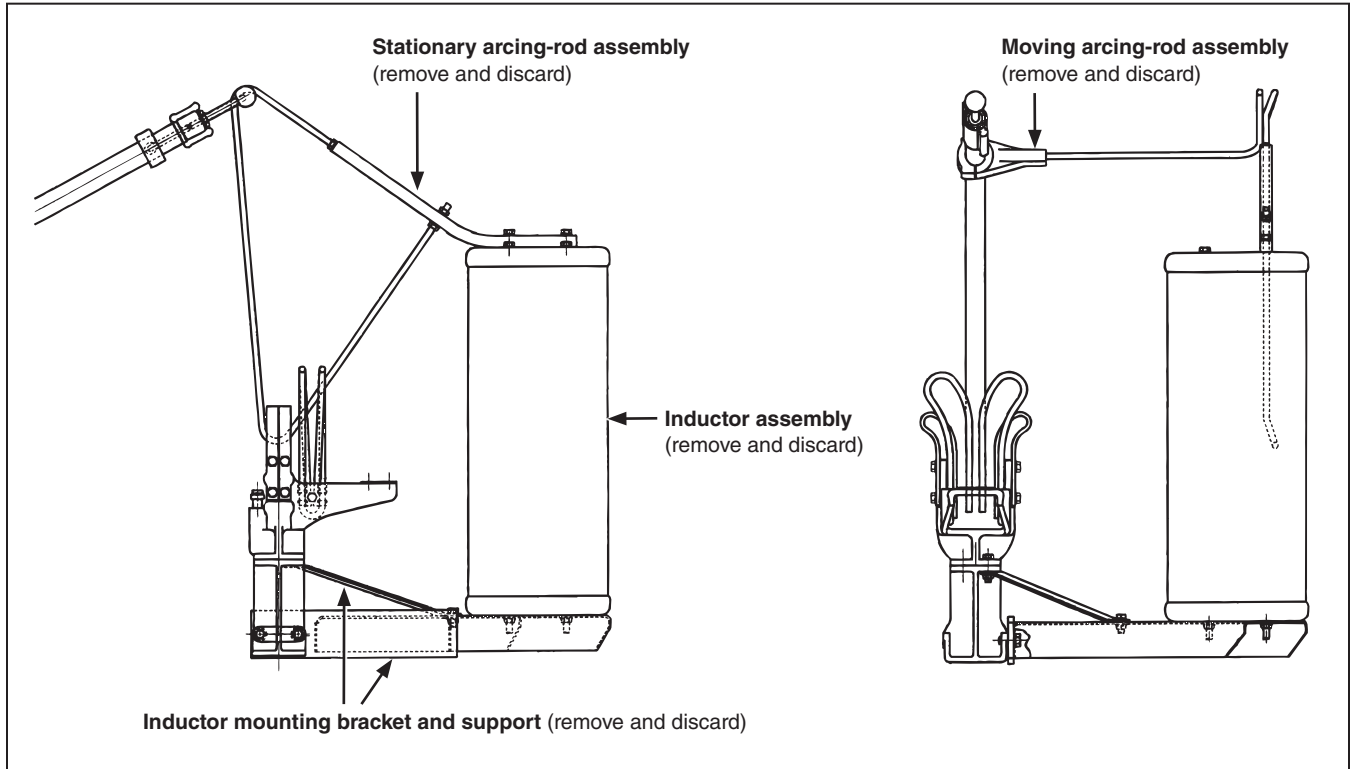


Figure 7. Removal of existing upgraded earlier-production 10-millihenry pre-insertion inductors on 115-kV and 138-kV vertical-break style circuit-switchers.

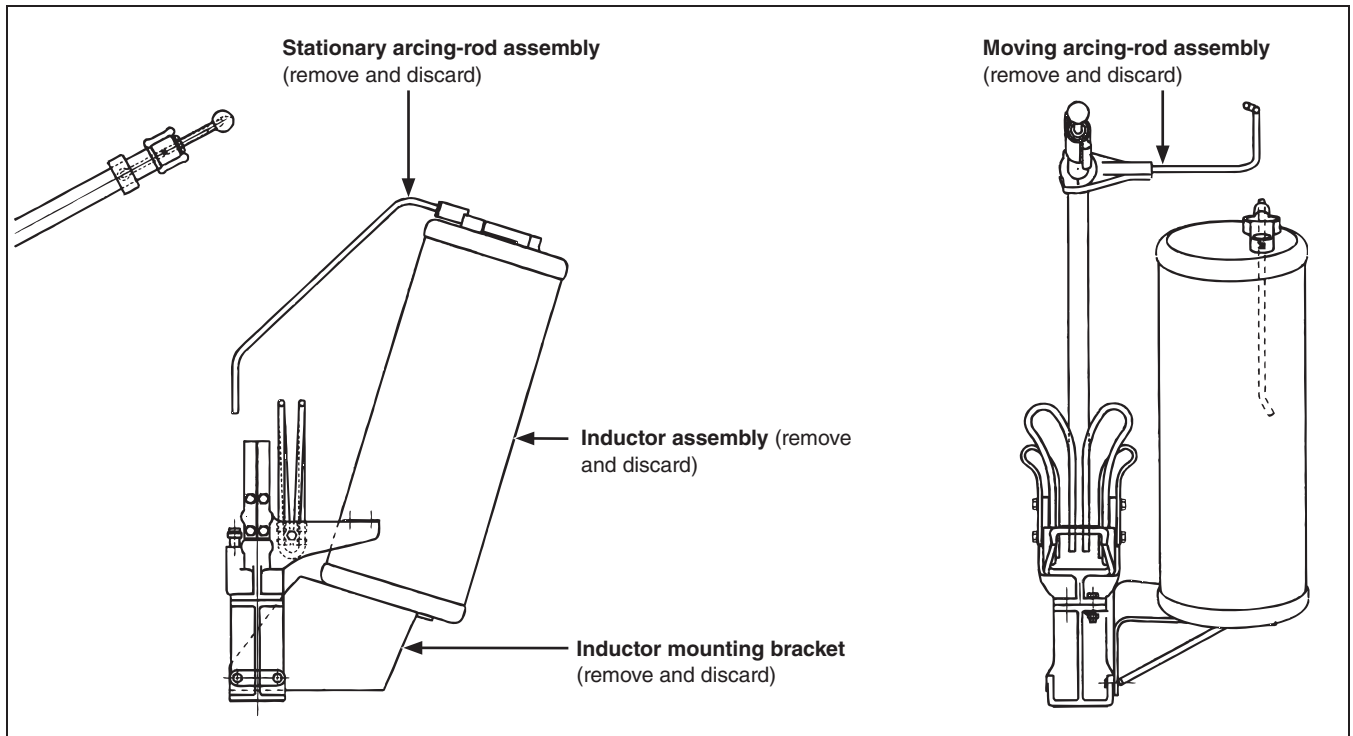


Figure 8. Removal of existing earlier-production 10-millihenry pre-insertion inductors on 115-kV and 138-kV vertical-break style circuit-switchers.

## Installation of Knee-Brace Assembly on Integer-Style Circuit-Switchers

### DANGER

De-energize and ground the circuit-switcher at all six terminals before installing the knee-brace assemblies. **Failure to fully de-energize the circuit-switcher before performing work will cause serious personal injury or death.**

### NOTICE

Integer-style circuit-switchers require the installation of a knee-brace assembly on the base of the circuit-switcher at the jaw-contact end and, in some instances, at the interrupter end. See Table 1.

To install the knee-brace assembly, complete the following steps:

**STEP 1.** Loosely assemble an upper clip angle and lower clip angle to each end of a knee brace using a  $\frac{5}{8}$ -11  $\times$  1 $\frac{3}{4}$ -inch galvanized hex-head cap screw, hardened flat washer, and hex nut. See Figure 9 on page 11, front view and top view.

**STEP 2.** Loosely attach the knee-brace assembly to the circuit-switcher base in accordance with Dimension A, using a  $\frac{5}{8}$ -11  $\times$  1 $\frac{3}{4}$ -inch galvanized hex-head cap screw, hardened flat washer, and hex nut. See Figure 9 on page 11, top view and front view.

**STEP 3.** Loosely attach the two support angles to the circuit-switcher mounting pedestal using two  $\frac{5}{8}$ -11-inch threaded rods, hardened flat washers, and hex nuts. See Figure 9 on page 11, front and side views.

**STEP 4.** Loosely attach the lower clip angles to the support angles using  $\frac{5}{8}$ -11  $\times$  1 $\frac{3}{4}$ -inch galvanized hex-head cap screws, hardened flat washers, and hex nuts. See Figure 9 on page 11.

