Operation

Table of Contents

This publication contains instructions for operation of fuses and manual Mini-Rupter Switches in remote supervisory PMH Pad-Mounted Gear. For operating instructions regarding Type PM Switch Operators or the control-equipment group components, refer to the applicable S&C instruction sheets.

March 11, 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 the remote supervisory PMH Pad-Mounted Gear. Become familiar with the Safety Information on pages 4 through 6 and Safety Precautions on pages 7 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 the remote supervisory 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 the PMH Pad-Mounted Gear are listed in the ratings table in Specification Bulletin 664-31. The ratings are also on the nameplate affixed to on the interior of the doors (right-hand door only for double door models.)

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 remote supervisory 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 remote supervisory PMH Pad-Mounted Gear where other than Fault Fiter® Electronic Power Fuses, S&C Switch Blades, or 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 of S&C Information Bulletin 660-50.

The seller's standard warranty does not apply to major components not of S&C manufacture, such as remote terminal units and communication devices, including hardware, software, resolution of protocol-related matters, and notification of upgrades or fixes for those devices.

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 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

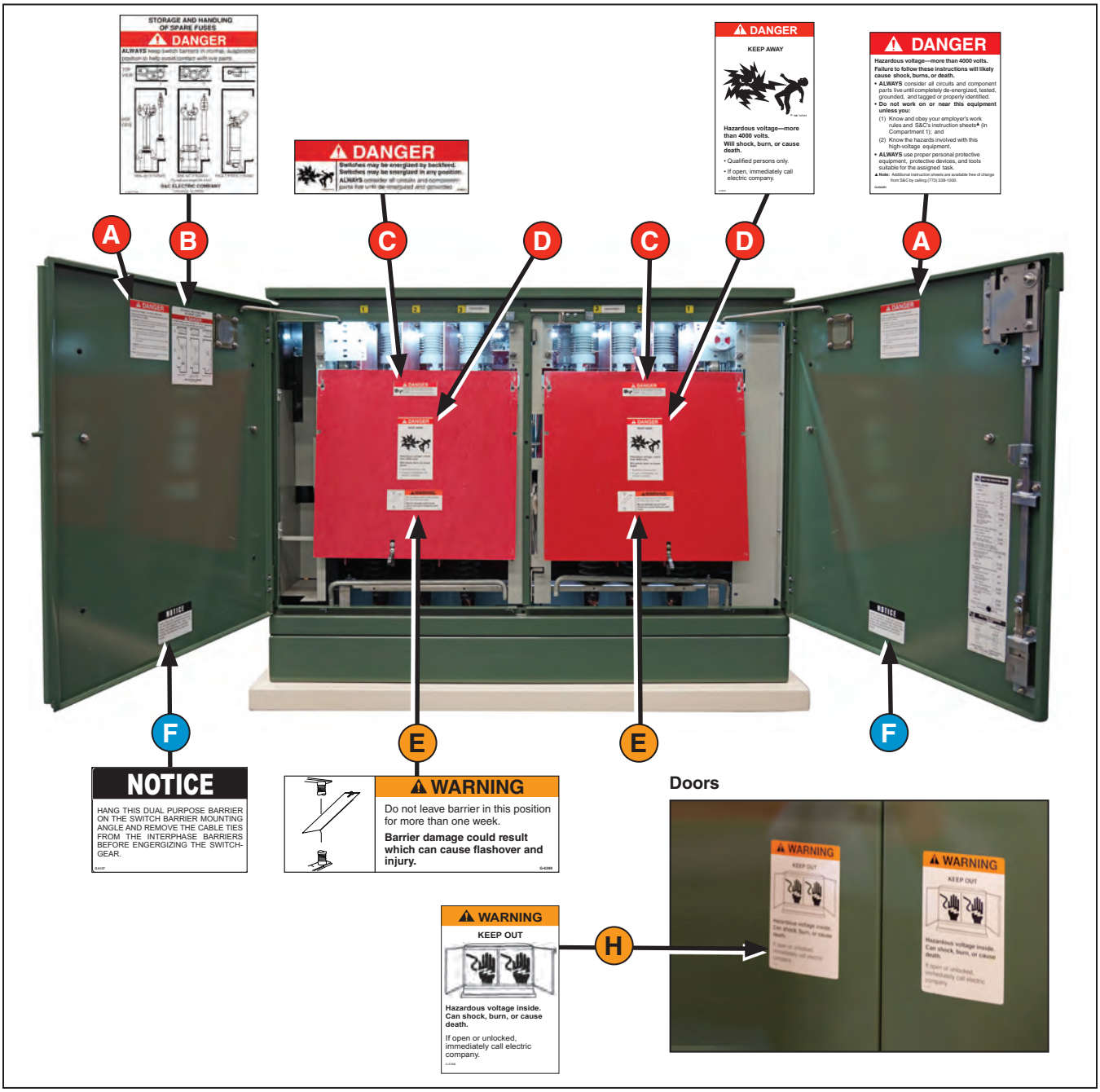
Read this instruction sheet thoroughly and carefully before installing the remote supervisory PMH Pad-Mounted Gear.

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.

