

# Installation

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## Introduction

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### Qualified Persons

#### **WARNING**

Only qualified persons who are knowledgeable in the installation, operation, and maintenance of overhead and underground electric distribution equipment, along with all associated hazards, may install, operate, and maintain the equipment covered by this publication. A qualified person is someone who is 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 S&C Instruction Handbook before installing or operating your Fault Fiter Electronic Power Fuse. Familiarize yourself with the Safety Information and Safety Precautions on pages 3 and 4. The latest version of this publication is available online in PDF format at [sandc.com/en/support/product-literature/](http://sandc.com/en/support/product-literature/).

### Retain this Instruction Sheet

This instruction sheet is a permanent part of your S&C Fault Fiter Electronic Power Fuses. Designate a location where you can easily retrieve and refer to this publication.

### Proper Application

#### **WARNING**

The equipment in this publication is only intended for a specific application. The application must be within the ratings furnished for the equipment. Ratings for S&C Fault Fiter Electronic Power Fuses are listed in the ratings table in Specification Bulletin 441-31. The ratings are also on the product.

### Warranty

The warranty and/or obligations described in S&C's Price Sheet 150 "Standard Conditions of Sale—Immediate Purchasers in the United States" (or Price Sheet 153, "Standard Conditions of Sale—Immediate Purchasers Outside the United States"), plus any special warranty provisions, as set forth in the applicable product-line specification bulletin, are exclusive. The remedies provided in the former for breach of these warranties shall constitute the immediate purchaser's or end user's exclusive remedy and a fulfillment of the seller's entire liability. In no event shall the seller's liability to the immediate purchaser or end user exceed the price of the specific product that gives rise to the immediate purchaser's or end user's claim. All other warranties, whether express or implied or arising by operation of law, course of dealing, usage of trade or otherwise, are excluded. The only warranties are those stated in Price Sheet 150 (or Price Sheet 153), and THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY EXPRESS WARRANTY OR OTHER OBLIGATION PROVIDED IN PRICE SHEET 150 (OR PRICE SHEET 153) IS GRANTED ONLY TO THE IMMEDIATE PURCHASER AND END USER, AS DEFINED THEREIN. OTHER THAN AN END USER, NO REMOTE PURCHASER MAY RELY ON ANY AFFIRMATION OF FACT OR PROMISE THAT RELATES TO THE GOODS DESCRIBED HEREIN, ANY DESCRIPTION THAT RELATES TO THE GOODS, OR ANY REMEDIAL PROMISE INCLUDED IN PRICE SHEET 150 (or PRICE SHEET 153.)

**Understanding Safety-Alert Messages**

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to your Fault Fiter Electronic Power Fuse. Familiarize yourself with these types of messages and the importance of these various 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 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. Their telephone numbers are listed on S&C’s website [sandc.com](http://sandc.com), or call the S&C Global Monitoring and Support Center at 1-888-762-1100.

<b>NOTICE</b>	
Read this instruction sheet thoroughly and carefully before installing your Fault Fiter Electronic Power Fuse.	

**Replacement Instructions and Labels**

If additional copies of this instruction sheet are needed, 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.

### ⚠ DANGER



**Fault Fiter Electronic Power Fuses 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 the Fault Fiter Electronic Power Fuses 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. Always maintain proper clearance from energized components.
3. **PERSONAL PROTECTIVE EQUIPMENT.** Always use suitable protective equipment, such as rubber gloves, rubber mats, hard hats, safety glasses, arc-flash clothing, and fall-protection, in accordance with safe operating procedures and rules.
4. **SAFETY LABELS AND TAGS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels and tags. Remove tags ONLY if instructed to do so.
5. **ENERGIZED COMPONENTS.** Always consider all parts live until de-energized, tested, and grounded. All voltage transformers must be disconnected when external voltage is used to test any secondary-side wiring or devices, to avoid energizing the high-voltage conductors through the voltage transformers. Draw out the voltage transformers completely if draw out-type transformers are provided. Otherwise, remove the primary fuses of the voltage transformers and disconnect the secondaries by removing the secondary fuses or by disconnecting the secondary leads.
6. **TEST FOR VOLTAGE.** Qualified persons should be certain 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.
7. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.
8. **DO NOT REMOVE THE INTERRUPTING OR CONTROL MODULES FROM THEIR CARTONS UNTIL READY TO USE.**
9. **HANDLE INTERRUPTING AND CONTROL MODULES WITH CARE.** Do not drop or throw them.
10. **ENERGIZING EQUIPMENT.** When returning the equipment to service, the following procedure should be observed:
  - Make certain each switchgear or vault door permitting access to high voltage is closed and latched before energizing the circuit or operating any switching device.
  - Make sure any grounding switch is opened, or other grounding means removed before closing the associated interrupter switch(es).
  - Lock interrupter switches in the **Open** or **Closed** position as dictated by circumstances.
  - Make sure all doors and switch-operating handles are fully locked before leaving the installation site, even momentarily. Observe this procedure even in those cases where the gear is accessible only to qualified persons.

