Operation

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March 4, 2024

Qualified Persons

⚠ WARNING

Only qualified persons 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 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 or operating manual PMH Pad-Mounted Gear. Become familiar with the Safety Information and Safety Precautions on pages 4 through 8. The latest version of this publication is available online in PDF format at **sandc.com/en/contact-us/product-literature/**.

Retain this Instruction Sheet

This instruction sheet is a permanent part of manual PMH Pad-Mounted Gear. 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 a specific application. The application must be within the ratings furnished for the equipment. Ratings for manual PMH Pad-Mounted Gear are described in S&C Specification Bulletin 662A-31. The ratings are also on the nameplate affixed to 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).

Warranty Qualifications

The standard warranty contained in the seller's standard conditions of sale (as set forth in Price Sheet 150) does not apply to manual PMH Pad-Mounted Gear where fuse units, fuse unit end-fittings, holders, refill units, or switch blades of other than S&C manufacture are used in conjunction with S&C SML Mountings. Nor does it apply to manual PMH Pad-Mounted Gear where current-limiting fuses are used other than as set forth in Table 1 of S&C Information Bulletin 660-50, or when current-limiting fuses are applied other than as set forth in the "Recommended Voltage Ratings" section in S&C Information Bulletin 660-50.

Understanding Safety-Alert Messages

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

⚠ DANGER

"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.

⚠ WARNING

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

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices that can result in minor personal injury if instructions, including recommended precautions, are not followed.

NOTICE

"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**, or call the S&C Global Support and Monitoring Center at 1-888-762-1100.

NOTICE

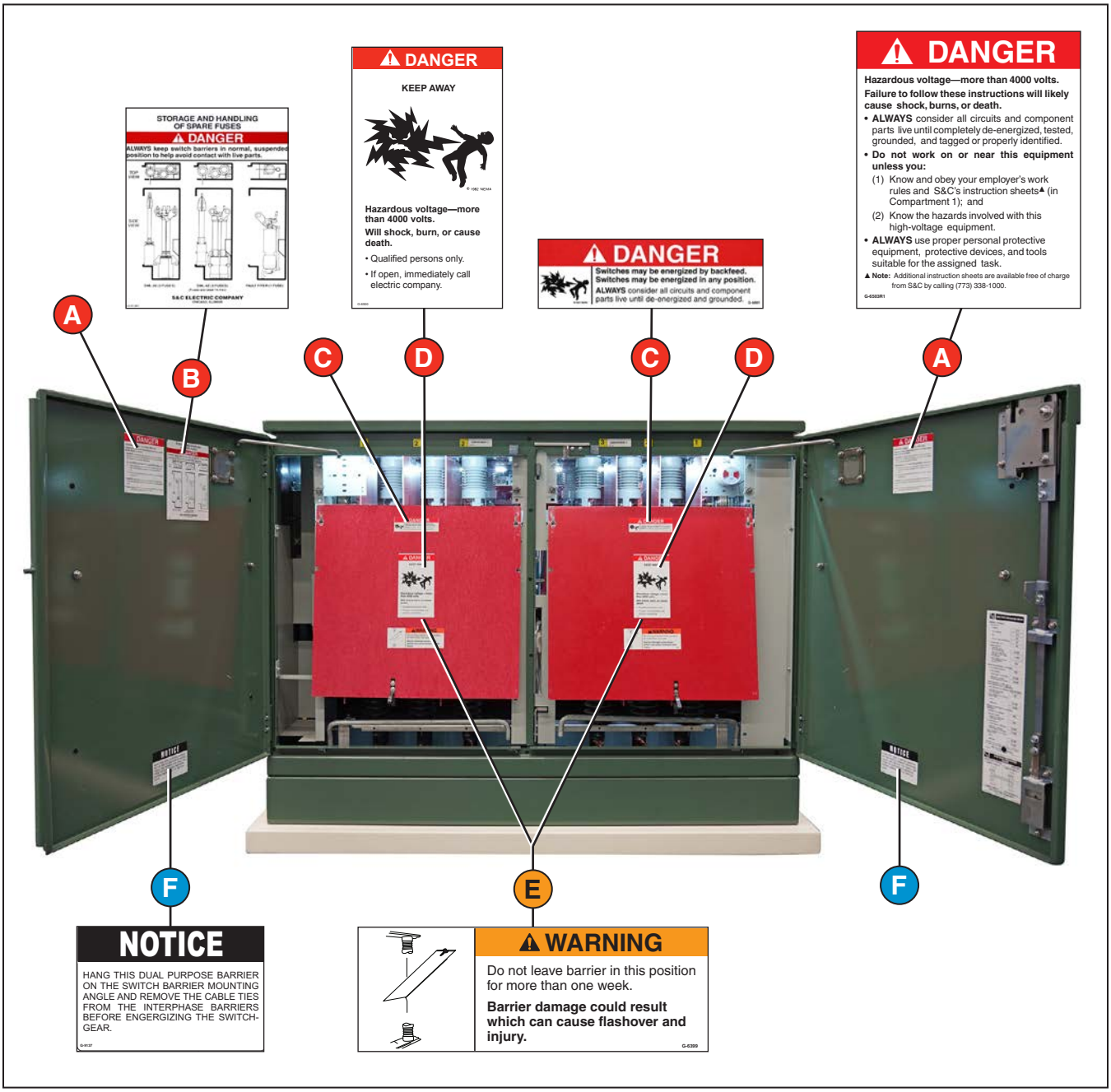
Read this instruction sheet thoroughly and carefully before installing manual PMH Pad-Mounted Gear.

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 that 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.