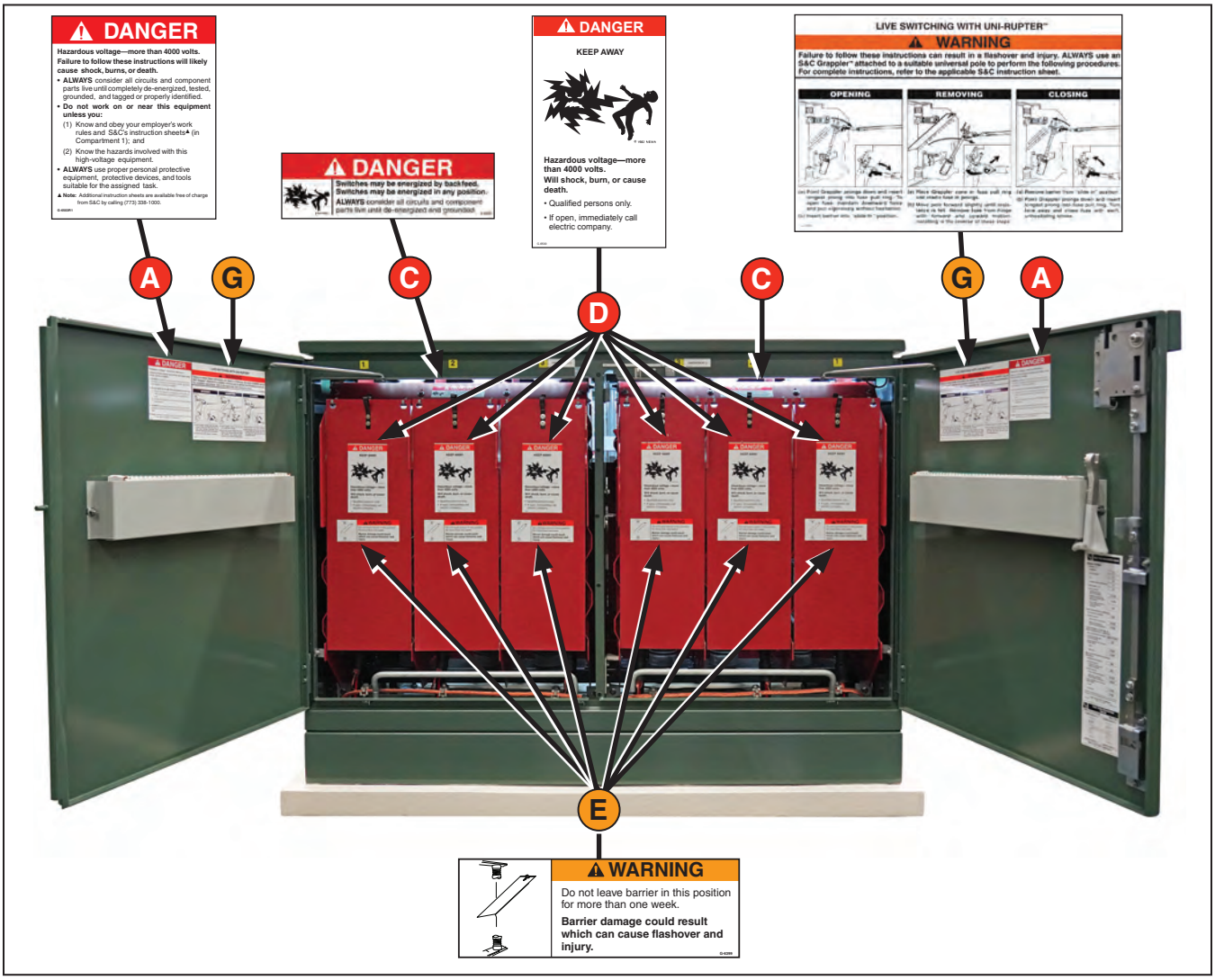
Location of Safety Labels



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-5147-1R1
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



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-5147-1R1
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
G	⚠ WARNING	Live switching with Uni-Rupter . . .	G-6369

⚠ DANGER

Remote supervisory PMH Pad-Mounted Gear 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 remote supervisory PMH 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 "DANGER," "WARNING," "CAUTION," or "NOTICE" labels.
5. **HIGH-VOLTAGE ISOLATION.** Switch operators and controls are isolated from high voltage in grounded, metal-enclosed compartments. Access to these components is controlled by padlockable covers, which incorporate a nonremovable manual handle. Other low-voltage components, such as meters, selector switches, toggle switches, etc., are similarly isolated.
6. **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 high-voltage 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.
7. **TEST FOR VOLTAGE.** Test for voltage using proper high-voltage test equipment before touching any device to be inspected, serviced, or repaired in the high-voltage compartments.
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. **GROUNDING.** Remote supervisory PMH Pad-Mounted Gear 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 switchgear, 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.
11. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.
12. **BACKFEED.** Mini-Rupter Switches and fuses may be energized by backfeed.
13. **GROUNDING EQUIPMENT.** Install suitable grounding equipment before touching any device to be inspected, serviced, or repaired in the high-voltage compartments.
14. **PADLOCKS.** Non-removable, manual handles in high-voltage compartment doors and hinged-padlockable covers, as well as hinged-bolted panels, have provisions for padlocks which must be in place and secured at all times unless work is being performed inside the enclosure. Padlocks must be installed and secured on manual switch operating handles at all times unless the switch is being operated.

⚠ DANGER

Remote supervisory PMH Pad-Mounted Gear 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.

15. **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.
16. **MECHANICAL CABLE INTERLOCKS.** Mechanical cable interlocks are provided to prevent access to fuses unless the switch is open and to prevent operation of stored-energy switch operators when the enclosure door is open. Do not attempt to operate any switch when the enclosure door is open. Periodically, verify these interlocks are functional.
17. **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.
18. **FUSES MUST BE DISCONNECTED.** Make sure fuses are disconnected from all power sources (including backfeed) before being inspected or replaced.
19. **SWITCH POSITION.**
    - Always confirm the **Open**/**Close** position of the Mini-Rupter Switches by visually observing the position of the switch blades.
    - Switches and switch terminals may be energized by backfeed.
    - Switches and switch terminals may be energized in any position.
20. **FUSE POSITION.** Fuses and fuse mountings (Uni-Rupter Interrupter, load-side hinge, and terminals) may be energized by backfeed even when the fuse is in the fully **Open** position.
21. **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.
22. **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.
23. **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.
24. **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.

Instruction manuals regarding installation and operation of the pad-mounted gear, switch operators, and control-equipment group components are included in the "Installation and Operation Information Kit" provided with each unit of remote supervisory PMH Pad-Mounted Gear. Wiring diagrams and a catalog dimensional drawing showing cable-locating and anchor-bolt dimensions are also provided in the information kit. All personnel involved with installation and operation of the gear should be thoroughly familiar with the contents of the kit.

The following instructions cover operation of fuses and manual Mini-Rupter Switches in remote supervisory PMH Pad-Mounted Gear. For operating instructions regarding Type PM Switch Operators or the control-equipment group components, refer to the applicable S&C instruction sheets.

