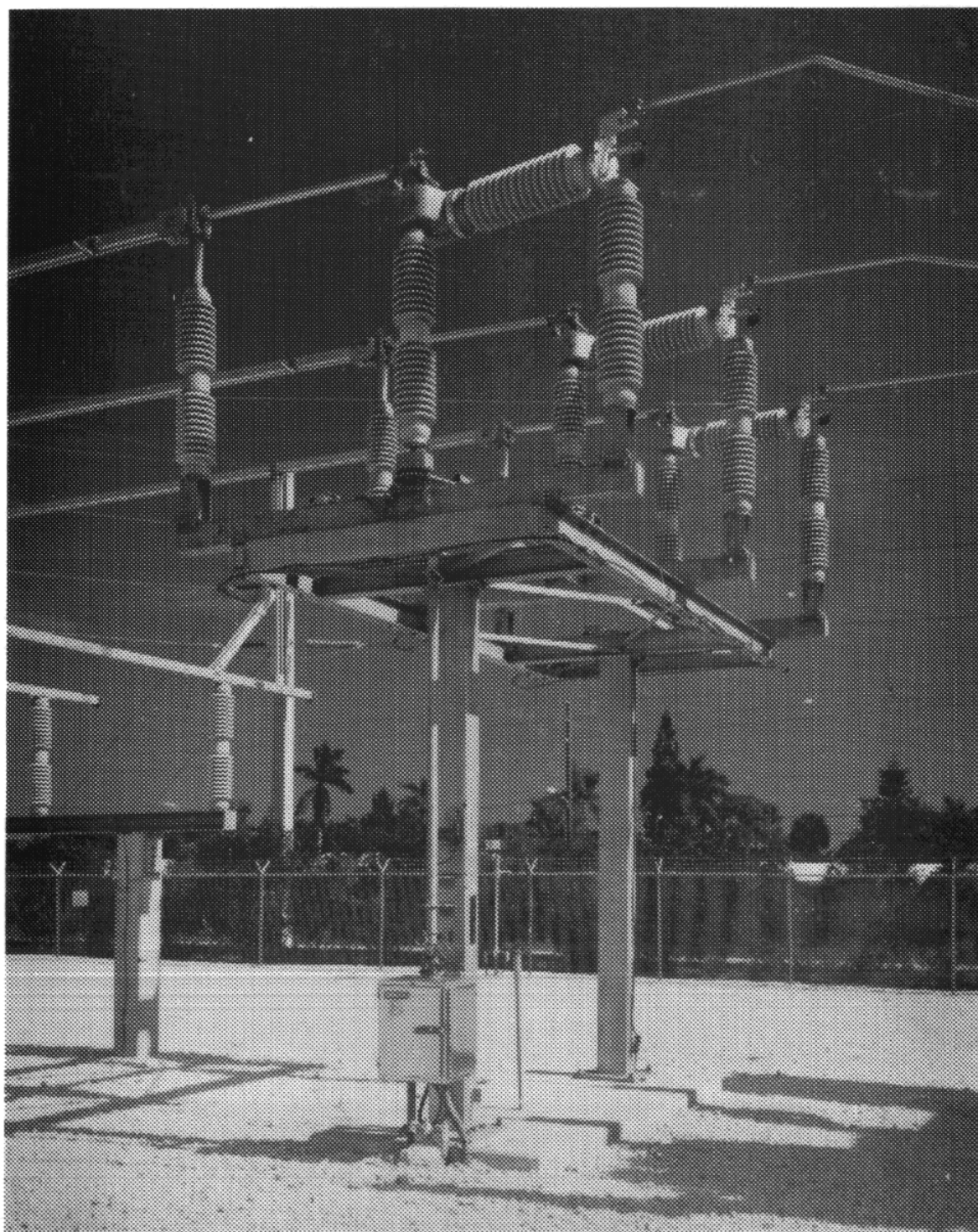


SIEMENS

Outdoor Circuit Switcher Type CPS and CPS-VB 38 - 242kV

Instructions
Installation
Adjustment
Maintenance



**For Emergency Service
Call: 1-800-241-4453**

Siemens Energy & Automation, Inc.

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Important

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Siemens reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material, or both, the latter shall take precedence.

Summary

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office.

The contents of this instruction manual should not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

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Introduction

The Siemens Circuit Switcher is an outdoor, high voltage interrupting device. The CPS-VB type is equipped with an in-series integral disconnect switch. Operation of the Siemens Circuit Switcher unit is controlled by a motor operator or by a manual wormgear operator.

The instructions included in this book are necessary for safe installation, maintenance and operation and to aid you in obtaining longer and more economical service from your Siemens circuit switchers. For proper installation and operation -- resulting in better service and lower maintenance costs -- this information should be distributed to your operators and engineers.


By carefully following these instructions, difficulties are avoided. However, they are not intended to cover all details or variations that may be encountered during the installation, operation and maintenance of this equipment.


Should additional information be desired, including replacement instruction books, contact your Siemens representative.

The successful field performance of these Circuit Switchers depends as much on proper Installation and Maintenance as it does on good design and careful manufacture. Refer to these sections before performing any installation or maintenance.

Distinctive signal words (DANGER, WARNING, CAUTION) are used in this instruction book to indicate degrees of hazard that may be encountered by the user. For the purpose of this manual and product labels these signal words are defined below.

DANGER	Indicates an imminently hazardous situation which, if not avoided, <u>will</u> result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, <u>could</u> result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, <u>may</u> result in minor or moderate injury.



**DANGER**

Hazardous voltage and mechanisms. Death or serious injury due to electrical shock, burns and entanglement in moving parts, or property damage will result if safety instructions are not followed.

To prevent:

Do not service or touch until you have de-energized high voltage, grounded all terminals and turned off control voltage.

Only qualified personnel should work on or around this equipment after becoming thoroughly familiar with all warnings, safety notices, instructions and maintenance procedures contained herein. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation and maintenance.

Qualified Person

For the purpose of this manual, a qualified person is one who is familiar with the installation, construction and operation of the equipment, and the hazards involved. In addition, he or she has the following qualifications:

- a) Is trained and authorized to energize, de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.
- b) Is trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc. in accordance with established safety practices.
- c) Is trained in rendering first aid.

Description

Page 2

Circuit Switcher

The Siemens Circuit Switcher device can switch and protect transformers, lines, cables, shunt capacitor-banks, and shunt reactors. For specific applications and rating, contact the nearest Siemens sales office.

Figure 1 shows all the different components on a typical CPS-VB pole unit. The components, their operation, and maintenance are covered in the following sections of this instruction book.

Not shown but similar to the CPS-VB is a CPS Type Circuit Switcher. These units do not have an integral disconnect blade. Line termination is on the driver end. Two instead of three insulator columns are used to support and operate the interrupter. Sections of this manual covering operations and adjustment of the disconnect blade and hinge are to be omitted when referring to the CPS type.

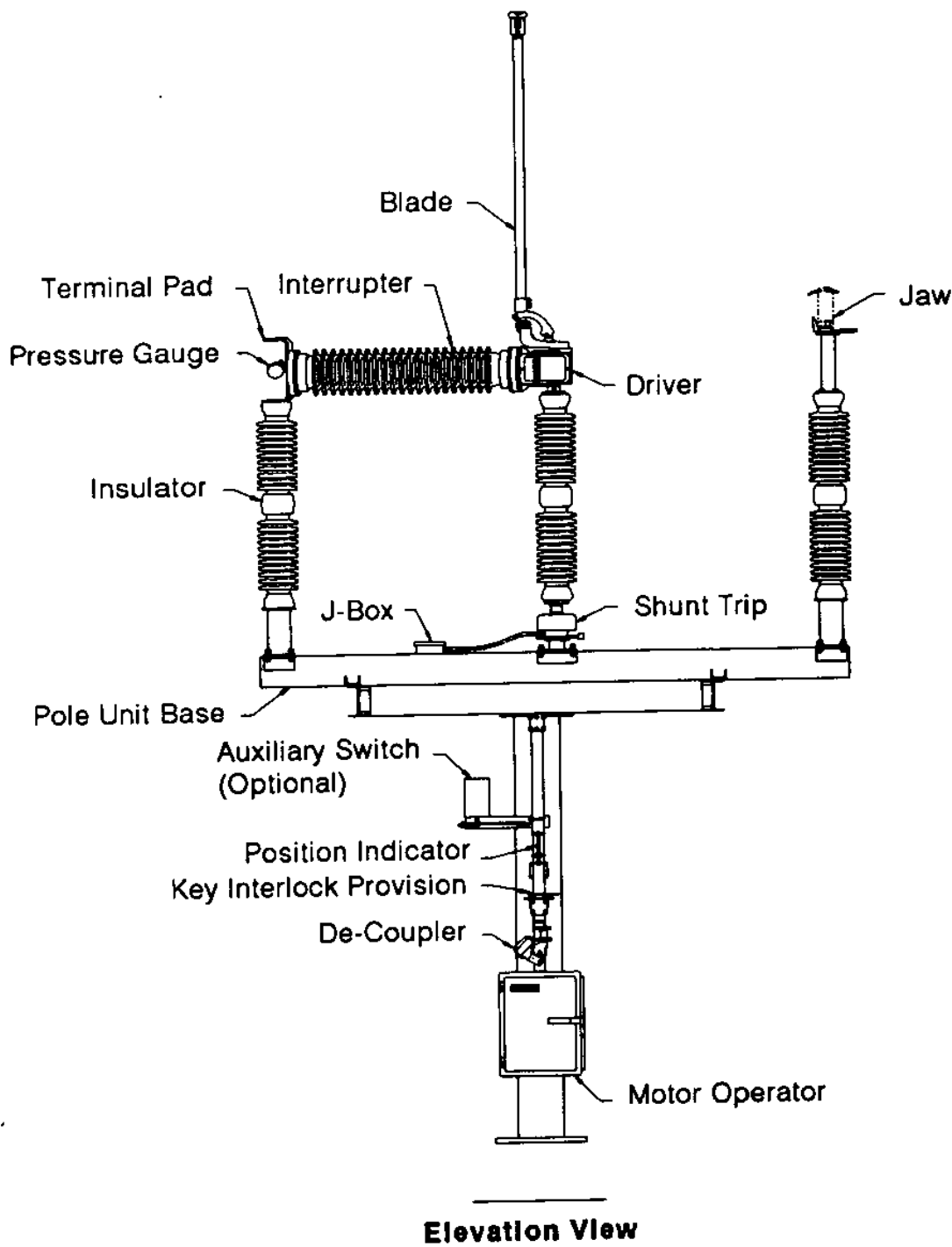


Figure 1 -- CPS-VB Pole Unit

72-265-035-433

Receiving, Handling, Storing

Page 3

Receiving

Siemens Circuit Switchers are packaged for shipment by the following two methods. Structure members, when furnished by Siemens, are in a separate shipping group.

A. Individual pole units are mounted on shipping channels as shown in Figure 2. This shipping assembly consists of:

1. Interphase, group control, and vertical control pipe banded together.
2. Outboard bearing bracket and interphase brace channels.
3. Motor operator within its crate.
4. Control parts box containing SF₆ fill kit, conduit assembly, outboard bearing assembly, and hardware kits.

B. Assembled pole units with control pipe and outboard bearing assembly are mounted on the top platform of the structure. This shipping assembly consists of:

1. Vertical control pipe.
2. Motor operator within its crate.
3. Control parts box containing SF₆ fill kit conduit assembly and hardware kits.

Packing List and Drawings

Packing list and drawings are provided in weather resistant envelopes enclosed in the motor operator cabinet and control parts box. The purchaser should use the included packing lists and drawings to check for missing parts. List all damage and missing parts on the bill of lading. File claim with delivering carrier and notify the local representative of Siemens. Failure to do so may affect damage or missing parts claim at a later date.

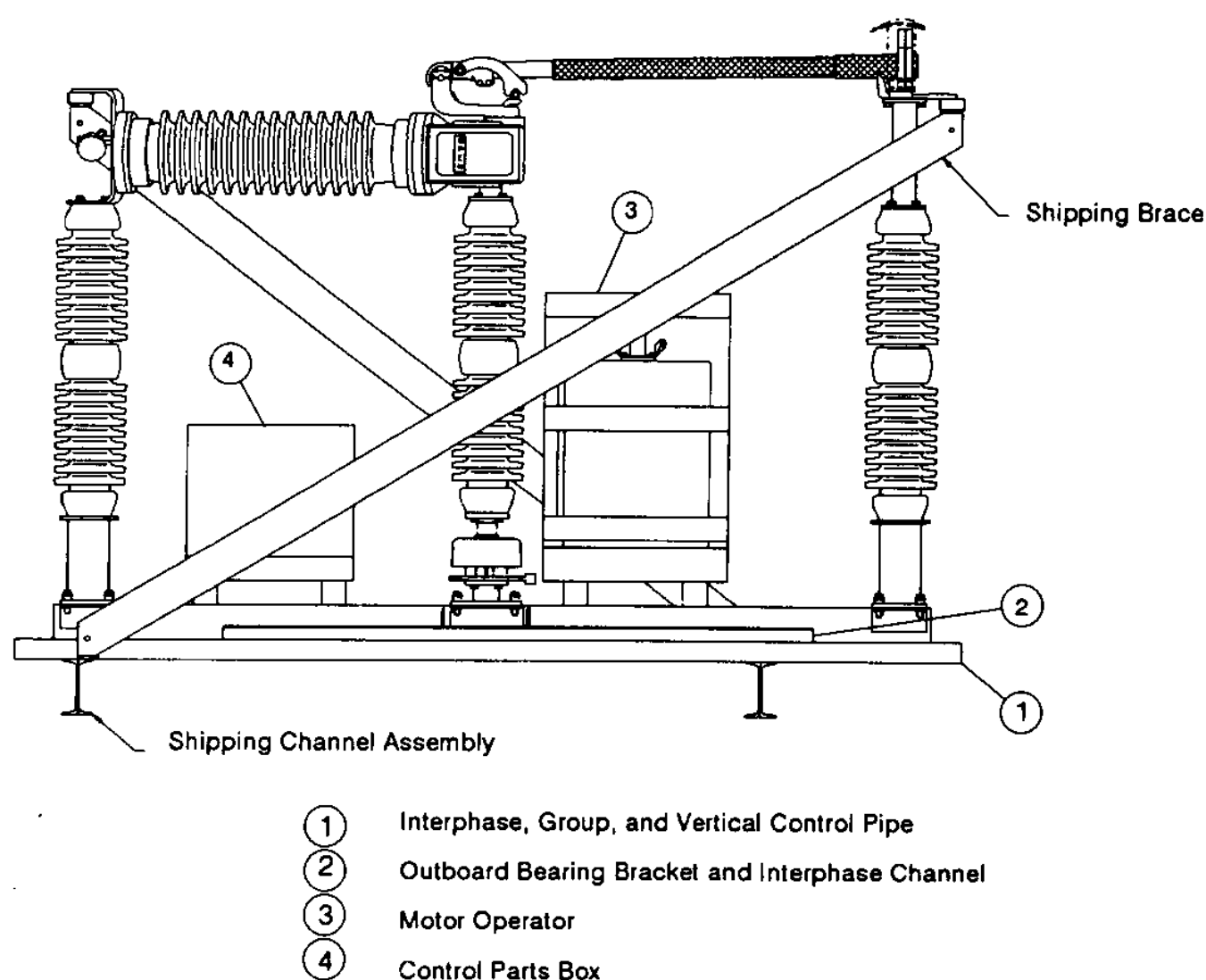


Figure 2 -- Three Pole Shipping Assembly

72-265-035-424

Receiving, Handling, Storing

Page 4

Handling

In order to minimize the hazard of handling pressurized porcelains, the pole units are shipped partially filled with SF₆ gas, approximately 5 psig. After installation is completed and before any operations are attempted, it is necessary to fill the interrupter to normal operating pressure as described under Maintenance.



WARNING

Pressurized interrupter housings.
Improper handling could result in death, serious injury, or damage to the pole units.

To prevent:

Do not strike, shock, or strain the interrupter housings or in any way cause the interrupter housings to rupture.

Do not move the pole units if the SF₆ pressure is above 10 psig.



WARNING

Heavy equipment with high center of gravity.
Improper handling could result in death, serious injury, or equipment damage.

To prevent:

When lifting three pole shipping assemblies, attach four cables or chains to the shipping channel eyebolts.