**STEP 5.** Push the support angles *up* as far as they will go and make sure there is no slack in the knee-brace assemblies. Verify the 28 $\frac{1}{4}$ -inch dimension shown in Figure 9 on page 11, side view. Tighten all hardware.

**Table 1. Requirements for Knee-brace Assembly**

Rating, KV, Nom.	No. of Interrupting Gaps	Type of Pre-insertion Inductors	Knee-Brace Assembly Required at	
			Jaw-Contact End	Interrupter End
34.5 & 46	1	Enhanced-Duty	Yes	No
69	1	Enhanced-Duty	Yes	No
69	1	40-mH, 5.5-ohm Standard-Duty	Yes	No
69	2	40-mH, 5.5-ohm Standard-Duty	Yes	Yes
69	2	Enhanced-Duty	Yes	Yes

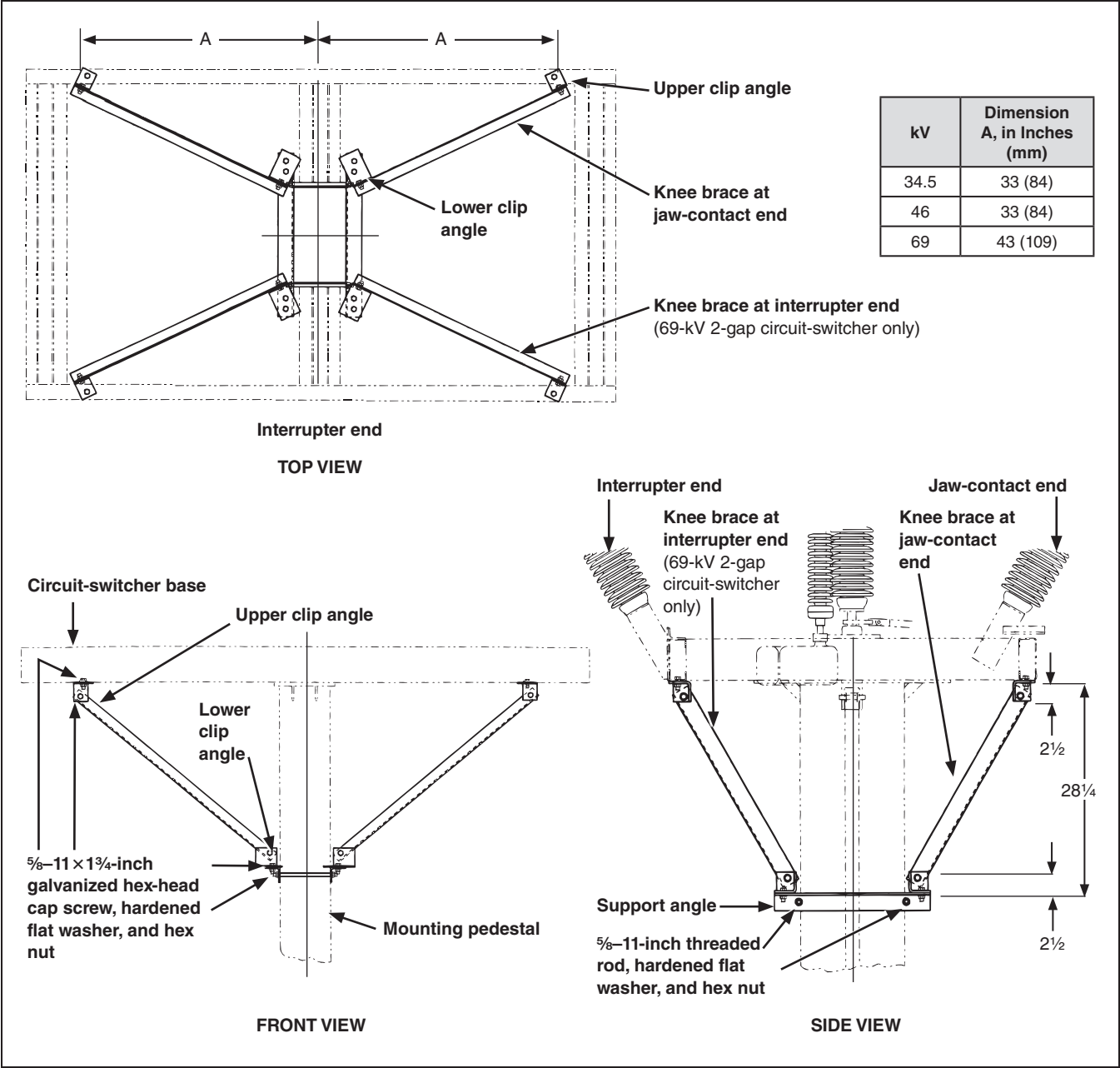


Figure 9. Installation of knee-brace assembly.

### Installation of High-Strength Insulators on Integer-Style Circuit-Switchers

#### DANGER

De-energize and ground the circuit-switcher at all six terminals before installing the high-strength insulators. **Failure to fully de-energize the circuit-switcher before performing work will cause serious personal injury or death.**

#### NOTICE

Integer-style circuit-switchers rated 69 kV furnished with enhanced-duty pre-insertion inductors require the installation of high-strength insulators at the jaw-contact end of the circuit-switcher.

Install the high-strength insulators using the following procedure:

- STEP 1.** Remove the four  $\frac{1}{2}$ -13  $\times$  1 $\frac{1}{4}$ -inch hex-head stainless steel cap screws and lockwashers securing the terminal adapter to the insulator mounting bracket. See Figure 10 on page 13, side view. Retain the terminal adapter and hardware.
- STEP 2.** Remove the two top  $\frac{5}{8}$ -11-inch hex nuts, lockwashers, and flat washers securing the insulator mounting weldment. See Figure 10 on page 13, View A-A. While supporting the insulator with an appropriate lifting device, remove the two  $\frac{5}{8}$ -11  $\times$  1 $\frac{1}{4}$ -inch hex-head cap screws, lockwashers, and four serrated washers securing the insulator mounting weldment to the switch base. Remove the insulator. Retain the hardware.
- STEP 3.** Remove the pivot rod from the insulator mounting weldment and install it in the replacement insulator mounting weldment. See Figure 10 on page 13, View A-A. Attach the replacement insulator mounting weldment and replacement insulator mounting bracket to the high-strength insulator using eight  $\frac{5}{8}$ -11  $\times$  1 $\frac{1}{4}$ -inch hex-head galvanized cap screws and lockwashers. Securely tighten the hardware.
- STEP 4.** Attach the high-strength insulator assembly to the switch base using two  $\frac{5}{8}$ -11  $\times$  1 $\frac{1}{2}$ -inch hex-head cap screws, lockwashers, and four serrated washers. See Figure 10 on page 13, View A-A. Secure the insulator mounting weldment with two  $\frac{5}{8}$ -11 hex nuts, lockwashers, and flat washers. Securely tighten the hardware.
- STEP 5.** Attach the terminal adapter to the insulator mounting bracket using four  $\frac{1}{2}$ -13  $\times$  1 $\frac{1}{4}$ -inch hex-head stainless steel cap screws and lockwashers. See Figure 10 on page 13, side view. Securely tighten the hardware.

#### NOTICE

Make sure the circuit-switcher disconnect blades are correctly aligned with their jaw-contact assemblies.

Failure to obtain correct alignment at each pole-unit can result in damage to the circuit-switcher.

- STEP 6.** Slowly close the circuit-switcher with the MANUAL OPERATING handle and observe the contacts.

As the circuit-switcher disconnect blade is closed, the circuit-closing tongue contact should engage each of the circuit-closing jaw-contact members with equal pressure, and the current-carrying tongue contact should enter between the current-carrying jaw-contact members with equal clearance on each side. The silver-surfaced area of the current-carrying tongue contact should center laterally with the silver-surfaced current-carrying jaw-contact members, and the blade should rotate with slight pressure against the blade bumper stop and come to rest either on the stop or slightly above it.

If adjustment of the jaw-contact assembly is necessary to obtain the described alignment, refer to the instruction sheet furnished for the specific circuit-switcher involved and proceed as outlined therein.