Remote supervisory PMH Pad-Mounted Gear permits automated switching and provides fault protection for underground distribution systems. See Figure 1, Figure 2 on page 11, and Figure 3 on page 12. This gear contains the following:

- 600-ampere Mini-Rupter Switches for three-pole live switching of three-phase source circuits

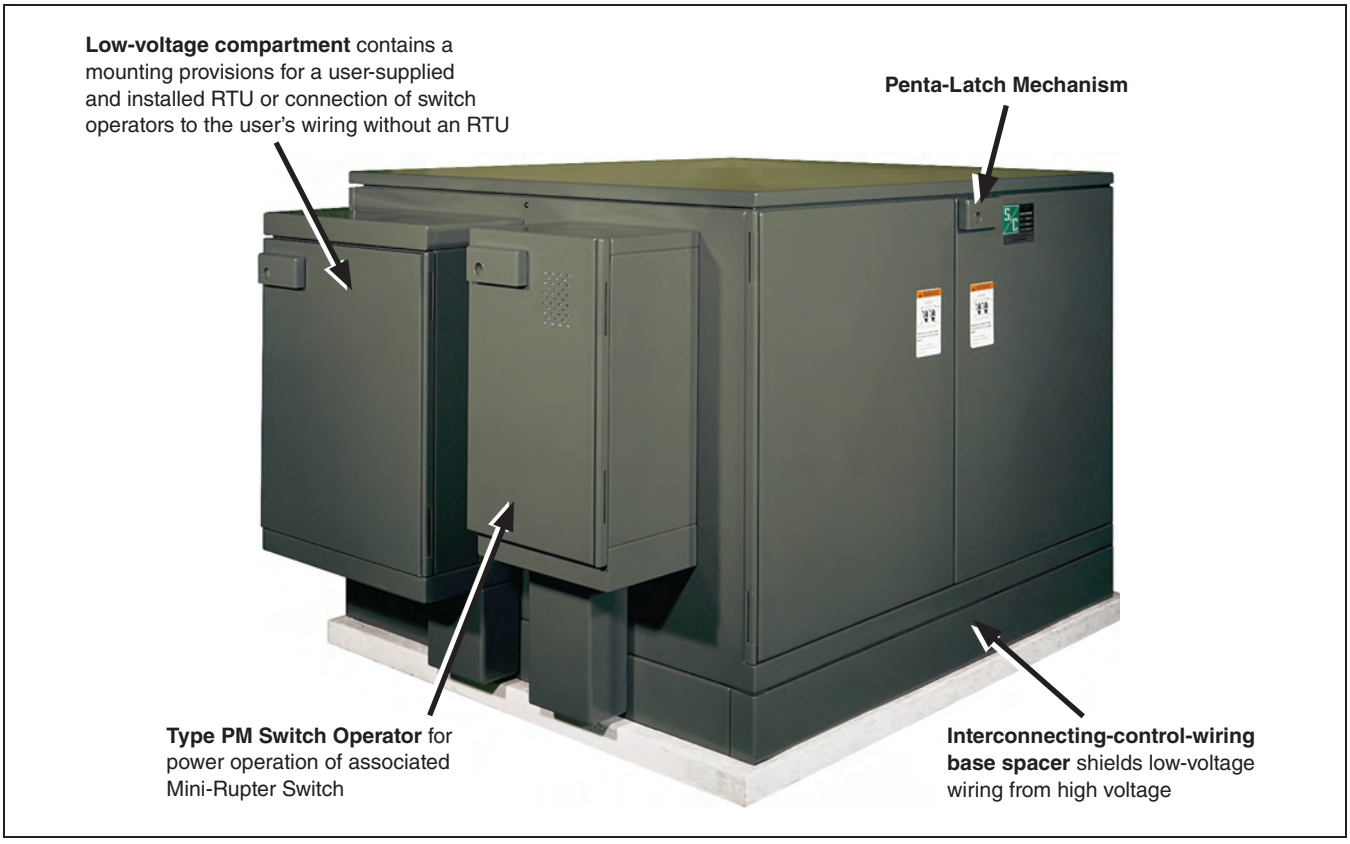


Figure 1. Remote supervisory Model PMH-9 with a Type PM Switch Operator and low-voltage compartment.

- Type PM Switch Operators to provide power operation of the associated Mini-Rupter Switches
- Control-equipment-group components and an interconnecting control-wiring base spacer with low-voltage wiring for each switch operator
- 200- or 400-ampere hookstick-operated S&C Power Fuses with a Uni-Rupter Interrupter for single-pole live fuse switching of single-phase or three-phase load circuits (Models available offer a choice of Type SML-20 or SML-4Z Power Fuses, Fault Fiter® Electronic Power Fuses, or a variety of single-barrel current-limiting fuses.)
- A Penta-Latch® Mechanism on doors for access control (The mechanism provides automatic door latching and permits padlocking only when the door is latched closed. Doors can be opened only with a pentahead socket wrench or tool except when hexhead actuators are specified.)

A variety of optional features are available for remote supervisory PMH Pad-Mounted Gear. The catalog number stamped on the nameplate affixed to the enclosure door is suffixed with letter-number combinations applicable to the gear furnished. Refer to Specification Bulletin 664-31 for descriptions of the optional features.