When lifting individual pole units, attach four cables or chains to the lugs provided on the pole unit base.

When lifting pole unit assemblies mounted on platform, attach four cables or chains to the lugs provided on the platform.

In all cases, cables or chains must not contact interrupter housings.

Do not use nylon slings because of their uncontrolled stretch.

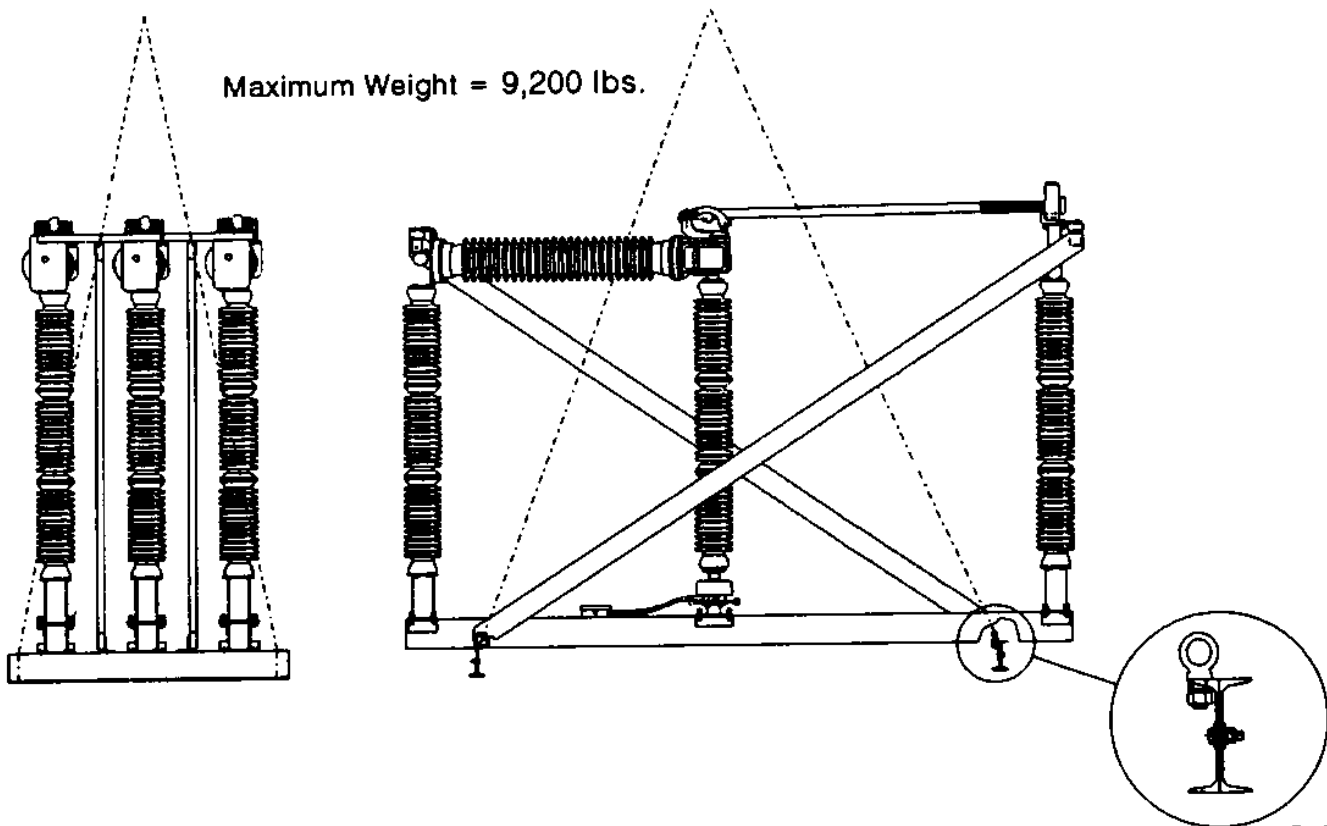


Figure 3 -- Three Pole Lifting Method

72-265-035-407

Receiving, Handling, Storing

When ready for installation as discussed later in this manual, remove the shipping braces, motor operator, parts box, pipe, and brace assemblies. Sling each pole unit as shown in Figure 4 and then unbolt from the shipping channels for lifting onto the structure. Follow handling warnings on page 4. Maximum weight of a pole unit is 2,700 pounds. Pole units remaining connected to the shipping channels should be supported until all are removed.

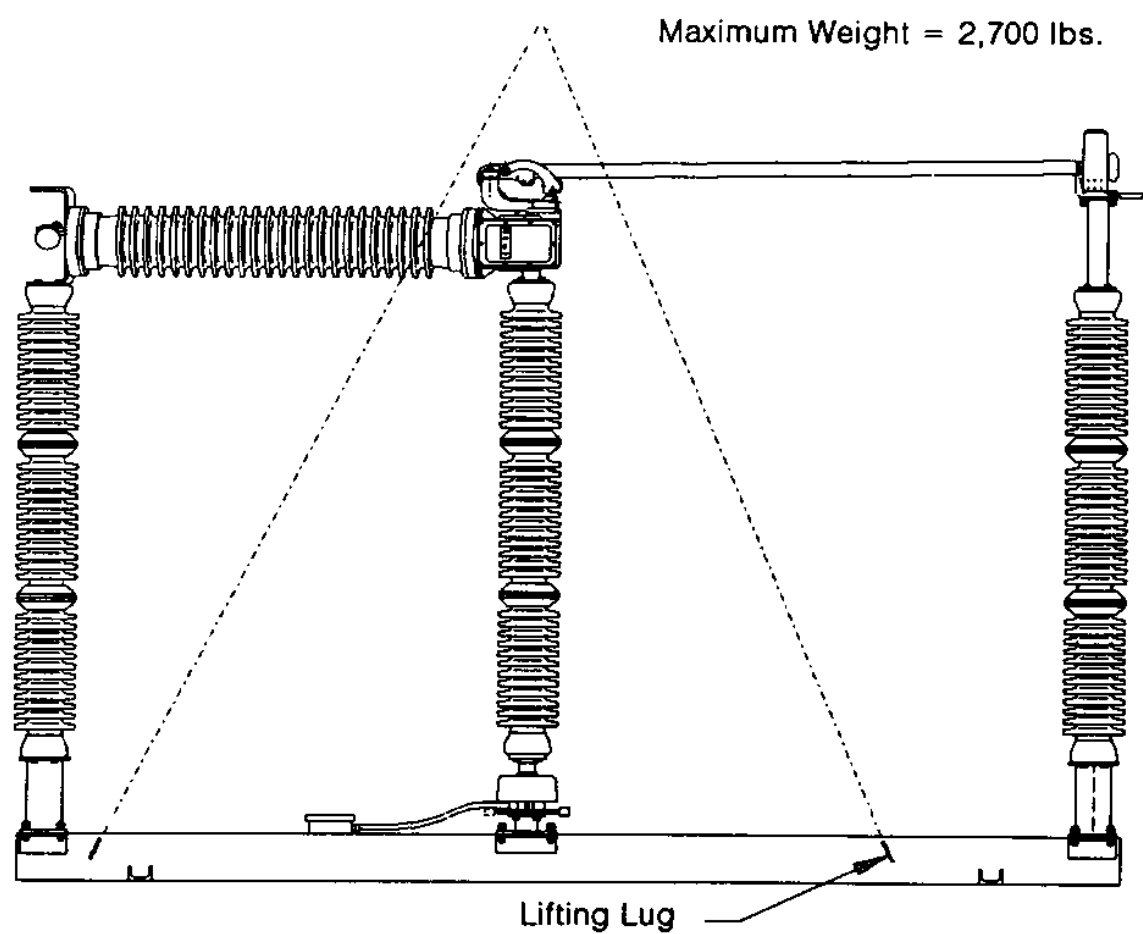


Figure 4 -- Single Pole Lifting Method

Receiving, Handling, Storing

Page 6

Circuit switchers assembled and shipped on their platform can be lifted by attaching lifting cables or chains to lifting lugs on platform as shown in Figure 5. Follow handling warnings on page 4. The rigging device must be capable of lifting 9,000 pounds.

Maximum Weight = 9,000 lbs.

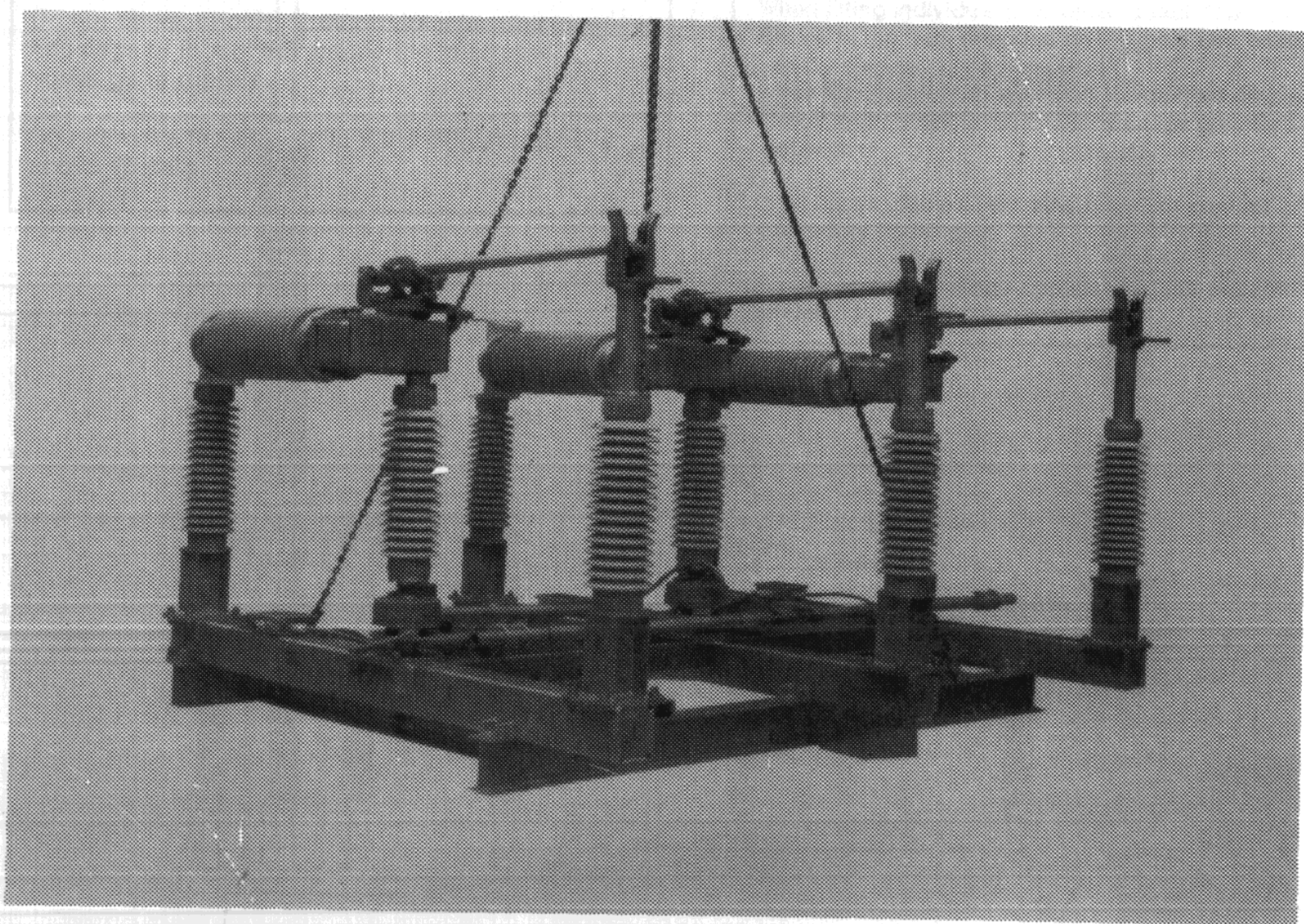


Figure 5 -- Platform Mounted Lifting Method

Receiving, Handling, Storing

Lifting Motor Operator

The motor operator unit has two factory installed adjustable stops on either side of the output shaft. Use appropriate cables or chains to lift into mounting position (see Figure 6).

Maximum Weight = 250 lbs.

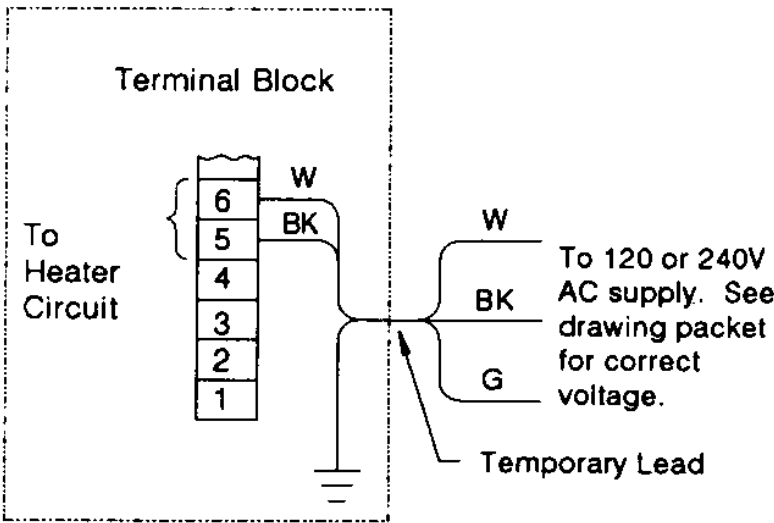


Figure 7 -- Motor Operator Heater Connection

72-265-035-409

Figure 6 -- Lifting Motor Operator

Storing

All parts should be left in the crates until the time of assembly. For outdoor storage, it is advisable to protect all moisture absorbing cartons (wood, cardboard, etc.) from water.

The motor operator space heater (Figure 7) and shunt trip heater circuits (Figure 8) should be energized if stored outdoors and as soon as possible after installation to prevent condensation. External temporary wiring has been provided and tagged for convenience in connecting these heater circuits. Discard the temporary leads upon installation of the Circuit Switcher unit. A special hole plug is provided with the motor operator to be installed on the housing when the temporary heater lead is removed.

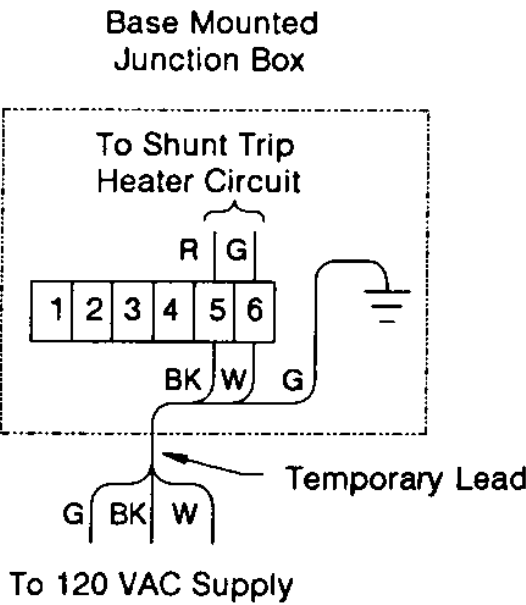


Figure 8 -- Shunt Trip Heater Connection

72-265-035-409

Operation

Page 8

Interrupter

The Siemens Circuit Switcher interrupter is a single-gap SF₆ "puffer" type, which provides full rated dielectric strength in the open position. During an opening operation, a cylinder attached to the moving contact compresses the SF₆ gas, and the resulting gas flow is directed to extinguish the arc.

Sulfur Hexafluoride Characteristics

The medium for interruption and dielectric strength is SF₆ gas. In its pure state, it is inert, non-flammable, non-toxic and odorless. However, after the gas has been exposed to arcing, there will be some breakdown producing minor amounts of gaseous by-product and gas-borne powders.

Molecular sieve filters are used as a desiccant to remove most of these decomposition products. Such decomposition is very slight and has a negligible effect on dielectric strength and arc interrupting ability.

The precautions to be followed in handling the gas are covered in detail under Maintenance, page 42.



WARNING

Molten material and explosion hazard. Falling molten material and/or flying shrapnel could result in death, serious injury, or equipment and property damage.

To prevent:

Circuit Switcher and Disconnect Switch must be operated only in the following prescribed sequence.