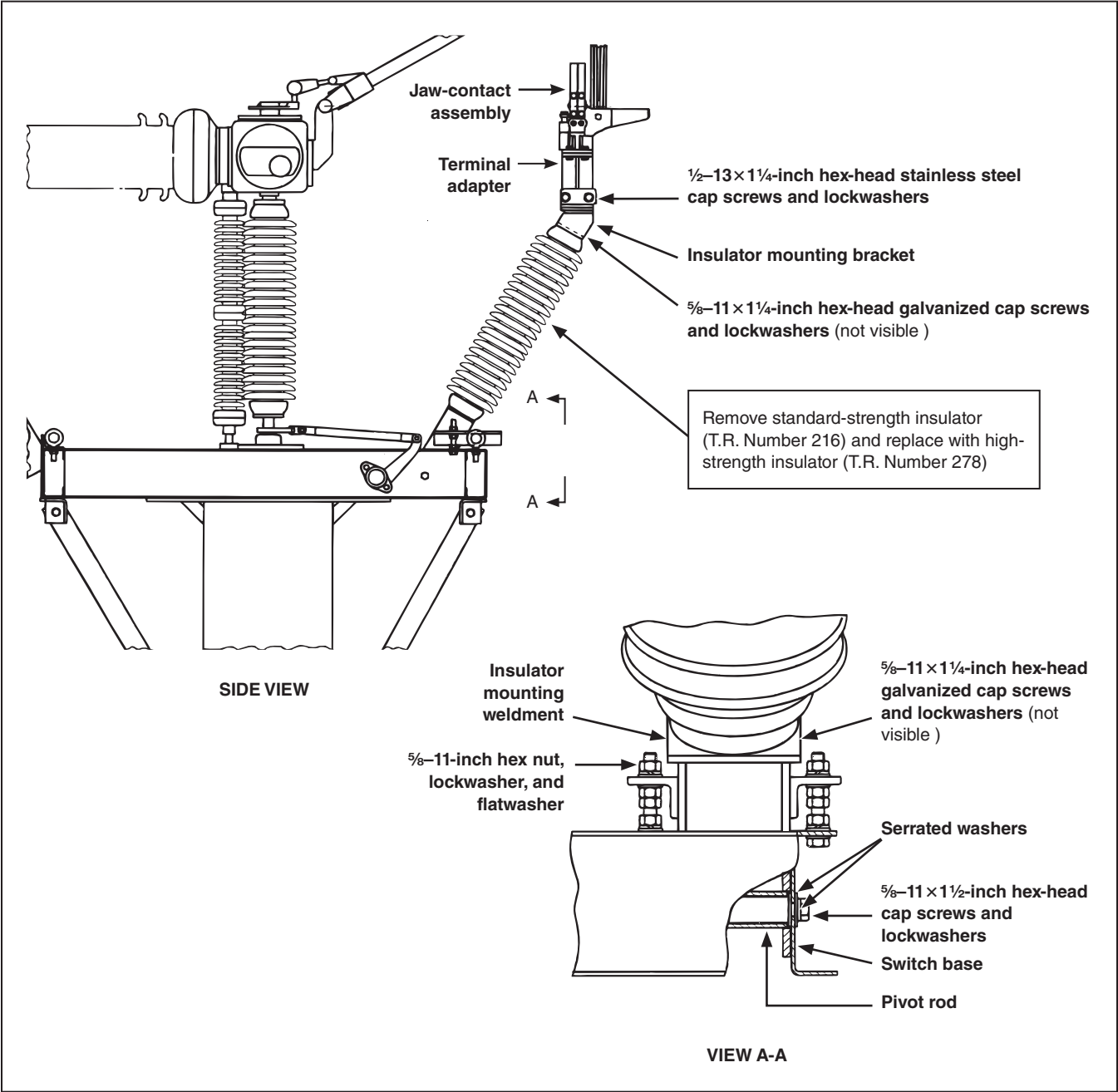


Figure 10. Installation of high-strength insulators.

### Replacement of Circuit-Closing Contacts on 34.5-kV through 69-kV Vertical-Break Style and Integer-Style Circuit-Switchers

#### DANGER

De-energize and ground the circuit-switcher at all six terminals before replacing the circuit-closing contacts. **Failure to fully de-energize the circuit-switcher before performing work will cause serious personal injury or death.**

#### NOTICE

Vertical-break style and integer-style circuit-switchers rated 34.5 kV through 69 kV require the installation of replacement circuit-closing contacts.

Repeat the following steps for each pole-unit:

- STEP 1.** Install the replacement circuit-closing jaw contacts on the jaw-contact terminal pad using two  $\frac{1}{2}$ -13  $\times$  1 $\frac{1}{4}$ -inch hex-head stainless steel cap screws, lockwashers, and clamps. See Figure 11 on page 18, side view. Adjust the contact height to  $9\frac{7}{8} \pm \frac{1}{8}$  inches (251 mm  $\pm$  3 mm) as shown. Manually close the circuit-switcher and verify the existing circuit-closing tongue contact engages both jaw contacts simultaneously. Securely tighten the hardware.
- STEP 2.** Remove the existing circuit-closing tongue contact and special  $\frac{3}{4}$ -inch washer from the end of the disconnect blade assembly. Discard the contact but retain the washer. See Figure 1 on page 5, Figure 4 on page 7, Figure 5 on page 8, or Figure 6 on page 8, as appropriate.
- STEP 3.** Pre-assemble the replacement circuit-closing tongue contact by installing a  $\frac{5}{8}$ -11 stainless steel hex nut and a  $\frac{3}{4}$ -16-inch stainless steel hex nut to the ends of the contact. See Figure 12 on page 19, Detail A. Screw the hex nuts all the way down onto the contact. Screw the circuit-closing tongue contact onto the circuit-closing tongue contact support so the center of the half-circle saddle is concentric to the  $\frac{3}{4}$ -16-inch threaded end of the circuit-closing tongue contact. See Figure 12 on page 19, View C-C.

- STEP 4.** Install the special  $\frac{3}{4}$ -inch washer with the radius edge towards the  $\frac{3}{4}$ -16-inch hex nut. See Figure 12 on page 19, Detail A. Remove the circuit-closing tongue contact support clamp and screw the  $\frac{3}{4}$ -16-inch threaded end of the circuit-closing tongue contact assembly all the way into the disconnect blade.


Make sure the half-circle saddle of the circuit-closing tongue contact support is in sliding contact with the disconnect blade pipe. It may be necessary to screw the circuit-closing tongue contact support in or out on the circuit-closing tongue contact so the half-circle saddle is in contact with the disconnect blade pipe.

The circuit-closing tongue contact should be in a vertical position when the disconnect blade is being closed and the circuit-closing tongue contact is just making contact with the circuit-closing jaw contacts. See Figure 11 on page 18 and Figure 12 on page 19, side view and View D-D. Securely tighten the  $\frac{3}{4}$ -16-inch hex nut.

- STEP 5.** Attach the circuit-closing tongue contact support clamp to the circuit-closing tongue contact support using two  $\frac{1}{4}$ -20  $\times$  1 $\frac{1}{4}$ -inch socket-head stainless steel cap screws and securely tighten. See Figure 11 on page 18 and Figure 12 on page 19, View D-D.

Install a  $\frac{5}{16}$ -18  $\times$   $\frac{3}{8}$ -inch socket-head set screw and securely tighten. Securely tighten the  $\frac{5}{8}$ -11-inch hex nut up to the circuit-closing tongue contact support. See Figure 12 on page 19, Detail A.

**Assembly Procedure for 34.5-kV through 69-kV Vertical-Break and Integer-Style Circuit-Switchers Pre-Insertion Inductors**

 <b>DANGER</b>
<p>De-energize and ground the circuit-switcher at all six terminals before assembly. <b>Failure to fully de-energize the circuit-switcher before performing work will cause serious personal injury or death.</b></p>

Prior to assembly of component parts, thoroughly wire-brush aluminum mating surfaces. Immediately coat these surfaces with Penetrox® A (available from Burndy Corporation). Repeat the following steps for each pole-unit:

- STEP 1.** Loosely attach the inductor mounting bar to the top of the jaw-contact terminal pad using four ½–13 × 2¼-inch hex-head stainless steel cap screws, eight hardened flat washers, and four ½–13-inch hex nuts furnished. See Figure 11 on page 18 and Figure 12 on page 19, top and side views.
- STEP 2.** Loosely attach the inductor mounting brackets and spacers to each side of the terminal adapter on the front insulator stack using four ⅝–11 × 1¾-inch hex-head stainless steel cap screws and four ⅝-inch hardened flat washers. See Figure 11 on page 18 and Figure 12 on page 19, front and side views.
- STEP 3.** *For 34.5-kV through 69-kV circuit-switchers furnished with 10-millihenry standard-duty inductors:* Remove and discard the two ½–13 × 1½-inch hex-head stainless steel cap screws and two ½-inch hardened flat washers securing the top inductor end cap to the inductor assembly. Attach the inductor lifting bracket to the top end cap using two ½–13 × 1¼-inch hex-head stainless steel cap screws and two hardened flat washers. Securely tighten the hardware. See Figure 11 on page 18 and Figure 12 on page 19, front and top views. Proceed to Step 4.

