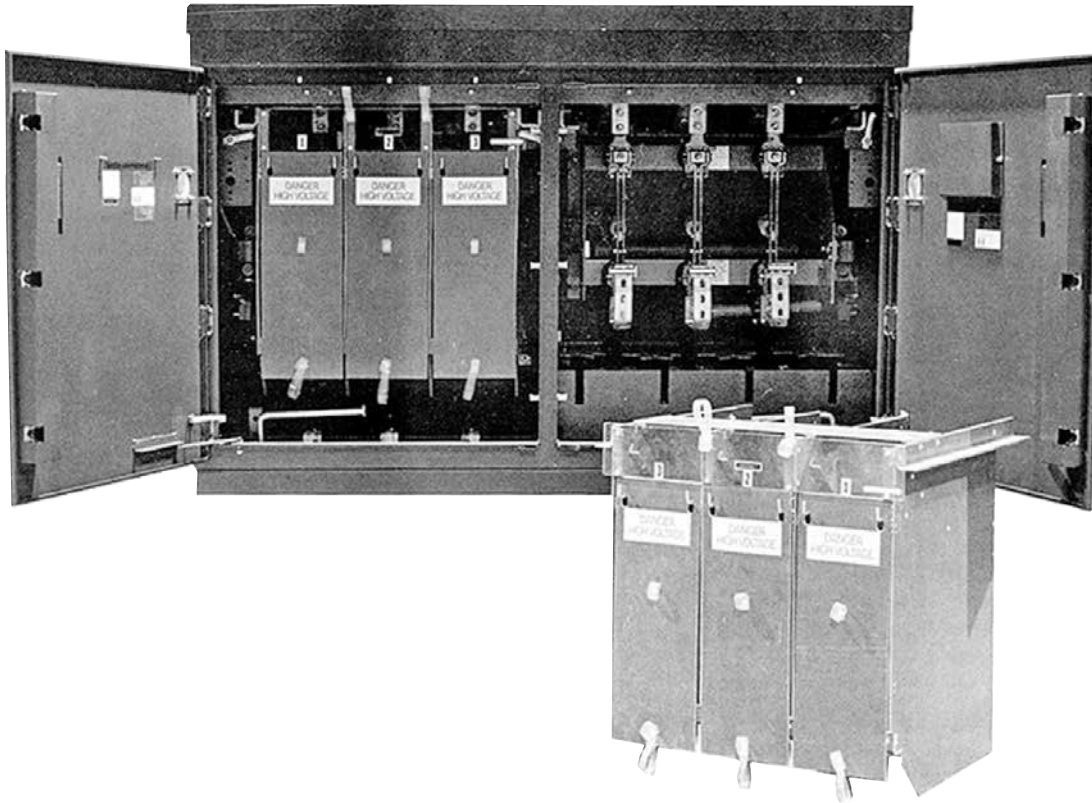


# TYPE PSI PAD-MOUNT SWITCHGEAR 15kV • 25kV • 35kV



## INSTRUCTIONS For Installation and Operation

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## Introduction

Type PSI pad-mounted switchgear is designed to make installation, operation and maintenance as simple as possible and to provide dependable on-the-line service.

High quality materials and careful workmanship have been combined to provide the best switchgear available. The switchgear has been thoroughly inspected and adjusted at the factory. However, successful operation depends on proper installation and care.

This manual has been written to assist you in obtaining long and economical service from your switchgear.

**Read this manual before installing and operating your switchgear.**

## Receiving

Upon receipt of the switchgear, check each item received for shipping damage. Each item should be checked against the shipping manifest to assure that the proper number of items were received. Should any shortage or damage exist, a claim must be filed at once with the carrier, and the Federal Pacific agent or sales office must be notified.

## Handling

The switchgear is securely mounted to a sturdy shipping pallet with provisions for forklift use in removing the unit from truck. The use of a forklift truck is not recommended, but if this method is used the forks must extend through the skid to avoid damaging the equipment.

Removable lifting plates are provided to allow the use of hooks to lift the complete enclosure. The lifting device should be arranged to evenly distribute the lifting force between the lifting plates. Do not lift at an angle less than 60 ° from the horizontal. (See Figure 1)

## Storage

The switchgear as received will be wrapped in a protective plastic film. If the switchgear is not to be installed immediately, the protective film must be removed for outdoor storage of unit.

Export or special packing is available as an option based on customer's requirements and special conditions. Separate instructions are available for these situations.

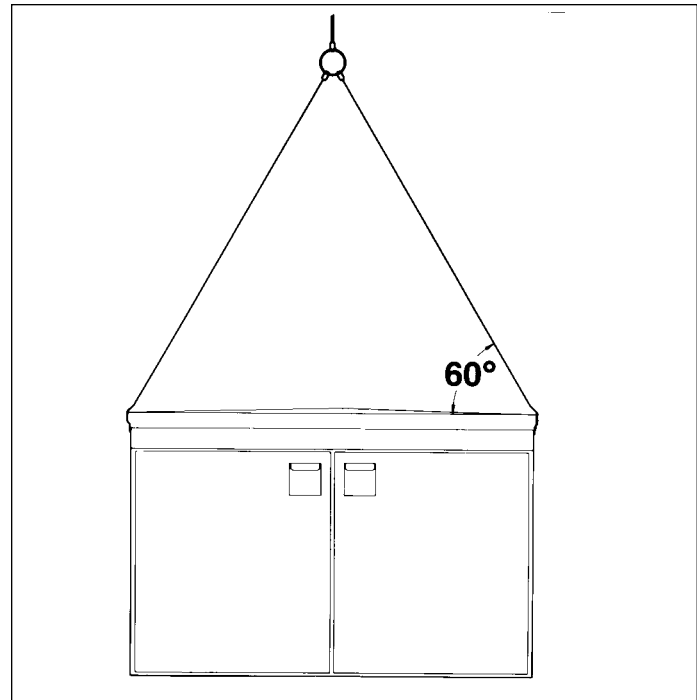


Figure 1. Lifting Method

## General Description

Type PSI pad-mounted switchgear consists of one or more three-pole, single-throw, gang-operated, quick-make, quick-break, load interrupter switches. When used in conjunction with power fuses, expulsion or current-limiting type, and other protective devices, the PSI switchgear provides a safe and efficient means of 3-pole switching and circuit protection.

## Safety Features

Type PSI pad-mounted switchgear incorporates a number of security features to minimize hazards to operating personnel.

1. Rugged 11-gauge steel, all welded construction of the enclosure, roof, and doors assures a tamper-resistant design.
2. Padlockable switch operating pocket handles and doors with security bolts provide user-controlled access.
3. Switch position indicators positively verify switch position.
4. Provisions to padlock switch in open or closed position permit user controlled switch operation. (Optional)
5. Key interlock to ensure a predetermined sequence of mechanical operations. (Optional)
6. Warning signs and labels, both external and internal, which indicate potential hazards to personnel.

## Installation

Each unit is shipped with this instruction bulletin which will be located inside the switch compartment door. These instructions should be reviewed prior to placing unit on pad.