Close Circuit Sequence

1. Close Disconnect Switch
2. Close Circuit Switcher

Open Circuit Sequence

1. Open Circuit Switcher
2. Open Disconnect Switch

Manifold and Relief Valve

The manifold is located on the end of the fixed contact of the interrupter. It is connected to the end plate through a straight thread union to allow the users to rotate the manifold and position the pressure gauge at any angle they desire before filling with gas (Figure 9). The manifold is factory installed with special type o-rings to seal at all operating temperatures. Chromate conversion treatment is applied to the manifold to provide corrosion protection. In case of excessive high pressure in the interrupter, an overpressure relief device located on the manifold is set to operate at 142 to 150 psig.

Pressure Gauge

The Siemens Circuit Switcher interrupter unit is equipped with a color coded pressure gauge for ease of reading. If the gauge is within the orange color, the unit should not be operated under fault conditions and should be removed from service. A table showing a picture of the gauge and an operating pressure range versus ambient temperature table is located on the inside door of the operator. Refer to Figure 47 which illustrates the table.

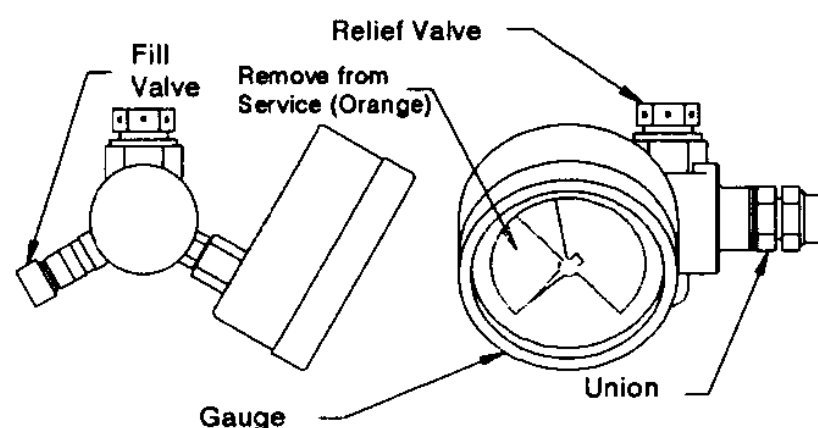



Figure 9 -- Manifold and Gauge Assembly

72-265-035-408

Operation

Driver



WARNING

Hazardous spring-loaded mechanism. Fractured spring or retainer could result in death or serious injury.

To prevent:

Do not stand nearby when operating with driver covers removed.

The driver mechanism at the top of the rotating insulator column contains the main closing springs, shunt trip charging bolt, trip latch, and lever system that controls interrupter opening and closing. The main operating shaft of the driver also operates the hinge mechanism for the disconnect switch.

Driver rotational positions are indicated by a green and a red band shown in Figure 10. These do not indicate interrupter position but are for adjustment purposes described later. A large window on the side of the driver contains a semaphore that indicates interrupter contact position.

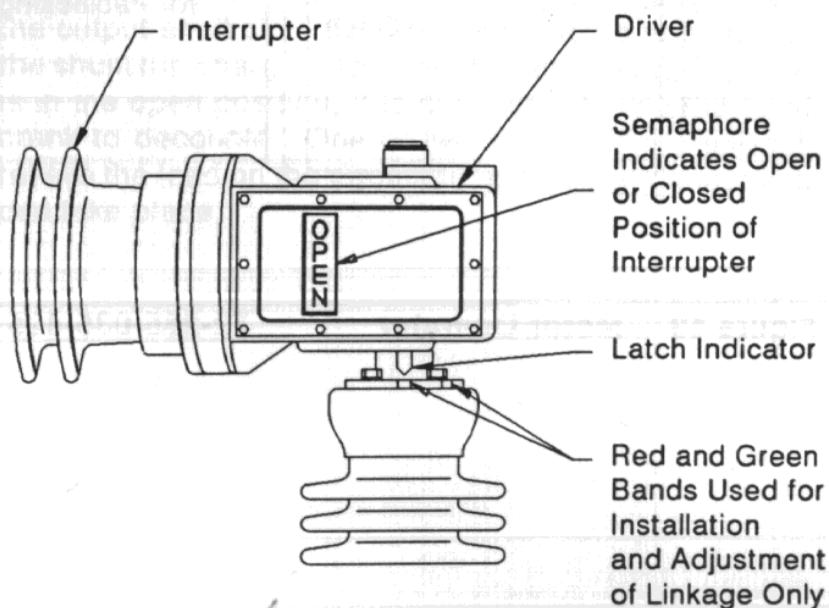


Figure 10 -- Driver Position Indicator

Shunt Trip

The shunt trip mechanism is a stored energy device with a trip coil that imparts high speed tripping to the interrupter. Energizing the trip coil releases a latch causing a spring to discharge, producing rapid rotation of the insulator. See Figure 11. If the shunt trip mechanism is not activated to trip the interrupter open and the motor operator is signaled to open, the interrupter trips open by a mechanical back-up operation.

Each shunt trip unit contains a trip coil cut-off switch, a space heater, and a latch check switch which senses charged status of the trip unit. A charged shunt trip unit is shown in Figure 12-a, representing the full open position of the circuit switcher. Contact with a charging bolt in the driver blocks further rotation of the shunt trip housing as the base plate continues to rotate. The last 12 degrees of opening rotation charges the shunt trip spring. This causes a gap to develop between the trip roller and latch which in turn permits the latching mechanism to reset. An inspection port is provided to view gap distance which is discussed later in the Final Adjustment Section.

Figure 12-b shows the discharged position of the shunt trip. Red semaphores on the housing and base plate indicate charged and discharged shunt trip position.

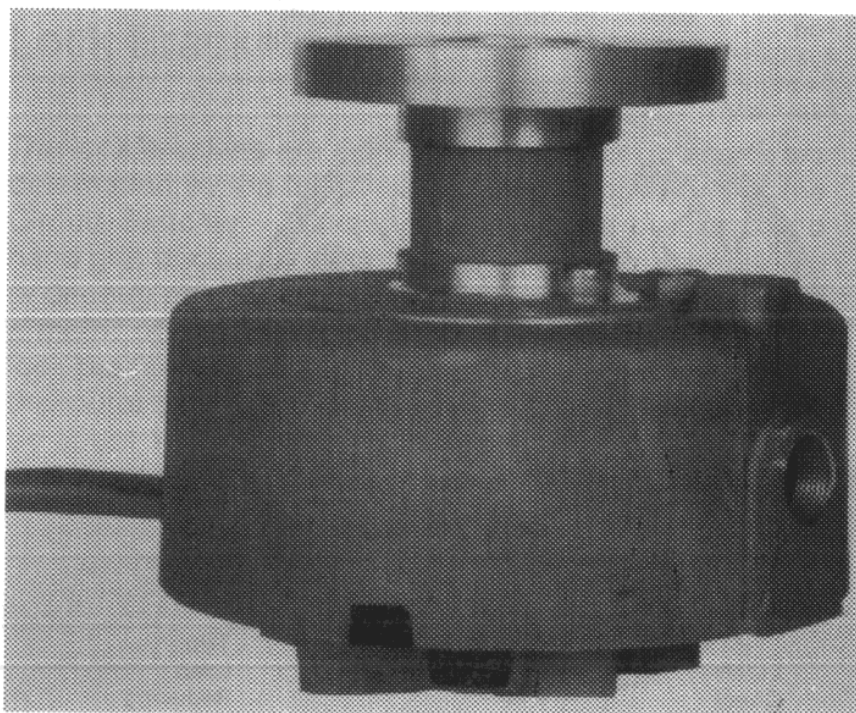
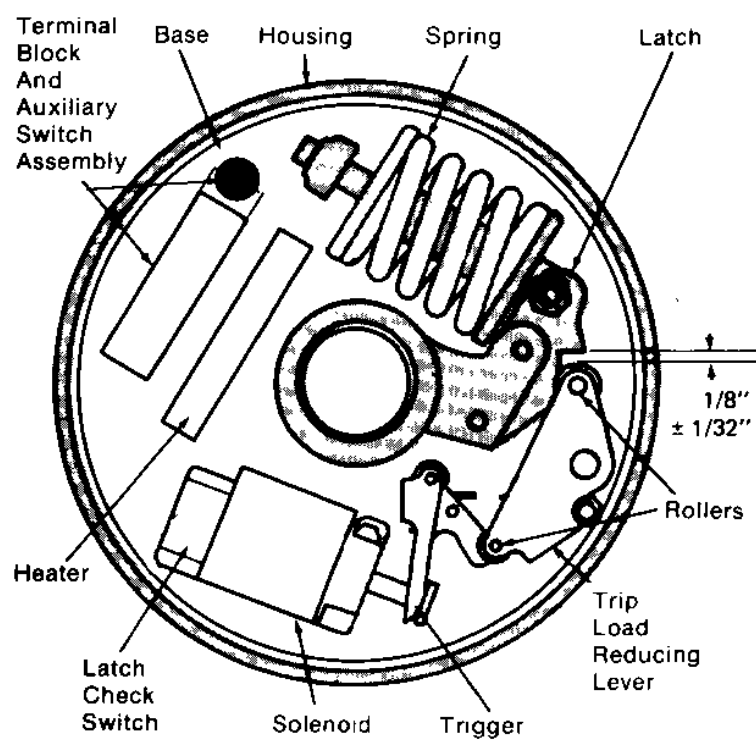


Figure 11 -- Shunt Trip Unit (Discharged Position)

Operation

12-a -- Charged



12-b -- Discharged

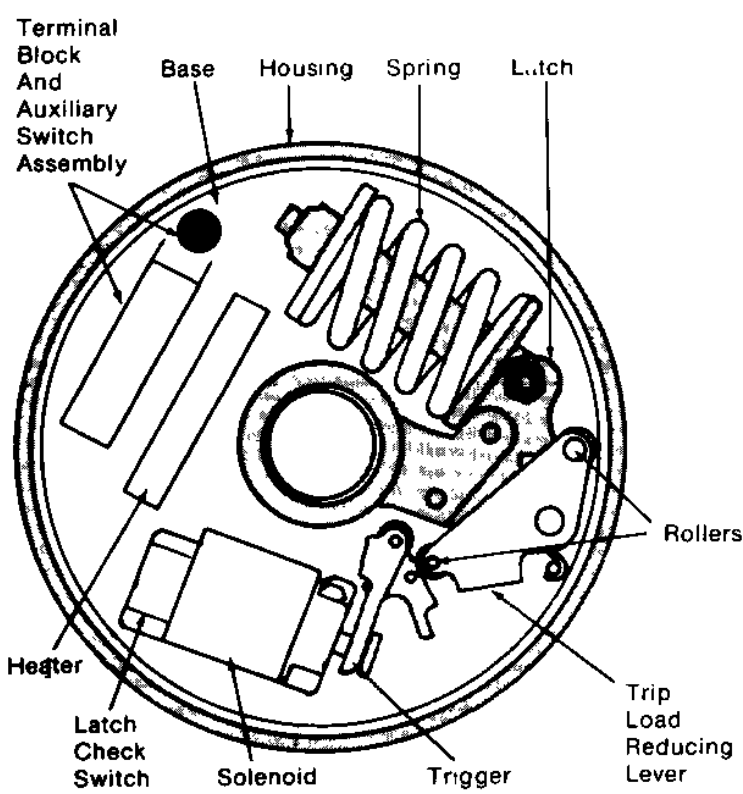


Figure 12 -- Shunt Trip Illustration

Motor Operator

The motor operator is shown in Figure 13. The operator has high torque for use with a Circuit Switcher and can be electrically operated from a remote station. Standard features include an all aluminum enclosure with corrosion resistant fittings, swing out removable doors, local electrical and manual operation, position indicating lights, thermostatically controlled space heater, operations counter, provisions for security locking, a decoupler, and internal auxiliary switch.

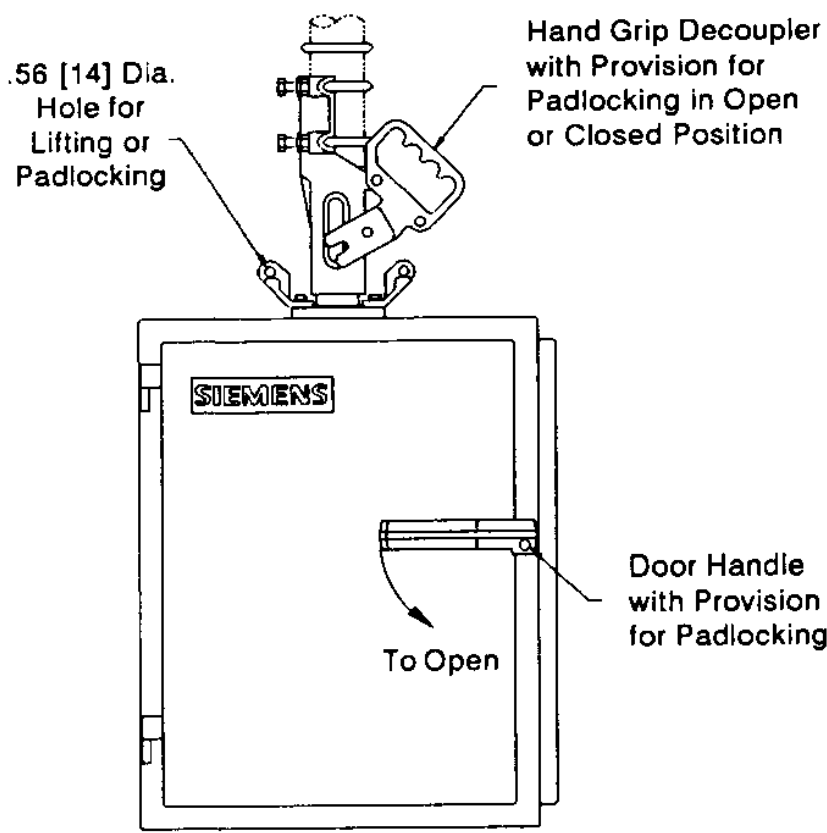


Figure 13 -- Motor Operator

72-265-035-425

Operation



WARNING

Hazardous rotational force and voltage. Incorrect decoupling could result in death or serious injury.

To prevent:

Decouple only in the full open or close positions with outboard bearing against bearing stop. Relieve any remaining load on decoupler pin by partial turn of the hand crank.

If operating the motor operator electrically when decoupled, **disconnect the shunt trip circuit by lifting the lead on terminal TA10 to prevent damage to the trip coils.**

Decoupler

A decoupling device is provided to permit testing of the motor operator without operating the Circuit Switcher.

Refer to Figure 14 which shows the hand grip decoupler, locking pin, and lock brackets. In order to assure that coupling is always in the right position, the slot in the output shaft is off center about 1/16-inch. This prevents coupling 180 degrees out of phase. With the handle in the up position as shown, the locking pin is engaged in the output shaft slot. Because of the force imposed by the shunt trip charging springs when the Circuit Switcher is in the open position, it is necessary to use the hand crank to decouple. One or two turns of the crank will relieve the load on the decoupler pin so that decoupling can take place.