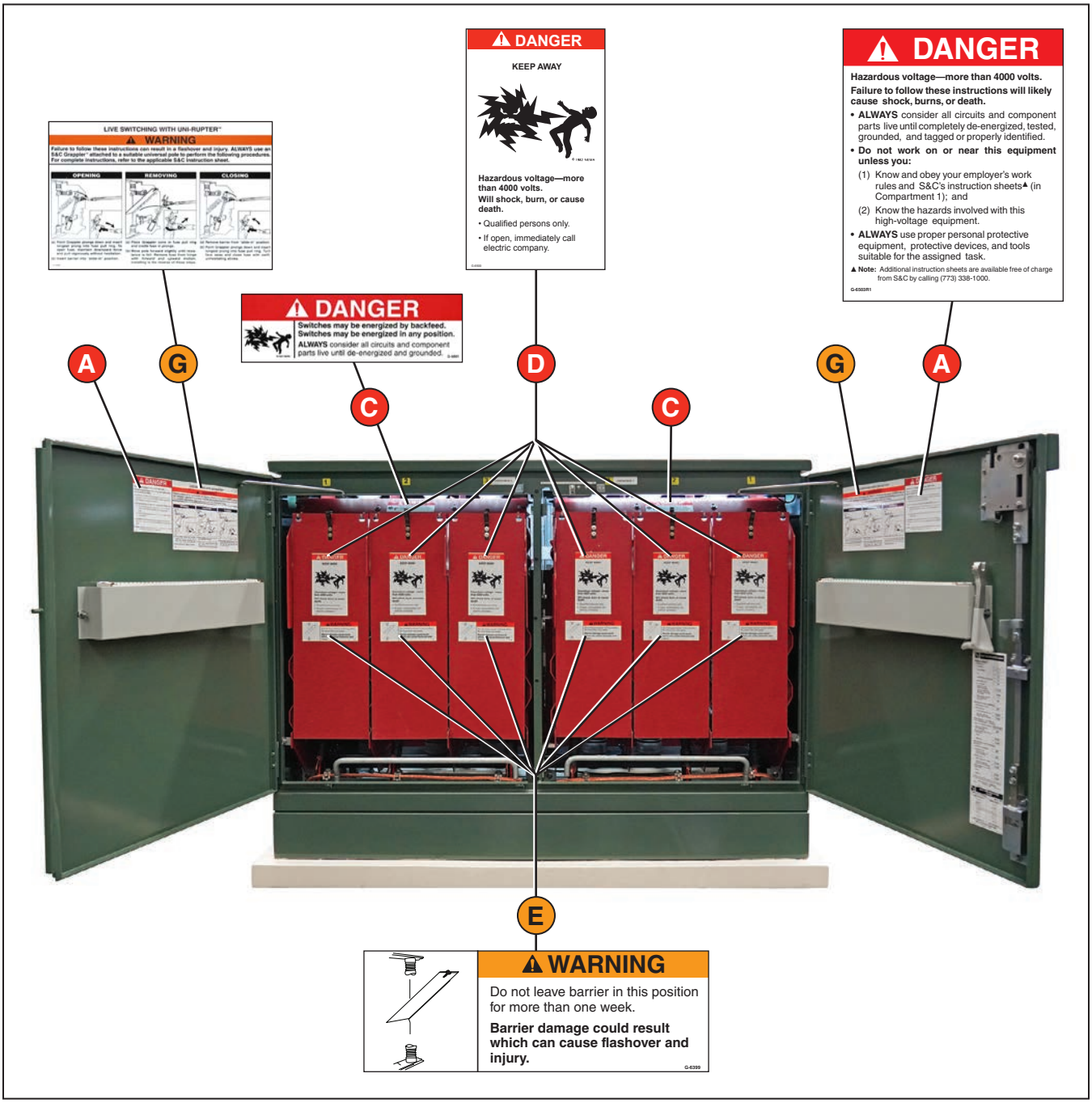
Location of Safety Labels



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Part Number
A	⚠ DANGER	Hazardous voltage —more than 400 volts . . .	G-6503
B	⚠ DANGER	Storage and handling of spare fuses	G-5147-2R1
C	⚠ DANGER	Switches may be energized . . .	G-6501
D	⚠ DANGER	Keep away. . .	G-6500
E	⚠ WARNING	Do not leave barrier in this position . . .	G-6399
F	*NOTICE*	Hang this dual purpose barrier . . .	G-9137

Location of Safety Labels



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E	⚠ WARNING	Do not leave barrier in this position . . .	G-6399
G	⚠ WARNING	Live switching with Uni-Rupter . . .	G-6369

⚠ DANGER

Pad-mounted gear contains high voltage. Failure to observe the precautions below will result in serious personal injury or death.

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

1. **QUALIFIED PERSONS.** Access to pad-mounted gear 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 "CAUTION," "WARNING," "DANGER," or "NOTICE" labels.
5. **KEY INTERLOCKS.**
   - If optional key interlocks were furnished, they must be in place.
   - Check the operating sequence of key interlocks to verify proper sequencing.
   - After the pad-mounted gear is installed, either: (1) destroy the extra set of keys or (2) make them accessible only to qualified persons. This will maintain the integrity of the key-interlock scheme.
   - Key interlocks are not security locks and are not substitutes for padlocks.
6. **OPENING DOORS.** Do not force doors open. Forcing a door open can damage the latching mechanism. If optional key interlocks are provided, correctly position the interlocks so the doors can be opened.
7. **CLOSING AND LOCKING DOORS.**
   - Doors must be securely closed and latched, with padlocks in place at all times unless work is being performed inside the enclosure.
   - Mini-Rupter Switches have switch-operating-shaft access covers located on the sides of the pad-mounted gear enclosure. They must be closed and padlocked at all times unless the switches are being operated.
8. **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 energized or installed near energized lines should be considered live until tested and grounded.
9. **ENERGIZED TERMINALS.** Always assume both sets of power terminals on any Mini-Rupter Switch or fuse are energized unless proved otherwise by test, by visual evidence of open-circuit conditions on both sets of terminals, or by observing that both sets of terminals are grounded.
10. **BACKFEED.** Mini-Rupter Switches and fuses may be energized by backfeed.
11. **DE-ENERGIZING, TESTING, AND GROUNDING.** Before touching any device that is to be inspected, replaced, serviced, or repaired in the high-voltage compartments, always disconnect Mini-Rupter Switches and fuses from all power sources (including backfeed), test for voltage, and properly ground. Test for voltage on both sets of power terminals of any Mini-Rupter Switch or fuse using proper high-voltage test equipment before touching any device that is to be inspected, replaced, serviced, or repaired in the high-voltage compartments.
12. **GROUNDING.**
    - Make sure the pad-mounted gear enclosure is properly grounded to the station or facility ground.
    - After the gear has been completely disconnected from all sources of power and tested for voltage, install suitable grounding cables in all compartments before touching any device to be inspected, replaced, serviced, or repaired in the high-voltage compartments.

CONTINUED ►

⚠ DANGER

Pad-mounted gear contains high voltage. Failure to observe the precautions below will result in serious personal injury or death.

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

13. **SWITCH POSITION.**
    - Always confirm the **Open/Close** position of Mini-Rupter Switches by visually observing the position of the switch blades.
    - Switches may be energized by backfeed.
    - Switches may be energized in any position.
14. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.
15. **FUSE STORAGE.**
    - Always store fuses in a clean, dry location.
    - Do not store end-fittings, holders, interrupting modules, or fuses in termination compartments unless the unit is equipped with the optional **Fuse Storage** feature.
16. **FUSES MUST BE DISCONNECTED.** Make sure fuses are disconnected from all power sources (including backfeed) before being inspected or replaced.
17. **CLOSING FUSES.** Closing a fuse into a faulted circuit will cause a loud noise, a flash of light at the Uni-Rupter Interrupter contacts, and the fuse to blow. Closing a fuse into a faulted circuit is always a possibility. When closing a fuse, always turn your face away. Then, use a swift, unhesitating thrust because the closing operation is completely operator dependent. With the Uni-Rupter Interrupter, a fuse can be closed into a fault current once or twice, and the Uni-Rupter Interrupter will remain operable and able to carry and interrupt rated current.
18. **FRONT BARRIERS.**
    - Always use a Grappler™ Handling Tool attached to a suitable universal pole to handle barriers in the high-voltage compartments.
    - Do not leave dual-purpose front barriers in the **Slide In** position for more than one week. If the barriers are left in the **Slide In** position for an extended period of time, there is the possibility of corona discharge to the barriers. Prolonged exposure to corona discharge can damage the barriers and result in a flashover, injury, and equipment damage.
    - **Switch Side:** These barriers are intended for temporary use to isolate the blades of the Mini-Rupter Switch from the main contacts while work is being performed.
    - **Fuse Side:** These barriers are intended for temporary use to isolate the fuse from the contacts of Uni-Rupter Interrupter while work is being performed.
19. **GRAPPLER HANDLING TOOL.**
    - The Grappler tool is the S&C fuse-handling fitting supplied with each unit equipped for fuses.
    - The Grappler tool improves grip, balance, and control of fuses during handling.
    - Always use the Grappler tool attached to a suitable universal pole (1¼-inch [32-mm] diameter) to handle barriers and to install, remove, open, or close fuses. The universal pole must be at least 4 feet (122 cm) long for 14.4-kV gear or at least 6 feet (183 cm) long for 25-kV gear.