A complete S&C Fault Fiter Electronic Power Fuse with Uni-Rupter® Interrupter consists of a mounting, including a Uni-Rupter Interrupter, a holder, a control module, and an interrupting module, as shown in Figure 1. The control module includes a current transformer and electronic circuits that provide control power, current sensing, and electronically determined time-current characteristics for the fuse.

The interrupting module carries load current continuously through a main current section and, during a fault condition, transfers current to a circuit-interrupting section in response to a signal from the control module. Following a fault-clearing operation, the interrupting module is replaced. The control module is reusable.

### Uni-Rupter Interrupter

The Uni-Rupter Interrupter offers the ultimate in circuit-interrupting simplicity; a firm, steady opening pull on the fuse with a hookstick provides direct-drive quick-break action of the Uni-Rupter Interrupter's internal moving contact through the arc-extinguishing chamber. Circuit interruption is accomplished by the deionizing gases generated by the thermal reaction of the arc on S&C's uniquely formulated chamber liner and moving-contact trailer—there is no external arc or flame. After circuit interruption, a Uni-Rupter Interrupter automatically self-resets for the next opening operation. Only a swift, unhesitating stroke with a hookstick is required for circuit closing. The Uni-Rupter Interrupter's fault-closing contacts and the fuse hinge provide a positive self-guiding action for the fuse. The following instructions are for operation of an S&C Fault Fiter Electronic Power Fuse with a Uni-Rupter Interrupter.