*For 34.5-kV and 46-kV circuit-switchers furnished with 10-millihenry or 18-millihenry enhanced-duty inductors and 69-kV circuit-switchers furnished with 18-millihenry enhanced-duty inductors:* Remove and discard the four ½–13 × ¾-inch hex-head stainless steel cap screws and four ½-inch hardened flat washers securing the top inductor end cap to the inductor assembly. Attach the inductor lifting bracket to the top end cap using two ½–13 × 1¼-inch hex-head stainless steel cap screws and two hardened flat washers. Securely tighten the hardware. See Figure 11 on page 18, front and top views. Proceed to Step 4.

*For 69-kV circuit-switchers furnished with 40-millihenry standard-duty inductors or enhanced-duty inductors:* Attach the inductor lifting bracket to the top end cap of the inductor assembly using two ½–13 × 1¼-inch hex-head stainless steel cap screws and two hardened flat washers. Securely tighten the hardware. See Figure 11 on page 18 and Figure 12 on page 19, front and top views.

- STEP 4.** *For 34.5-kV through 69-kV circuit-switchers furnished with 10-millihenry standard-duty inductors:* Lift the inductor assembly on top of the inductor mounting bar and inductor mounting brackets. Attach the bottom end cap of the inductor assembly to the inductor mounting bar and inductor mounting brackets using the four studs on the end cap, four ½-inch hardened flat washers, and four ½–13-inch stainless steel hex nuts. Securely tighten the hardware. See Figure 11 on page 18 and Figure 12 on page 19, side and front views. Proceed to Step 5.

*For 69-kV circuit-switchers furnished with 40-millihenry standard-duty inductors and 34.5-kV through 69-kV circuit-switchers furnished with 10-millihenry, 18-millihenry, or 40-millihenry enhanced-duty inductors:* Lift the inductor assembly on top of the inductor mounting bar and inductor mounting brackets. Attach the bottom end cap of the inductor assembly to the inductor mounting bar and inductor

mounting brackets using four  $\frac{1}{2}$ -13 $\times$ 2 $\frac{1}{4}$ -inch hex-head stainless steel cap screws and four  $\frac{1}{2}$ -inch hardened flat washers. Securely tighten the hardware. See Figure 11 on page 18 and Figure 12 on page 19, side and front views.

- STEP 5.** Securely tighten the four  $\frac{1}{2}$ -13 $\times$ 2 $\frac{1}{4}$ -inch hex-head stainless steel cap screws attaching the inductor mounting bar to the top of the jaw-contact terminal pad. See Figure 11 on page 18, side and top views.
- STEP 6.** Securely tighten the four  $\frac{5}{8}$ -11 $\times$ 1 $\frac{3}{4}$ -inch hex-head stainless steel cap screws attaching the inductor mounting brackets and spacers to each side of the terminal adapter on the front insulator stack. See Figure 11 on page 18 and Figure 12 on page 19, side and front views.
- STEP 7.** Remove the two  $\frac{1}{2}$ -13 $\times$ 1 $\frac{1}{4}$ -inch hex-head stainless steel cap screws and two hardened flat washers securing the lifting bracket to the top end of the inductor assembly.
- STEP 8.** Loosely attach the inductor jaw-contact assembly to the contact support tube using two  $\frac{3}{8}$ -16 $\times$  $\frac{3}{4}$ -inch hex-head stainless steel cap screws and two serrated washers. See Figure 11 on page 18 and Figure 12 on page 19, side and front views.
- STEP 9.** Loosely attach the contact support tube to the inductor assembly top end cap using two support tube mounting clamps, four  $\frac{1}{2}$ -13 $\times$ 1 $\frac{1}{4}$ -inch hex-head stainless steel cap screws, and four  $\frac{1}{2}$ -inch serrated washers. See Figure 11 on page 18, top view.

- STEP 10.** As the circuit-switcher disconnect blade is closed, the circuit-closing tongue contact should engage each of the circuit-closing jaw-contact members with equal pressure. The current-carrying tongue contact should enter between the current-carrying jaw-contact members with equal clearance on each side.

The silver-surfaced area of the current-carrying tongue contact should center laterally with the silver-surfaced current-carrying jaw-contact members. The blade should rotate with slight pressure against the blade bumper stop and come to rest either on the stop or slightly above it.

### NOTICE

Make sure the circuit-switcher disconnect blades are correctly aligned with their jaw-contact assemblies. Failure to obtain correct alignment at each pole-unit can result in damage to the circuit-switcher.

If adjustment of the jaw-contact assembly is necessary to obtain the described alignment, refer to the instruction sheet furnished for the specific circuit-switcher involved and proceed as outlined in that document.

- STEP 11.** Manually close the circuit-switcher so the circuit-closing tongue contact engages both contacts of the inductor jaw-contact assembly with equal pressure on each side. See Figure 12 on page 19, View B-B. Adjust the contact support tube to attain the dimension shown in Figure 12 on page 19, Detail A.

Securely tighten the four  $\frac{1}{2}$ -13 $\times$ 1 $\frac{1}{4}$ -inch hex-head stainless steel cap screws securing the support tube mounting clamps to the inductor assembly top end cap.

**STEP 12.** Level the inductor jaw-contact assembly vertically while maintaining the circuit-closing tongue contact engaged between the inductor contacts with equal pressure. See Figure 11 on page 18 and Figure 12 on page 19, View B-B. Securely tighten the two  $\frac{3}{8}$ -16  $\times$   $\frac{3}{4}$ -inch hex-head stainless steel cap screws attaching the inductor jaw-contact assembly to the contact support tube. See Figure 11 on page 18 and Figure 12 on page 19, side and front views.

**STEP 13.** Continue closing the circuit-switcher and verify the circuit-closing tongue contact continues to engage both contacts with equal pressure as it exits the inductor contact assembly. See Figure 12 on page 19, View B-B. If adjustment is necessary, proceed to Step 14. If adjustment is not necessary, proceed to Step 15 on page 17.

**STEP 14.** Loosen the  $\frac{3}{4}$ -16-inch stainless steel hex nut securing the circuit-closing tongue contact to the disconnect blade and loosen the two  $\frac{1}{4}$ -20  $\times$   $1\frac{1}{4}$ -inch socket-head cap screws and  $\frac{5}{16}$ -18  $\times$   $\frac{3}{8}$ -inch socket-head set screw securing the circuit-closing tongue contact support to the disconnect blade. See Figure 12 on page 19, Detail A and View D-D.

Rotate the circuit-closing tongue contact on the disconnect blade so the tongue contact engages both contacts of the inductor jaw-contact assembly with equal pressure as it exits the assembly during closing. Securely tighten the  $\frac{3}{4}$ -16-inch stainless steel hex nut, the two  $\frac{1}{4}$ -20  $\times$   $1\frac{1}{4}$ -inch socket-head cap screws, and the  $\frac{5}{16}$ -18  $\times$   $\frac{3}{8}$ -inch socket-head set screw.

**STEP 15.** Manually operate the circuit-switcher to make sure the circuit-closing tongue contact is centered on the contacts of the inductor jaw-contact assembly during closing and opening. Lubricate the contact surfaces with S&C catalog number 9999-043 lubricant, furnished. See Figure 12 on page 19, Detail A.

### NOTICE

Contact surfaces must be properly lubricated. Failure to lubricate these surfaces can result in excessive contact wear.

Use Shell Gadus® S2 U1000 2 Lubricant, S&C catalog number 9999-043, Shell Darina SD2, Dow 33, or equivalent.

### NOTICE

The circuit-closing tongue contact does not simultaneously engage the inductor jaw-contact assembly and the circuit-closing jaw contacts.

**STEP 16.** Inspect the exterior finish of the inductor winding for damage or exposure of the fiberglass roving. Use the furnished touch-up kit to refinish any damaged surfaces. Refer to the “Inspection Recommendations” section on page 27.

Should the inductor winding be damaged to the extent coiled conductor is exposed, the inductor must be removed from service and replaced.