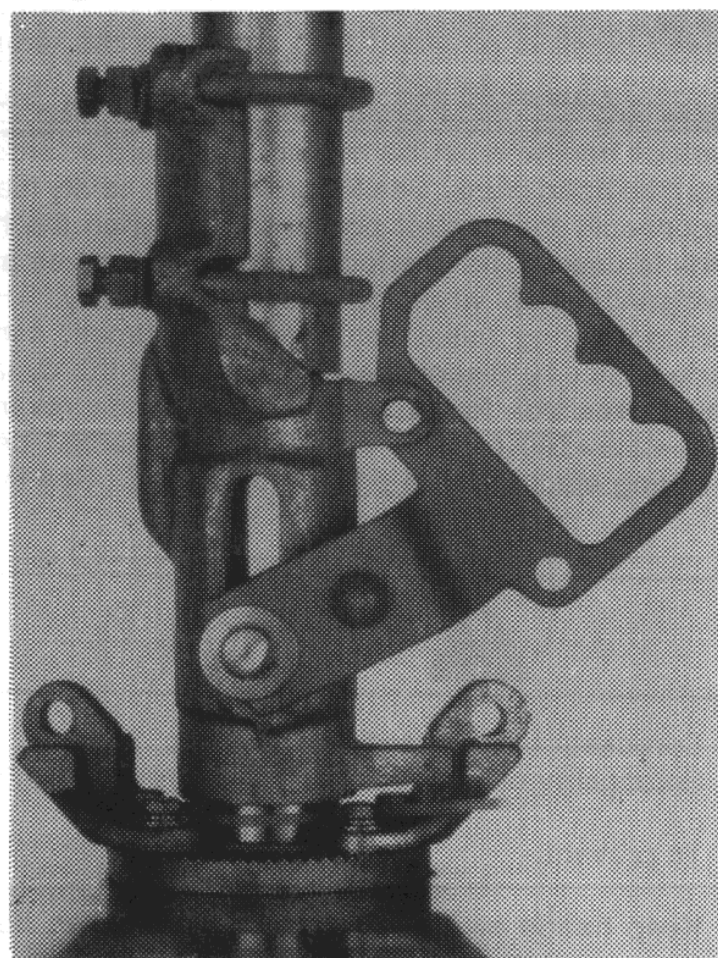


Figure 14 -- Hand Grip Decoupler (Coupled Position)

Lock Brackets


The lock brackets are adjustable and their positions are determined by the full closed and open positions of the Circuit Switcher. Matching holes in the brackets and hand grip decoupler permit locking in either the coupled or decoupled positions. Even though they are used to lift a motor operator, operating torques are such that the lock brackets will not stop rotation of the output shaft of the motor operator. At the limits of rotation, there should be about 1/8-inch clearance between the lock brackets and the decoupler handle.

Operation

Page 12

Manual Operation

A hand crank is provided for completing the required adjustments of the motor operator and Circuit Switcher before any electrical operations are attempted. The interlock handle must be moved downward in order to insert the hand crank. See Figure 15. This safety feature disconnects the control power source when the hand crank is used. The interlock handle also serves as an emergency stop when operating electrically. Hand cranking during initial setup and adjustment can be made easier by disconnecting one end of the dynamic braking resistor found on the front of the reversing contactor. The resistor **must be** reconnected before operating electrically to prevent overtravel. See Figure 16.



CAUTION

Sprocket/chain hazard.
Entanglement in moving parts may result in injury.

To prevent:

Keep hands away from moving parts when dead front panel is removed.



Figure 15 -- Manual Operation

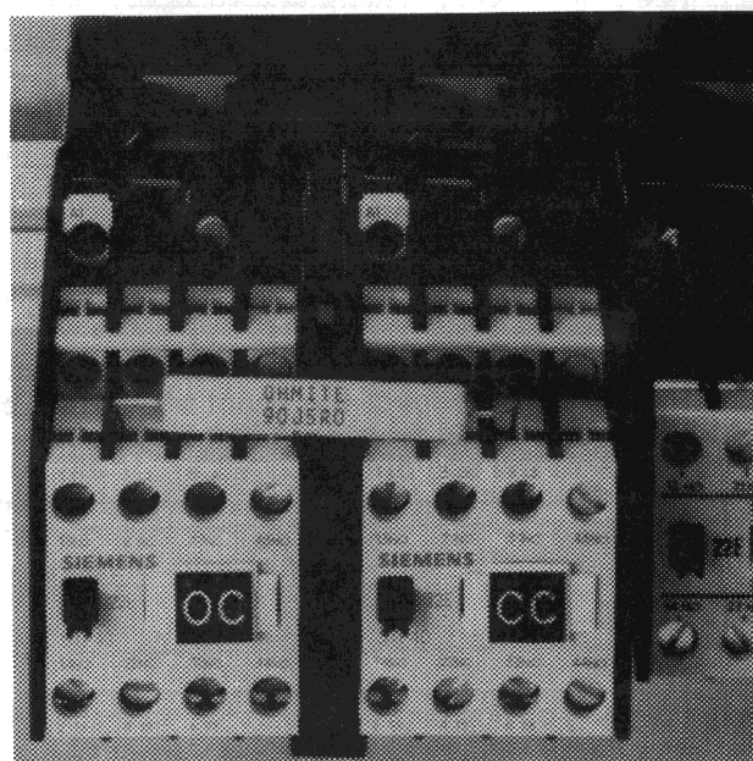


Figure 16 -- Dynamic Braking Resistor

Electrical Connections

The housing floor is removable in order to drill for conduit connections. Customer wiring connections are made to the right hand side of terminal blocks.

Electrical Operation

A mechanical and electrical interlocked reversing contactor is used for controlling direction of motor rotation. Proper direction to close the Circuit Switcher is shown on the Installation Arrangement drawing. Electrical data and a typical control schematic are shown in the Technical Data Section of this manual.

Limit Switches

Limits of rotation are controlled by cam operated limit switches that are adjustable from 150 to 200 degrees of rotation. The upper most cam and limit switch is always the open position limit switch and the lower assembly the

close limit switch. The steep rise of the cam activates the limit switch roller as the cam rotates in a direction from the hinged end of the limit switch roller towards the roller end (Figure 17). Limit switch cams are adjusted by the use of a 3/16-inch hex wrench in the socket head clamping bolt. Limit switch actuation can be heard except when operating electrically.

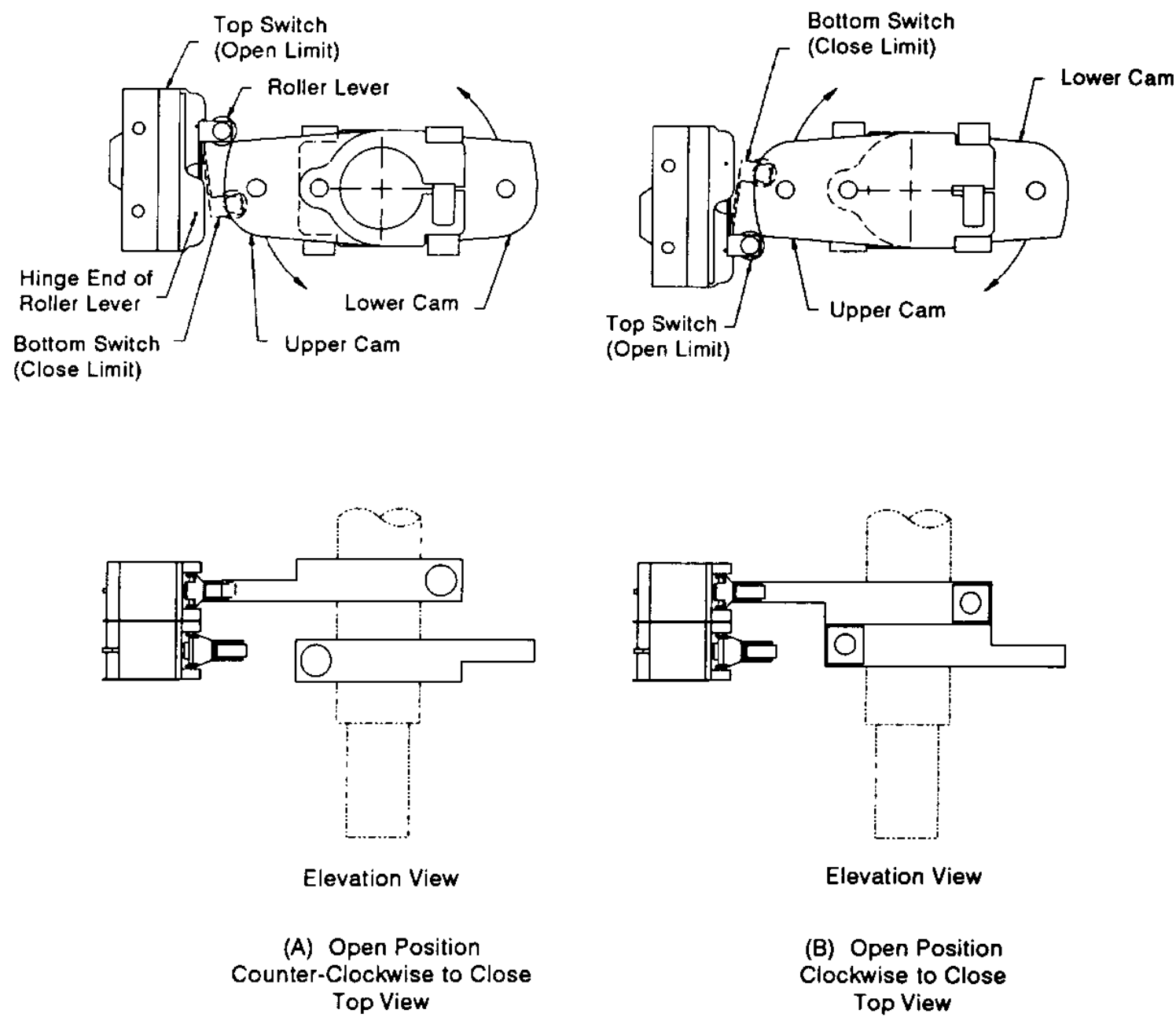


Figure 17 -- Limit Switch Actuation

Operation

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Mechanical Controls

A typical three pole arrangement of the CPS-VB is shown in Figure 18. The three single pole units are mechanically connected so that they operate simultaneously from a single operator, similar to group operation of a disconnect switch.

The center insulator of each pole unit acts not only as a support but also as a torsion drive for the operation of

the disconnect switch and the interrupter. This center insulator is bolted to the shunt trip mechanism which, in turn, is bolted to the lever and bearing assembly.

Interphase operating pipe connects the outside poles to the center pole. The center pole is driven by means of a group control pipe, outboard bearing assembly, vertical control pipe, and then to the operator. Operator rotation of about 186 degrees provides an overtoggle action at the full open and close positions of the outboard bearing lever.

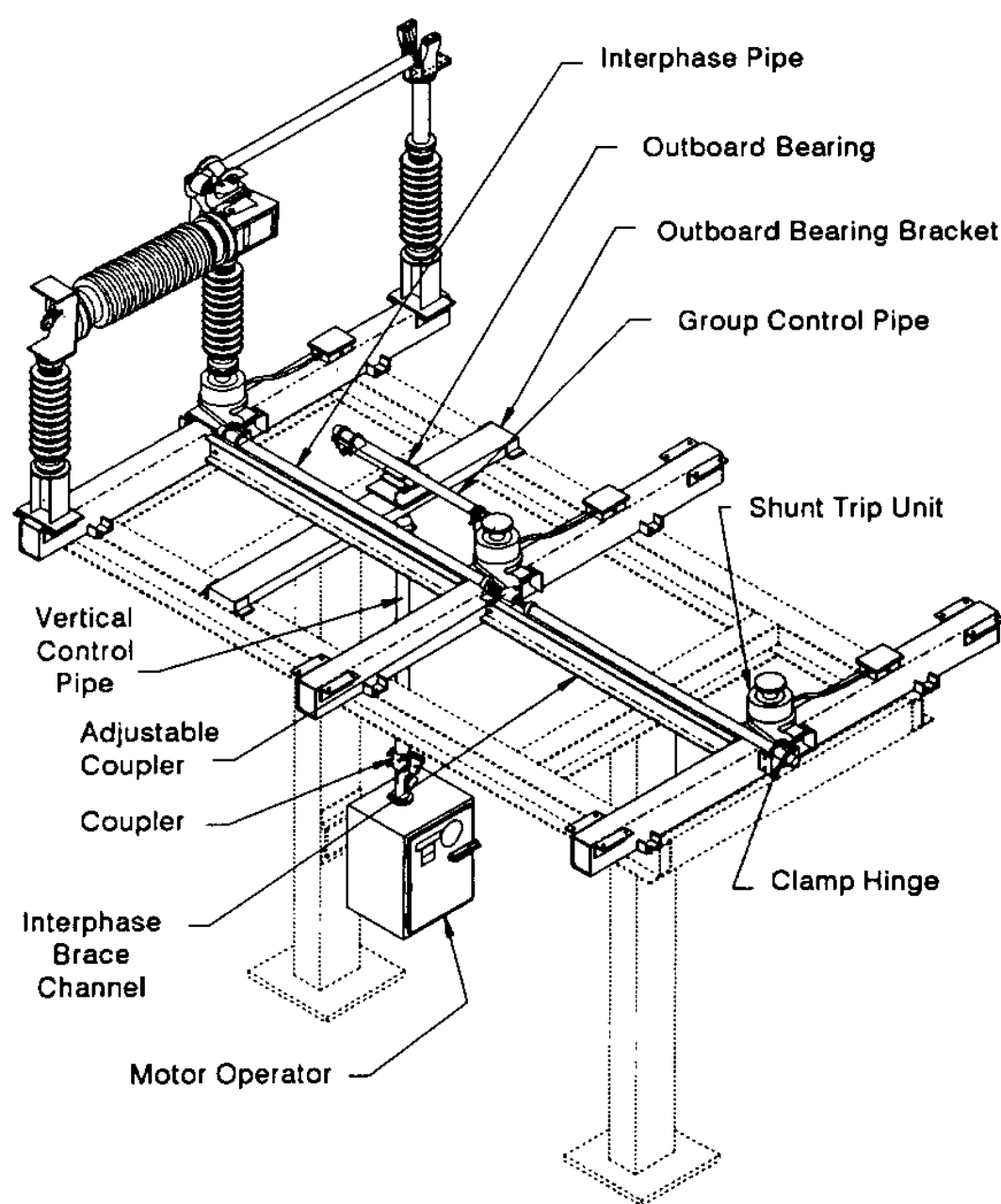


Figure 18 -- Three Pole Arrangement

72-265-035-423

Sequence

Sequence of operation for the Type CPS-VB, starting from the fully closed position, is illustrated in Figure 19. When the center insulator is rotated 12 degrees - by a shunt trip mechanism, motor operator, or hand crank - the opening springs in the driver mechanism are released, resulting in high speed opening of the interrupter contacts as shown in Step 1-3.

Continued insulator rotation, Step 4, starts to open the switch blade. Upon reaching the full open blade position the driver is reset for a closing sequence. Charging of shunt trip equipped units will occur during the last 12 degrees of opening rotation.

Insulator rotation to close results in blade travel and charging of the interrupter closing springs in the driver. The last few degrees of rotation release the closing springs, closing the interrupter and charging the opening springs.

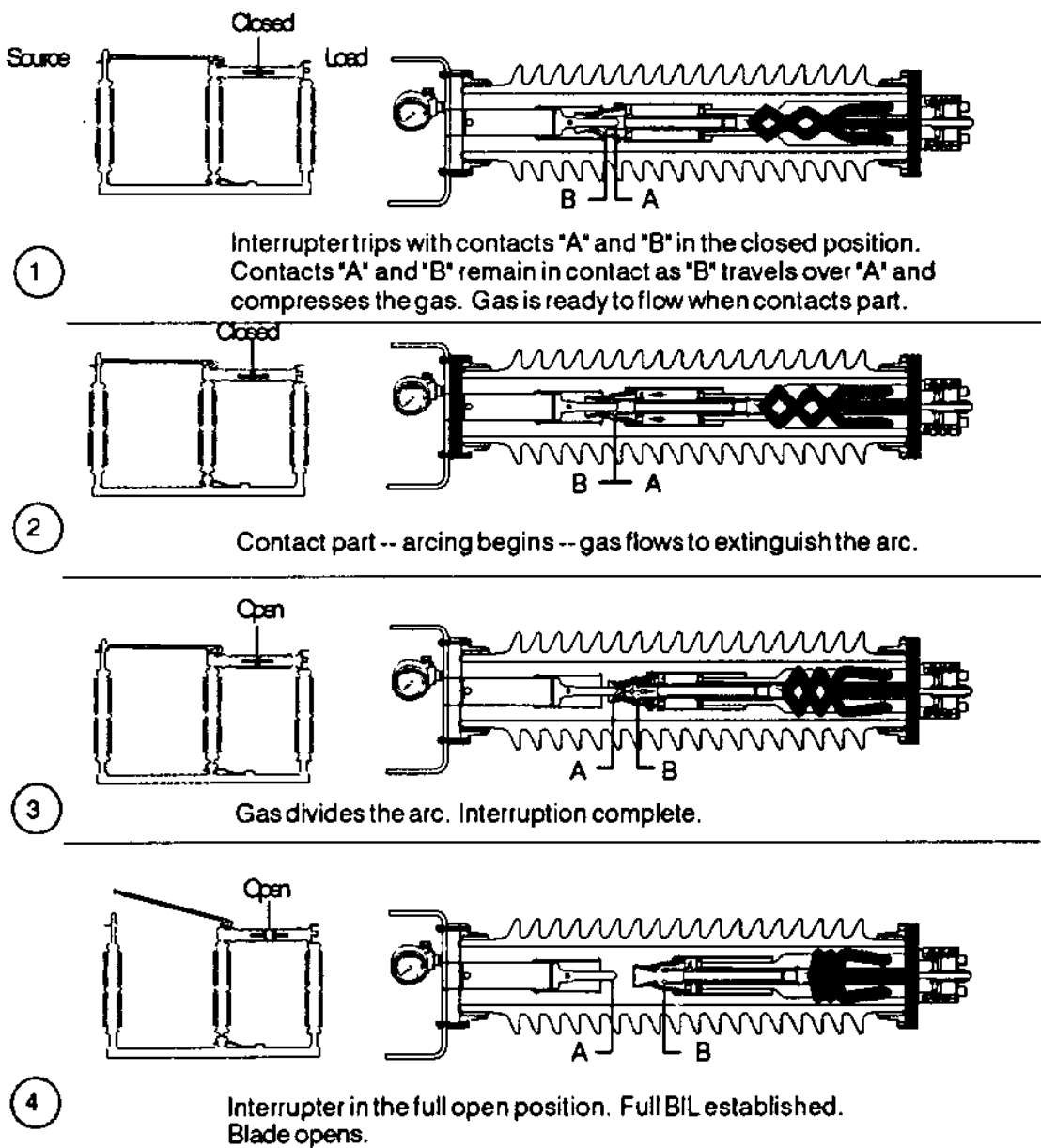


Figure 19 -- Operating Sequence

Operation

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Position Indicators

There are three indicators on each phase to indicate the status of the Circuit Switcher. See Figure 20.