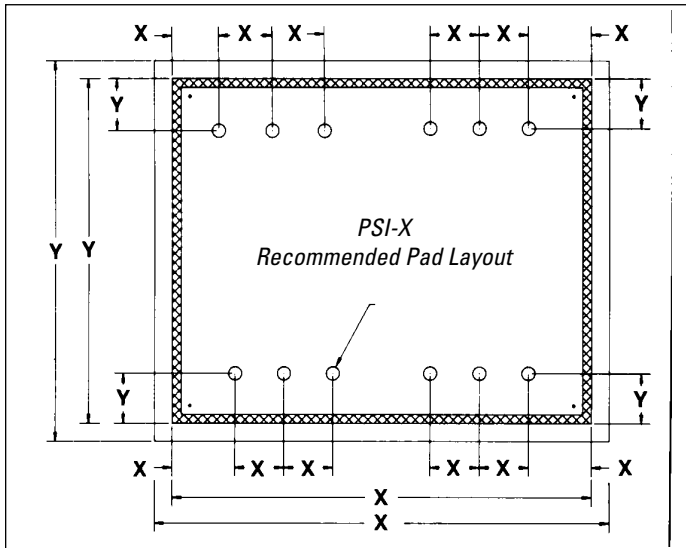


Figure 2. Typical Pad Layout

## Placement of Unit

Remove unit from shipping pallet per handling procedures of Page 2 (Figure 1). When unit has been correctly oriented and placed on pad (Figure 2), verify that unit is level and shim if necessary between unit base and pad. Secure unit to pad using four (4) tie-down clips as furnished (see Figures 3 and 4). Check compartment door operation for any binding due to enclosure distortion and re-shim if necessary. A recessed grouting should then be applied between unit base and pad to prevent entry of foreign objects.

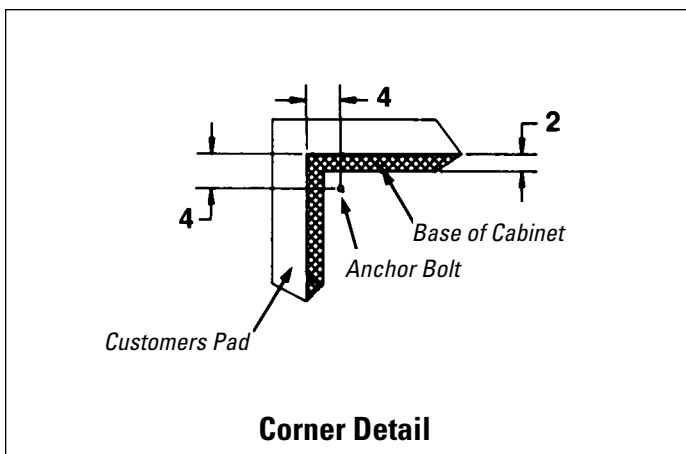


Figure 3. Typical Anchor Bolt Location

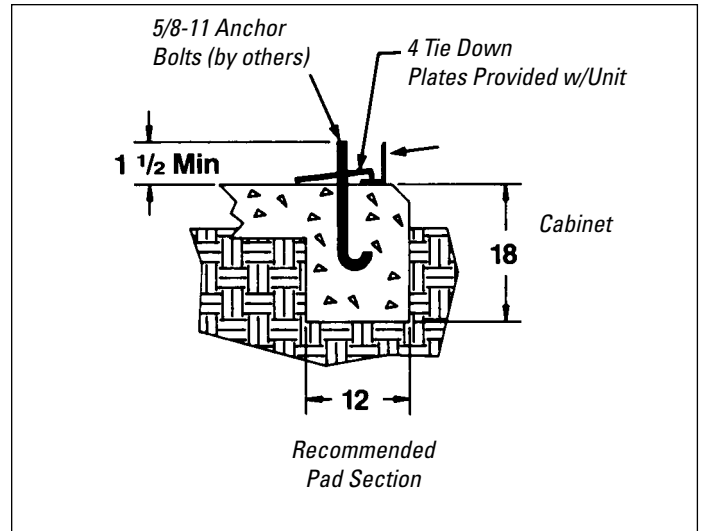


Figure 4. Bolting Units to Pad

## Barrier System Removal

The use of interphase, phase-to-ground, and dual purpose front barriers enhances the operation of pad-mounted switchgear by field personnel. The standard barrier system for Type PSI pad-mounted switchgear is the patented drawout barrier system which maintains all the features of a barrier system and permits the removal of all barriers from a compartment during initial installation and cable termination when the switchgear is completely de-energized and grounded.

Removal of the barriers is readily accomplished as follows:

1. The unit must be completely disconnected from all power sources, tested for voltage and grounded before barrier removal is attempted.
2. Open main door and secure with door keeper.
3. Remove the dual purpose barriers from their normal hanging position. If the optional B4/B5 barrier is provided, it must be removed before dual purpose barriers may be accessed (see page 4).
4. Rotate barrier retaining latches to vertical position. (Figure 5)
5. Grasp nylon pull loops located at upper corners of viewing window and withdraw barrier assembly approximately 12 inches. (Figure 6)
6. Grasp side-support angles located at upper sides and remove barrier assembly from unit. (Figure 7)
7. Place barrier assembly and components in convenient location. (Figure 8)
8. Barrier system may be re-installed by reversing the steps above.

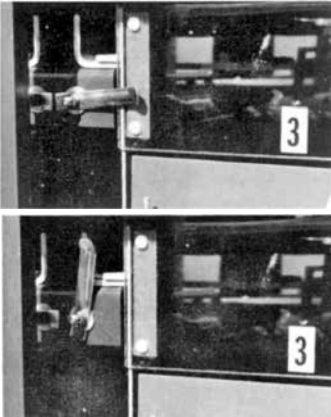


Figure 5

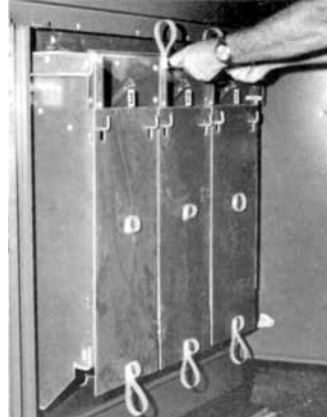


Figure 6

The optional B4/B5 lift-off barrier is provided to meet the requirements of Section 381-G of the National Electrical Safety Code. The B4/B5 barrier (if provided) may be removed as follows:

1. Disengage security bolts at the top of the B4/B5 barrier. See Figure 6.
2. Grasp nylon lifting loops, remove barrier from support hooks and remove barrier from unit. See Figure 7.
3. B4/B5 barrier may be reinstalled by reversing the steps above.