# Assembly and Installation

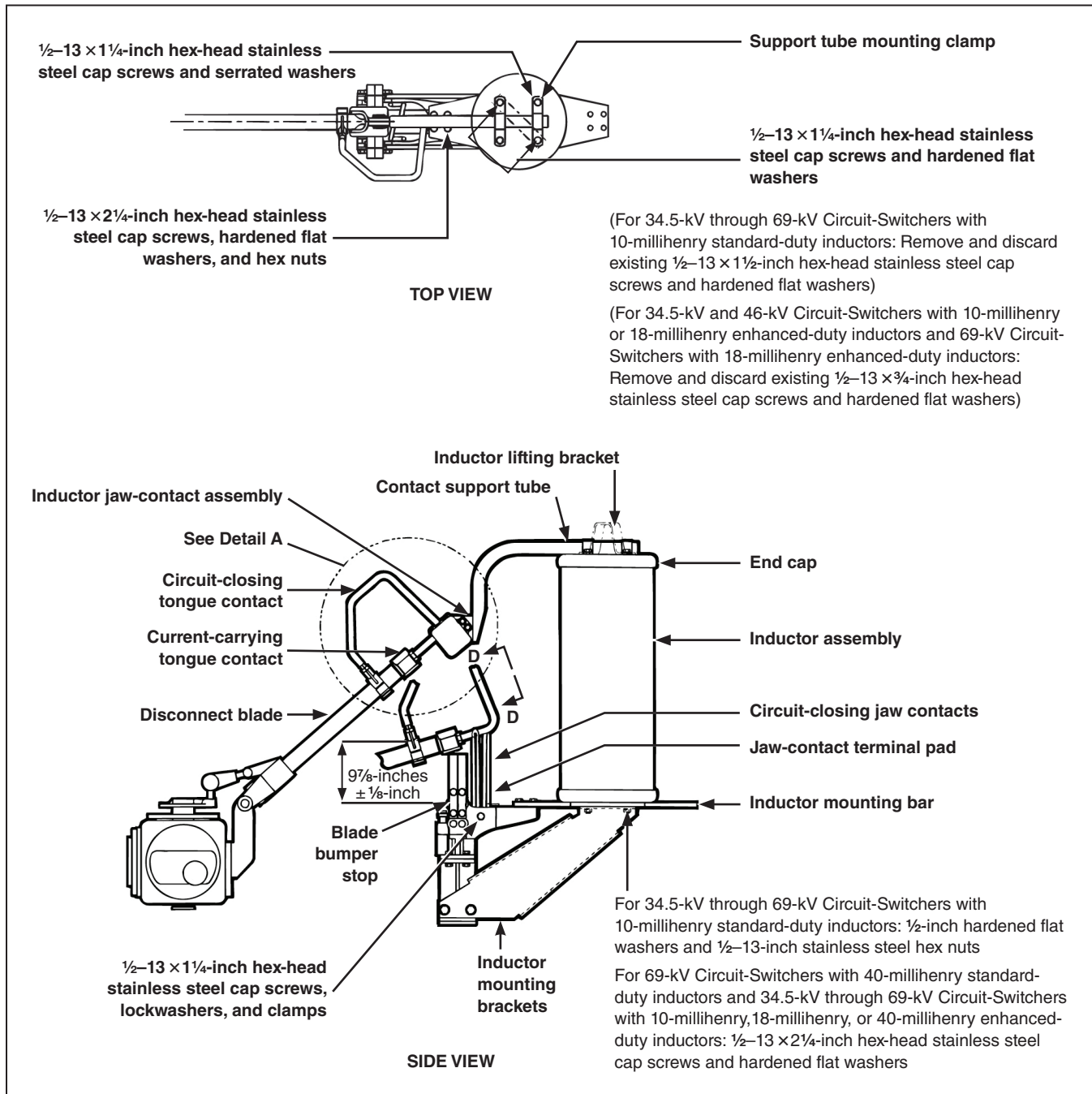


Figure 11. Assembly details of pre-insertion inductors for 34.5-kV through 69-kV vertical-break style and integer-style circuit-switchers. 10-millihenry inductors illustrated.

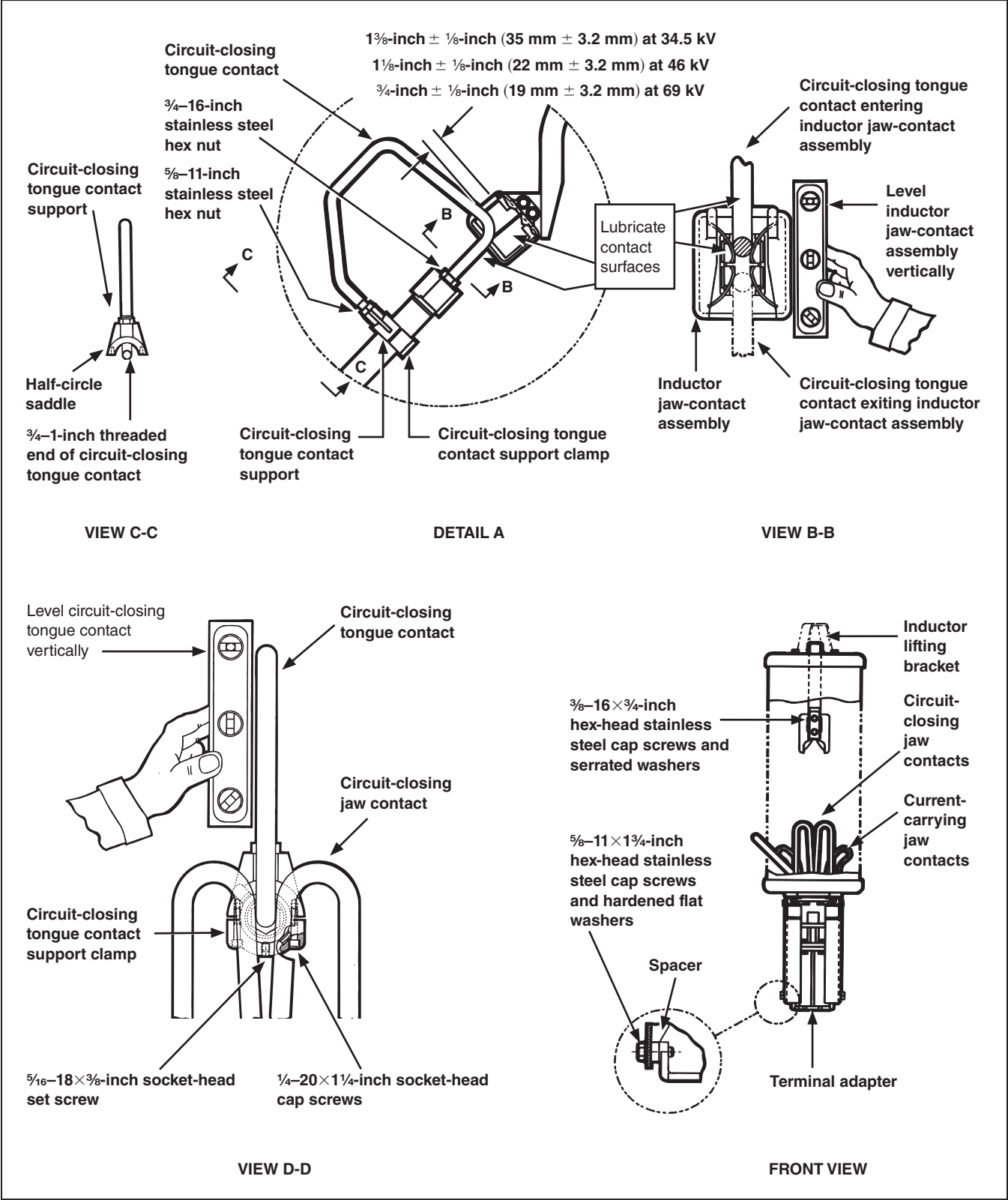


Figure 12. Detail views of standard-duty pre-insertion inductors for 34.5-kV through 69-kV vertical-break style and inter-style circuit-switchers.