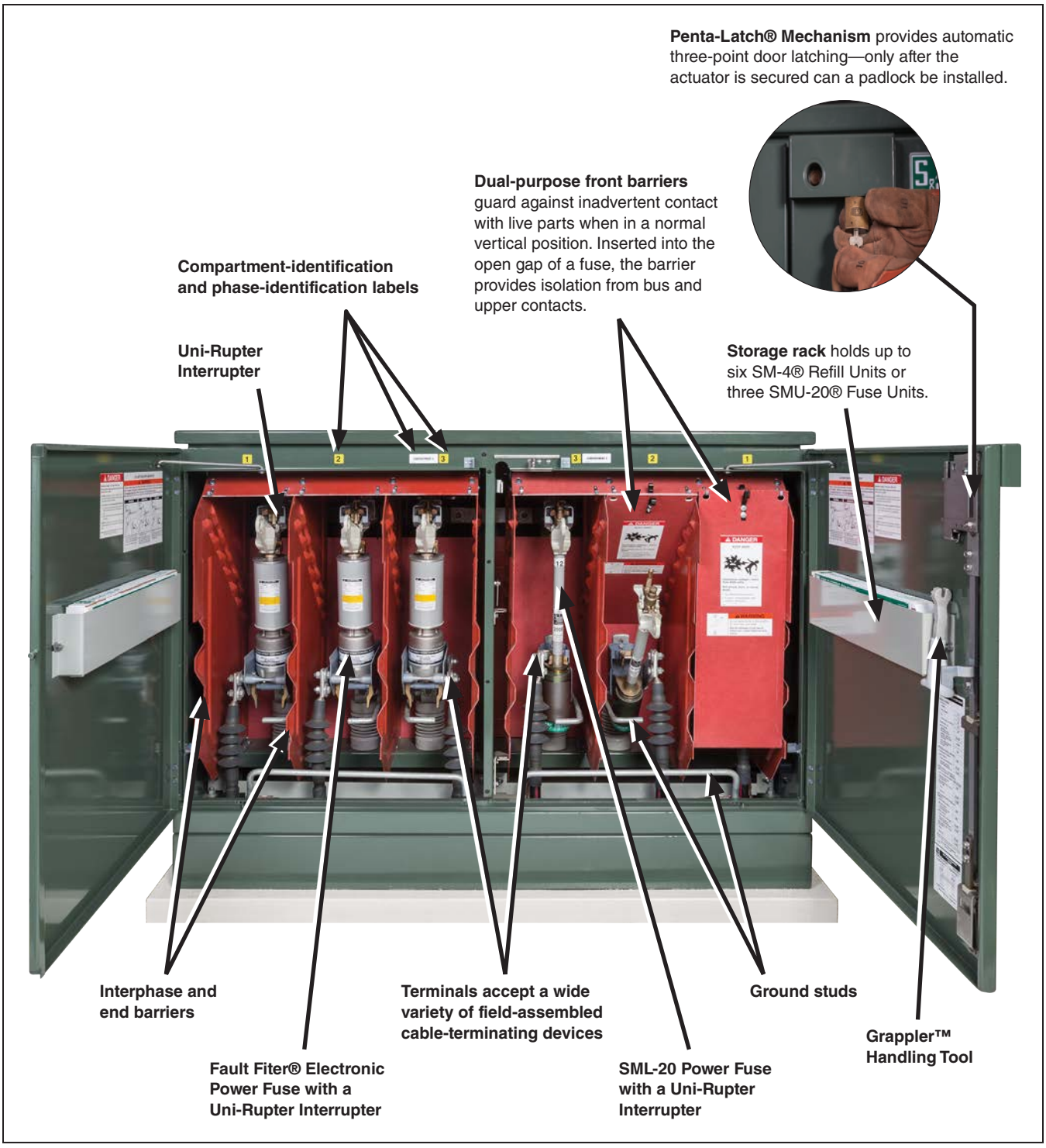
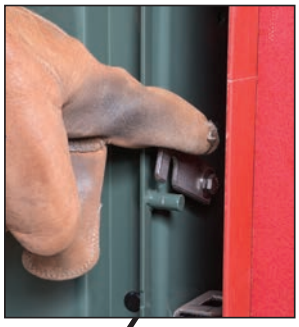


Figure 1. Fuse-side view of a Model PMH-9 with SML-20 Power Fuses in the right-hand compartment and Fault Fiter Electronic Power Fuses in the left-hand compartment. (This nonstandard combination of fuses is shown for comparison only.)

Viewing window for visible verification of the switch position is removable for phasing. To remove the window, loosen the wing-head screws and lift the window off the alignment bolts.

Left-hand door retainer—Rotate the latch upward to open the door. To secure the left-hand door closed, rotate the latch downward over the stop mounted on outer edge of the door.



Optional mounting provisions for user-supplied fault indicators

Main bus

Door holder

Ground pad on the inside at the bottom the door stile in each compartment accommodates connectors for attachment of cable concentric-neutral ground leads and ground studs.

Ground studs

Instruction manual holder

Optional fuse-storage feature

Circuit diagram

Interphase and end-barriers for 14.4-kV gear; the end-barrier is provided with the optional fuse-storage feature only.

Dual-purpose front barrier guards against inadvertent contact with live parts when in a normal vertical position. Inserted into the open gap of a switch, the barrier provides isolation from bus and upper contacts.

S&C Mini-Rupter Switch—Manually operated switches are furnished with a manual operating handle that folds for storage behind the switch operating-hub cover.

Figure 2. Switch-side view of a Model PMH-9.

⚠ DANGER

When access to high-voltage compartments is required for inspection, service, or repairs, always observe the precautions below. **Failure to observe these precautions may result in serious personal injury or death.**

1. Access to pad-mount gear must be restricted only to qualified persons. See the "Qualified Persons" section on page 2.
2. Always follow safe operating procedures and rules.
3. Before touching any device, always disconnect switches and fuses from all power sources (including backfeed), test for voltage, and properly ground.
4. Always assume both sets of power terminals on any switch or fuse are energized unless proved otherwise by test, by visual evidence of open-circuit conditions on both sets of terminals, or by observing that both sets of terminals are grounded.
5. Test for voltage on both sets of power terminals of any switch or fuse using proper high-voltage test equipment.
6. After the gear has been completely disconnected from all sources of power and tested for voltage, install suitable grounding cables in all compartments.
7. Make sure the enclosure is properly grounded to the station or facility ground. Do not return equipment to service unless such grounds are properly made.

Opening and Closing the Doors

Complete the following steps to open the doors:

STEP 1. To access a side of the enclosure, remove the padlock from the doors.

STEP 2. Insert a pentahead socket wrench or tool (a hexhead socket wrench or tool when catalog number suffix "-B1" or "-B2" is specified) into the latching mechanism. Rotate the wrench or tool 60° counterclockwise to unlatch the doors. See Figure 3.

NOTICE

Do not apply any undue force when attempting to open the doors. The use of undue force may damage the latching mechanism.

Figure 3. To unlock the doors, turn the pentahead socket wrench 60° counterclockwise against spring resistance until a "click" is heard and the wrench reaches its stop.

Figure 4. The left-door latching mechanism disengaged.

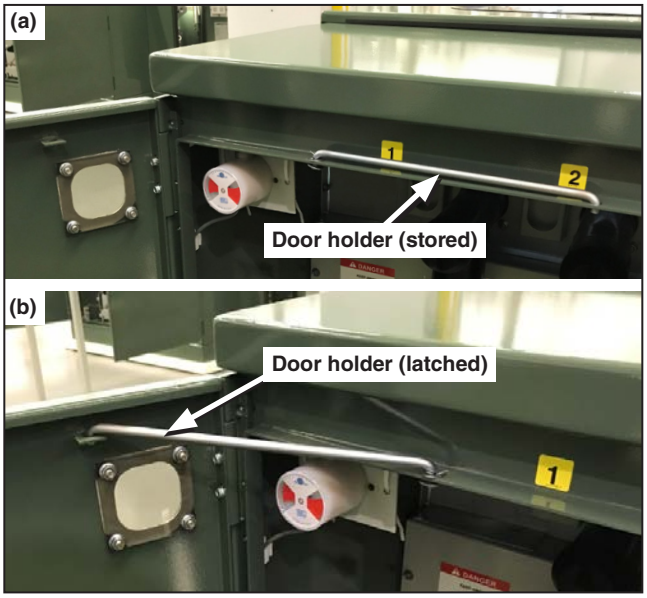


Figure 5. Using the door holder to hold the door open.

STEP 3. Disengage the left-door latching mechanism by turning the latch clockwise. See Figure 4 on page 11.

STEP 4. Open each door fully and latch the door holders. See Figure 5 page 11.

STEP 5. To gain access to the other side of the enclosure, repeat Steps 1 through 4 to open the doors.

Complete the following steps to close and lock the doors:

STEP 1. Lift the door holder up to allow the door to swing closed. See Figure 6. Make sure the door holder is placed back in the storage position to allow the door to be fully closed. See Figure 7.

STEP 2. Repeat Step 1 for the other door.

STEP 3. Engage the left-door latching mechanism. See Figure 8.

STEP 4. The right-hand door of the unit is equipped with the Penta-Latch Mechanism, which latches automatically when the door is closed. To close a door equipped with the Penta-Latch Mechanism, place one hand at the midpoint of the door-front near the edge and firmly push the door closed. When the latch points are positively engaged, the spring mechanism will trip to latch the door.

STEP 5. Insert the padlock shackle through the hole in padlock recess and lock the padlock. See Figure 9.

STEP 6. Repeat Steps 1 through 5 for the doors on the other side of the enclosure (if open).

Figure 6. Lift the door holder to allow the door to swing closed.

Figure 7. The door holder placed in the storage position to allow the door to close.

Figure 8. The left-door latching mechanism engaged.

Figure 9. The enclosure doors padlocked.

Operating the Mini-Rupter Switch

The Mini-Rupter Switch is a three-pole, 600-A switch used to switch between power sources. The operating shaft used to control the switch is located on the same side of the enclosure with respect to the switch location.

Before proceeding with the instructions on operating the Mini-Rupter Switch, refer to the "DANGER" message on page 7.

STEP 1. Remove the padlock and open the switch-operating-shaft access cover. See Figures 10, 11, and 12.

STEP 2. Remove the folding switch-operating handle from its storage pocket behind the access cover. Unfold the handle until it is latched and slide it onto the hex switch-operating shaft.