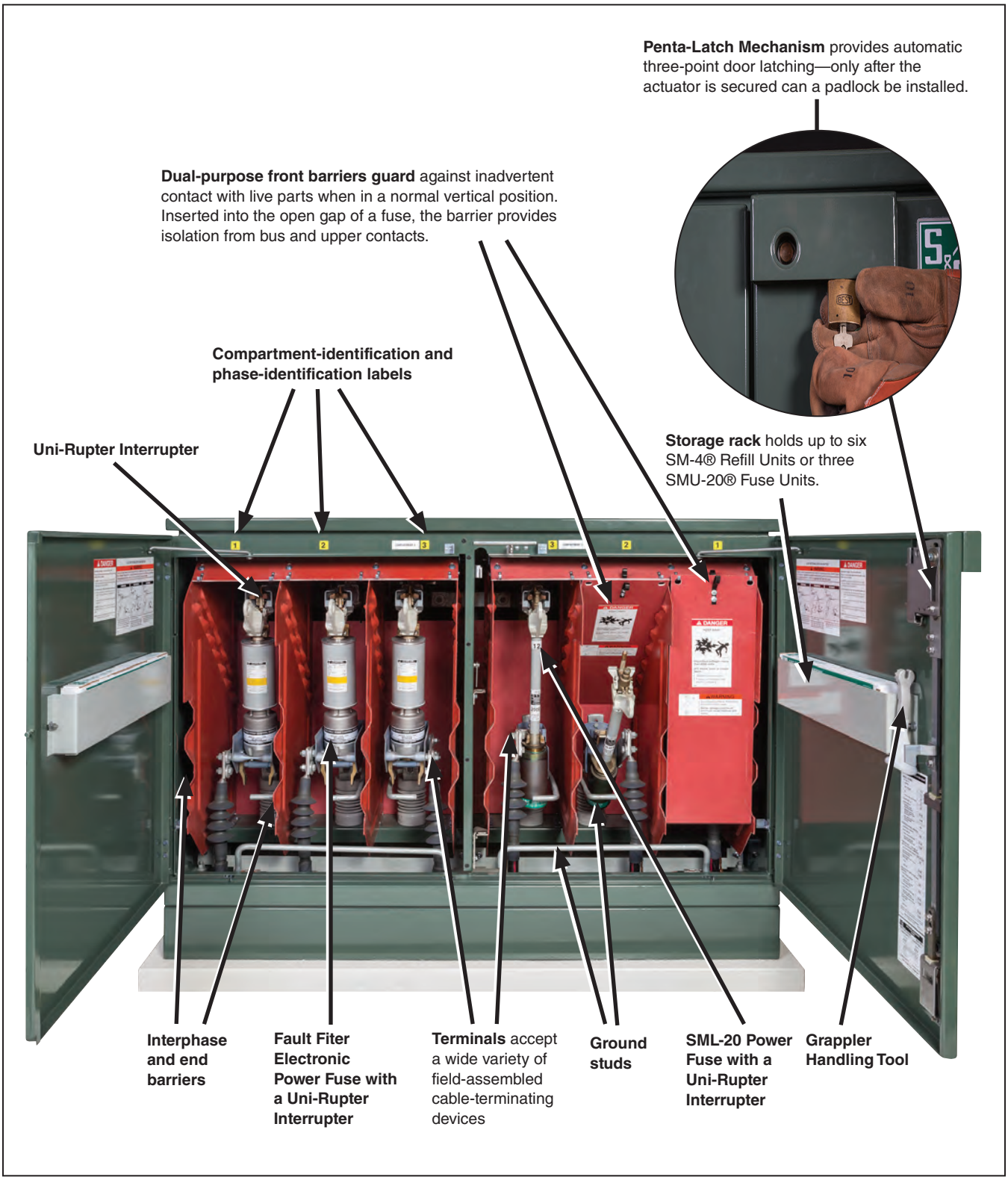


Figure 2. Fuse-side view of a Model PMH-9 with SML-20 Power Fuses in the right-hand compartment and Fault Fiter Electronic Power Fuses in the left-hand compartment. (This nonstandard combination of fuses is shown for comparison only.)

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

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.

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

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

Optional fuse-storage feature

Circuit diagram

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

Figure 3. 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 4.

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

STEP 3. Disengage the left-door latching mechanism by turning the latch clockwise. See Figure 5.

Figure 4. 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 5. The left-door latching mechanism disengaged.

STEP 4. Open each door fully and latch the door holders. See Figure 6.

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 7. Make sure the door holder is placed back in the storage position to allow the door to be fully closed. See Figure 8.

STEP 2. Repeat Step 1 for the other door.

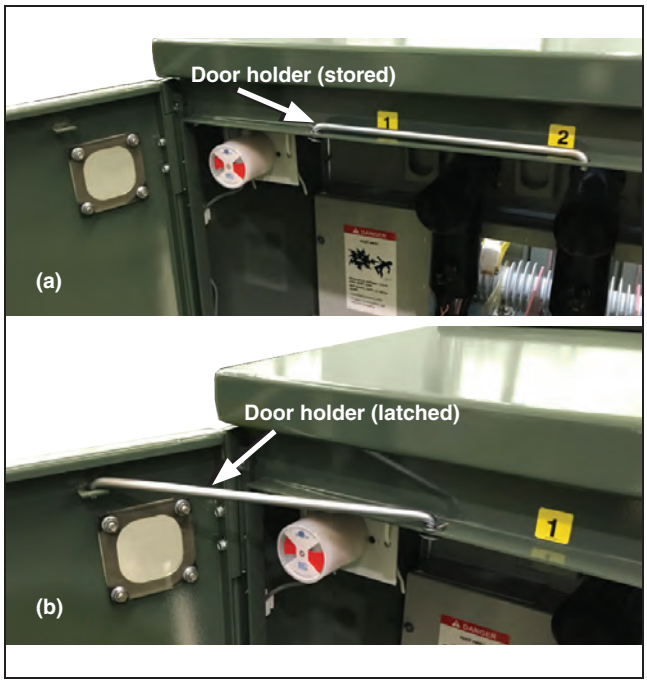


Figure 6. Using the door holder to hold the door open.

Figure 7. Lift the door holder to allow the door to swing closed.

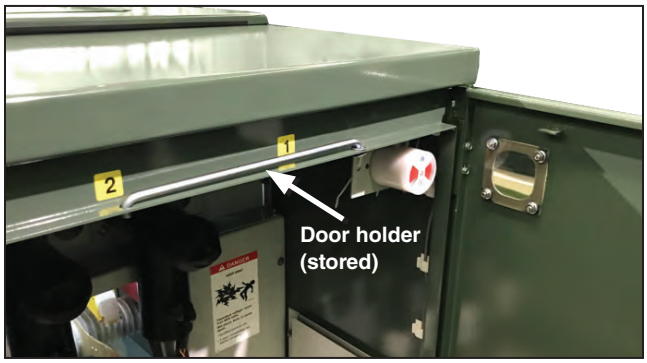


Figure 8. The door holder placed in the storage position to allow the door to close.