### Assembly Procedure for 115-kV and 138-kV Vertical-Break Style Circuit-Switcher Pre-Insertion Inductors

#### DANGER

De-energize and ground the circuit-switcher at all six terminals before assembly. **Failure to fully de-energize the circuit-switcher before performing work will cause serious personal injury or death.**

Prior to assembly of component parts, thoroughly wire-brush aluminum mating surfaces. Immediately coat these surfaces with Penetrox A (available from Burndy Corporation). Repeat the following steps for each pole-unit:

- STEP 1.** Loosely attach the inductor mounting bar to the top of the jaw-contact terminal pad using four  $\frac{1}{2}$ -13  $\times$  2 $\frac{1}{4}$ -inch hex-head stainless steel cap screws, eight hardened flat washers, and four  $\frac{1}{2}$ -13-inch hex nuts furnished. See Figure 13 on page 22, top and side views.
- STEP 2.** Refer to Figure 12 on page 19, front view, and insert, from the underside, four  $\frac{5}{8}$ -11  $\times$  1 $\frac{3}{4}$ -inch hex-head stainless steel cap screws and hardened flat washers through the tapped holes on each face of the terminal adapter. Loosely attach the inductor mounting brackets to the terminal adapter using four  $\frac{5}{8}$ -inch hardened flat washers and  $\frac{5}{8}$ -11-inch hex nuts furnished. See Figure 12 on page 19 and Figure 13 on page 22, front and side views.
- STEP 3.** Attach the inductor lifting bracket to the top end cap of the inductor assembly using two  $\frac{1}{2}$ -13  $\times$   $\frac{3}{4}$ -inch hex-head stainless steel cap screws and hardened flat washers furnished. See Figure 13 on page 22, top view. Securely tighten the hardware.
- STEP 4.** Lift the inductor assembly on top of the inductor mounting bar and the inductor mounting bracket. Attach the bottom end cap of the inductor assembly to the inductor mounting bar and inductor mounting bracket using four  $\frac{1}{2}$ -13  $\times$  2 $\frac{1}{4}$ -inch hex-head stainless steel cap screws and hardened flat washers. See Figure 13 on page 22, side view. Securely tighten the hardware.
- STEP 5.** Securely tighten the  $\frac{1}{2}$ -13  $\times$  2 $\frac{1}{4}$ -inch hex-head stainless steel cap screws attaching the inductor mounting bar to the top of the jaw-contact terminal pad.
- STEP 6.** Securely tighten each  $\frac{5}{8}$ -11-inch hex nut attaching the inductor mounting bracket to the terminal adapter, while holding the associated  $\frac{5}{8}$ -11  $\times$  1 $\frac{3}{4}$ -inch hex-head stainless steel cap screw to prevent it from turning. See Figure 12 on page 19, front view. Now tighten each  $\frac{5}{8}$ -11-inch hex nut  $\frac{1}{3}$  additional turn.
- STEP 7.** Remove and retain the hardware securing the inductor lifting bracket to the top end cap of the inductor assembly and remove the lifting bracket.
- STEP 8.** Remove and retain the appropriate  $\frac{1}{2}$ -13  $\times$   $\frac{3}{4}$ -inch hex-head stainless steel cap screw and hardened flat washer from the top end cap of the inductor assembly. See Figure 13 on page 22, top view. Loosely attach the stationary arcing-rod assembly to the top end cap using two  $\frac{1}{2}$ -13  $\times$  1 $\frac{1}{4}$ -inch hex-head stainless steel cap screws and hardened flat washers furnished.
- Insert a  $\frac{1}{2}$ -13  $\times$   $\frac{3}{4}$ -inch hex-head stainless steel cap screw and hardened flat washer into each of the other three tapped holes in the top end cap and securely tighten each of these screws.
- STEP 9.** As the circuit-switcher disconnect blade is closed, the circuit-closing tongue contact should engage each of the circuit-closing jaw-contact members with equal pressure. The current-carrying tongue contact should enter between the current-carrying jaw-contact members with equal clearance on each side.
- The silver-surfaced area of the current-carrying tongue contact should center laterally with the silver-surfaced current-carrying jaw-contact members. The blade should rotate with slight pressure against the blade bumper stop and come to rest either on the stop or slightly above it.

#### NOTICE

Make sure the circuit-switcher disconnect blades are correctly aligned with their jaw-contact assemblies.

Failure to obtain correct alignment at each pole-unit can result in damage to the circuit-switcher.

If adjustment of the jaw-contact assembly is necessary to obtain the described alignment, refer to the instruction sheet furnished for the specific circuit-switcher involved and proceed as outlined in that document.

- STEP 10.** Loosely attach the moving arcing-rod support to the disconnect blade in accordance with the 3/8-inch (79-mm) dimension shown in Figure 13 on page 22, Detail A.
- STEP 11.** Manually close the circuit-switcher so the minimum metal-to-metal clearance between the current-carrying tongue contact and the nearest circuit-closing jaw contact is equal to Dimension A, as shown in Figure 13 on page 22 and Figure 14 on page 23, side view and front view.
- With the circuit-switcher disconnect blade in this position, rotate the moving arcing rod to the horizontal position, as shown in Figure 14 on page 23, front view. Fully tighten the two 1/4–20×1 1/4-inch socket-head stainless steel cap screws. Apply furnished Loctite “A” to the two cap screws.
- STEP 12.** Using the tapped hole in the moving arcing-rod support as a guide, drill a 5/16-inch diameter hole, 3 inches deep in the disconnect blade. See Figure 14 on page 23, Detail B. Drive in the groove pin furnished, then stake the support casting.
- STEP 13.** Manually close the circuit-switcher so the minimum metal-to-metal clearance between the current-carrying tongue contact and the nearest circuit-closing jaw contact is equal to Dimension A, as shown in Figure 13 on page 22, side view and front view.

Adjust the stationary arcing-rod assembly to attain a 0-inch to 1/8-inch (3-mm) gap between the stationary arcing rod and the moving arcing rod. See Figure 14 on page 23, front view. Securely tighten the two 1/2–13×1 3/4 hex-head stainless steel cap screws. Lubricate the contact surfaces with an appropriate lubricant, such as S&C catalog number 9999-043 or equivalent. See Figure 14 on page 23, front view.

### NOTICE

Contact surfaces must be properly lubricated. Failure to lubricate these surfaces can result in excessive contact wear.

Use Shell Gadus® S2 U1000 2 Lubricant, S&C catalog number 9999-043, Shell Darina SD2, Dow 33, or equivalent.

- STEP 14.** Manually operate the circuit-switcher to recheck the alignment between the moving and stationary arcing rods. During closing, the clearance between the moving and stationary arcing rods should be 0-inch to 1/8-inch (3-mm), as shown in Figure 14 on page 23, front view. Readjust the stationary arcing-rod assembly, if necessary, then re-tighten the cap screws on the inductor assembly end cap.
- STEP 15.** Verify the minimum metal-to-metal clearance between the stationary arcing rod and the nearest current-carrying jaw contact is equal to Dimension A, as shown in Figure 14 on page 23, front view. If necessary loosen the four 1/2–13×2 1/4 hex-head stainless steel cap screws securing the inductor assembly to the inductor mounting bar and inductor mounting bracket and reposition the inductor assembly.
- Re-tighten the cap screws. Make sure the 0-inch to 1/8-inch (3-mm) gap between the stationary arcing rod and the moving arcing rod shown in Figure 14 on page 23, front view, has been maintained.
- STEP 16.** Inspect the exterior finish of the inductor winding for damage or exposure of the fiberglass roving. Use the furnished touch-up kit to refinish any damaged surfaces. Refer to the “Inspection Recommendations” section on page 27.

Should the inductor winding be damaged to the extent coiled conductor is exposed, the inductor must be removed from service and replaced.