Note the switch-position indicator that is attached to the hex switch-operating shaft and rests against a stop in either the **Open** or **Closed** position.

STEP 3. Rotate the handle in the appropriate direction to open or close the switch, and check the switch-position indicator to verify the switch is in the desired position.

STEP 4. Follow the instructions to open the enclosure doors on "Opening and Closing the Doors" on page 11.

STEP 5. Check the physical position of the switch by using the viewing window provided in the switch-termination compartment. See Figure 13.

⚠ WARNING

Always confirm the **Open/Close** position of the Mini-Rupter Switch by visually observing the position of the switch blades. **Failure to confirm the position of the switch blades can result in electric shock, personal injury, or death.**

STEP 6. Remove and fold the switch-operating handle, and return the handle to its storage position. Then, close and padlock the access cover.

⚠ CAUTION

Do not leave the switch-operating-shaft access cover unlocked if the gear is left unattended by qualified persons. **Failure to do so can result in equipment damage and personal injury.**

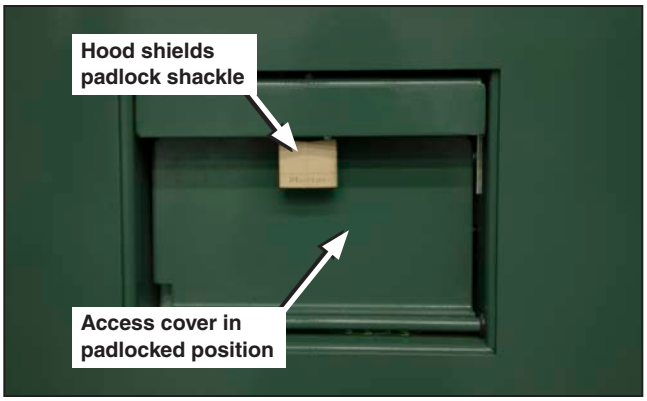


Figure 10. The access cover padlock.

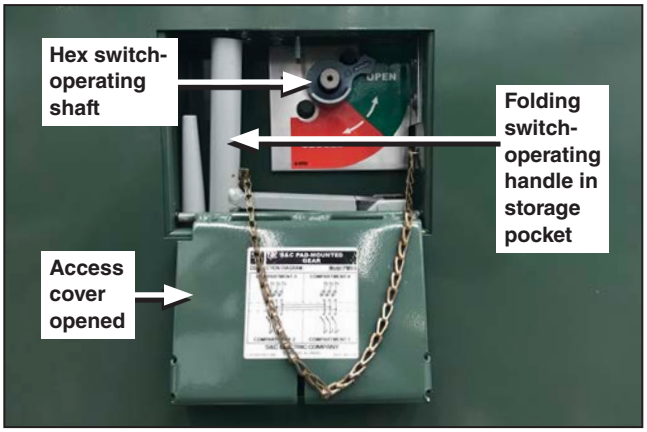


Figure 11. The access cover door is open.

Figure 12. The switch operating handle installed.

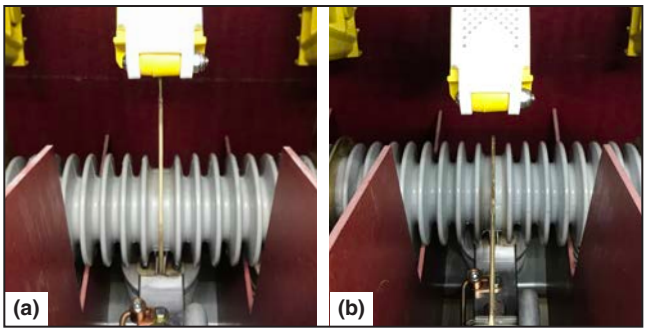


Figure 13. (a) Shows the switch in the Closed position, and (b) shows the switch in the Open position.

Front Barriers

Before proceeding with the instructions on handling the front barriers, refer to the "DANGER" message on page 7.

S&C recommends the dual-purpose front barrier be inserted into the **Slide In** position when the Mini-Rupter Switch is open. When the barrier is in the **Slide In** position, the switch blades are isolated from the main contacts; moreover, the blades are blocked from closing if, for any reason, the Mini-Rupter Switch is operated.

⚠ WARNING

Always use a Grappler Handling Tool attached to a suitable universal pole to insert, remove, or replace front barriers. No other tools are recommended. **Failure to use the proper tools can result in damage to the equipment, flashover, and injury.**

Grappler Handling Tool

Talon™ Handling Tool

Distribution prong

Station prong

⚠ WARNING

Dual-purpose front barriers must be wiped clean before placing them in the **Slide In** position. In addition, do not leave dual-purpose front barriers in the **Slide In** position for more than one week. These barriers are intended for temporary use only to isolate the blades of the Mini-Rupter Switch from the main contacts while work is being performed. If the barriers are left in the **Slide In** position for extended periods of time, there is the possibility of corona discharge to the barriers. **Prolonged exposure to corona discharge may damage the barriers and result in a flashover and injury.**

Figure 14. Dual-purpose front barrier for switch in its normal, suspended position.

Figure 15. A Grappler Handling Tool being used to lift the barrier. Note the door holder is in place and the adjacent door is latched closed to reduce exposure to high voltage.

To insert the barrier in the **Slide In** position, use a Grappler Handling Tool attached to and in line with a suitable universal pole●. Figure 15 on page 14 and Figures 16 through 17 show the suggested insertion method. The Grappler tool's prong is pointed upward when lifting the front barrier.

NOTICE

Before closing a Mini-Rupter Switch, remove the dual-purpose front barrier from the **Slide In** position.

Closing a switch on the barrier will block the switch blades and result in a stalled condition.

If the Mini-Rupter Switch is inadvertently closed with the front barrier in the **Slide In** position, it will be necessary to unblock the blades. To do this, rotate the switch-operating handle all the way to the **Open** position. This will return the blades to the **Open** position.

To restore the dual-purpose front barrier to the normal suspended position, use a Grappler Handling Tool attached to a suitable universal pole. Slowly and carefully withdraw the barrier with the Grappler tool's prong pointed upward, as shown in Figure 16, so that as it clears the **Slide In** position, the hooks on the gear settle into the holes in the barrier. Then, lower the barrier to its normal, suspended position.

If, for any reason the barrier was completely removed from the enclosure, a suggested method of placing it in its normal, suspended position is shown in Figure 17.

Note: The barrier is supported on the Grappler tool and held there by engagement of the lifting ring with the Grappler tool's cone. Place the barrier on the hooks of the gear, and lower the barrier to its suspended position.

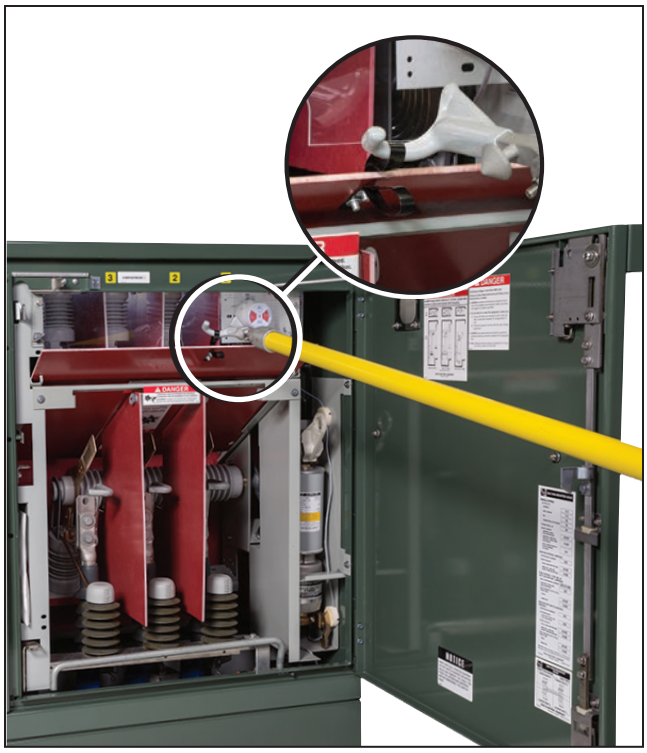


Figure 16. The Grappler tool, after lifting and pivoting the barrier, is used to lower it into the Slide In position. The image also shows the Grappler tool being used to return the barrier to its normal, suspended position.