STEP 3. Engage the left-door latching mechanism. See Figure 9.

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 10.

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

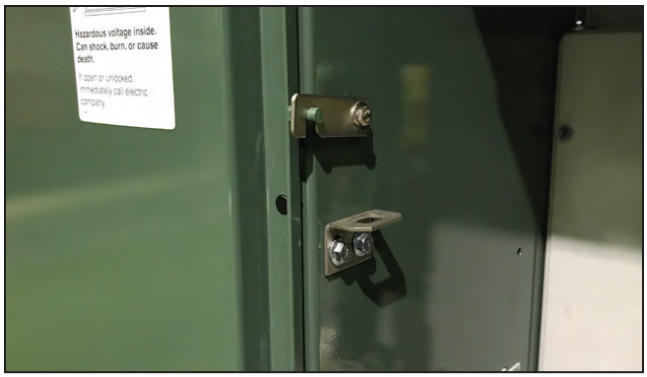


Figure 9. The left-door latching mechanism engaged.

Figure 10. The enclosure doors padlocked.

The following instructions are for operation of manual Mini-Rupter Switches. For Mini-Rupter Switches operated by Type PM Switch Operators, refer to Instruction Sheet 669-515. Complete ratings for Mini-Rupter Switches as applied in remote supervisory PMH Pad-Mounted Gear are shown in Specification Bulletin 664-31. Before proceeding, refer to the "Safety Precautions" section on pages 7 and 8.

Operating the Mini-Rupter Switch

Follow these steps to operate the Mini-Rupter Switch:

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

STEP 2. Remove the folding switch-operating handle from its storage pocket behind the access cover. Unfold the handle and slide it onto the hex switch-operating shaft. See Figure 13.

Note the switch-position indicator attached to the hex switch-operating shaft and resting against a stop in either the **Open** or **Closed** position. Arrows indicate **Switch-Open** or **Switch-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.

NOTICE

Always confirm the **Open/Close** position of the Mini-Rupter Switch by visually observing the position of the switch blades. See Figure 14.

STEP 4. 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 may result in personal injury or equipment damage.**

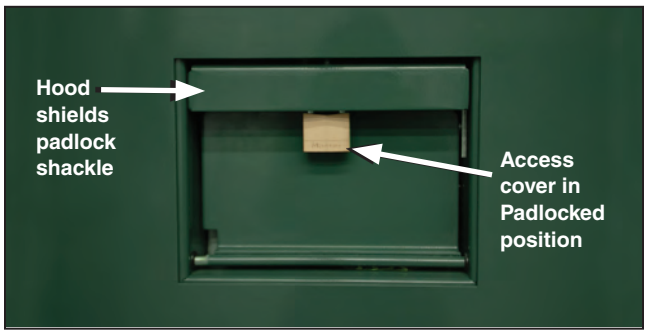


Figure 11. The access cover padlock.

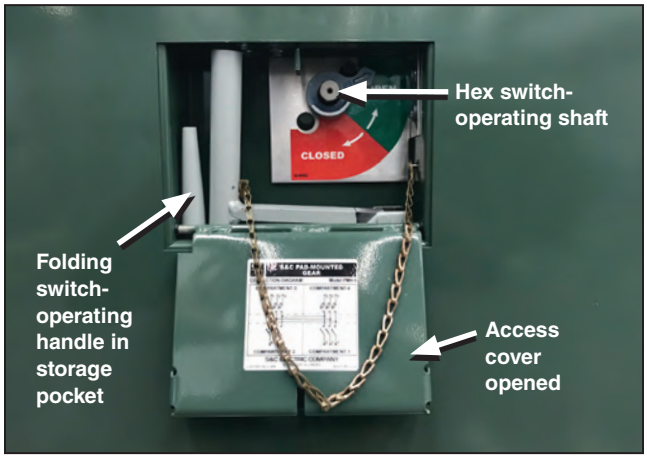


Figure 12. The access cover door is open.

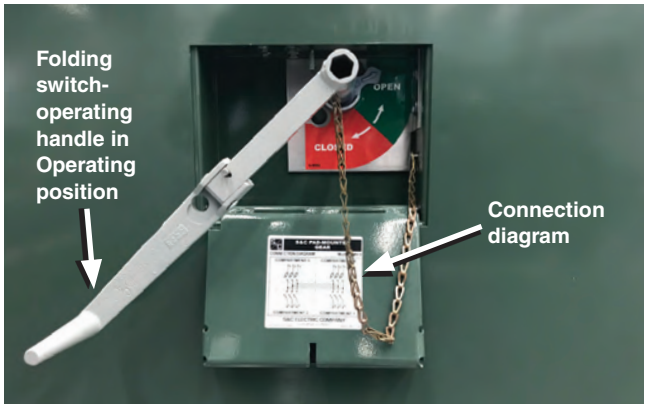


Figure 13. The switch operating handle installed.

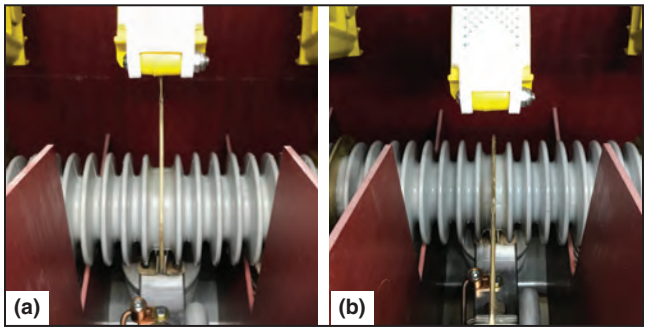


Figure 14. (a) Shows the switch in the Closed position, and (b) shows the switch in the Open position.

Front Barriers

⚠ DANGER

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

Always use a Grappler Handling Tool attached to a suitable 1¼-inch (32-mm) diameter universal pole 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.