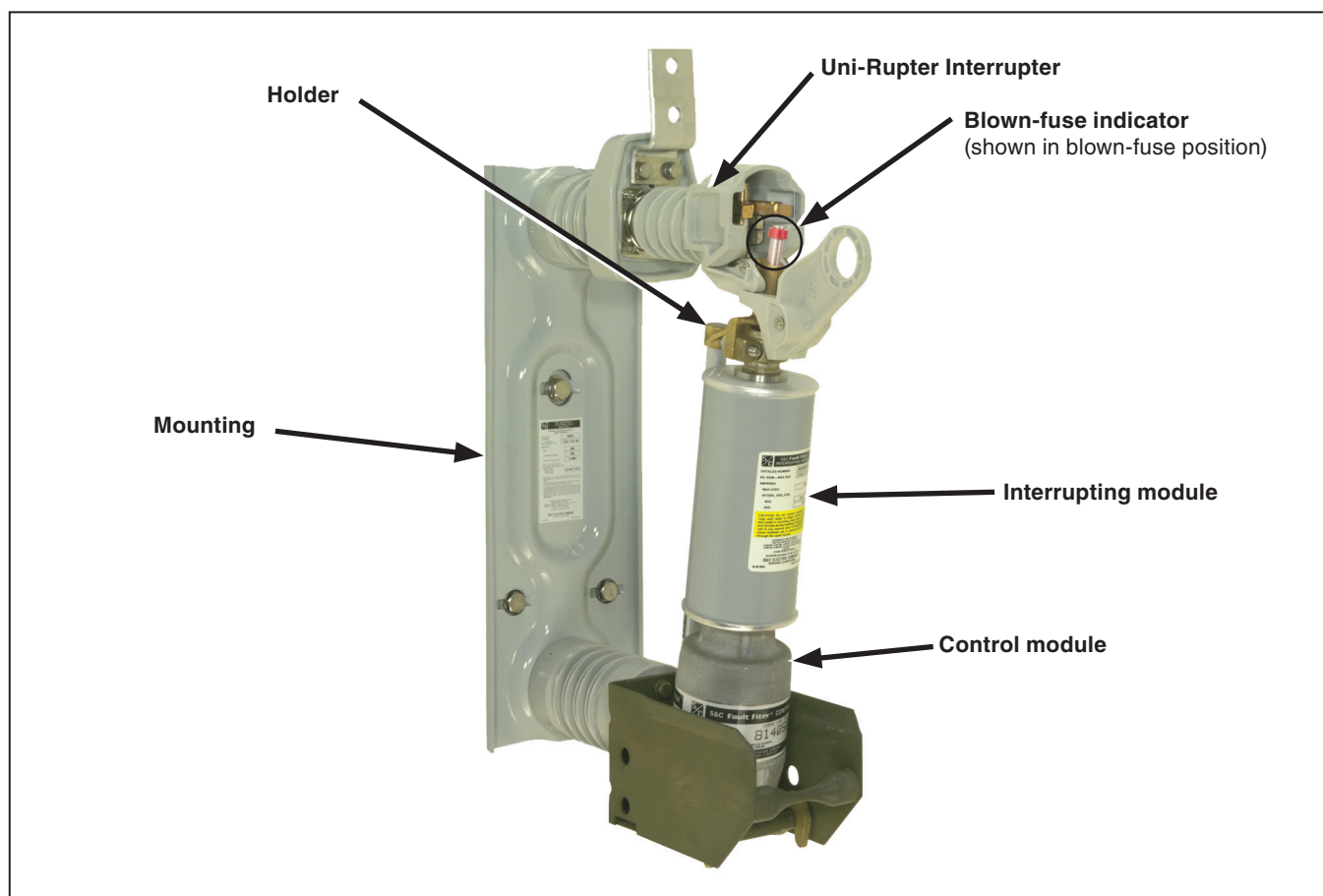


Figure 1. An S&C Fault Fiter Electronic Power Fuse with a Uni-Rupter Interrupter.

An S&C Fault Fiter Electronic Power Fuse with a Uni-Rupter Interrupter is suitable for the following single-pole live-switching duties in single-phase or three-phase circuits of distribution systems rated 13.8 kV or 25 kV:

### **Live Switching—Opening**

- **Transformer switching**—Transformer load currents up through 400 amperes at 13.8 kV or 200 amperes at 25 kV, as well as transformer magnetizing currents associated with the applicable loads
- **Line switching**—Load splitting (parallel or loop switching) and load dropping of currents up through 400 amperes at 13.8 kV or 200 amperes at 25 kV; also line dropping (charging currents typical for distribution systems of these voltage ratings)
- **Cable switching**—Load splitting (parallel or loop switching) and load dropping of currents up through 400 amperes at 13.8 kV or 200 amperes at 25 kV; also cable dropping (charging currents typical for distribution systems of these voltage ratings)

### **Live Switching—Closing**

- **Circuit closing**—Inrush currents associated with the above opening duties
- **Duty-cycle fault closing**●—One-time capability of 22,400 amperes RMS asymmetrical at 13.8 kV and 20,000 amperes RMS asymmetrical at 25 kV, and two-time duty-cycle fault-closing capability of 13,000 amperes RMS asymmetrical at 13.8 kV or 25 kV

### **A Note on Single-Pole Switching**

In single-pole switching of ungrounded-primary three-phase transformers or banks (or single-phase transformers connected line to line), circuit connections or parameters may, in some cases, produce excessive overvoltages. In particular, for the following applications above 22 kV, single-pole switching by any means—including Uni-Rupter Interrupters—should be performed only under the conditions stated in italics:

- Switching unloaded or lightly loaded delta-connected or ungrounded-primary wye-wye connected three-phase transformers or banks (or line-to-line connected single-phase transformers), rated 150 kVA or less three-phase, or 50 kVA or less single-phase—or of any kVA rating when combined with unloaded cables or lines—where maximum system operating voltage exceeds 22 kV (*Single-pole switching should be performed only if each phase is carrying 5% load or more or if the transformer or bank is temporarily grounded at the primary neutral during switching.*)
- Switching loaded or unloaded ungrounded-primary wye-delta connected three-phase transformers or banks—alone or combined with unloaded cables or lines—where maximum system operating voltage exceeds 22 kV (*Single-pole switching should be performed only if each phase is carrying 5% load or more and if the lighting-load phase is always switched open first (or closed last), or if the transformer or bank is temporarily grounded at the primary neutral during switching.*)
- These values represent the fault-closing capabilities of the fuse with a Uni-Rupter Interrupter when the fuse is closed with a purposeful thrust without hesitation. The values are the available fault currents into which the fuse can be closed the specified number of times (once or twice), with Uni-Rupter Interrupter remaining operable and able to carry and interrupt rated current.