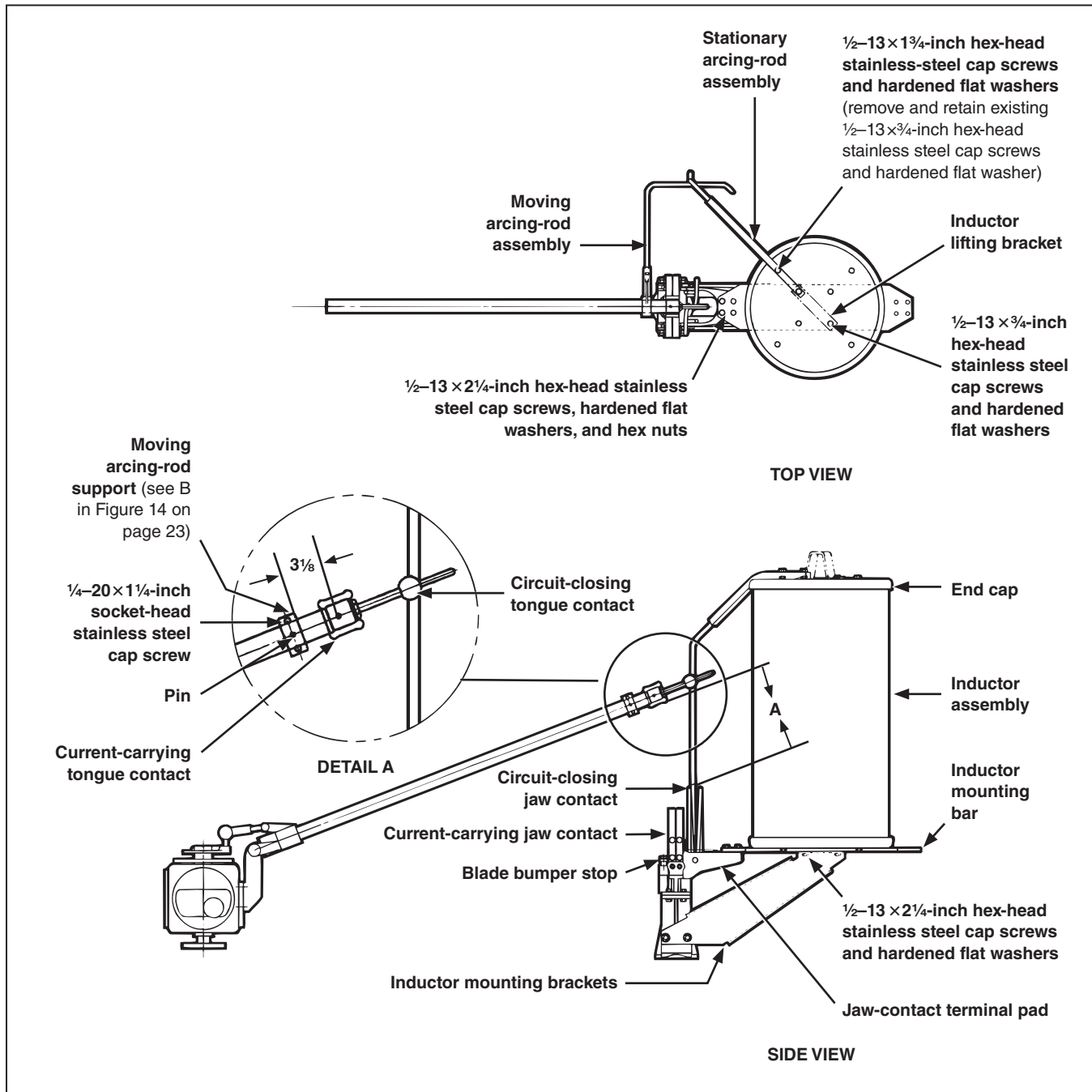


Figure 13. Assembly details of pre-insertion inductors for 115-kV and 138-kV vertical-break style circuit-switchers.

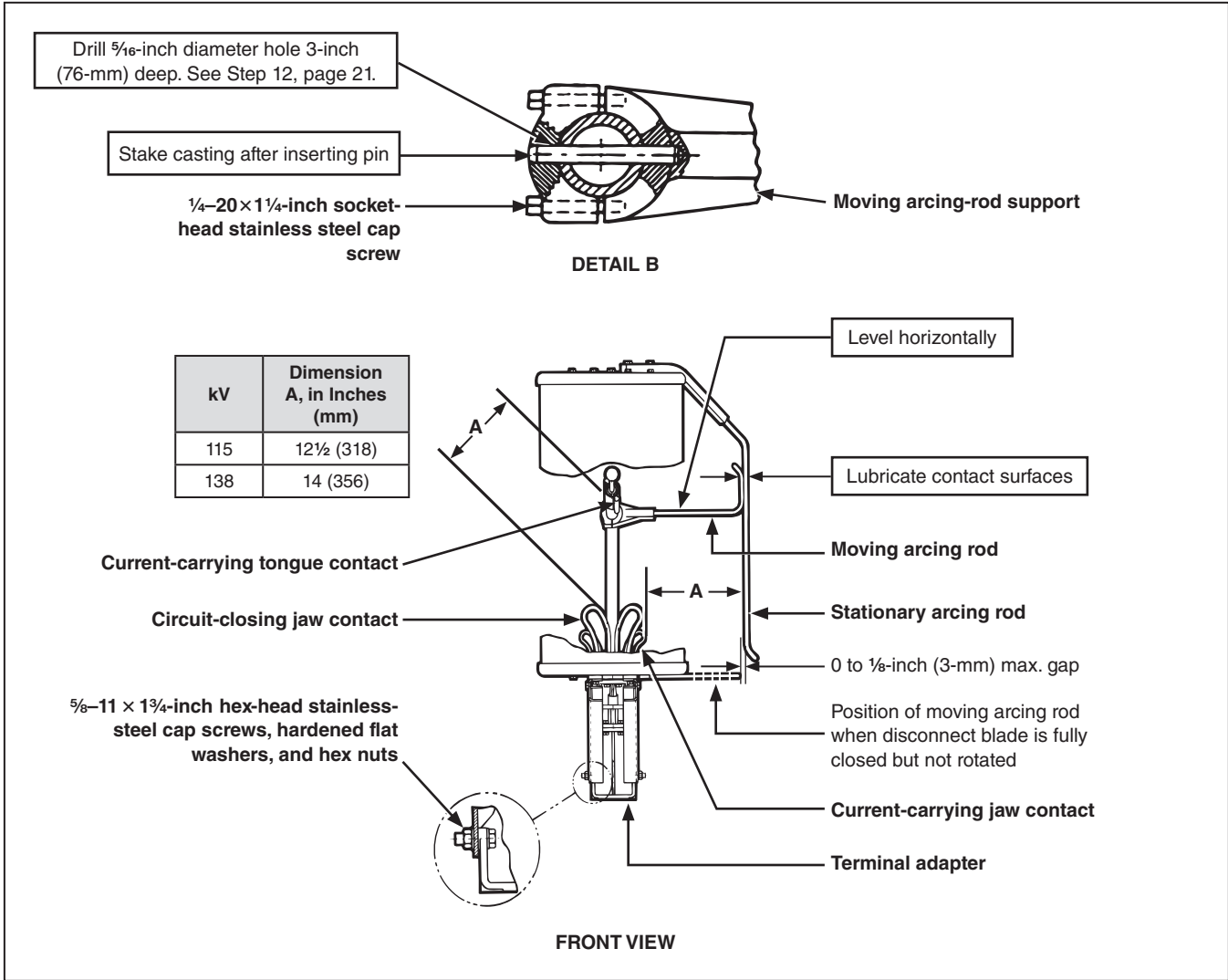


Figure 14. Detail B and front view of pre-insertion inductors for 115-kV and 138-kV vertical-break style circuit-switchers.

### Assembly Procedure for 230-kV and 345-kV Center-Break Style Circuit-Switcher Pre-Insertion Inductors

Prior to assembly of component parts, thoroughly wire-brush aluminum mating surfaces. Immediately coat these surfaces with Penetrox A (available from Burndy Corporation). Repeat the following steps for each pole-unit:

**STEP 1.** If pre-insertion resistors were not originally furnished with the circuit-switcher, skip to Step 2.

With the circuit-switcher in the fully **Closed** position, attach the inductor mounting adapters as follows:

(a) Draw guide marks at the juncture of the tongue-contact disconnect blade and its associated blade-hinge assembly to use as a reference so, during this step, the disconnect-blade contact alignment (longitudinal and rotational) can be maintained.

Remove the tongue-contact disconnect-blade clamp and replace it with an inductor mounting adapter using four  $\frac{1}{2}$ -13  $\times$  1 $\frac{1}{2}$ -inch hex-head stainless steel cap screws, serrated washers, and split lockwashers.

Make sure the inductor mounting surface of the adapter is level (parallel to the pole-unit base) and the disconnect blade is aligned with its blade-hinge assembly in accordance with the guide marks previously drawn. Then, fully tighten the cap screws.

**For 345-kV circuit-switchers:**

Repeat (a) for the jaw-contact disconnect blade.

**For 230-kV circuit-switchers,**

attach a second inductor mounting adapter to the jaw-contact disconnect blade, using the blade clamp which was removed as directed in (a), positioned as shown in Figure 15 on page 26, side view. Make sure the inductor mounting surface of the adapter is level. Then fully tighten the cap screws.

(b) Manually open and then reclose the circuit-switcher and verify, during the closing stroke, the circuit-closing contact members are in proper mesh and the current-carrying tongue contact enters the current-carrying jaw contact evenly with no tendency to clash against either side. Should adjustment be necessary, realign the tongue-contact disconnect blade only, as directed in the instruction sheet furnished for the circuit-switcher.

**STEP 2.** Mount the two inductor assemblies on the inductor mounting adapters, using four  $\frac{1}{2}$ -13-inch stainless steel hex nuts and hardened flat washers. Securely tighten the nuts.