Figure 7

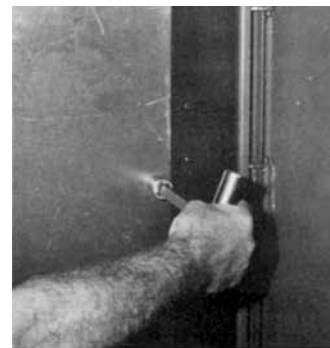


Figure 9



Figure 10

### Customer Cable Connections

With draw-out barrier assembly removed, customer cables may be easily terminated per the following procedure:

1. The hanging weight of the primary cables must not be allowed to place undue strain on the switch/fuse termination bus. Should this situation exist, cable supports must be used. The mounting holes in the switch/fuse termination bus and the cable connector must align to prevent undue strain.
2. Make up the primary cable connections per user URD operating procedures, cable manufacturer instructions, and cable terminator manufacturer instructions.
3. Remove surface oxides and coat both surfaces with suitable joint compound.
4. Attach cable connector to the switch/fuse termination bus using 1/2-inch hardware as shown in Figure 8.
5. Connect the concentric neutral wires and enclosure grounding pads inside enclosure to establish a ground system conforming to user's standard grounding procedures.

**NOTE: The maximum momentary rating of the switchgear must be considered when selecting cable size for connecting switchgear to system ground. Refer to unit rating plate.**

6. Install and connect surge arresters or fault indicators, if applicable.
7. Install draw-out barrier system. (See section on barrier system removal).



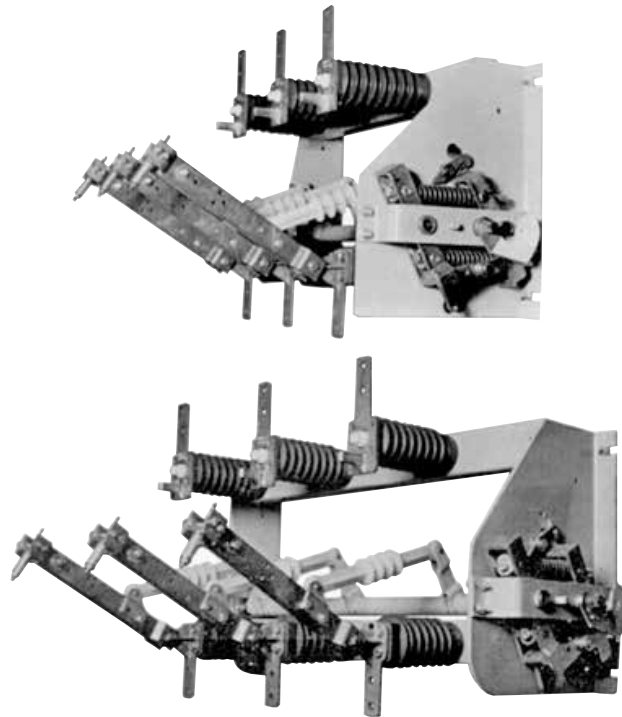
Figure 8

## Switch Description

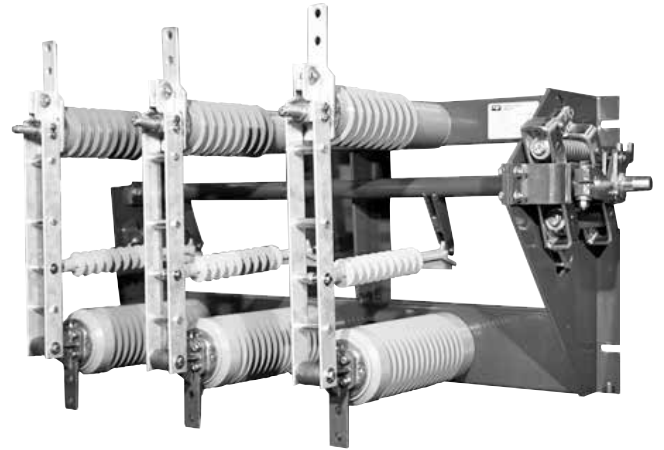
The Auto-jet® switch provides a unique method of load interruption, producing a laminated jet of air which extinguishes the arc.

Auto-jet® switches have a heavy gauge steel, all welded base frame that assures proper alignment and eliminates any problem of switch-to-enclosure alignment. A quick-make, quick-break stored energy mechanism with heavy duty, long life die springs provides high speed opening and closing independent of the operating handle speed. This durable mechanism assures safe load make, 3-time fault closing capability, and load interruption with the Auto-jet® interrupter.

### 15 kV and 25 kV Switches



### 34.5 kV Switches



### RATINGS

kV				Amperes RMS				Fault-Close Duty Cycle*
Nom.	Max. Des.	BIL	Cont.	Interrupting			Mom. & Fault-Close (ASYM KA)	
				Load	Cap.	Mag.		
15	17	95	600	600	100	21	40	3
15	17	95	1200	1200	100	21	40	3
25	27	125	600	600	100	21	40	3
34.5	38	150	600	600	27	21	40	3

\*The three-time duty-cycle fault-closing rating means that the switch can be closed three times into rated fault amperes and remain operable and able to carry and interrupt its rated load current.

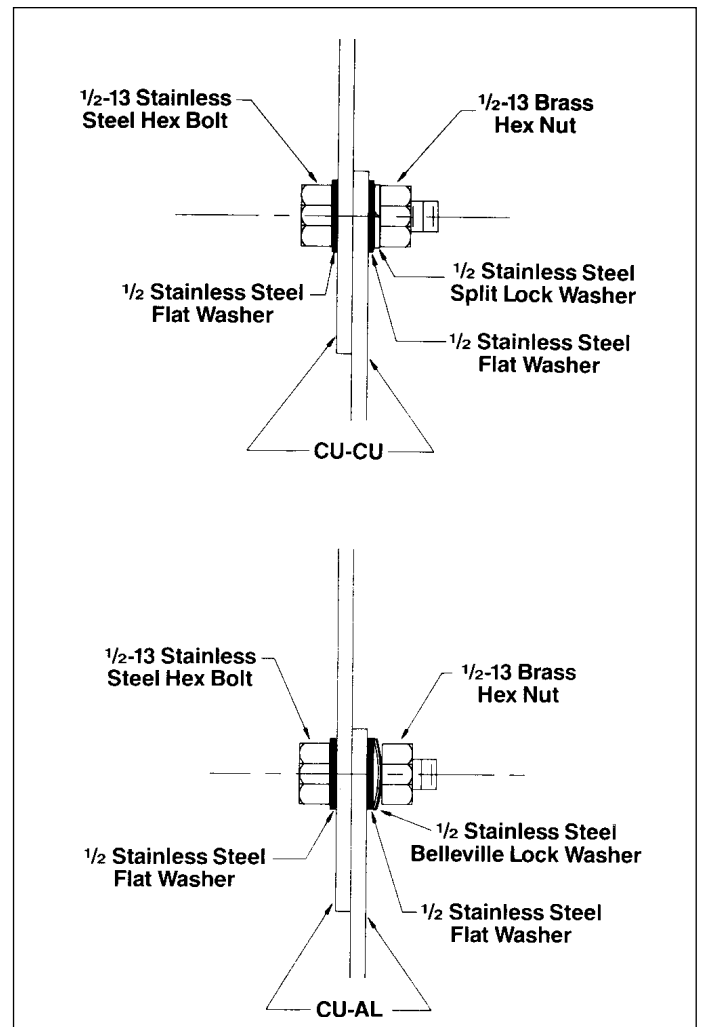
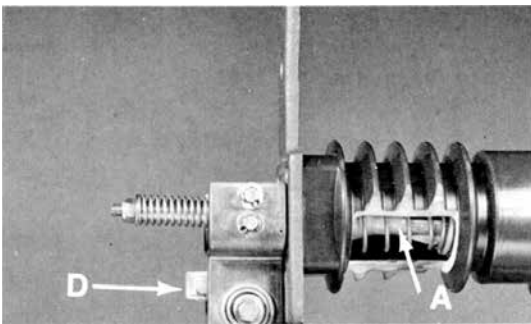