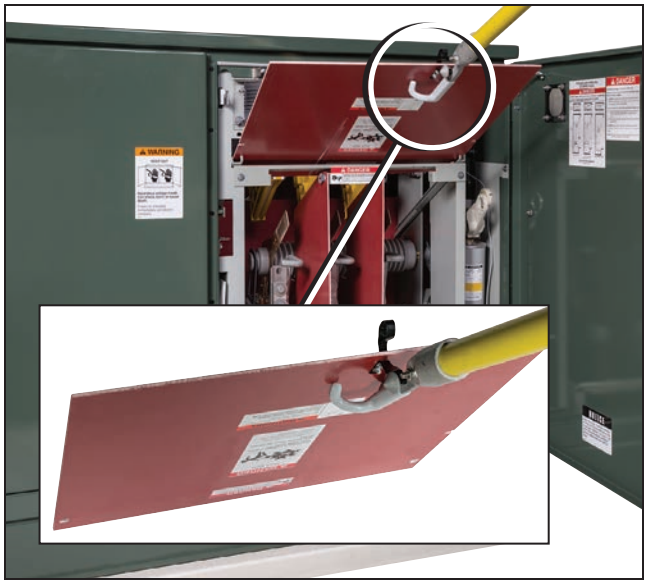


Figure 17. Alternate method for replacing the front barrier using a Grappler tool: Place the barrier on the hooks of the gear and lower the barrier to its suspended position. The inset image shows a close-up of the Grappler tool in position to replace the barrier.

● Use a universal pole 1¼ inches (31.8 mm) in diameter and at least 6 feet (1829 mm) long for 14.4-kV gear; or at least 8 feet (2438 mm) long for 25-kV gear.

Manual PMH Pad-Mounted Gear is furnished with S&C Fuse Mountings with Uni-Rupter Interrupters that accommodate Type SML-20 Power Fuses, Type SML-4Z Power Fuses, or Fault Fiter Electronic Power Fuses. Fault Fiter Electronic Power Fuse Mountings also accommodate a variety of current-limiting fuses.

⚠ WARNING

When selecting a current-limiting fuse, the voltage rating of the fuse must conform to the recommendations in S&C Information Bulletin 660-50. **Failure to conform to these recommendations can result in a flashover, injury, and equipment damage.**

Assembling the Fuse

S&C Power Fuses

Install an SMU-20 Fuse Unit into each set of end-fittings, an SM-4 Refill Unit into each holder, or a Fault Fiter fuse interrupting module and control module into each holder, in accordance with the instruction sheet furnished with the fuse unit, refill unit, or interrupting module.

Current-Limiting Fuses

S&C Holders for current-limiting fuses are designed for use in pad-mounted gear models that include mountings for Fault Fiter Electronic Power Fuses. These holders will accommodate the current-limiting fuses listed in Table 1 of S&C Information Bulletin 660-50. For instructions on installing current-limiting fuses in current-limiting fuse holders, refer to S&C Instruction Sheet 660-500.

Installing the Fuse in the Mounting

Follow the instructions found in the “Installing and Closing the Fuse” section on pages 17 through 20.

Installing and Closing the Fuse●

Before proceeding with the instructions on installing and closing the fuse, refer to the "Safety Precautions" section on page 7.

⚠ WARNING

Always use a Grappler Handling Tool attached to a suitable universal pole to insert, remove, or replace front barriers. No other tools are recommended. **Failure to use the proper tools can result in damage to the equipment, flashover, and injury.**

Grappler Handling Tool

Talon™ Handling Tool

Distribution prong

Station prong

Use a Grappler Handling Tool attached to and in line with a suitable universal pole■▲ to perform the following procedures:

STEP 1. Open the appropriate fuse-compartment door and secure it with the door holder. See Figure 18.

⚠ WARNING

On double-door models, the adjacent compartment door should be closed and latched to minimize exposure to high voltage. **Failure to do so can result in personal injury.**

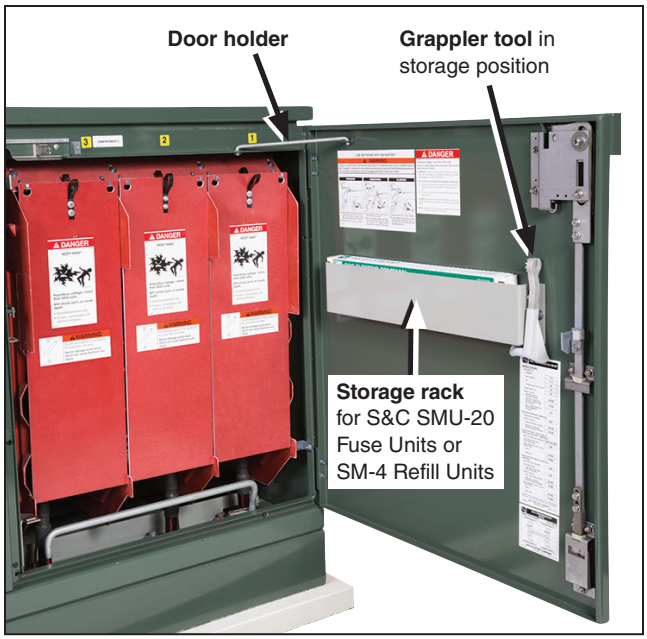


Figure 18. Dual-purpose front barriers for fuses in their normal, suspended positions. Note the door holder is in place.

Figure 19. Removing or replacing the dual-purpose front barrier with the Grappler tool.

● Although the operations described in this section often refer simply to "fuses," the procedures apply to Type SML-20 and SML-4Z Power Fuses, Fault Fiter Electronic Power Fuses, and current-limiting fuses used in Fault Fiter Electronic Power Fuse Mountings with Uni-Rupter Interrupters.

■ Use a universal pole 1¼ inches (31.8 mm) in diameter and at least 6 feet (1829 mm) long for 14.4-kV gear; or at least 8 feet (2438 mm) long for 25-kV gear.

▲ If the enclosure is furnished with an optional base spacer (or is attached to a higher-than-normal mounting pad), it may be desirable, for easier handling at the increased height, to reposition the Grappler tool on the universal pole at a favorable angle.

STEP 2. If optional inner barrier panels are furnished, loosen the pentahead bolts and remove the panel.

STEP 3. Remove only the dual-purpose front barrier associated with the fuse mounting into which the fuse is to be installed. See Figure 19 on page 17.

STEP 4. Insert the barrier into the **Slide In** position using the Grappler tool, as illustrated in Figure 20. Note the barrier is supported on the Grappler tool's prongs and held there by engagement of the lifting ring with the Grappler tool's cone.

> **⚠ WARNING**
>
> Dual-purpose front barriers must be wiped clean before placing them in the **"Slide-in"** position. In addition, do not leave dual-purpose front barriers in the **"Slide-in"** position for more than one week. These barriers are intended for temporary use only to isolate the blades of the Mini-Rupter Switch from the main contacts while work is being performed. If the barriers are left in the **"Slide-in"** position for extended periods of time, there is the possibility of corona discharge to the barriers. **Prolonged exposure to corona discharge may damage the barriers and result in a flashover and injury.**

STEP 5. ***For all fuses except 25-kV Fault Fiter Electronic Power Fuses:*** Install a fuse into its hinge as follows:

(a) Position the Grappler tool's cone in the fuse pull-ring and cradle the fuse in the Grappler tool's prongs. See inset of Figure 21.

(b) Grasp the universal pole with both hands (approximately 2 feet (610 mm) apart), with one hand at the opposite end of the pole from the Grappler tool.

Figure 20. Inserting the dual-purpose front barrier into the "Slide-in" position using a Grappler tool.

Figure 21. Installing a fuse using a Grappler Handling Tool. The inset image shows a close-up of a Grappler tool in position to install the fuse.

(c) Lift the fuse and lower it into its hinge. See Figure 21 on page 18. Make sure the fuse is securely seated in the hinge and then disengage the Grappler tool from the fuse. See Figure 22.

⚠ WARNING

Keep the fuse away from the Uni-Rupter Interrupter contacts when installing the fuse into its hinge. **Touching the contacts will close the circuit, which can cause a flashover and serious injury.** Always place the dual-purpose front barrier in the **Slide In** position whenever a fuse is open or is being removed from or installed into its hinge

STEP 6. ***For 25-kV Fault Fiter Electronic Power Fuses***: De-energize, test, and properly ground the mounting in accordance with local operating practices, and then install the fuse in its mounting by hand using suitable personal protective equipment (PPE).

NOTICE

Do not close a door on a fuse in the **Open** position. The door will strike the fuse pull-ring and interfere with door closing. The door may be closed if the fuse is removed from its mounting.