A mechanical semaphore on each phase, in the driver unit window, is directly connected to the interrupter operating rod and indicates the OPEN-CLOSED position of the interrupter contacts. THIS SEMAPHORE HAS NO REFERENCE TO THE POSITION OF THE DISCONNECT BLADE.

There is a latch indicator on the under side of the housing of each driver. The painted marks serve to indicate limits of travel of the driver shaft and are used during installation and adjustment of the Circuit Switcher operating linkage. They have no other function and should not be used for any other purpose.

Each shunt trip housing has a red semaphore. Alignment of the housing semaphore with the base semaphore indicates the charged (spring loaded) position of the shunt trip device.

Manual Operation -- Circuit Switcher

To open the Circuit Switcher, operate the crank handle in the direction indicated. Approximately the first three turns will open the interrupter. Crank from stop to stop on the outboard bearing lever in order to properly complete an opening or closing sequence.

A latch must reset in the driver to permit closing. This is done in the final few degrees of opening rotation.

To close, operate in the opposite direction. Be sure to crank from stop to stop. With shunt trip units, observe semaphores to determine shunt trips charged before closing. This applies to both manual operation (worm-gear) and hand cranking through the motor operator when control power is not available.

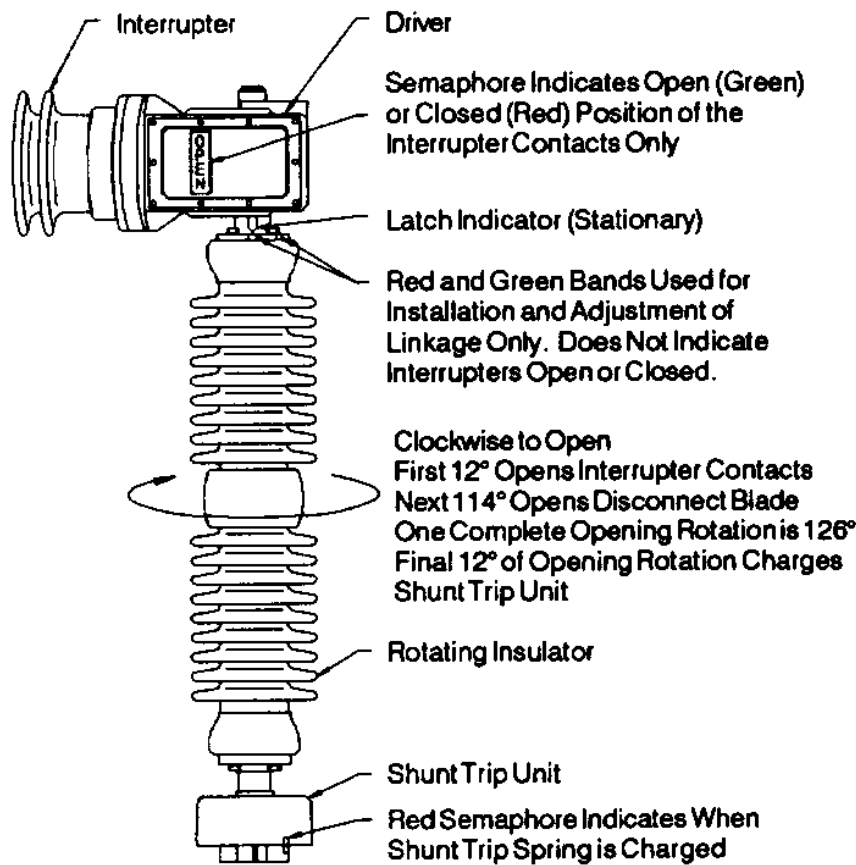


Figure 20 -- Sequence and Status Indicators

72-265-035-415

Three-Pole Assembly

Circuit Switchers complete with insulators are factory adjusted and timed on a 3-pole basis at the specified phase spacing and outboard bearing location. The unit has been operated at the factory with its motor operator by means of a temporary short section of vertical operating pipe.

Minimum disassembly has been done to accommodate shipping clearance restrictions. Major assemblies are numbered and/or match marked for ease of reassembly. The interrupters are shipped in the open position, blades closed and shunt trip units charged.

The following step-by-step instructions take into consideration the different ratings and type of structure. Required number of bolts, washers, nuts, etc., for each assembly step have been supplied in kit form and are numbered as to where used.

All 1/2-inch hardware should be tightened to 55 ft.-lbs. and 5/8-inch to 90 ft.-lbs. An anti-seize compound should be used on all stainless steel bolt threads. An all purpose grease should be used on both the point and threads of piercing screws to aid in piercing the pipes.

Circuit Switchers Supplied On Shipping Channels

- 1. After assembling the structure (platform to columns using kit #7), locate each pole unit on the top platform as shown on the installation arrangement drawing provided with the order. A typical arrangement is shown in Figure 21. Observe proper relationship of interrupter and switch ends of a pole unit with respect to the structure and outboard bearing location. Refer to Handling Section of this manual for warnings and proper method of lifting the pole units. Use kit #1 and LOOSELY fasten pole units to the structure.

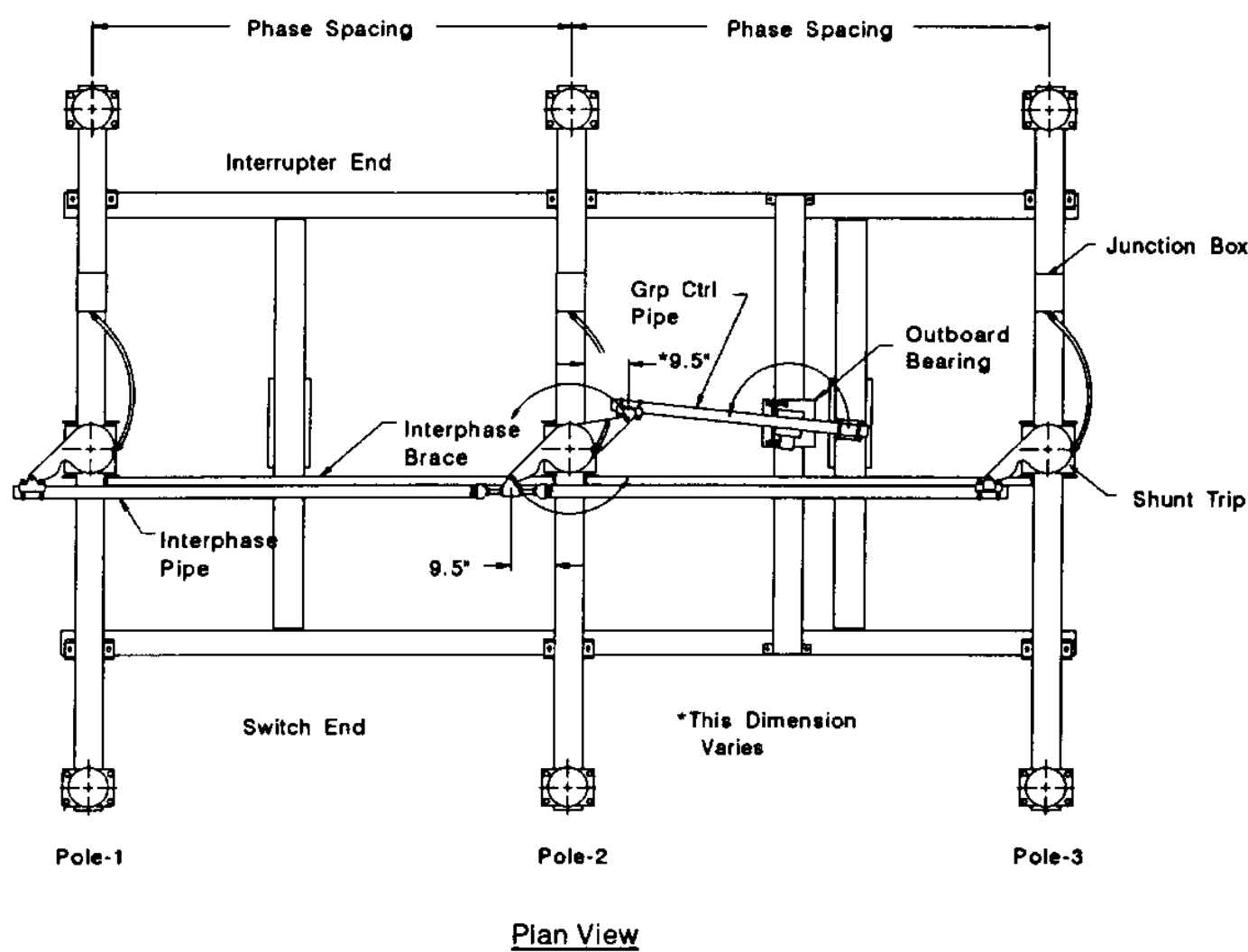


Figure 21 -- Typical Arrangement

Installation

Page 18

2. Install interphase brace channels using kit #2. These brace channels establish centerline distances between pole units. Securely tighten the brace channels first and THEN tighten the pole-to-structure fastening hardware. See Figure 22. If applicable use kit #9 to mount the outboard bearing to the interface channel.

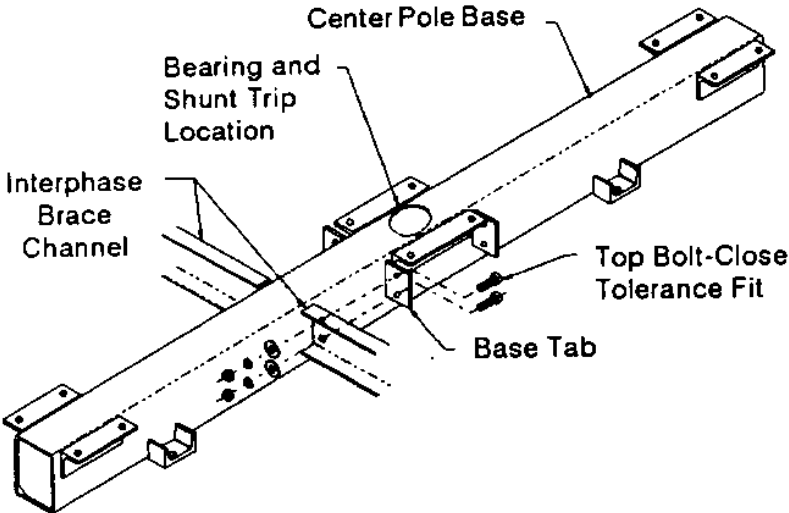


Figure 22 -- Interphase Brace Channel Assembly
72-265-035-426

3. Install the outboard bearing assembly shown in Figure 23 using kit #3. Check orientation against drawings such that bearing stops are in the proper location.

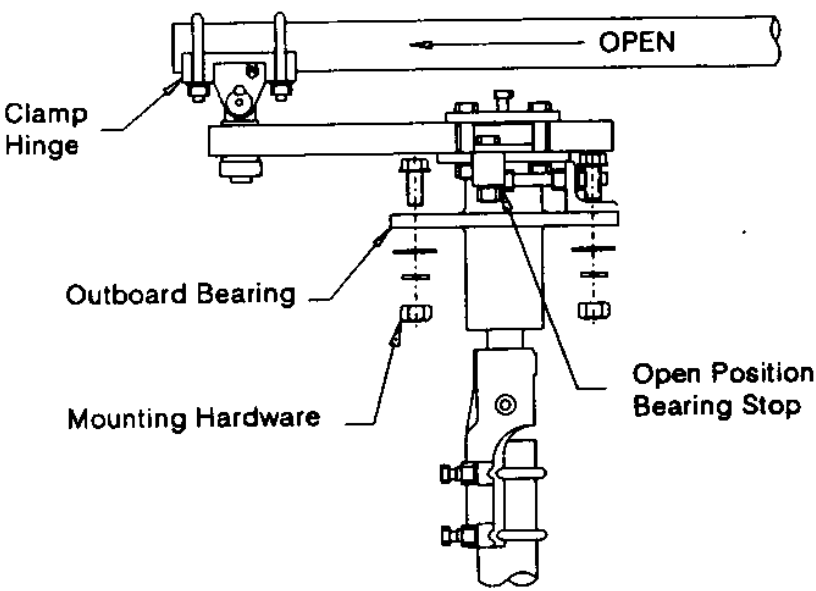


Figure 23 -- Outboard Bearing
72-265-035-427

4. Reassemble the interphase operating pipe to the adjustable clevis by lining up the match marks. While supporting the ends of this pipe assembly, pin the clevis to the center pole operating lever first. Outside poles may have to be rotated slightly to accommodate pin insertion. Refer to Figure 24 for details.

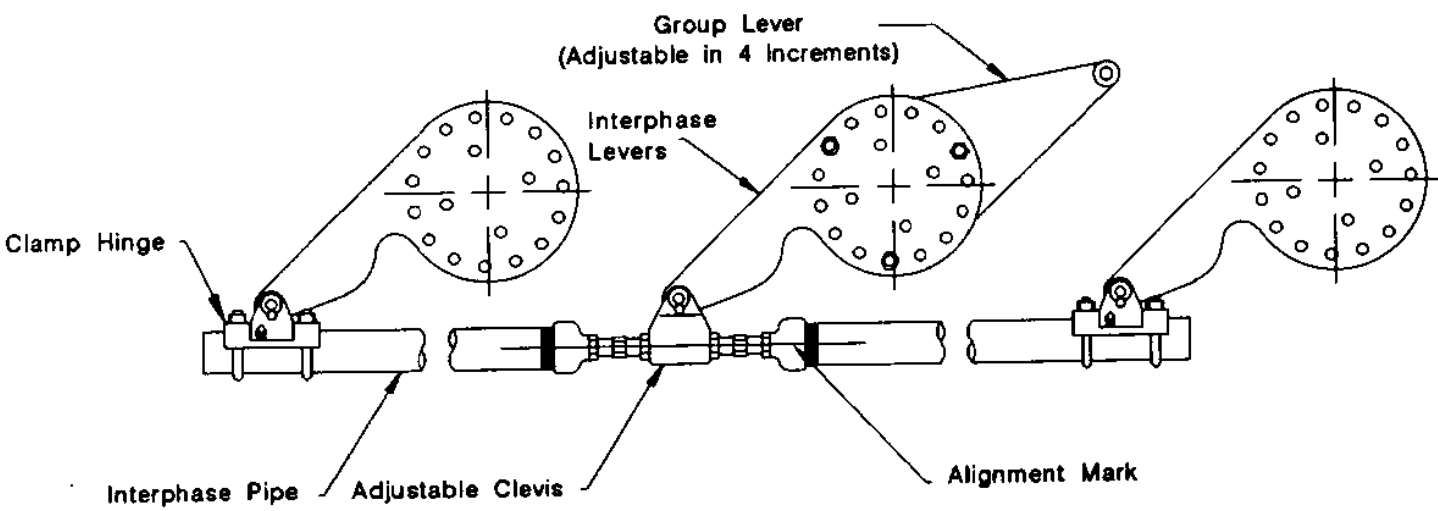


Figure 24 -- Operating Control Levers

72-265-035-414

Installation

5. By reference to Figure 25, install group control pipe to the group control lever and then to the outboard bearing lever. Clamp hinges have been factory set in the proper positions on the group control pipe.