Figure 11. Connector/Termination Detail

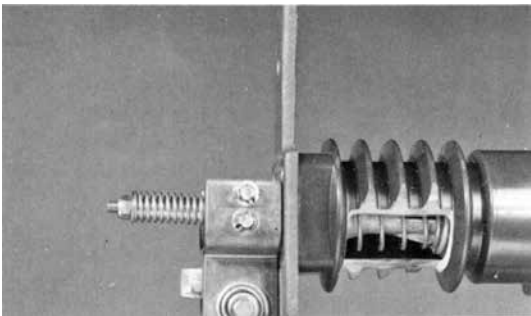
## Interrupter Operation

The Auto-jet<sup>®</sup> switch has a highly efficient system for load current interruption. This device consists of a piston (A) mounted in the cavity of the upper insulator. The movable arcing probe (B) engages a tulip contact (C) inside the piston. As the switch blade (D) is pulled open by the stored energy mechanism, the main contacts open. The piston is pulled forward by means of the movable arcing probe, which compresses a heavy gauge spring encircling the piston and a spring encircling the arcing

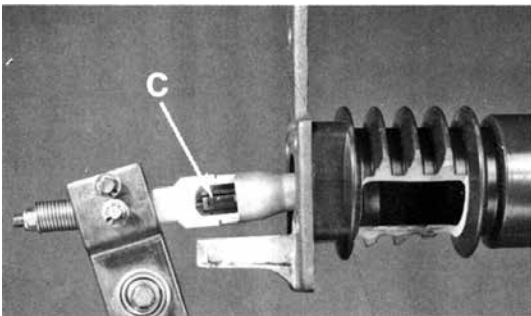
probe. At the end of its travel, the piston released from the arcing probe and, under the action of the heavy spring, is rapidly pushed backward into the cavity. This travel produces a jet of laminated compressed air up through the hollow center of the piston, which extinguishes the arc. The spring encircling the movable arcing probe rapidly retracts the probe and increases the speed of separation, which prevents restriking.



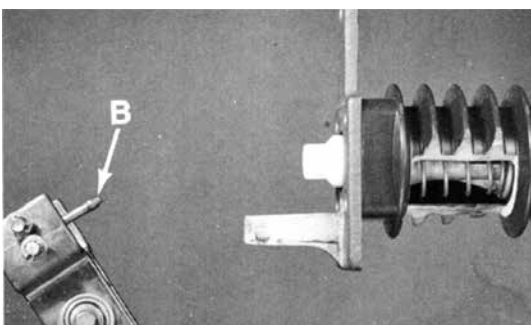
*Switch closed with opening spring relaxed.*



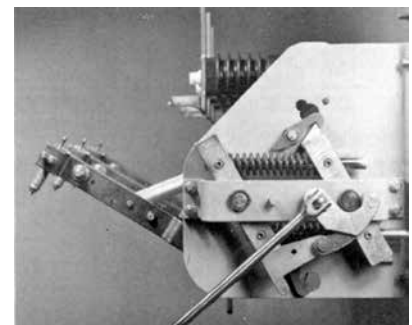
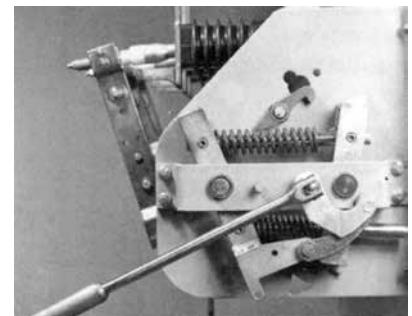
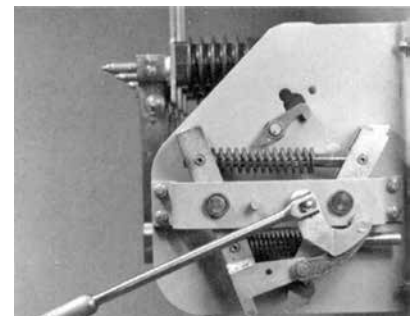
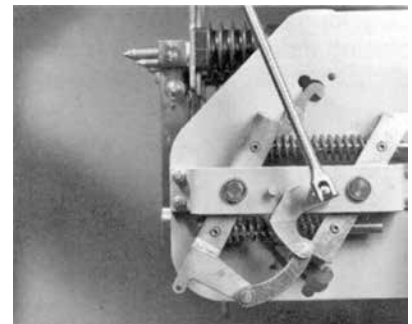
*Switch closed with opening spring charged by manual operating handle.*



*Main contacts parted, puffer and arcing springs charged. (Simulated condition for illustrative purposes, actual duration of event is approximately 1/2 cycle.)*



*Switch open with latch engaged to hold switch in position.*



## Operating the Auto-Jet® Switch

1. Remove padlock and open switch lockbox access cover. (Figure 12)
2. Remove switch operating handle from storage tube and place on hex switch-operating shaft (Fig. 13). If provision to padlock switch in open or closed position is provided (K2 option), padlock must be removed before access to hex switch-operating shaft can be accomplished.  
  
If key interlock(s) are provided (Optional), switch may be locked in the open position.
3. Rotate handle in the direction as indicated to open or close switch. Verify switch position by observing the switch position indicator. (Figure 14)
4. Remove handle and return to handle storage tube.
5. Close switch lockbox access cover and padlock.

**Caution: Access cover should be padlocked whenever switchgear is left unattended.**

**NOTE:** The standard barrier system provides dual purpose barriers for insertion into the open gap when switch is in the open position (Figure 14). Should an attempt be made to close the switch with the DP barriers in the inserted position, the DP barriers will prevent the switch blades from closing (Figure 15). Should this occur, turn the switch handle briskly in the direction required to open the switch. The switch mechanism will latch and after the DP barriers are removed and returned to the hanging position, the switch may be closed in the normal manner.