Place the dual-purpose front barrier in the **Slide In** position whenever the Mini-Rupter Switch is open. When the barrier is in the **Slide In** position, the switch blades are isolated from the main contacts. This also keeps the blades from closing if, for any reason, the Mini-Rupter Switch is operated.

To insert the barrier in the **Slide In** position, use a Grappler tool attached to and in line with a suitable universal pole. Figure 15 and Figure 16, as well as Figure 17 on page 20, show the suggested insertion method. The Grappler tool prongs are pointed upward when lifting the front barrier.

Figure 15. Dual-purpose front barrier for switch in its normal, suspended position.

Figure 16. 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.

⚠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.

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. If a power-operated Mini-Rupter Switch is closed with the dual-purpose front barrier in the **Slide In** position, refer to the "If Operator Stalls" section in Instruction Sheet 669-515.

To restore the dual-purpose front barrier to the normal suspended position, use an S&C Grappler tool attached to a suitable universal pole. With the Grappler tool prongs pointed upward (as shown in Figure 17), slowly and carefully withdraw the barrier so that, as it clears the **Slide In** position, the holes in the barrier catch on the hooks of the gear. 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 18.

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

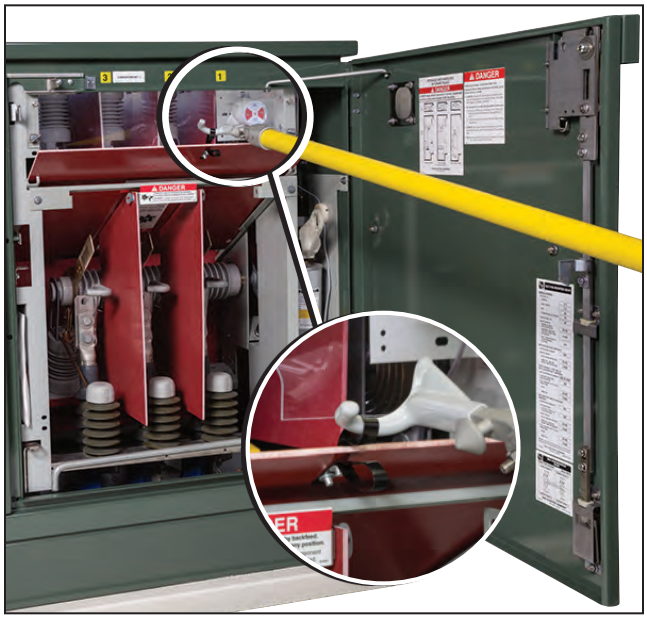


Figure 17. The Grappler tool, after lifting and pivoting the barrier, is used to lower it into the Slide In position. The image also shows the Grappler tool being used to return the barrier to its normal, suspended position

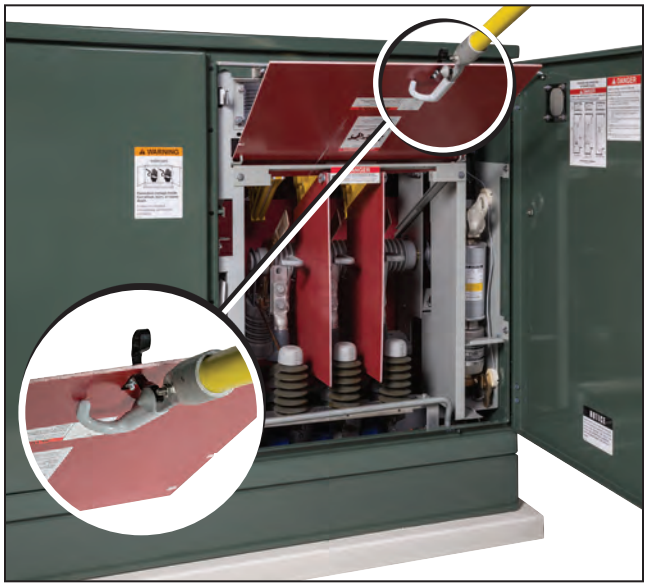


Figure 18. Alternate method for replacing the front barrier using a Grappler tool: Place the barrier on the hooks of the gear and lower the barrier to its suspended position. The inset image shows a close-up of the Grappler tool in position to replace the barrier.

Remote supervisory PMH Pad-Mounted Gear is furnished with S&C Fuse Mountings with a Uni-Rupter Interrupter that accommodates 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 current-limiting fuses, the voltage rating of the fuses must conform to the recommendations in the "Recommended Voltage Ratings" section of S&C Information Bulletin 660-50.

Failure to follow 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 and Closing the Fuse●

Before proceeding, refer to the "Safety Precautions" section on pages 7 through 8.

⚠ DANGER

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

Always use a Grappler Tool attached to a 1¼-inch (32-mm) diameter universal pole 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.

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 19.

⚠ 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.**

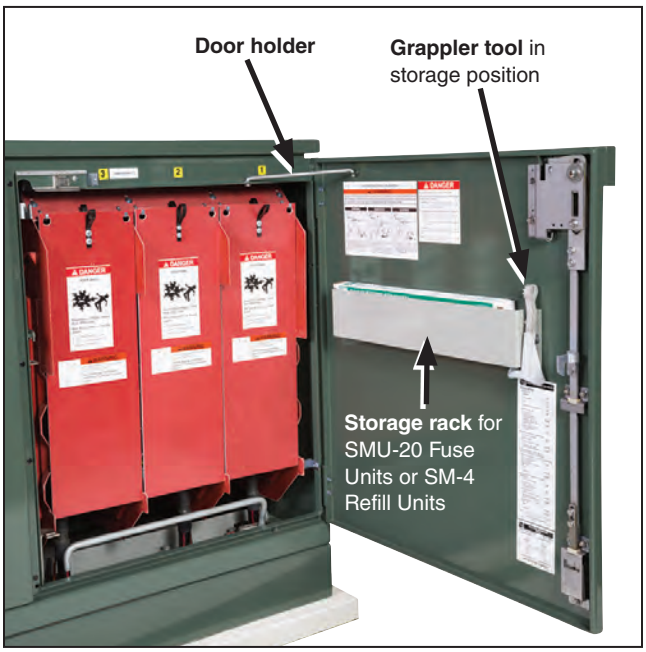


Figure 19. Dual-purpose front barriers for fuses in their normal, suspended positions. Note the door holder is in place.