### Switching with a Uni-Rupter Interrupter

The functional performance and live-switching capability of Uni-Rupter Interrupters are described in the “Application Notes” section on page 6. Complete the following steps to operate a Uni-Rupter Interrupter using a universal pole● equipped with an S&C Grappler™ Handling Tool.■

#### Opening

**STEP 1.** With the Grappler tool’s prongs pointed downward, insert the longest prong in the pull-ring of the fuse. See Figure 2.

**STEP 2.** Pull the fuse vigorously through its full travel without hesitation at any point. See Figure 3. A downward force should be maintained on the universal pole through the fuse-opening operation to counteract any tendency the fuse may have to bounce toward the Closed position.

**Note:** The Uni-Rupter Interrupter is designed to require a hard pull to unlatch the fuse, thus reducing the possibility of an incomplete opening operation.

**STEP 3.** Remove the Grappler tool from the fuse pull-ring.

<p><b>⚠ CAUTION</b></p>
<p>Although a fuse in the fully <b>Open</b> position provides visual evidence of an open circuit, it does not necessarily mean either the Uni-Rupter Interrupter, the load-side hinge, or the fuse is de-energized.</p>

**STEP 4.** Use a universal pole, equipped with an S&C Grappler Handling Tool or an S&C Extra-Large Clamp▲ to remove holders from mountings rated 13.8 kV. See the next section on page 8. Holders for fuses rated 25 kV should be removed by hand, provided the mounting has been de-energized and properly grounded in accordance with local operating practices.

- A 1½-inch (38 mm) diameter universal pole, at least 6 feet (183 cm) long, is recommended (S&C catalog number 4202R-2E or equivalent).
- S&C catalog number 4423R1.
- ▲ S&C catalog number 4424.

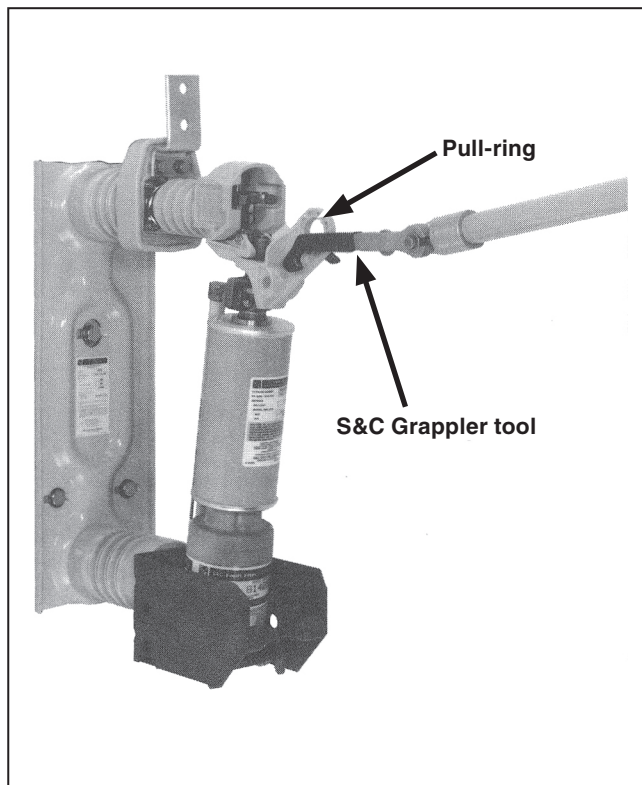


Figure 2. A Grappler tool, positioned for an opening (or closing) stroke, with the longer prong inserted in the holder pull-ring.