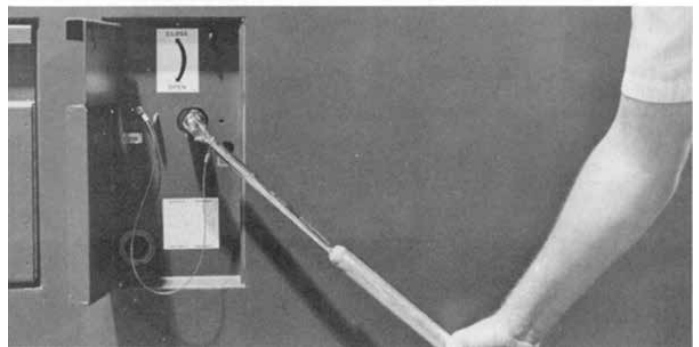
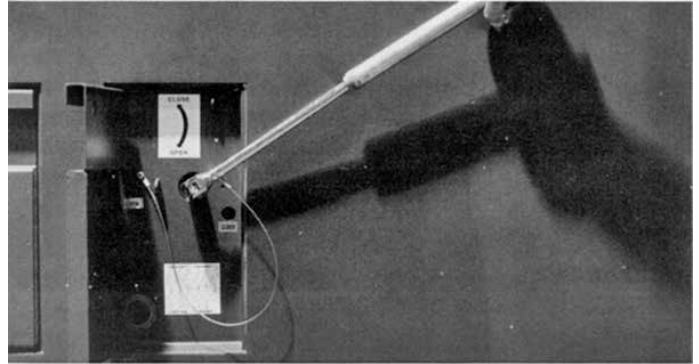


Figure 14. Rotate Handle in direction as indicated.

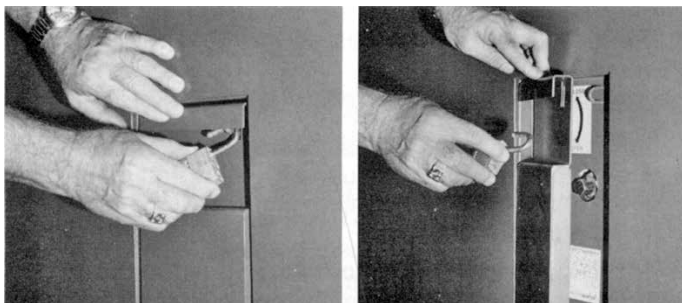


Figure 12. Remove Padlock and Open Door.

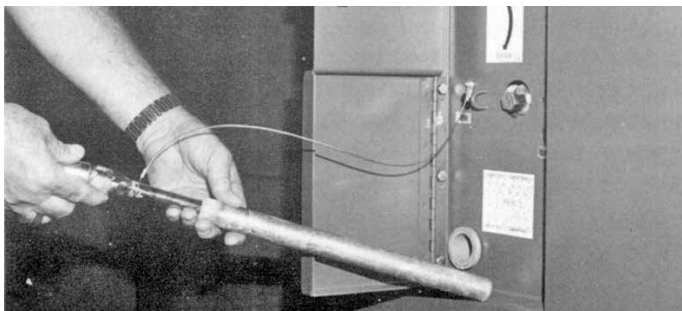


Figure 13. Remove Handle. (chained)

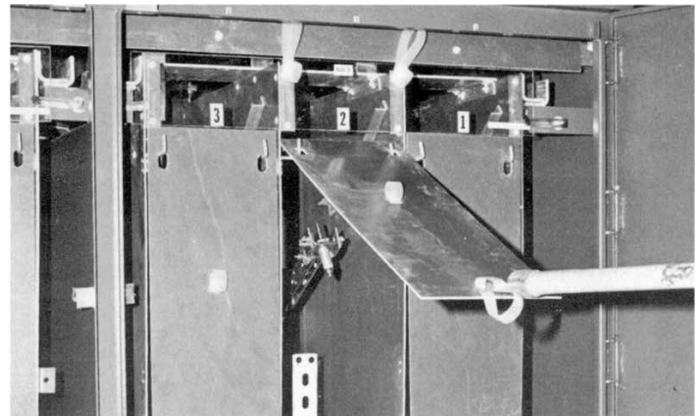


Figure 15. DP Barrier lifted to slide into place.



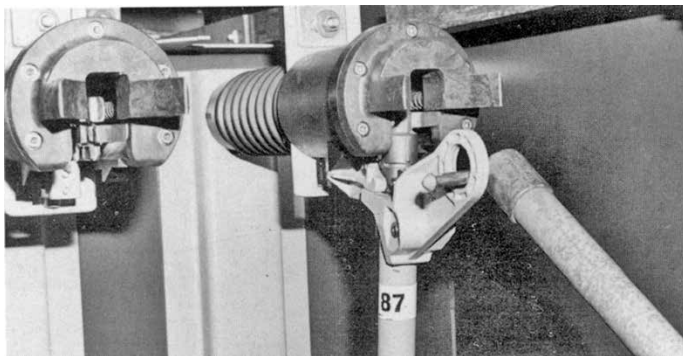
Figure 16. DP Barrier in slide-in position.

## Auto-Jet® Load-break Fuse

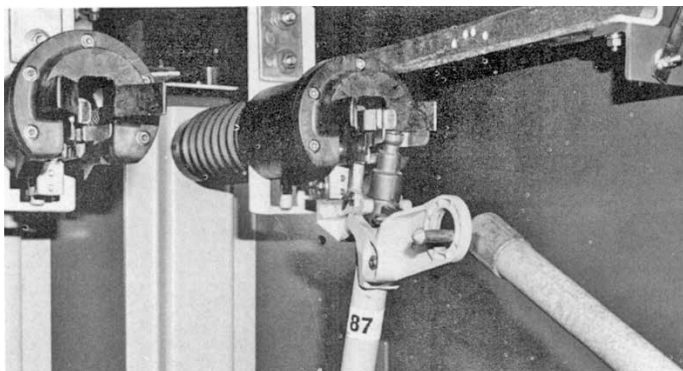
The Auto-jet® fuse mounting has a stored energy load-break device that permits single-pole live switching in single phase or three phase circuits by the use of an ordinary hotstick. The device has a 3-time fault close duty-cycle when the fuse is closed briskly without hesitation. The overall unit rating may be limited by the fuse rating.

The same unique laminated air jet interrupter system used in the 3-pole group operated switches is applied in the Auto-jet® load-break fuse mountings.

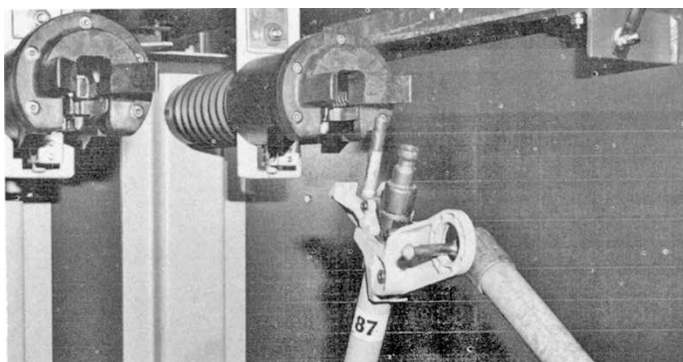
### Illustration of Auto-Jet® Fuse Interrupter



1. Closed: Hookstick Ready To Open



2. Main contacts Have Parted, Puffer Spring Charged, and Interrupter Parted



3. Holder Parted, Auto-jet® Reset For Next Operation

## Load-break Fuse Operation

1. Open appropriate fuse compartment door and secure.
2. Remove optional B4/B5 inner door barrier, if applicable. Remove optional B2 fuse dual purpose barrier, if applicable, permitting access to desired fuse. The dual purpose barrier may be removed using hotstick and grappler tool arrangements. See Figure 16.
3. Install grappler tool as shown.
4. Pull the fuse open with one brisk continuous motion to fully open position (45°). Maintain downward force on fuse until fuse opening motion has ceased to prevent tendency for fuse to bounce toward the closed position. See Figure 17.