**STEP 3.** Attach the arcing-arm assemblies to the inductor assemblies as shown in Figure 15 on page 26, side view, using four  $\frac{1}{2}$ -13  $\times$  1 $\frac{1}{2}$ -inch hex-head stainless steel cap screws, serrated washers, and split lockwashers. Mounting holes of inductor arm assemblies are slotted to permit adjustment of arm.

**STEP 4.** Manually open the circuit-switcher to the point where the arcing-arm tips are aligned vertically, i.e., tip over tip. At this point of minimum separation, adjust the arms to obtain a clearance equal to Dimension A, as shown in Figure 15 on page 26, side view. If necessary, use the special shims (furnished) between the arcing-arm assemblies and the inductor assemblies to attain this clearance.

**STEP 5.** Continue opening the circuit-switcher until reaching the point where the metal-to-metal separation between the disconnect blades is equal to Dimension B, as shown in Figure 15 on page 26, top view. Then, while maintaining this disconnect-blade positioning, loosen the four  $\frac{1}{2}$ -13  $\times$  1 $\frac{1}{2}$ -inch hex-head stainless steel cap screws securing each arcing-arm assembly and adjust the angle of both arcing arms by equal amounts to obtain a separation equal to Dimension C, as shown in Figure 15 on page 26, top view.

Recheck to make sure Dimension A has been maintained. If necessary, repeat the above procedure. Then, fully tighten the  $\frac{1}{2}$ -13  $\times$  1 $\frac{1}{2}$ -inch hex-head stainless steel cap screws which fasten the arcing-arm assemblies to the inductor assemblies.

- STEP 6.** If pre-insertion resistors were not originally furnished with the circuit-switcher, skip to Step 7.

At the location indicated in Figure 15 on page 26, side view, remove one of the  $\frac{1}{2}$ -13  $\times$  1 $\frac{1}{2}$ -inch hex-head stainless steel cap screws from the blade clamp at the jaw-contact end of the disconnect blade (not applicable to 345-kV circuit-switchers). At the inside corner of the bolt cavity, drill a  $\frac{5}{16}$ -inch diameter hole through the clamp and the wall of the disconnect blade. Aim the drill to enter the blade on center. Insert the  $\frac{5}{16}$ -inch diameter Spirol pin furnished. Replace and fully tighten the clamp bolt.

- STEP 7.** Inspect the exterior finish of the inductor winding for damage or exposure of the fiberglass roving. Use the furnished touch-up kit to refinish any damaged surfaces. Refer to the "Inspection Recommendations" section on page 27.

Should the inductor winding be damaged to the extent coiled conductor is exposed, the inductor must be removed from service and replaced.

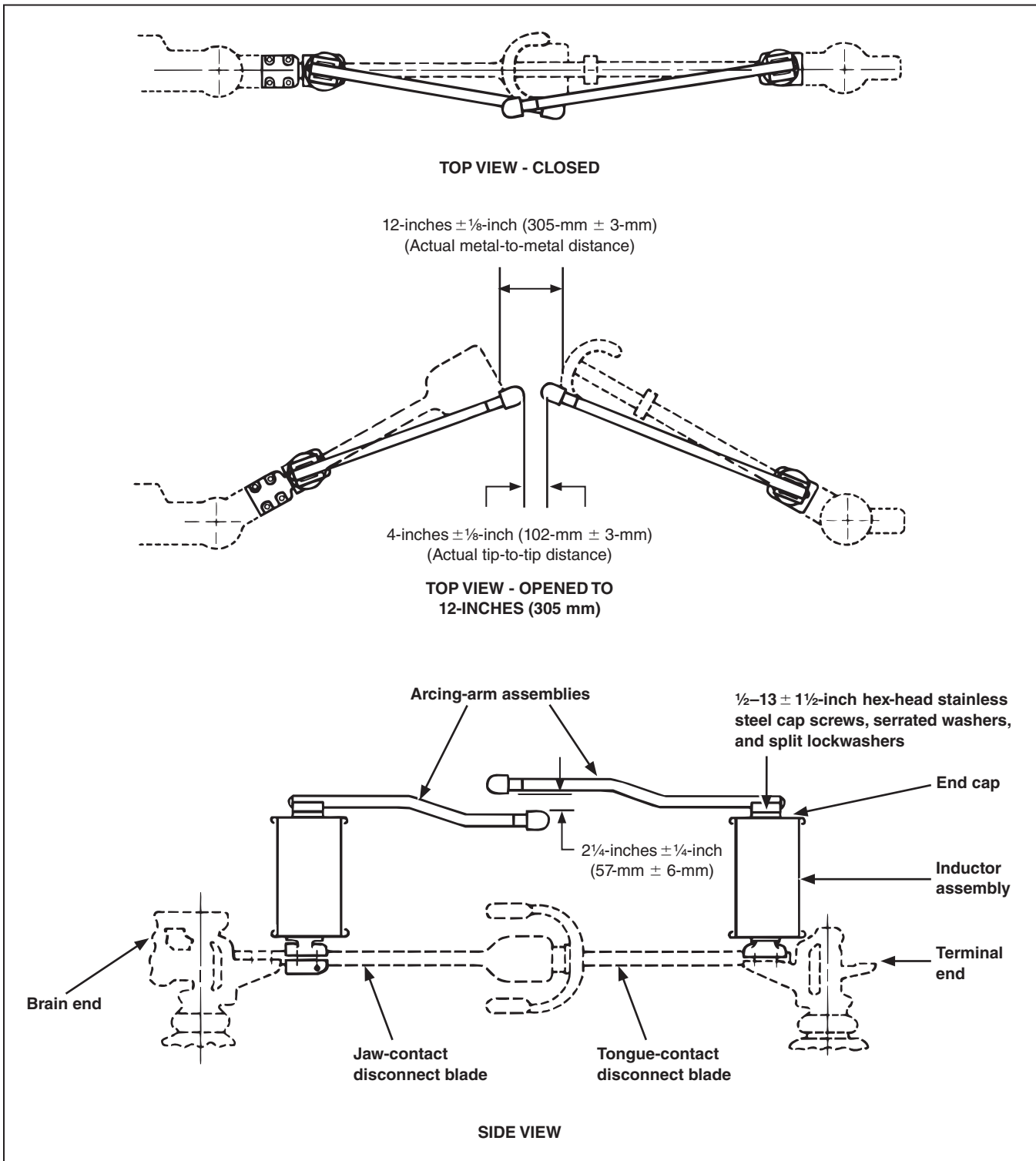


Figure 15. Assembly details of pre-insertion inductors for 230-kV and 345-kV center-break style circuit-switchers. 230-kV circuit-switcher illustrated.

 **DANGER**

De-energize and ground the circuit-switcher at all six terminals before cleaning or maintaining the pre-insertion inductors. **Failure to fully de-energize the circuit-switcher before performing work will cause serious personal injury or death.**

After inspecting the inductor windings, inspect the arcing-arm assemblies to verify their proper setting. These components should be replaced if they show significant wear or erosion.

***For vertical-break style and integer-style circuit-switchers:***

Clean the exterior finish of the inductor windings on frequently operated circuit-switchers (typically 200 or more closing operations per year) annually using a nontoxic, nonflammable solvent. Clean the exterior finish of the inductor windings on less-frequently operated circuit-switchers every 2500 closing operations or five years, whichever occurs first. Do not power wash.

While cleaning the inductor windings, inspect for damage or exposure of the fiberglass roving. Use the furnished touch-up kit to refinish any damaged surfaces.

First, thoroughly wire-brush the surface to be refinished, then sand with No. 1 sandpaper. Smooth the surface with No. 0 sandpaper.

Brush on the paint. Drying time is approximately six hours. Should the inductor winding be damaged to the extent coiled conductor is exposed, the inductor must be removed from service and replaced.

After cleaning and inspecting the inductor windings, inspect the moving and stationary arcing rods to verify their proper setting. These components should be replaced if they show significant wear or erosion.

***For center-break style circuit-switchers:***

Inspect the exterior finish of the inductor windings for damage or exposure of the fiberglass roving every 2500 closing operations or five years, whichever occurs first. Use the furnished touch-up kit to refinish any damaged surfaces.

First, thoroughly wire-brush the surface to be refinished, then sand with No. 1 sandpaper. Smooth the surface with No. 0 sandpaper.

Brush on the paint. Drying time is approximately six hours. Should the inductor winding be damaged to the extent coiled conductor is exposed, the inductor must be removed from service and replaced.