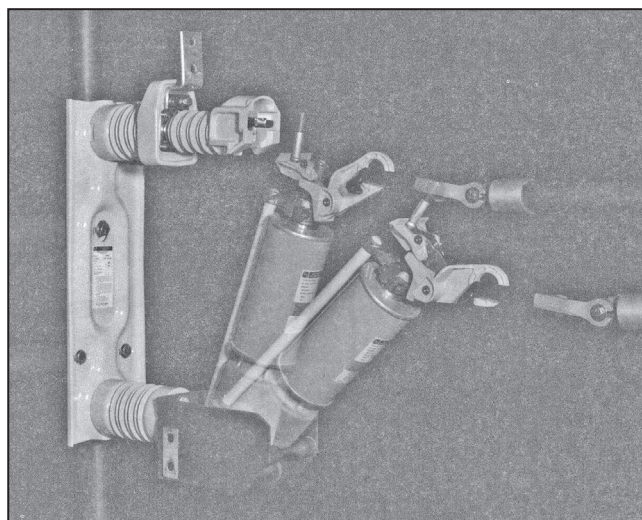


Figure 3. Closing (or opening) the fuse.

## Operation

### Removing the Holder Using the S&C Grappler Handling Tool

Complete the following steps to remove the holder using the Grappler tool:

- Attach the Grappler tool to the universal pole approximately in line with the center line of the pole, as shown in Figure 4(a). However, because the most advantageous positioning for the Grappler tool depends on the elevation of the fuse mounting relative to the operator, the handling tool should be adjusted as required to accommodate conditions.
- Grasp the universal pole with both hands [approximately 2 feet (61 cm) apart] with one hand at the end of the pole opposite from the Grappler tool.
- Position the Grappler tool cone in the pulling of the holder. Then, standing in a normal upright position facing the universal pole, remove the holder from the mounting using an upward lifting motion. See Figure 4(a).

### Removing the Holder Using the S&C Extra-Large Clamp

Complete the following steps to remove the holder using the extra-large clamp:

- Attach the extra-large clamp to the universal pole, as shown in Figure 4(b). However, because the most advantageous positioning for the extra-large clamp depends on the elevation of the fuse mounting relative to the operator, the handling tool should be adjusted as required to accommodate conditions.
- Grasp the universal pole with both hands [approximately 2 feet (61 cm) apart] with one hand at the end of the pole opposite from the extra-large clamp.
- Position the extra large clamp around the holder. Then, standing in a normal upright position facing the universal pole, remove the holder from the mounting using an upward lifting motion. See Figure 4(a).

### Closing

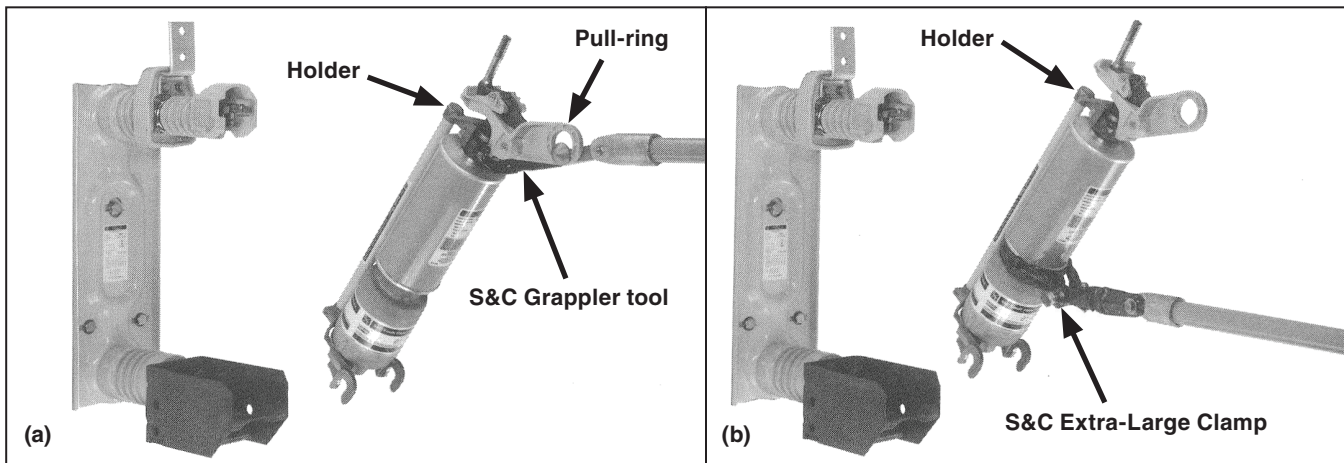


Figure 4. Removing (or installing) the holder using the S&C Grappler tool 4(a) or the S&C Extra-Large Clamp 4(b).