STEP 7. Use the Grappler tool to remove the dual-purpose front barrier from the **Slide In** position. See Figure 23.

⚠ CAUTION

Closing a fuse into a faulted circuit will cause a loud noise, a flash of light at the Uni-Rupter Interrupter contacts, and the fuse to blow. Closing a fuse into a faulted circuit is always a possibility. When closing a fuse, always turn your face away. Then, use a swift, unhesitating thrust because the closing operation is completely operator dependent. **Failure to do so can result in personal injury.**

Figure 22. A fuse installed in mounting in the Open position.

Figure 23. Removing dual-purpose front barrier from the "Slide-in" position using a Grappler tool.

NOTICE

With a Uni-Rupter Interrupter, a fuse can be closed into a fault current once or twice as specified in Specification Bulletin 662A-31, and the Uni-Rupter Interrupter will remain operable and able to carry and interrupt rated current.

STEP 8. With the Grappler tool's prong pointed downward (preferred), insert the prong into the pull-ring of the fuse. Rotate the hookstick clockwise slightly to ensure full and complete engagement of the Grappler tool's prong with the pull-ring of the fuse. See inset of Figure 24 on page 21. Then, with one's face turned away, close the fuse with a swift, unhesitating stroke. See Figure 24 on page 21.

If space is tight between the pull-ring of the fuse and an interphase or end barrier, it's acceptable to attach the Grappler tool to the pull-ring with the prong pointed up. See inset of Figure 24 on page 21.

STEP 9. Remove the Grappler tool from the pull-ring.

STEP 10. After removing the Grappler tool from the pull-ring, make sure complete fuse closure was attained by pushing against the fuse, below the upper end-fitting, with the Grappler tool.

⚠ WARNING

Failure to completely close the fuse may result in damage to the Uni-Rupter Interrupter, flashover and injury.

STEP 11. Use the Grappler tool to hang the dual-purpose front barrier in its normal, suspended position. See Figure 19 on page 17. Also install the optional inner barrier panel, if furnished.

STEP 12. Close and latch the doors and install a padlock. Pull on the doors to verify they are securely latched.

A Note on Single-Pole Fuse Switching

In single-pole fuse 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 fuse switching by any means—including a Uni-Rupter Interrupter—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 fuse 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 fuse 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 switched closed last) or if the transformer or bank is temporarily grounded at the primary neutral during switching.)*

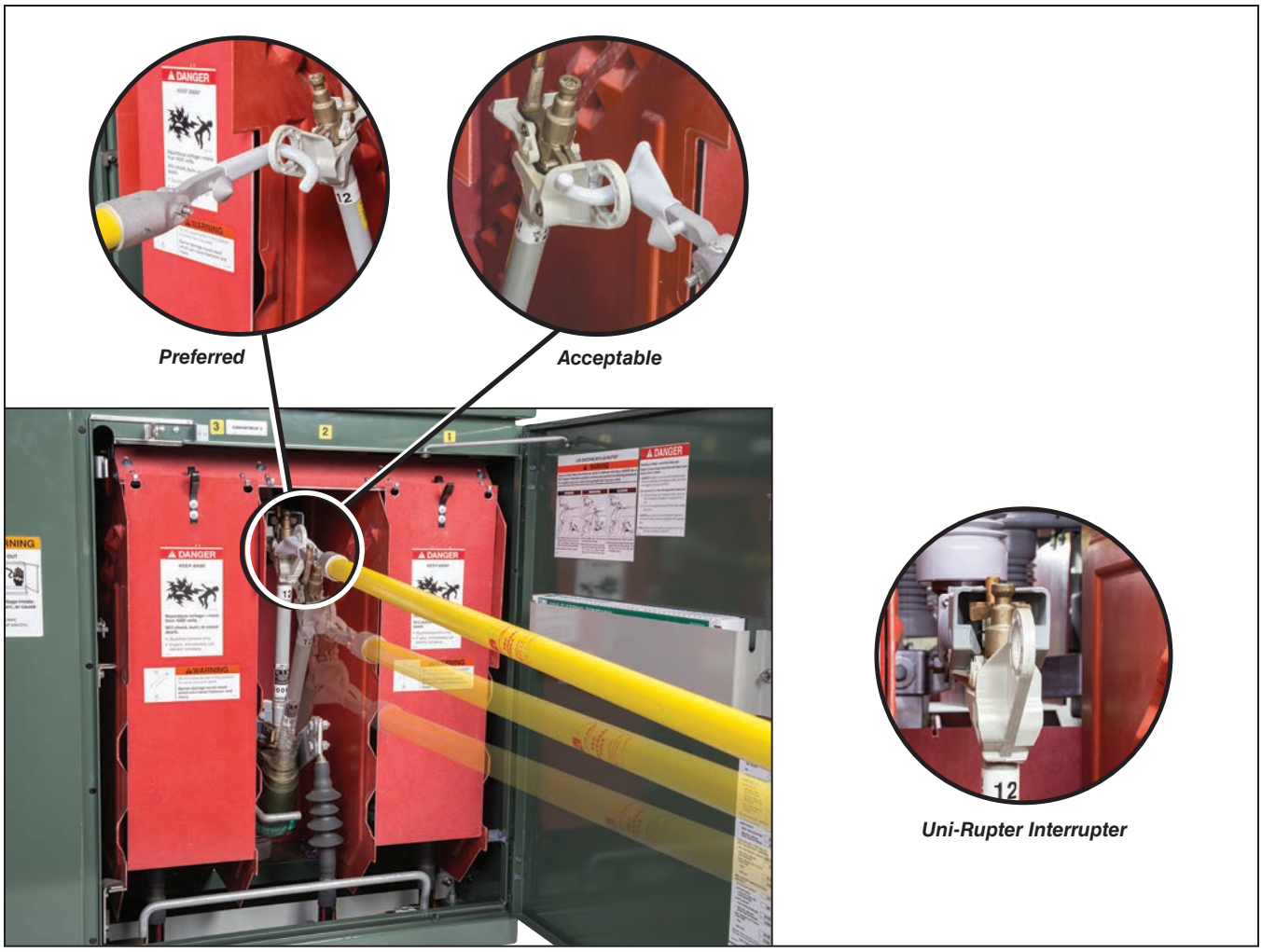


Figure 24. Closing the fuse with a swift, unhesitating stroke. The upper left inset shows a close-up of a Grappler tool in the preferred position to close the fuse. The upper right inset shows a close-up of a Grappler tool in an acceptable position to close the fuse. The lower right inset shows a close-up of a Uni-Rupter Interrupter with the fuse fully closed.

Opening and Removing the Fuse

Before proceeding with the instructions on opening and removing the fuse, refer to the "Safety Precautions" section on page 7.

⚠ WARNING

Always use a Grappler Handling Tool attached to a suitable universal pole to insert, remove, or replace front barriers. No other tools are recommended. **Failure to use the proper tools can result in damage to the equipment, flashover, and injury.**

Grappler Handling Tool

Talon™ Handling Tool

Distribution prong

Station prong

Use Grappler Handling Tool attached to and in line with a suitable universal pole● to perform following procedures:

STEP 1. Open the appropriate fuse-compartment door and secure it with the door holder. See Figure 18 on page 17.

⚠ WARNING

On double-door models, the adjacent door should be closed and latched to minimize exposure to high voltage. **Failure to do so can result in personal injury.**

STEP 2. If optional inner barrier panels are furnished, loosen the pentahead bolts and remove the panel.

STEP 3. Remove only the dual-purpose front barrier associated with the fuse to be opened using the Grappler tool for this purpose. See Figure 19 on page 17

Figure 25. Grappler tool, as positioned for an opening stroke.

● Use a universal pole 1¼ inches (31.8 mm) in diameter and at least 6 feet (1829 mm) long for 14.4-kV gear; or at least 8 feet (2438 mm) long for 25-kV gear.

STEP 4. With the Grappler tool's prong pointed downward (preferred), insert the prong into the pull-ring of the fuse. Rotate the hookstick clockwise slightly to ensure full and complete engagement of the Grappler tool's prong with the pull-ring of the fuse. See Figure 25 on page 22.

If the space is tight between the pull-ring of the fuse and an interphase or end barrier, it's acceptable to attach the Grappler tool to the pull-ring with the prong pointed up. See lower inset of Figure 25 on page 22.

STEP 5. Pull the fuse vigorously through its full travel without hesitation at any point. See Figure 26. 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 6. Remove the Grappler tool from the fuse pull-ring.