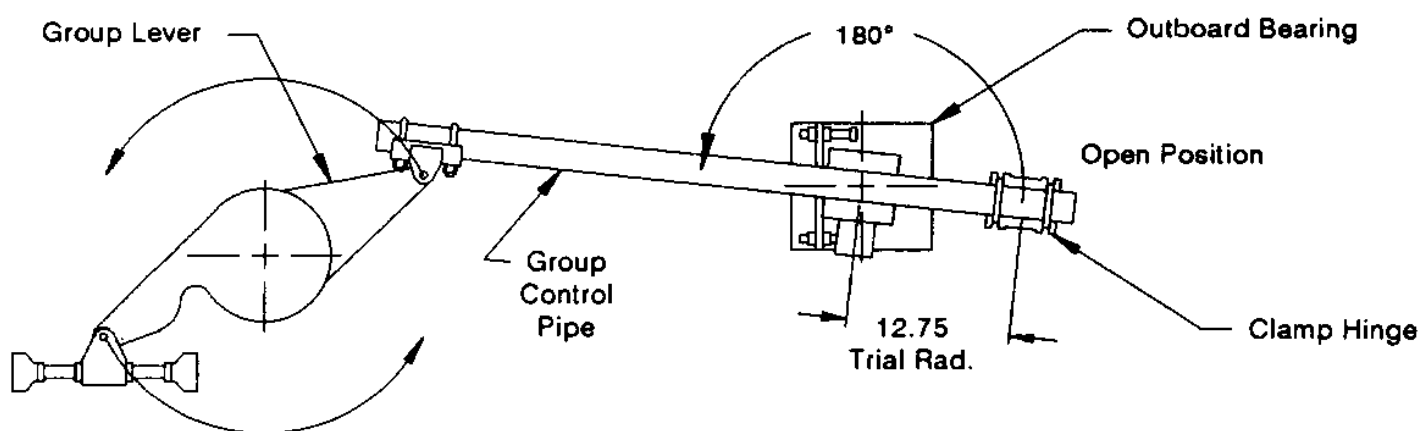


Figure 25 -- Outboard Bearing Detail

72-265-035-421

6. The motor operator is bolted to the column leg as shown in Figure 26 by using kit #4. Proper lifting method is shown in the Handling section. Further details of the motor operator are covered in the Operation Section of this manual. If unfamiliar with the Motor Operator, this section should be reviewed before proceeding.

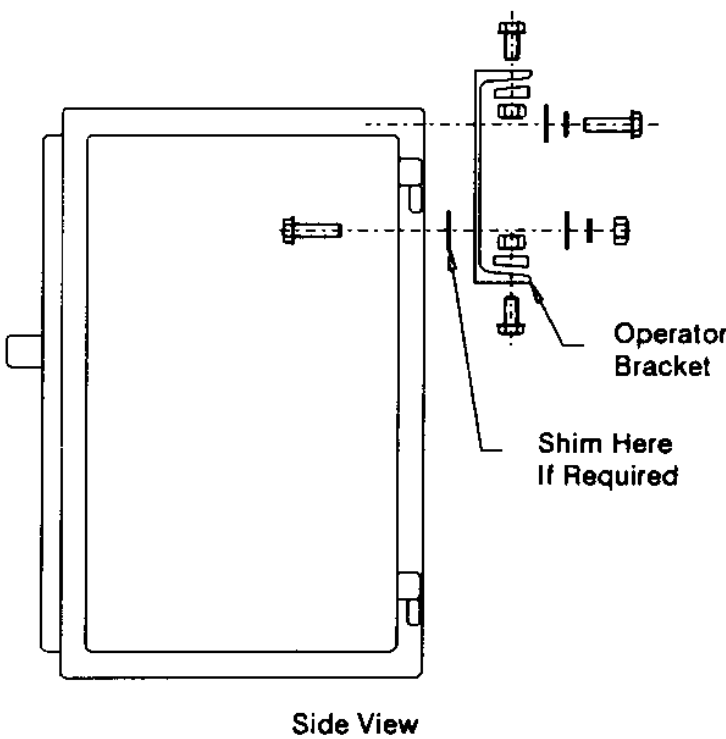


Figure 26 -- Motor Operator Mounting

72-265-035-434

Installation

Page 20

- 7. Install vertical control pipe between outboard bearing clamp and the flat abutment surface on the motor operator decoupler. Be sure the 5/8 inch gauge block is in position to space the decoupler at this height above the serrated disk on top of the motor operator as shown in Figure 27. Use kit #5 and kit #6 to mount the ground braid and position indicator respectively.
- 8. Clamp and pierce vertical control pipe at outboard bearing clamp. Grease should be applied to the point and threads of the piercing screws. Leave the U-bolts and piercing screws loose at the decoupler so that vertical pipe will turn easily in decoupler clamp.

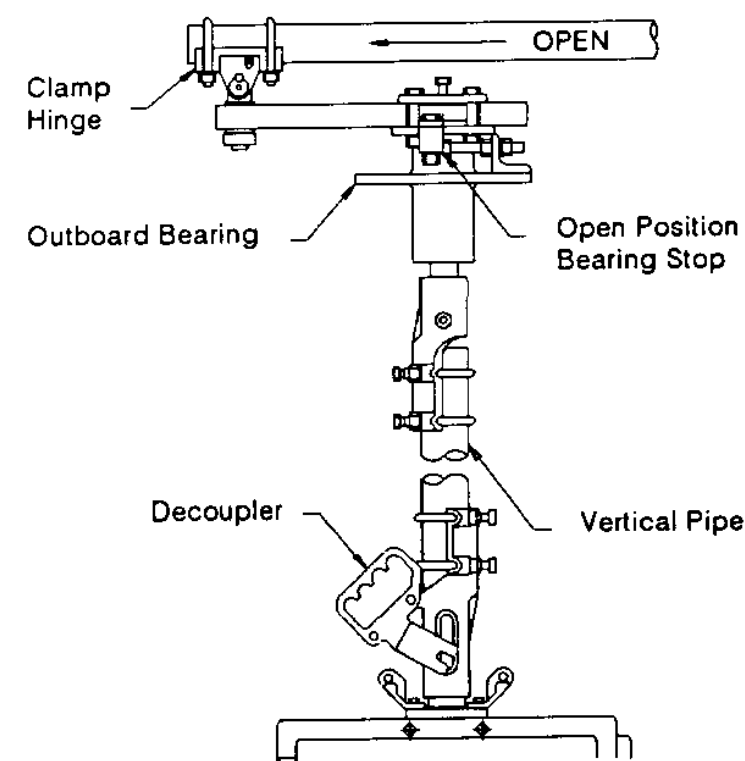


Figure 27 -- Vertical Control Pipe Installation

72-265-035-428

- 9. Rotate the pole units clockwise to the open position by pushing against the interphase levers and/or hand turning the insulators. When full open, there will be resistance to further rotation and the latch pointers will indicate in the green bands underneath the drivers. See Figure 28.

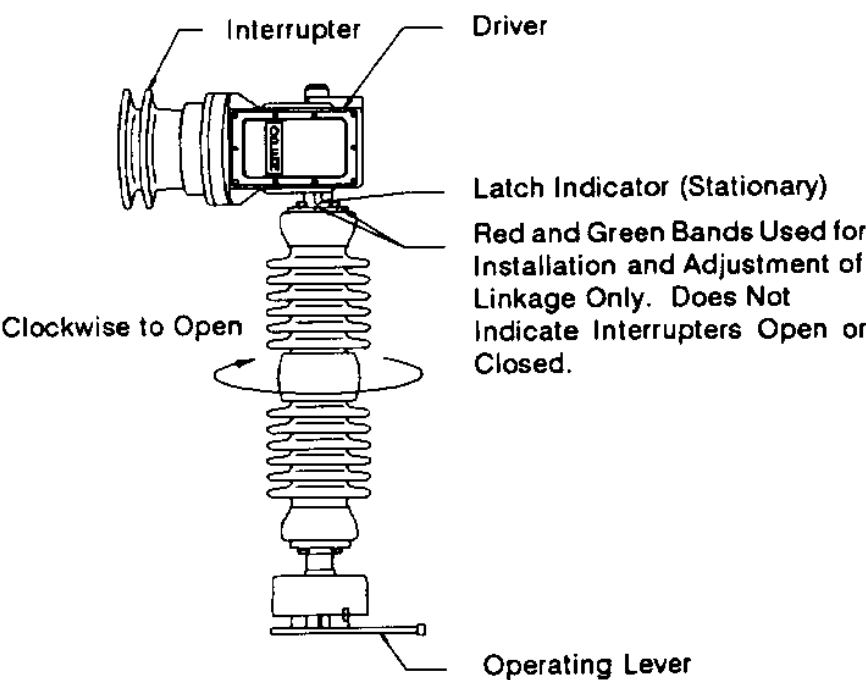


Figure 28 -- Opening Procedure 72-265-035-418

- 10. Maintain this position by holding or blocking, tighten U-bolt clamps on decoupler and lightly set piercing screws with motor operator decoupler set temporarily at approximate mid position. DO NOT pierce pipe at this time. Decoupler should be in the "coupled" position, i.e., pin engaged with the slot in the output shaft.
- 11. Match mark with pencil on sides of the clamps to pipe to serve as an indication if any slippage occurs before final piercing of the pipe.
- 12. Install the conduit kit supplied for connection between the motor operator and shunt trip junction boxes. Drawings for this installation have been provided with the drawing package.
- 13. Proceed to Final Adjustment section on page 25.

Installation

Circuit Switchers Supplied For Mounting On Customer Structures

Installation of these units are the same as the preceding method in that the pole units are supplied bolted to shipping channels. Group control pipe adjustments are required because of mounting tolerances of the outboard bearing assembly on the structure.

1. Refer to the preceding method and complete steps 1 through 4 on pages 17 and 18.
2. Install group control pipe by attaching to group control lever. This clamp hinge has been factory set and pierced. See Figure 29.
3. Leave clamp hinge loose at outboard bearing end of group control pipe so that pipe will slide in clamp and pin clamp to pivot fitting at end of outboard bearing lever.

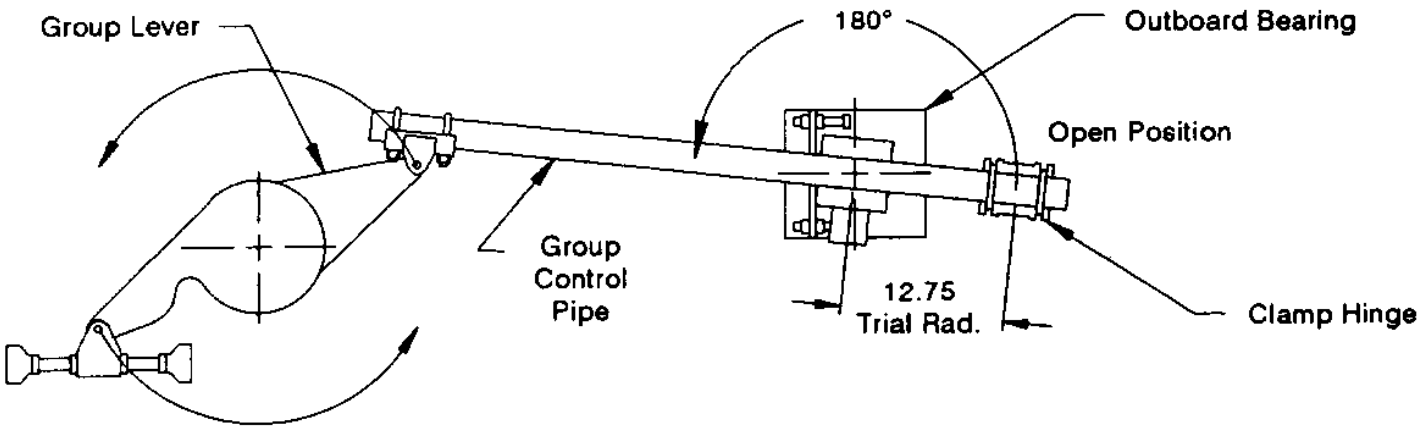


Figure 29 -- Installation of Group Control Pipe

72-265-035-421

4. Rotate outboard bearing lever to approximately 4 degrees over-toggle in the full open position against the open position bearing stop. See Figure 30 which illustrates an over-toggle position. The bearing stop may require some readjustment at this time to set this overtoggle position.
5. The motor operator is bolted to the column leg as shown in Figure 31 by using kit #4. Proper lifting method is shown in the Handling section. Further details of the motor operator are covered in the Operation Section of this manual. If unfamiliar with the motor operator, this section should be reviewed before proceeding.

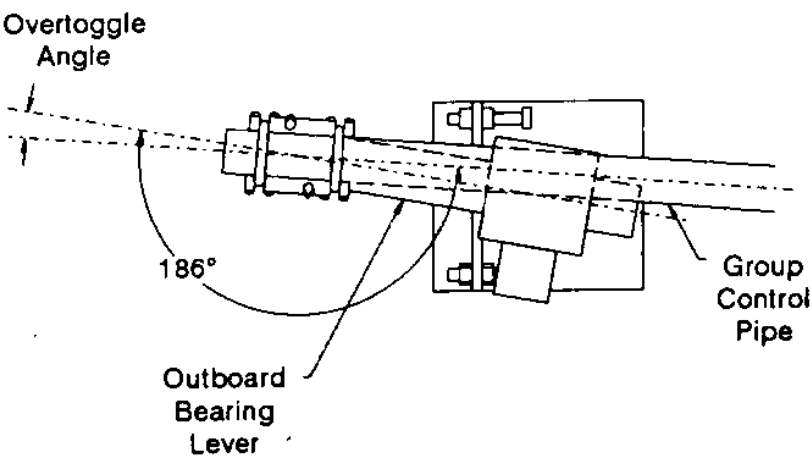


Figure 30 -- Outboard Bearing Overtoggle

72-265-035-422

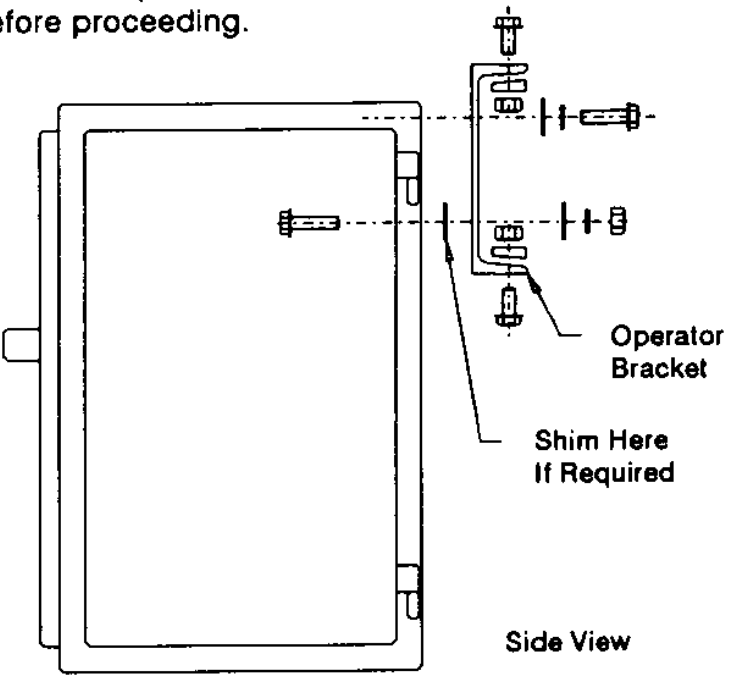


Figure 31 -- Motor Operator Mounting

72-265-035-434

Installation

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6. Install vertical control pipe between outboard bearing clamp and the flat abutment surface on the motor operator decoupler. Be sure the 5/8 inch gauge block is in position to space the decoupler at this height above the serrated disk on top of the motor operator as shown in Figure 32. Use kit #5 and kit #6 to mount the ground braid and position indicator respectively.
7. Clamp and pierce vertical control pipe at outboard bearing clamp. Grease should be applied to the point and threads of the piercing screws. Leave the U-bolts and piercing screws loose at the decoupler so that vertical pipe will turn easily in decoupler clamp.