**NOTICE**

Because there is always the possibility of closing the fuse into a faulted circuit and because the closing operation is completely operator-dependent (with no assist from a quick-make mechanism), the closing operation must be accomplished as described below. When so operated, the Uni-Rupter Interrupter associated with the fuse is capable of closing into a fault current at the rated value the specified number of times (once or twice), remaining operable and able to carry and interrupt rated current.

**STEP 1.** Use a universal pole● equipped with an S&C Grappler■ or an S&C Extra-Large Clamp▲ to install holders in mountings rated 13.8 kV. See Figure 4 on page 8. Holders for fuses rated 25 kV should be installed by hand, provided the mounting has been de-energized and properly grounded in accordance with local operating practices. For fuse closing instructions, refer to Step 2.

### ***Installing the Holder using the S&C Grappler Tool***

Complete the following steps to install the holder using the Grappler tool:

- (a) Attach the Grappler tool to the universal pole approximately in line with the center line of the pole as shown in Figure 4(a). However, because the most advantageous positioning for the Grappler tool depends on the elevation of the fuse mounting relative to the operator, the handling tool should be adjusted as required to accommodate conditions.
- (b) Grasp the universal pole with both hands [approximately 2 feet (61 cm) apart] with one hand at the end of the pole opposite from the Grappler tool.
- (c) Position the Grappler tool cone in the pull-ring of the holder. Then, standing in a normal upright position facing the universal pole, lift the holder and lower it into the hinge, making sure the holder is securely seated in the hinge before disengaging the Grappler tool.

### ***Installing the Holder using the S&C Extra-Large Clamp***

Complete the following steps to install the holder using the extra large clamp:

- (a) Attach the extra-large clamp to the universal pole, as shown in Figure 4(b) on page 8. However, because the most advantageous positioning for the extra-large clamp depends on the elevation of the fuse mounting relative to the operator, the handling tool should be adjusted as required to accommodate conditions:
- (b) Grasp the universal pole with both hands [approximately 2 feet (61 cm) apart] with one hand at the end of the pole opposite from the extra-large clamp.
- (c) Securely attach the handling tool at the location shown in Figure 4(b) on page 8. Make sure the handling-tool jaws are fully tightened before attempting to lift the holder. Then, standing in a normal upright position facing the universal pole, lift the holder and lower it into the hinge, making sure the holder is securely seated in the hinge before disengaging the handling tool.

**STEP 2.** With the Grappler tool prongs pointed downward, insert the longest prong in the pull-ring of the fuse. Then, keeping your face turned away, close the fuse with a swift, unhesitating stroke. See Figure 3 on page 7.

**STEP 3.** Remove the Grappler tool from the pull-ring. Use the Grappler tool to push against the fuse to ensure complete fuse closure was attained.

- A 1½-inch (38 mm) diameter universal pole, at least 6 feet (183 cm) long, is recommended (S&C catalog number 4202R-2E or equivalent).
- S&C catalog number 4423R1.
- ▲ S&C catalog number 4424.

### **Installing the Modules in a Holder**

Complete instructions for installation of Fault Fiter fuse control modules and Fault Fiter fuse interrupting modules in holders are provided in the instruction sheet furnished with each module.

### **Installing the Holder in the Mounting**

Follow the instructions found in the “Closing” section on page 9.

### **How to Detect a Blown Fuse**

From a safe distance, check for indication of a blown fuse. If the fuse has operated, a blown-fuse indicator will be visible at the upper end of the Fault Fiter fuse interrupting module (see Figure 1 on page 5).

### **Removing the Holder from the Mounting**

Follow the instructions found in the “Opening” section on page 7.

### **Replacing the Interrupting Module**

Complete instructions for replacement of Fault Fiter fuse interrupting modules are provided in the instruction sheet furnished with each module.

### **Installing the Holder in the Mounting**

Follow the instructions found in the “Closing” section on page 9.