⚠ DANGER

The fuse and fuse mounting (Uni-Rupter Interrupter, load-side hinge, and terminals) may be energized by backfeed even when the fuse is in the fully **Open** position Always assume both terminals of a fuse are energized unless proved otherwise by test, by visual evidence of open-circuit conditions on both terminals, or by observing both terminals are grounded. **Failure to follow these precautions will result in serious injury or death.**

NOTICE

Do not close a door on a fuse in the **Open** position. The door will strike the fuse pull-ring and interfere with door closing. The door may be closed when the fuse is removed from its mounting.

Figure 26. Opening the fuse.

⚠ WARNING

Dual-purpose front barriers must be wiped clean before placing them in the **"Slide-in"** position. In addition, do not leave dual-purpose front barriers in the **"Slide-in"** position for more than one week. These barriers are intended for temporary use only to isolate the blades of the Mini-Rupter Switch from the main contacts while work is being performed. If the barriers are left in the **"Slide-in"** position for extended periods of time, there is the possibility of corona discharge to the barriers. **Prolonged exposure to corona discharge may damage the barriers and result in a flashover and injury.**

STEP 7. Place the dual-purpose front barrier associated with the fuse to be removed in the **Slide In** position. Use the Grappler tool for this, as illustrated in Figure 27. Note that the barrier is supported on the Grappler tool's prongs and held there by engagement of the lifting ring with the Grappler tool's cone.

STEP 8. ***For all fuses except 25-kV Fault Fiter Electronic Power Fuses:*** Remove the fuse from its hinge as follows:

(a) Grasp the universal pole with both hands (approximately 2 feet (610 mm) apart), with one hand at the opposite end of the pole from the Grappler tool.

(b) Position the Grappler tool's cone in the fuse pull-ring and cradle the fuse in the Grappler tool's prongs. See Figure 28.

(c) Stand in a normal, upright position facing the universal pole. Move the pole forward until resistance between the Grappler tool and the fuse is felt, or approximately 2 inches (51 mm). Then, remove the fuse from its hinge with a *forward and upward* lifting motion. See Figure 29 on page 25.

Figure 27. Inserting dual-purpose front barrier into the "slide-in" position using a Grappler tool.

Figure 28. A Grappler tool positioned for fuse removal.

⚠ DANGER

Keep the fuse away from the Uni-Rupter Interrupter contacts when removing the fuse from its hinge. **Touching the contacts will close the circuit, which can cause a flashover and serious injury.** Always place the dual-purpose front barrier in the **Slide In** position whenever a fuse is open or is being removed from or installed into its hinge.

STEP 9. ***For 25-kV Fault Fiter Electronic Power Fuses***: De-energize, test, and properly ground the mounting in accordance with local operating practices, and then remove the fuse from its mounting by hand using suitable personal protective equipment (PPE).

STEP 10. Hang the dual-purpose front barrier in its normal, suspended position using the Grappler tool. See Figure 19 onpage 17. Also install the optional inner barrier panel, if furnished. Then, close and latch the doors, and padlock securely. Pull on the doors to verify they are securely latched.

NOTICE

If fuses are removed from the mountings, they should be stored in a clean, dry location. Do not store end-fittings, holders, interrupting modules, or current-limiting fuses in high-voltage compartments unless the unit is equipped with the optional **Fuse Storage** feature.

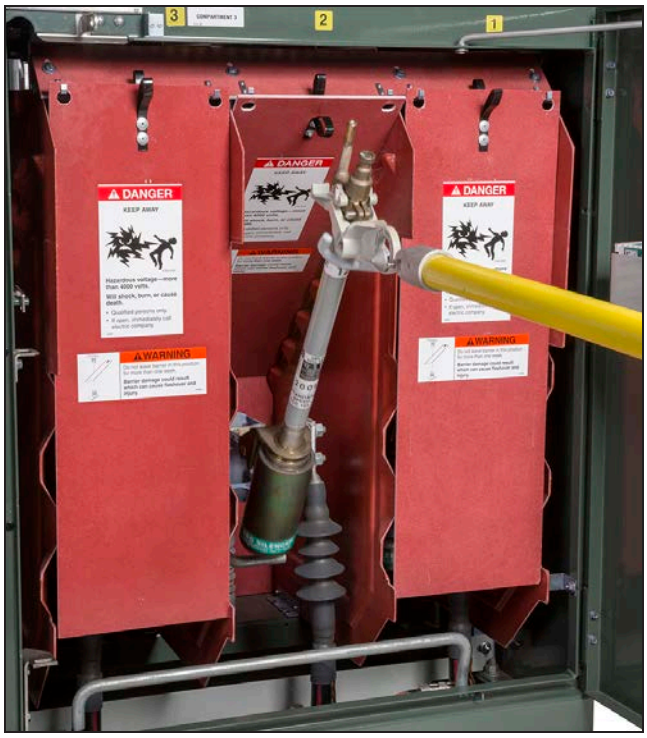


Figure 29. Removing a fuse from its hinge with a forward and upward lifting motion.

The optional **Fuse Storage** feature, if furnished, can accommodate three completely assembled spare Type SML Fuses, two spare Fault Fiter Interrupting Modules, one spare Fault Fiter Electronic Power Fuse Holder, or one spare current-limiting fuse holder in each switch compartment, as applicable. The **Fuse Storage** feature is mounted inside the enclosure, between the interrupter switch and the side wall of the enclosure. For storage, position the assembled fuses in the **Fuse Storage** feature as shown on the label headed "STORAGE AND HANDLING OF SPARE FUSES" affixed to the inside of each applicable switch-compartment door.

⚠ DANGER

Do not handle spare fuses unless the front barriers for the switches are in their normal, suspended positions to guard against inadvertent contact with live parts. **Failure to follow this precaution can result in serious injury or death.**

How to Detect and Replace a Blown Fuse

To detect and replace a blown fuse:

STEP 1. Open the appropriate fuse-compartment door and secure it with the door holder.

> **⚠ WARNING**
>
> On double-door models, the adjacent door should be closed and latched to minimize exposure to high voltage. **Failure to do so can result in personal injury.**

STEP 2. Remove the optional inner barrier panel, if furnished. Then, using the Grappler tool, remove the dual-purpose front barrier associated with the fuse mounting which will be inspected.

> **⚠ DANGER**
>
> When working in high-voltage compartments, always maintain proper clearance from energized components. **Failure to maintain proper clearance will result in serious injury or death.**

STEP 3. ***For S&C Power Fuses:*** From a safe distance, observe the blown-fuse target for the fuse type furnished. Refer to Figure 30:

- ***For SML-4Z Power Fuses:*** A fluorescent-orange target in the translucent SML-4Z Holder moves to the BLOWN indicator window when the fuse operates, permitting a positive visual check of fuse condition without removing the fuse from its mounting. The target fluoresces when illuminated.