**Do not assume that an open fuse position indicates the fuse to be de-energized.**

5. Reinstall grappler onto fuse assembly and while grasping hotstick firmly, lift fuse assembly up and out of mounting. See Figure 18.
6. If optional dual-purpose barriers are supplied, use grappler to install into slide-in position to provide barrier between Auto-jet® fuse interrupter and fuse bottom hinge. See Figure 19.

**Do not attempt to close main door unless open fuse has been removed from unit.**

7. Re-fuse using the procedures included with the replacement fuse unit.
8. Remove optional dual purpose barriers, if supplied, using grappler. See Figure 19.
9. Reinstall grappler onto fuse assembly and place fuse assembly into fuse mounting in the 45° open (disconnect) position. See Figure 18.
10. Insert grappler prong into fuse pull ring and push up briskly on the fuse assembly, completing the closing stroke in one motion. See Figure 17.
11. Before removing grappler from fuse pull ring, push firmly to assure that the fuse is completely closed and latched.
12. Use grappler to return optional dual purpose barrier, if furnished, to the normal, hanging position. See Figure 16.
13. Close the main door and padlock before leaving gear.



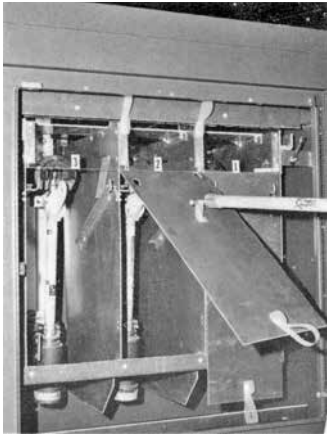


Figure 17.

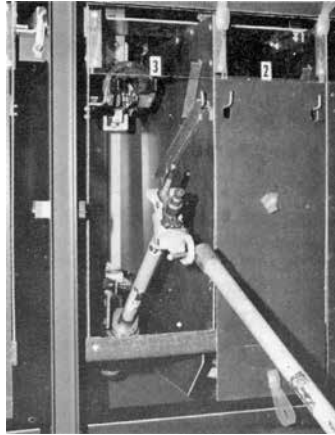


Figure 18.

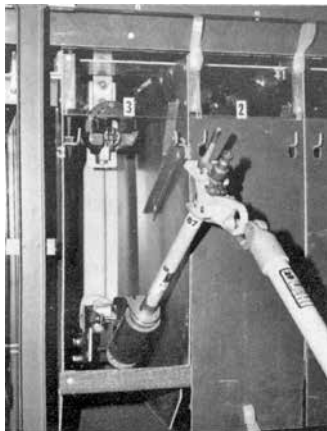


Figure 19.

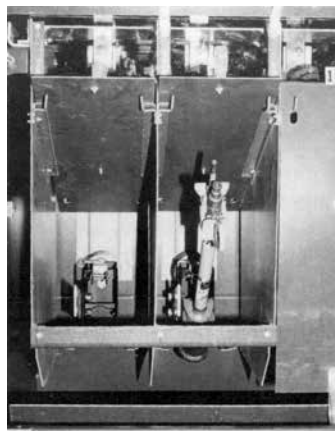


Figure 20.

### Non-Load-break Fuse Operation

When non-load-break style fuse mountings are furnished, such as the S&C type SM-5 or the clip style mountings to accommodate Cooper Type NX and Type Q, the fuse replacement procedure would be similar to those for the Auto-jet® fuse. However, the following precautions should be observed when work is performed on non-load-break fuses:

1. Any upstream device which could energize the fuse must be opened and rendered inoperative to remove possibility of inadvertently energizing the fuse.
2. Upon opening the fuse compartment door, the equipment should be tested for the presence of voltage using a suitable voltage sensing device and hotstick arrangement.
3. If no voltage is present, the appropriate fuse terminal should be grounded using proper device and technique.
4. Fuse(s) may then be removed and replaced using appropriate fuse replacement procedures.

### Optional Features

Standard options can be supplied that best serve the customer's needs and operating practices. These are listed below:

#### Adapter Base

(Applicable to all models except 35kV)

3" non-compartmented to match S&C PMH dimension at pad.

#### Base Spacer

Non-compartmented or compartmented.

#### Barriers — Inner Door

Lift-off insulating barrier secured with penta-head bolt.

#### Fuse Storage Hooks

#### Finish Color and Special Cabinet Material

#### Ground Studs

#### Key Interlocks

#### Penta-Head Security Bolts

#### Distribution Surge Arresters

#### Cable Terminators

#### Cable Supports

#### Terminal Adapters

#### Fault Indicators

#### Copper Bus

#### Strip Heaters

#### Hinged Roof

Figure 21 shows a PSI-9 unit equipped with fault indicator with viewing windows on associated doors, 24" base spacer to provide for increased cable terminating height, and shipping pallet.

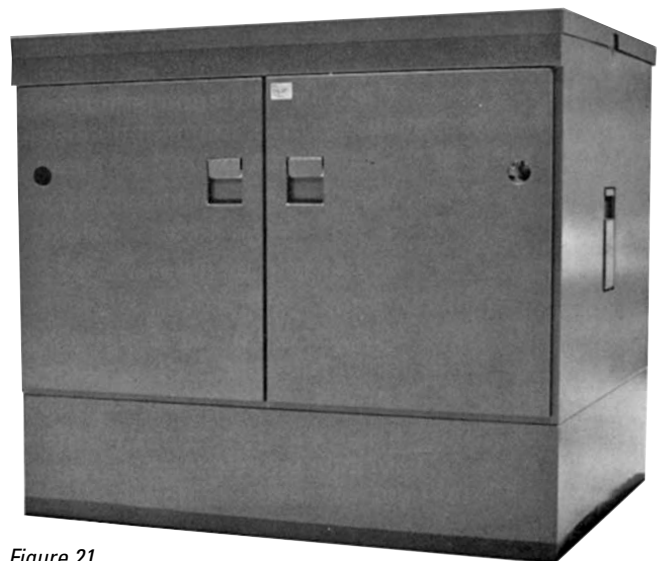


Figure 21.