● Although the operations as 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 a Uni-Rupter Interrupter.

■ 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.

▲ Use a universal pole 1¼ inches (32 mm) in diameter and at least 6 feet (183 cm) long for 14.4-kV gear or at least 8 feet (244 cm) long for 25-kV gear.

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 will be installed. See Figure 20.

STEP 4. Insert the barrier into the **Slide In** position using the Grappler tool as illustrated in Figure 21.

Note: the barrier is supported on the Grappler tool prongs and held there by engagement of the lifting ring with the Grappler tool 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 to isolate the fuse from the contacts of the Uni-Rupter Interrupter while work is being performed. 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.

Figure 20. Removing or replacing the dual-purpose front barrier with the Grappler tool.

Figure 21. Inserting the dual-purpose front barrier into the Slide In position using a Grappler tool.

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 cone in the fuse pull-ring and cradle the fuse in the Grappler tool prongs. See inset of Figure 22.

(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.

(c) Lift the fuse and lower it into its hinge. See Figure 22. Make sure the fuse is securely seated in the hinge. Then, disengage the Grappler tool from the fuse. See Figure 23.

⚠ 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 safe operating procedures and rules, and then install the fuse into 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, which will interfere with door closing. The door may be closed if the fuse is removed from its mounting.

Figure 22. 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.

Figure 23. A fuse installed in mounting in the Open position.

STEP 7. Use the Grappler tool to remove the dual-purpose front barrier from the **Slide In** position. See Figure 24.

⚠ 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.**

NOTICE

With a Uni-Rupter Interrupter, a fuse can be closed into a fault current once or twice as specified in S&C Specification Bulletin 664-31, and the Uni-Rupter Interrupter will remain operable and able to carry and interrupt rated current.

Figure 24. Removing dual-purpose front barrier from the Slide In position using a Grappler tool.

With the Grappler tool prongs pointed downward, insert the longer prong into the pull ring of the fuse. See inset of Figure 25. Then, with one's face turned away, close the fuse with a swift, unhesitating stroke. See Figure 25.

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 25.

STEP 8. Remove the Grappler tool from the pull-ring.

STEP 9. After removing the Grappler tool from the pull-ring, make sure complete fuse closure was attained by pushing against the fuse with the Grappler tool.

⚠ WARNING

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

STEP 10. Use the Grappler tool to hang the dual-purpose front barrier in its normal, suspended position. See Figure 20 on page 23. Also, install the optional inner barrier panel, if furnished.

STEP 11. Close and latch the doors and install a padlock. Pull on the doors to verify they are securely latched.

Figure 25. Closing the fuse with a swift, unhesitating stroke. The top left inset shows a close-up of a Grappler tool in the preferred position to close the fuse. The top right inset shows a close-up of a Grappler tool in an acceptable position to close the fuse. The bottom inset shows a close-up of a Uni-Rupter Interrupter with the fuse fully closed.

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.)*

Opening and Removing the Fuse

Before opening the fuse, refer to the "Safety Precautions" section on pages 7 through 8.

⚠ DANGER

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

Always use a Grappler Tool attached to a 1¼-inch (32-mm) diameter universal pole 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.

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 procedure:

STEP 1. Open the appropriate fuse-compartment door and secure it with the door holder. See Figure 19 on page 22.

⚠ 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.**

● Use a universal pole 1¼ inches (32 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 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 20 on page 23.

STEP 4. With the Grappler tool's prongs pointed downward, insert the longer 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 pull-ring of the fuse. See Figure 26.

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 inset of Figure 26.

STEP 5. Pull the fuse vigorously through its full travel without hesitation at any point. See Figure 27. 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 can result in serious injury or death.**

Figure 26. A Grappler tool, as positioned for an opening stroke.

Figure 27. Opening the fuse.

NOTICE

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

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 28. Note that the barrier is supported on the Grappler tool prongs and held there by engagement of the lifting ring with the Grappler tool cone.

⚠ WARNING

Do not leave dual-purpose front barriers in the **Slide In** position for more than one week. These barriers are intended for temporary use to isolate the fuse from the contacts of the Uni-Rupter Interrupter while work is being performed. 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.

Figure 28. Inserting dual-purpose front barrier into the Slide In position using a Grappler tool.

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 cone in the fuse pull-ring and cradle the fuse in the Grappler tool prongs. See Figure 29.

(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 (approximately 2 inches (51 mm)). Then, remove the fuse from its hinge with a forward and upward lifting motion. See Figure 30.

⚠ 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 will 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.

Figure 29. A Grappler tool positioned for fuse removal.

Figure 30. Removing a fuse from its hinge with a forward and upward lifting motion.

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

STEP 10. Hang the optional dual-purpose front barrier in it's normal, suspended position using the Grappler tool. See Figure 20 on page 23. 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

Always store fuses 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.

The optional **Fuse Storage** feature, if furnished, can accommodate three completely assembled spare Type SML Fuses, two spare Fault Fiter fuse 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** compartment 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 will result in serious injury or death.

How to Detect and Replace a Blown Fuse

Follow these steps to detect and replace a blown fuse:

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

> **⚠ WARNING**
>
> To minimize exposure to high voltage on double-door models, close and latch the adjacent door. **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. See Figure 31.

For an SML-20 Power Fuse or Fault Fiter Electronic Power Fuse: A red blown-fuse target projects from the top of the SML-20 Power Fuse upper end-fitting or the Fault Fiter Holder when the fuse has operated, making it easy to check the 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.

For an SML-4Z Power Fuse: 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 the fuse condition without removing the fuse from its mounting. The target fluoresces when illuminated.