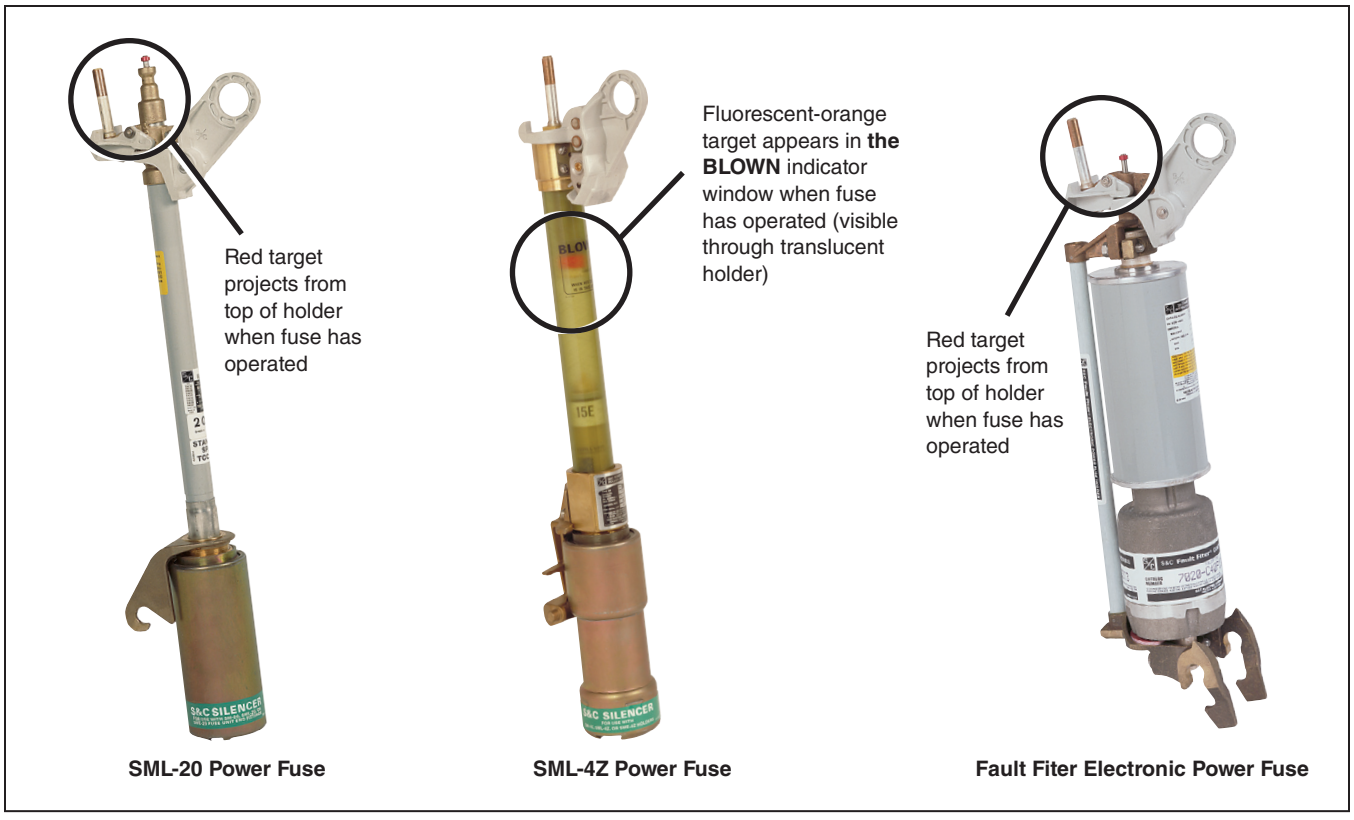


Figure 30. Blown-fuse target locations for the fuse types used in PMH models of S&C Pad-Mounted Gear.

- ***SML-20 Power Fuse or Fault Fiter Electronic Power Fuses:*** A red blown-fuse target projects from the top of the SML-20 Power Fuse upper end-fitting or the Fault Fiter fuse holder when the fuse has operated, making it easy to check fuse condition with the fuse in the **Closed** position. The blown-fuse target retracts within the end-fitting or holder when the blown fuse unit or interrupting module is replaced.

Note On Handling: The present-design upper end-fitting for use in SML-20 Power Fuses and the Fault Fiter fuse holder uses a free-floating blown-fuse target that can move (by force of gravity) into the **Blown** position should the fuse be inverted during handling. The fuse condition can be verified by returning the fuse to the upright position. If the fuse is blown, the target will remain in the extended (projecting) position.

STEP 4. Remove the blown fuse from its mounting following the instructions found in the "Opening and Removing the Fuse" section on pages 20 through 22. Then, follow the instructions for replacing blown SM-4 Refill Units, SMU-20 Fuse Units, or Fault Fiter Interrupting Modules (as applicable) provided with each new refill unit, fuse unit, and interrupting module.

For Current-Limiting Fuses: To find the blown fuse(s), remove each fuse in turn from its mounting (the target cannot be seen while the fuse is in its mounting), following the instructions found in the "Opening and Removing the Fuse" section on pages 20 through 22. Then, inspect the fuse and check for a blown-fuse target.

Note: Take the blown fuse back to the service center for proper disposal.

Note: Following a two- or three-phase fault at a three-phase installation, any unblown fuses that carried the fault current should also be replaced. For instructions on replacing current-limiting fuses in S&C Holders, refer to S&C Instruction Sheet 660-500. S&C Holders will accommodate the current-limiting fuses listed in Table 1 of S&C Information Bulletin 660-50.

Installing the Fuse in the Mounting

Follow the instructions found in the "Installing and Closing the Fuse" section on pages 16 through 18.

Components

No mechanical maintenance is required for S&C Manual PMH Pad-Mounted Gear. However, occasional inspection of the gear and exercising of the Mini-Rupter Switches is recommended. In addition, inspection and cleaning—of insulators and cable terminators in particular—should be performed periodically, at intervals based on environmental conditions. Refer to S&C Instruction Sheet 662-590, "*Inspection Recommendations*."

⚠ DANGER

When access to high-voltage compartments is required for inspection, service, or repairs, always observe the precautions in the "Safety Precautions" section on page 7. **Failure to observe these precautions will result in serious injury or death.**

NOTICE

When, in the user's judgment, cleaning is required, S&C recommends the pad-mounted gear be completely de-energized and properly grounded according to the user's operating and safety procedures, and thoroughly cleaned by hand. If it is not possible to de-energize the gear, the use of pressure sprayed dry ice (solid CO_2) is an acceptable alternative cleaning method.

Never use pressure sprayed abrasives to clean pad-mounted gear. Pressure-sprayed abrasives will damage switch and fuse components.

⚠ WARNING

Dual-purpose front barriers for switch and fuse compartments should be inserted into the open gap of the Mini-Rupter Switch or fuse to provide physical isolation for additional security in the event it is necessary to work on the cables connected to the Mini-Rupter Switch or fuse. See Figure 16 on page 15 and Figure 18 on page 17. **Failure to do so can result in personal injury.**

Returning Equipment to Service

When returning the equipment to service, observe the following procedures :

STEP 1. Make sure switch and fuse grounding means are removed and that dual-purpose front barriers are removed from the **"Slide-in"** position before closing the associated Mini-Rupter Switch or power fuses.

STEP 2. Make sure the Mini-Rupter Switches are in the correct positions (**Open** or **Closed**) as dictated by system circumstances.

STEP 3. Close each door permitting access to high voltage and make sure the associated Penta-Latch Mechanisms are securely latched before energizing the circuit or operating any switching device.

STEP 4. Padlock all doors and switch-operating-shaft access covers before leaving the installation site, even momentarily. Observe this procedure even in those cases where the gear is accessible only to qualified persons.

★ These recommendations may differ from the user's operating and safety procedures. Where a discrepancy exists, users should follow their procedures.

Enclosure Finish

The responsibility for ensuring that a finish protects the enclosure lies with both the manufacturer and the user. Manual PMH Pad-Mounted Gear is finished with the Ultradur® II Outdoor Finish, which provides lasting protection for the enclosure. To retain this protection, the user should take periodic corrective action as follows:

STEP 1. Touch up any penetration of the finish to bare metal—such as scratches and abrasions due to shipping or vandalism—to maintain the original integrity. S&C touch-up finish and primer are available in aerosol spray cans. See S&C Specification Bulletin 662A-31 for catalog number information used for ordering. No other finish or primer is approved.

STEP 2. Clean the area to be touched up to remove all oil and grease.

STEP 3. Sand the area, removing any traces of rust that may be present, and make sure all edges are feathered before applying primer.

STEP 4. Provide an occasional simple washdown—such as an automobile would be given—to remove surface contaminants. Use any ordinary mild household detergent solution.

Note: When the enclosure must be refinished by the user before the finish has weathered—for example, to match other equipment—a special precaution must be taken. The entire surface must be sanded to provide a tooth to bond the new coat to the unusually tough and smooth Ultradur II Outdoor Finish.

Figure 31. Touch-up kit components.

For the convenience of users who normally perform electrical tests on system components such as pad-mounted gear, appropriate withstand test values are given in Table 1.

Table 1. Ratings and Insulation Test Values

Rating, kV		Withstand, kV		
Nom.	Max①	60-Hz, RMS②	Dc③④	Impulse (BIL)
14.4	17.0	36	50	95
25	27●	60	70	125
25	29■	60	70	125

① Maximum voltage ratings are lower than the values listed when current-limiting fuses are used. Consult the appropriate current-limiting fuse manufacturer for complete fuse ratings.

② Ac withstand tests made on this equipment after shipment by S&C should be conducted at no more than 0.75 times the values shown. When making ac tests, the time duration for application of the test voltage should be limited to less than 10 seconds.

③ The column headed "Dc" is given as a reference only for those making dc tests and represents values believed to be appropriate and approximately equivalent to the corresponding power-frequency withstand test values specified for components of this voltage class. The presence of this column in no way implies any requirement for a dc withstand test on these components.

④ Dc withstand tests made on this equipment after shipment by S&C should be conducted at no more than 0.75 times the values shown. When making dc tests, the test voltage should be raised in discrete steps—one minute per step.

● With fuses.

■ Without fuses.