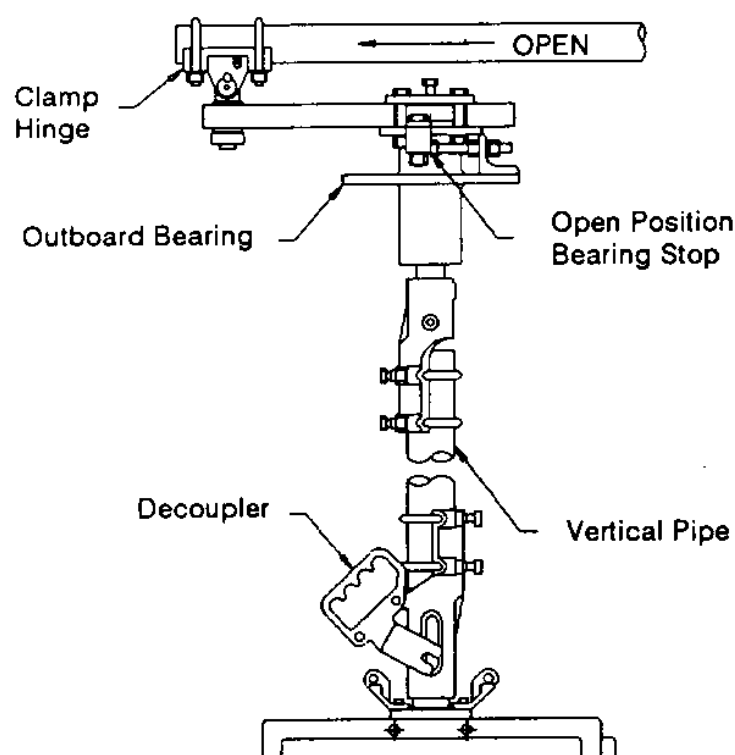


Figure 32 -- Vertical Control Pipe Installation

72-265-035-428

8. Rotate the pole units clockwise to the open position by pushing against the interphase levers and/or hand turning the insulators. When full open, there will be resistance to further rotation and the latch pointers will indicate in the green bands underneath the drivers. See Figure 33.

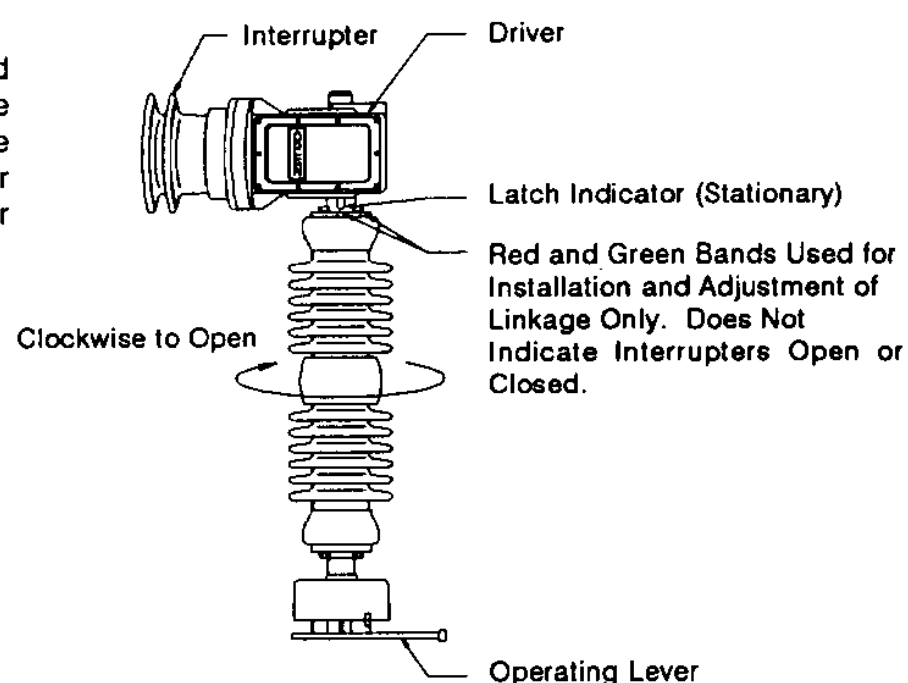


Figure 33 -- Opening Procedure 72-265-035-418

9. Maintain this position by holding or blocking, tighten U-bolt clamps on decoupler and lightly set piercing screws with motor operator decoupler set temporarily at approximate mid position. DO NOT pierce pipe at this time. Decoupler should be in the "coupled" position, i.e., pin engaged with the slot in the output shaft.
10. Match mark with pencil on sides of the clamps to pipe to serve as an indication if any slippage occurs before final piercing of the pipe.
11. Conduit and wiring will need to be complete between the motor operator and shunt trip junction boxes.
12. Proceed to Final Adjustment section on page 25.

Circuit Switchers Shipped Installed On Structure Platform

- 1. Refer to the structure drawings provided with the order and install the column legs of the structure on the footings.
- 2. Lift the three-pole assembly with structure top platform into position and connect to the column legs using kit #7. Reference installation arrangement drawing for proper orientation of the Circuit Switcher on the structure. See Figure 5 for warnings and correct method of lifting in Handling Section of this manual.
- 3. The motor operator is bolted to the column leg as shown in Figure 34 by using kit #4. Proper lifting method is shown in the Handling section. Further details of the motor operator are covered in the Operation Section of this manual. If unfamiliar with the motor operator, this section should be reviewed before proceeding.

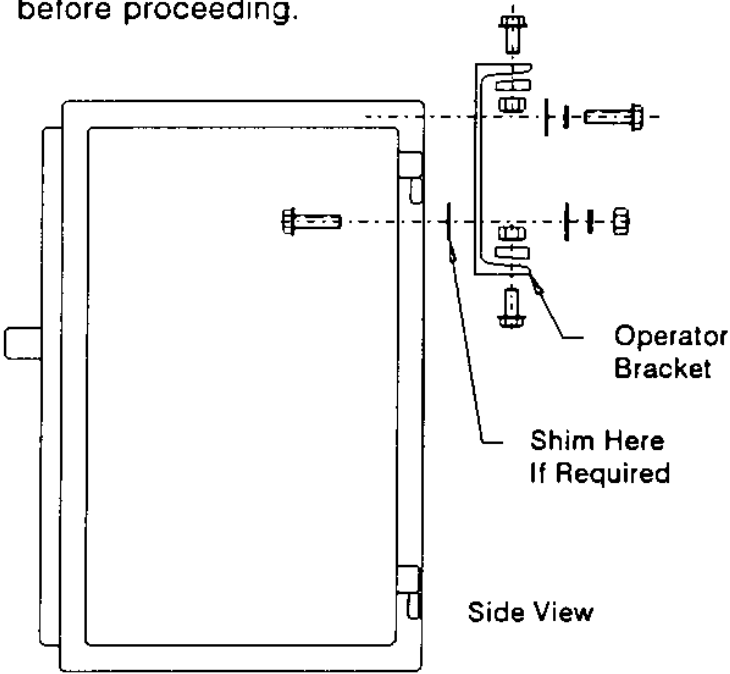


Figure 34 -- Motor Operator Mounting 72-265-035-434

- 4. Install vertical control pipe between outboard bearing clamp and the flat abutment surface on the motor operator decoupler. Be sure the 5/8 inch gauge block is in position to space the decoupler at this height above the serrated disk on top of the motor operator as shown in Figure 35. Use kit #5 and kit #6 to mount the ground braid and position indicator respectively.
- 5. Clamp and pierce vertical operating pipe at outboard bearing clamp. Grease should be applied to the point and threads of the piercing screws. Leave the

U-bolts and piercing screws loose at the decoupler so that vertical pipe will turn easily in decoupler clamp.

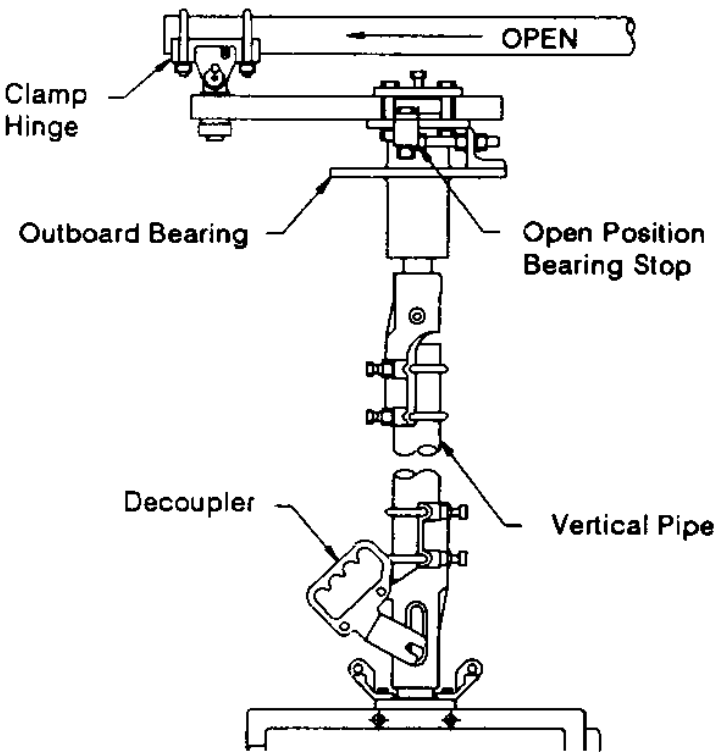


Figure 35 -- Vertical Control Pipe Installation 72-265-035-428

- 6. Rotate the pole units clockwise to the open position by pushing against the interphase levers and/or hand turning the insulators. When full open, there will be resistance to further rotation and the latch pointers will indicate in the green bands underneath the drivers. See Figure 36.

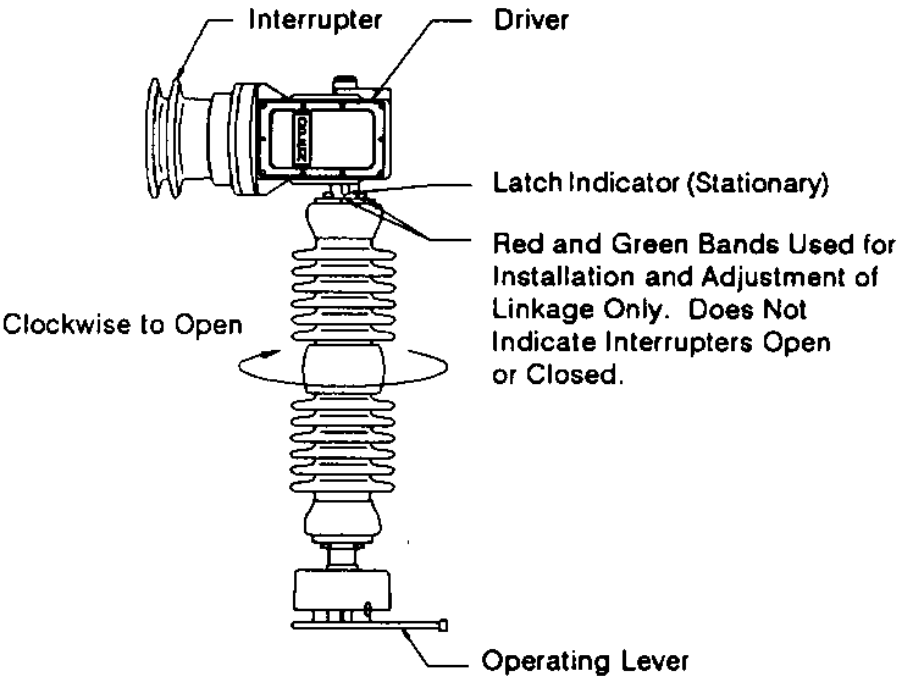


Figure 36 -- Opening Procedure 72-265-035-418

Installation

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7. Maintain this position by holding or blocking, tighten U-bolt clamps on decoupler and lightly set piercing screws with motor operator decoupler set temporarily at approximate mid position. DO NOT pierce pipe at this time. Decoupler should be in the "coupled" position, i.e., pin engaged with the slot in the output shaft.
8. Match mark with pencil on sides of the clamps to pipe to serve as an indication if any slippage occurs before final piercing of the pipe.
9. Install the conduit kit supplied for connection between the motor operator and shunt trip junction boxes. Drawings for this installation have been provided with the drawing package.
10. Proceed to Final Adjustment section on page 25.

Final Adjustment and Inspection

The following adjustment steps are for Circuit Switchers supplied mounted on the top platform of the structure and for those supplied mounted on shipping channels. Refer to end of this section, page 28, to adjust the type intended for mounting on customer structures.

- 1. Fill each interrupter with SF₆ gas. For proper procedure, refer to Maintenance Section, page 42. **Do not operate circuit switcher without gas.**
- 2. Hand crank to the full open over-toggle position against the open position outboard bearing stop while observing the shunt trip gaps and the green band positions. Shunt trips gaps MUST NOT exceed 3/16 inch as shown in Figure 37. Green band positions should indicate having traveled 1/2 to 3/4 into the bands. See Figure 10. DO NOT over rotate beyond any of the green bands.

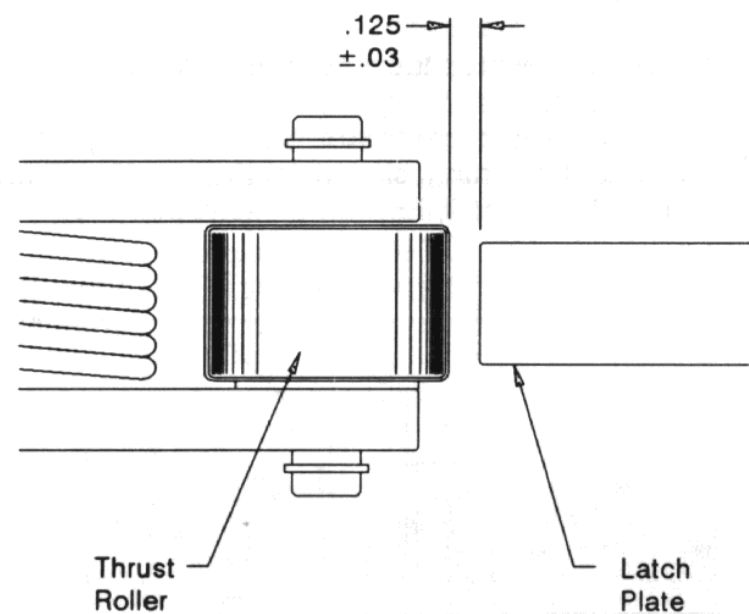



Figure 37 -- Shunt Trip Gap 72-265-035-432

**CAUTION**

Improper operation may cause circuit switcher damage.

To prevent:

Do not operate until unit has been filled with SF₆ gas.

- 3. If the adjustments in step 2 are not as described, continue steps 4 through 8. Otherwise, proceed to step 9.
- 4. If it is found necessary to adjust the shunt trip gap, the charging bolt in the driver housing controls the gap position. Reducing excessive gap is done by backing out the charging bolt as shown in Figure 38 while observing gap position. Increasing gap is done easier if the Circuit Switcher is hand cranked about 5 turns towards the close direction to remove the load from the charging bolt. It is recommended that the charging bolt be turned in about 1/2 turn and then the unit be hand cranked back full open to recheck gap position.