Note on Handling: The present design of the upper end-fitting for use in SML-20 Power Fuses and the Fault Fiter fuse holder use a free-floating blown-fuse target that can move (by force of gravity) into the **Blown** position

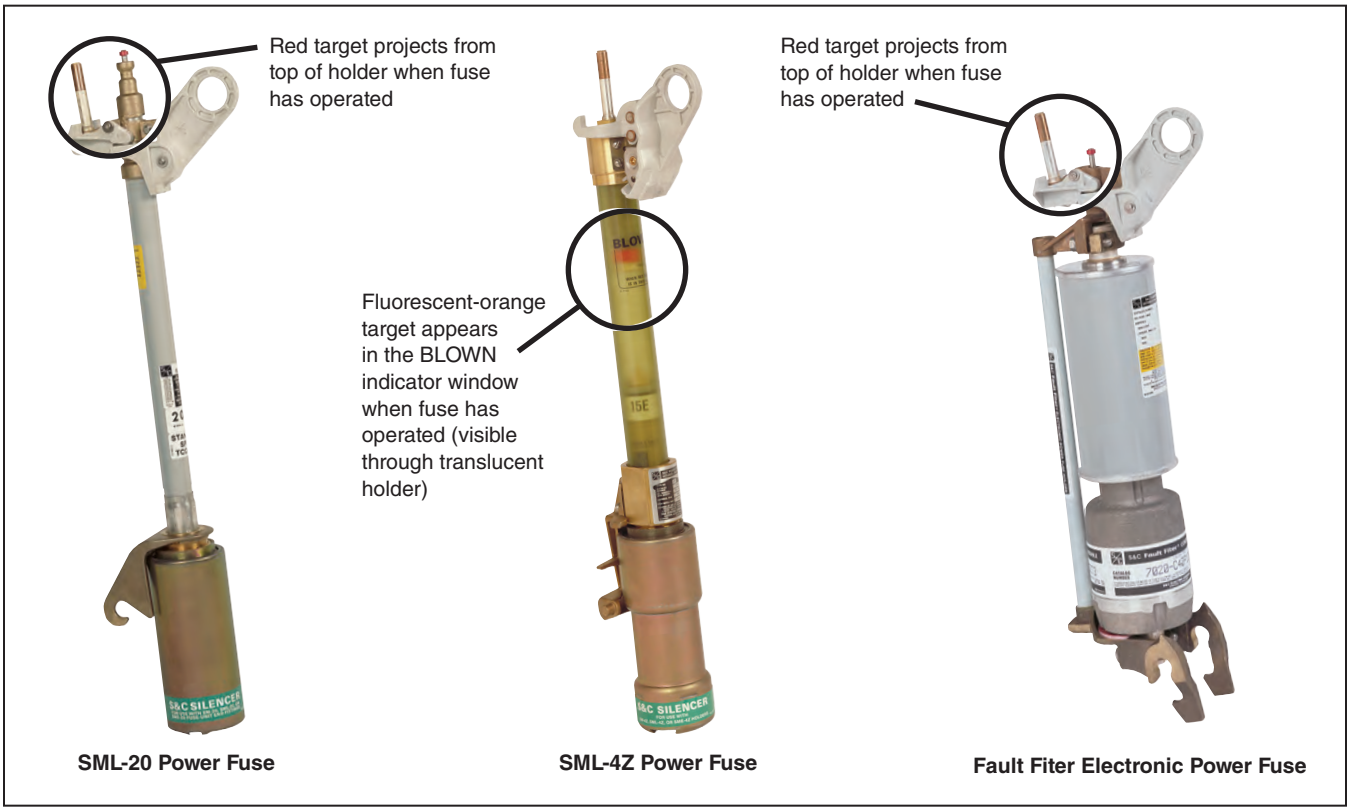


Figure 31. Blown-fuse target locations for the fuse types used in PMH models of S&C Pad-Mounted Gear.

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 in the "Opening and Removing the Fuse" section on pages 28 through 32. Then, follow the instructions for replacing blown SM-4 Refill Units, SMU-20 Fuse Units, or Fault Fiter fuse interrupting modules (as applicable) that are provided with each new refill unit, fuse unit, or 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) by following the instructions found in the "Opening and Removing the Fuse" section on pages 28 through 32. 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 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 22 through 25.

Components

No mechanical maintenance is required for remote supervisory PMH Pad-Mounted Gear. However, occasional inspection of the gear and exercising of the Mini-Rupter Switches is recommended. Exercising of Type PM Switch Operators once per year in accordance with the "Exercising and Maintenance" section in S&C Instruction Sheet 669-515 is also recommended to verify proper functioning of the system. In addition, inspection and cleaning—of insulators and cable terminators in particular—should be performed periodically, at intervals based on environmental conditions.

When, in the user's judgment, cleaning is required, S&C recommends the pad-mount gear be completely de-energized, tested, and grounded the pad-mounted gear 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.

Note: The maintenance of other low-voltage components isolated from high-voltage compartments may be performed under the safety rules for equipment rated 600 volts or less. If maintenance is to be performed on devices connected to the secondary of a voltage sensor, short-circuit the secondary connections. A separate drawing will be provided with the replacement part explaining how to properly short-circuit the secondary connections.

⚠ DANGER

When access to high-voltage compartments is required for inspection, service, or repairs, always observe the precautions on pages 7 through 8. **Failure to observe these precautions will result in serious injury or death.**

NOTICE

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 17 on page 20 and Figure 22 on page 24. **Failure to do so can result in personal injury.**

Returning Equipment to Service

Follow these steps to return the equipment to service:

STEP 1. Make sure the switch and fuse-grounding means are removed and the 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. Make sure the associated Penta-Latch Mechanisms are securely latched and pad-locked before energizing the circuit or operating any switching device.

STEP 4. For proper setting of Type PM Switch Operators, refer to the "Final Checks Before Walking Away" section in S&C Instruction Sheet 669-515.

STEP 5. 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. Close the low-voltage compartment door and make sure the associated Penta-Latch Mechanism is completely latched and padlocked.

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

Enclosure Finish

Ensuring the finish protects the enclosure is the responsibility of both the manufacturer and the user. Remote supervisory 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 and follow these steps:

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 664-31 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 washing, 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.

Dielectric Testing

When high-voltage dielectric tests are to be performed on remote supervisory PMH Pad-Mounted Gear, special precautions should be taken to prevent damage to the voltage sensor(s) and voltage limiter. Refer to S&C Instruction Sheet 591-500.