## Fuse Ratings

Fuse Manufacturer and Type ①††	Amperes RMS ④				3-Phase MVA SYM ④
	Max. Cont.	Load-break*	Interrupting SYM ⑤	Momentary & 3-Time Fault-Close† ASYM	
<b>At 14.4kV Nominal Voltage • 95 kV BIL</b>					
S&C SM-4	200	200	12,500	20,000	310
S&C SMU-20	200	200	14,000	22,400	350
S&C SM-5	400	NLB	25,000	N/A	620
Eaton DBU	200	200	14,000	22,400	350
Cooper NX	①	⑤	50,000	40,000	620
Cooper Q	①	⑤	12,500	40,000	620
<b>At 25kV Nominal Voltage • 125 kV BIL</b>					
S&C SM-4	200	200	12,500	20,000	540
S&C SMU-20	200	200	12,500	20,000	540
S&C SM-5	300	NLB	20,000	N/A	865
Eaton DBU	200	200	12,500	20,000	540
Cooper NX	②	⑤	50,000	40,000	1,080
Cooper Q	②	⑤	25,000	40,000	1,080

\*In conjunction with Auto-jet® Fuse Mountings.

† Three time fault-close rating: The Auto-jet® fuse mounting can withstand a fuseholder or fuse with end fitting being closed into a fault of the magnitude specified three times when closed briskly without hesitation and remain operable and able to carry and interrupt the rated continuous current. (The fuse must be replaced after each interruption. Refer to S&C instruction manual for SML-4Z holder and SML-20 end fitting maintenance required after each fault close or fault interruption).

### 14.4kV Nominal

**SM-4** fused units require three S&C Cat. No. 92352 SML-4Z fuse-holders and three S&C SM-4 fuse refills per fuse compartment. ††

**SMU-20** fused units require three S&C Cat. No. 3097 SML-20 fuse end fittings and three S&C SMU-20 fuse units per fuse compartment. ††

**SM-5** fused units require three S&C Cat. No. 86642R2 SM-5S fuse-holders and three S&C SM-5 fuse refills per fuse compartment. ††

**DBU** fused units require three FP Cat. No. EFA-42 DBU end fittings and three Eaton DBU fuse units per fuse compartment. ††

① **NX** fused units: Auto-jet® fuse mountings will accommodate one 100 ampere Cooper Type NX current limiting fuse rated 8.3kV, one 100 ampere fuse rated 13.5kV, or one 80 ampere fuse rated 15kV. Three sets of Auto-jet® end fittings and three appropriately rated fuses are required in each fuse compartment. ††

① **Q** fused units: Auto-jet® fuse mountings will accommodate one 100 ampere Cooper Type Q current limiting fuse rated 8.3kV or 15kV. Three sets of Auto-jet® end fittings and three appropriately rated fuses are required in each fuse compartment.

### 25kV Nominal

**SM-4** fused units require three S&C Cat. No. 92353 SML-4Z fuse-holders and three S&C SM-4 fuse refills per fuse compartment. ††

**SMU-20** fused units require three S&C Cat. No. 3097 SML-20 fuse end fittings and three S&C SMU-20 fuse units per fuse compartment. ††

**SM-5** fused units require three S&C Cat. No. 86643R2 SM-5S fuse-holders and three S&C SM-5 fuse refills per fuse compartment. ††

**DBU** fused units require three FP Cat. No. EFA-42 DBU end fittings and three Eaton DBU fuse units per fuse compartment. ††

② **NX** fused units: Auto-jet® fuse mountings will accommodate one 100 ampere Cooper Type NX current limiting fuse rated 13.5kV, one 80 ampere fuse rated 15kV, or one 40 ampere fuse rated 23kV, or one 50 ampere fuse rated 27kV. Three sets of Auto-jet® end fittings and three appropriately rated fuses are required in each fuse compartment. ††

② **Q** fused units: Auto-jet® fuse mountings will accommodate one 100 ampere Cooper Type Q current limiting fuse rated 15.5 kV, one 100 ampere fuse rated 23kV, or one 80 ampere fuse rated 27kV. Three sets of Auto-jet® end fittings and three appropriately rated fuses are required in each fuse compartment. ††

⑤ Ratings expressed in RMS amperes asymmetrical are 1.6 times the symmetrical values listed.

④ Unit overall ratings are limited to the lowest component rating.

⑤ Load-break rating same as maximum continuous current rating.

†† For fuse application and ordering information refer to the current issue of:

- S&C Bulletin 252-31
- Cooper (McGraw-Edison) Cat. Sect. 240-60
- Eaton Cat. Sect. 4.4
- Eaton Cat. Sect. AD36-643
- Eaton Cat. Sect. PL36-609

## Auto-Latch Features

The automatic door latching feature furnished on the main doors provides ease in opening and closing of the doors. Features of the Auto-latch system are:

- Automatic 3-point latching upon door closure. See Figure 22.
- After unlatching on opening, the door is automatically set for latching upon door closure.
- A recessed, flush-mounted, stainless steel pocket contains the padlock and security bolt.
- To discourage tampering, the padlock must be removed in order to raise protective cover and gain access to security bolt.
- A closed, latched, Auto-latch door can successfully withstand a "pull" greater than 600 pounds at any point on the door.

## Auto-Latch Operation

### Opening:

1. Remove padlock and raise protective cover exposing security bolt. (Figure 24)
2. Using a standard 9/16 inch socket for hexhead security bolt or standard pentahead socket for pentahead security bolt, rotate the captive actuator bolt head 60° in either direction to release latching mechanism. (Figure 25)
3. Open door and secure with door keeper. (Figure 23)

### Closing:

1. Lift up door keeper and close door by pushing briskly. Mechanism will automatically latch.
2. Install protective cover and install padlock.

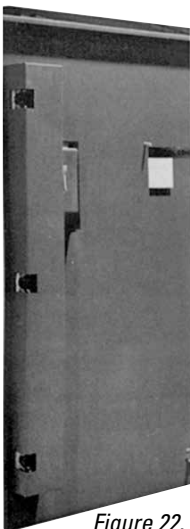


Figure 22.

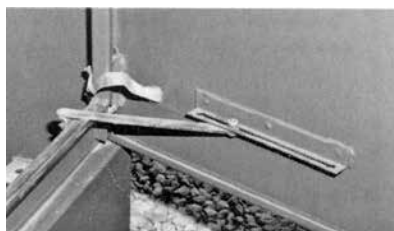


Figure 23.

*Caution: It is not necessary to apply torque on the bolt once the door is unlatched. The bolt is not removable. A force of 25 to 30 ft. - pounds will cause a failure.*

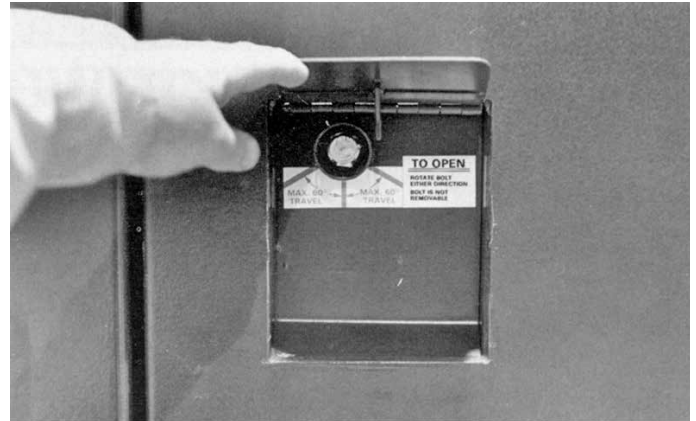


Figure 24.

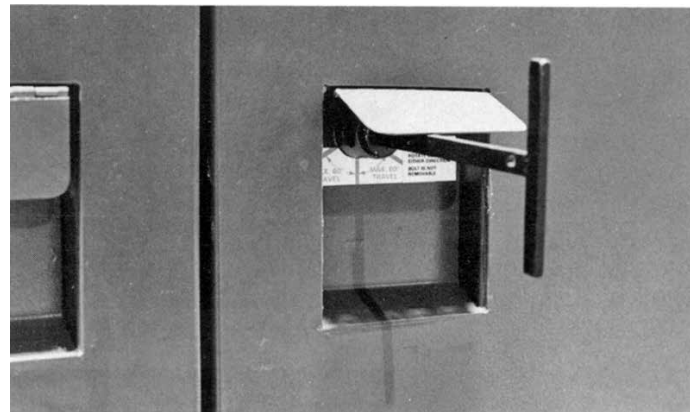


Figure 25.

## Maintenance

Federal Pacific switchgear does not require routine mechanical or electrical maintenance. However, the following are some recommendations for enhancing continued service of the equipment.

1. Yearly mechanical exercising of the switch is recommended.

**Warning: The switchgear must be completely de-energized from all sources before any attempt is made to enter switchgear.**

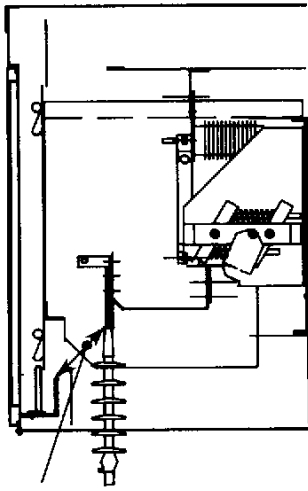
2. Check for cleanliness generally, but particularly for accumulation of any foreign material on insulators.

**Caution: Do not put grease on switch probe or puffer.**

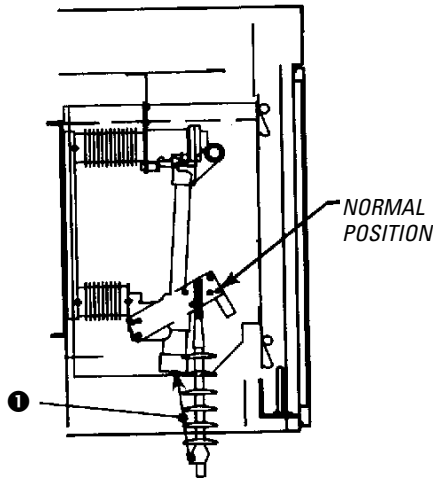
3. If the switch is closed on a short circuit within the making capacity rating and the short circuit is cleared by circuit breakers or fuses, the switch will not sustain damage which would require major repairs. However, the switch should be inspected before returning to service to determine switch condition.

## RECOMMENDED CLEARANCES

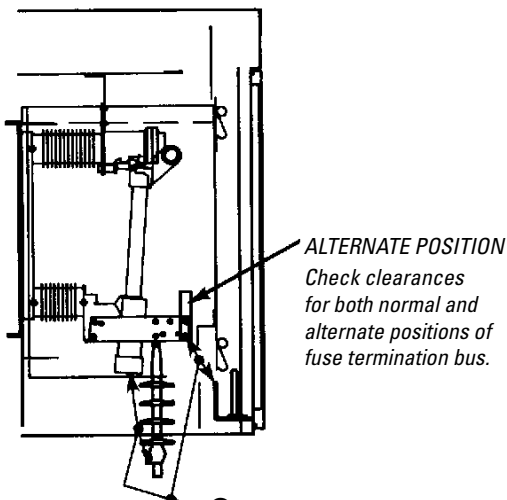
SEE TABLE BELOW



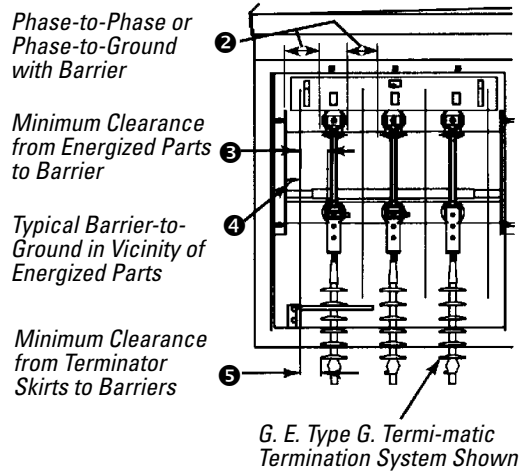
**1** Minimum Clearance from Energized Parts to Electrical Ground without Barrier.



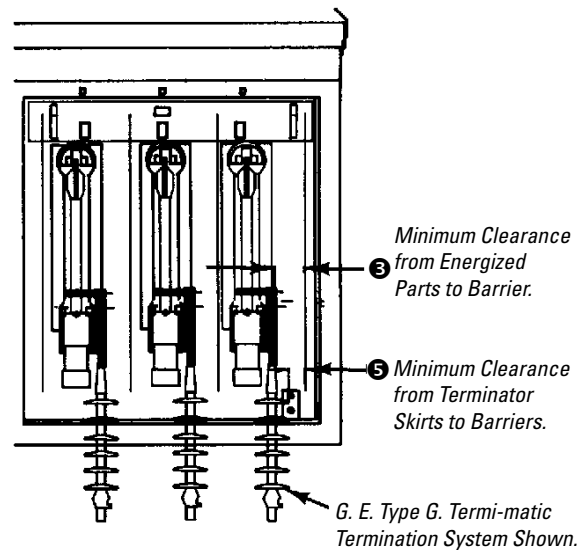
Minimum Clearance from Energized Parts to Electrical Ground without Barrier.



**1** Minimum Clearance from Energized Parts to Electrical Ground without Barrier.



G. E. Type G Termination System Shown



G. E. Type G Termination System Shown.

15kV, 25kV and 35kV Pad-mounted Unit Rating kV, BIL	Recommended Clearances (Minimum) in Inches				
	Phase-to-Phase or Phase-to-Ground without Barrier	Phase-to-Phase or Phase-to-Ground with Barrier	Energized Bus (or device) to Barrier	Barrier to Ground in Vicinity of Energized Bus (or device)	Terminator Skirts to Barrier
	Note 1	Note 2	Note 3	Note 4	Note 5
95	5-1/2	3	1	3/4	1/2
125	7-1/2	5	2-1/4	2	1-1/4
150	10	6	3	2	2

Every effort is made to ensure that customers receive an up-to-date instruction manual on the use of Federal Pacific products; however, from time to time, modifications to our products may without notice make the information contained herein subject to alteration.