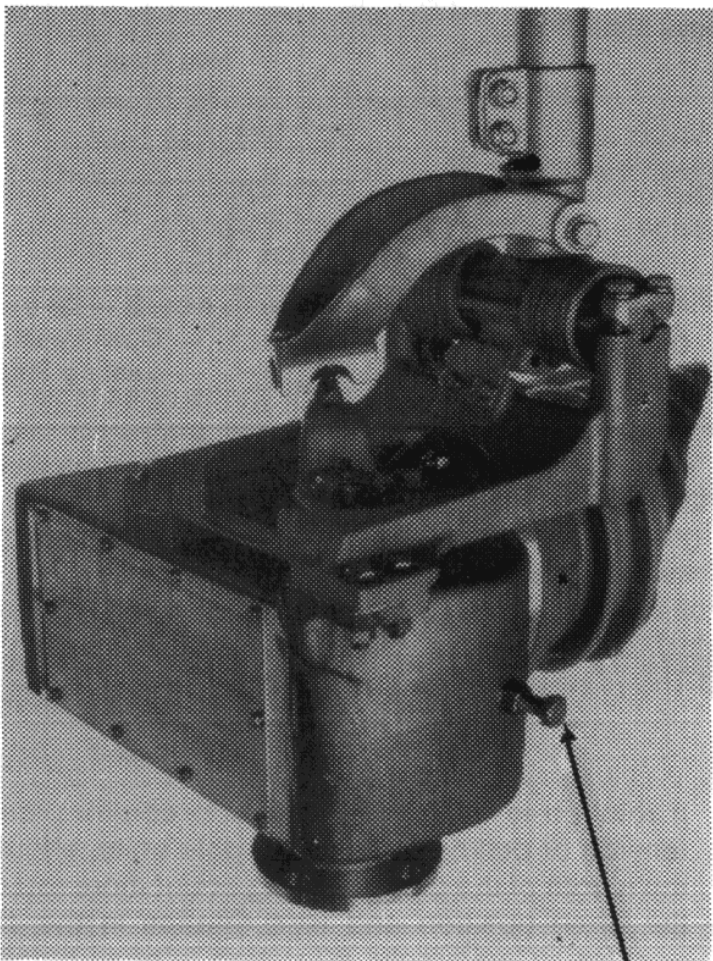


Figure 38 -- Charging Bolt

- 5. A shunt trip gap change also results in changing green band position. The green band tolerance given in step 1 must be maintained. Adjustments described in following steps 6 and 7 may be necessary to adjust green band position because of the inter-relationship between gap and band positions.

Final Adjustment and Inspection

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6. A trial radius of 12.75 inches has been set on the outboard bearing lever. This is the measurement shown in Figure 39. A longer radius length produces more rotation in both open and close directions while a shorter radius reduces the amount of rotation in both directions.

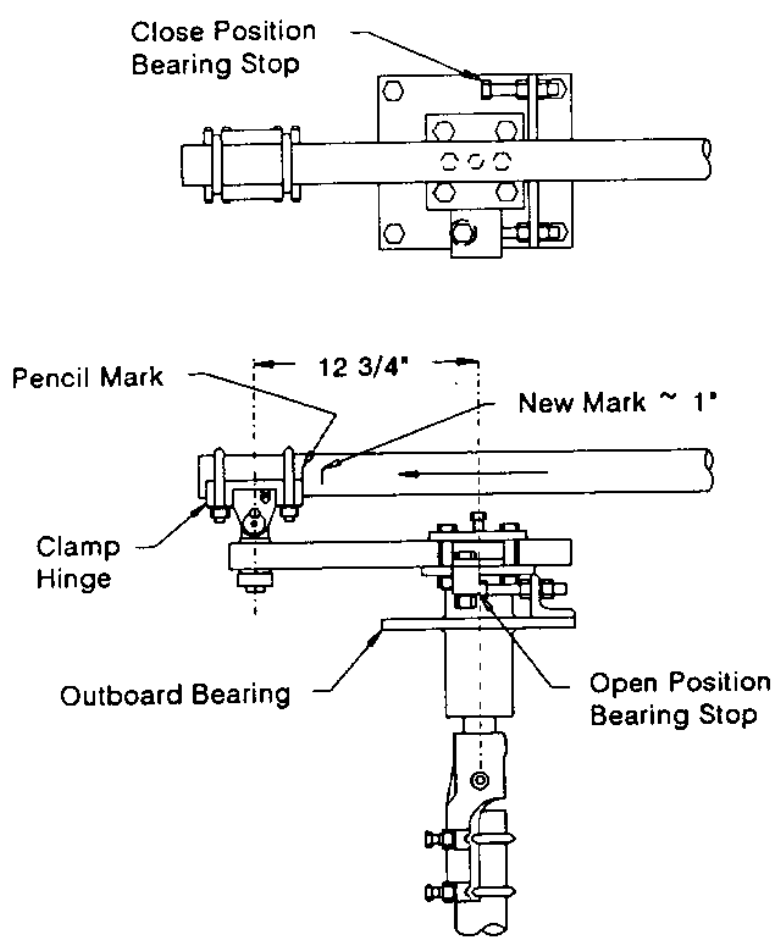




Figure 39 -- Outboard Bearing Lever Trial Radius
72-265-035-429

7. If rotation is such that the group control pipe is in tension or pulling to open the pole units, shortening the length of the pipe will bring about more rotation in the open position and less rotation in the closed position. Conversely, if rotation to open places the group control pipe in compression, shortening the length of the pipe will reduce rotation in the open direction and increase rotation in the closed direction.
8. Repositioning of the decoupler to vertical control pipe will be required. Loosen piercing screws and U-bolts so that pipe-to-clamp joint will turn freely.

 WARNING	
	Hazardous voltage. Contact could result in death or serious injury.
	To prevent:
	Do not contact energized parts when operating with dead front panel removed or when right hand side door is open.

9. Hand crank 1/2 turn further into the open direction and then tighten the decoupler U-bolts followed by piercing the vertical operating pipe.
10. Hand crank towards the close position. As the blades enter into the stationary contacts verify entrance is centered. Adjustments are made by means of the adjustment bushing shown in Figure 40. Blades should close first followed by interrupter closure.

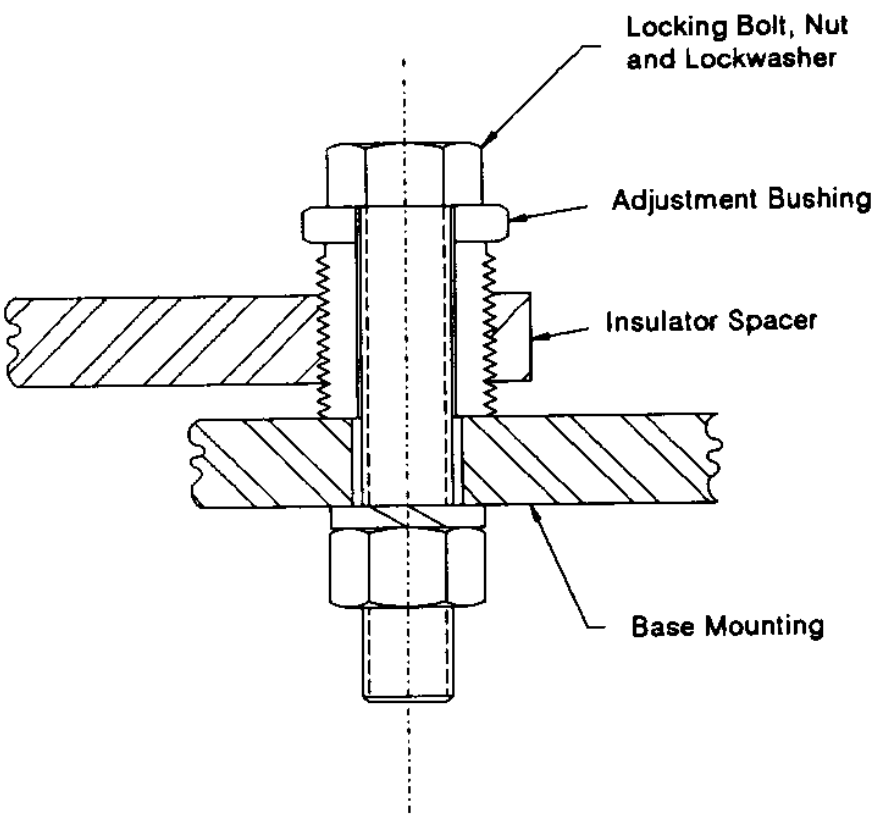
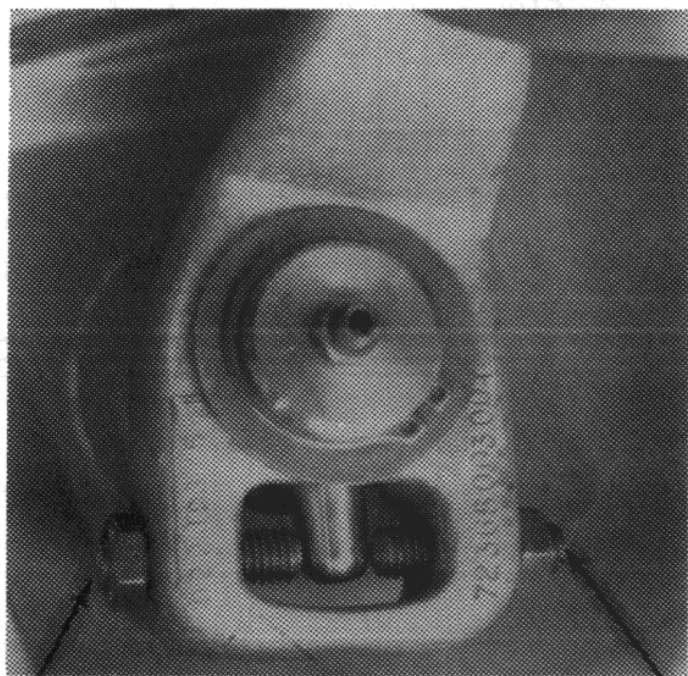


Figure 40 -- Adjustment Bushing 72-265-035-435

Final Adjustment and Inspection

Page 27

11. Continue hand cranking the Circuit Switcher to the closed position and verify all interrupters have closed, driver rotation is into the red bands, outboard bearing lever is in line with the group control pipe, a 1/8 inch gap occurs on the close position bearing stop, and the close limit switch in the motor operator has been actuated.
12. Disable shunt trip circuit and check incoming DC polarity. Refer to the electrical drawing furnished with the Circuit Switcher. Operate motor operator electrically to check for correct rotation. Run motor operator to open position as determined by open limit switch operation. In this position there should be about 1/8 inch clearance at the open position bearing stop (see Figure 39). Also, the open position limit switch should have been actuated as shown in Figure 17.
13. In the full open over-toggle position, check for disconnect blade vertical position and adjust if necessary by means of the crank arm A and B bolts of the hinge mechanism shown in Figure 41. To increase the open angle, screw "A" bolt in and "B" bolt out together. At the completion of the adjustment, tighten the locknut on one bolt, turn the other bolt in until snug, then back out 1/8-turn and tighten its locknut.



Bolt "A"

Bolt "B"

Figure 41 -- A and B Crank Arm Adjusting Bolts

14. In the closed position, check that blade contact is horizontal as shown in Figure 42 and that the blade rests on the closed position blade stop.

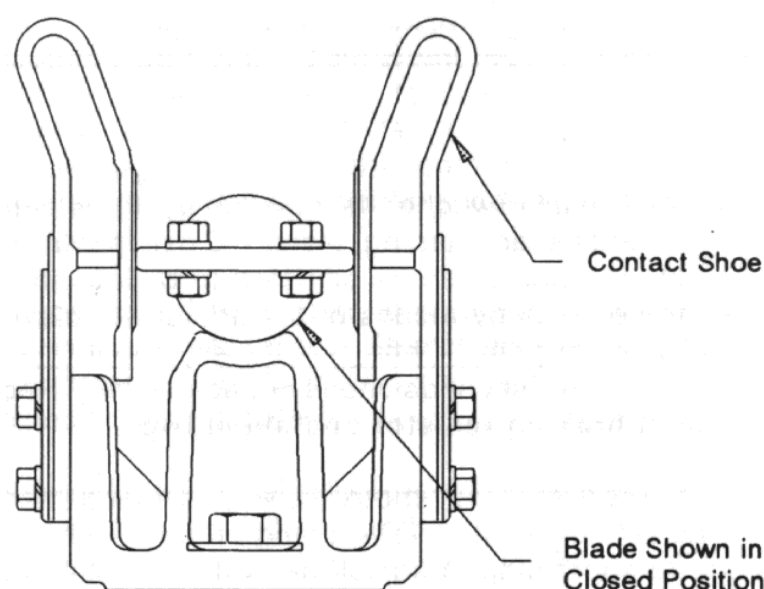


Figure 42 -- Blade Jaw Adjustment 72-265-035-441

15. If necessary, adjust this position by means of the ball joint adjusting screws shown in Figure 43. First, loosen the set screw in the fork. Then to lower the blade, turn screw "C" in and screw "D" out together. Check the adjustment by opening and reclosing the blade. With the blade on the blade stop, screw "C" should be tight against the ball stud. Tighten screw "D" against the ball, then back out by 1/8-turn. Tighten the set screw to lock the adjusting screws in position.

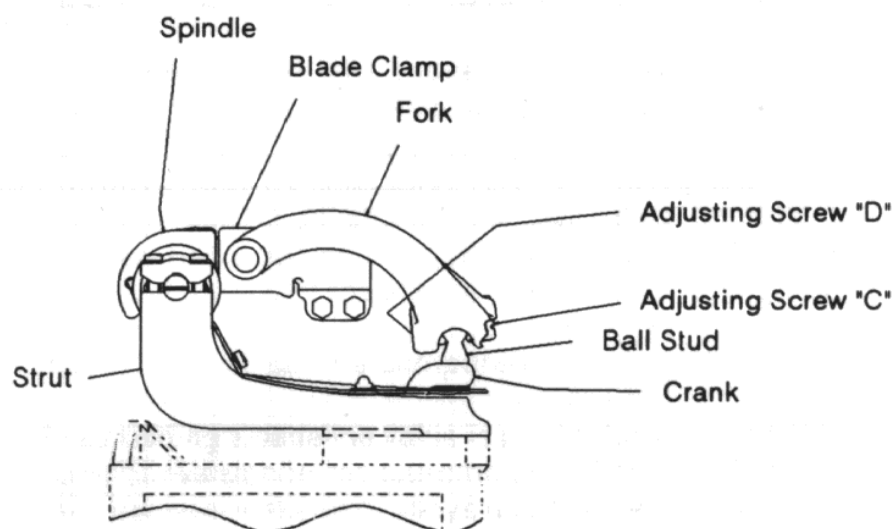


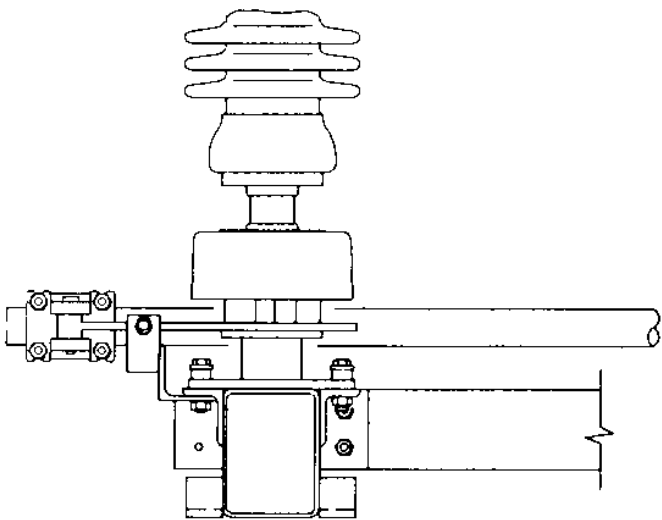
Figure 43 -- C and D Ball Joint Adjusting Screws 72-265-035-430

Final Adjustment and Inspection

Page 28

- 16. If the blade contact is not horizontal after the previous adjustment, note the departure from horizontal and then open the Circuit Switcher. Loosen the blade clamp bolts and rotate the blade to the required position. Verify this adjustment by closing the switch and checking the blade contact angle.
- 17. Verify all hardware is tight and that all pipe has been pierced.
- 18. The Circuit Switcher is now ready for electrical operations and timing tests. Close simultaneity between poles can be adjusted to be less than 16 milliseconds by means of the adjustable clevis on the center pole. Open simultaneity should be less than 12 milliseconds and is not adjustable. **Reconnect braking resistor and shunt trip.**
- 19. The lever stop bolt should be re-positioned after any adjustment of the close timing of the switcher. Before attempting to adjust the switcher close timing, loosen the stop bolt lock nuts and back the stop bolt away from the lever closed position.

After making any necessary close timing adjustments, put the switcher in the closed position. Place the head of the stop bolt against the lever and turn the left lock nut finger tight against the bolt mounting block. Hold the bolt head with a wrench to prevent it from turning while the right lock nut is tightened. The recommended tightening torque is 90 lb.-ft.



Section "A" - "A"

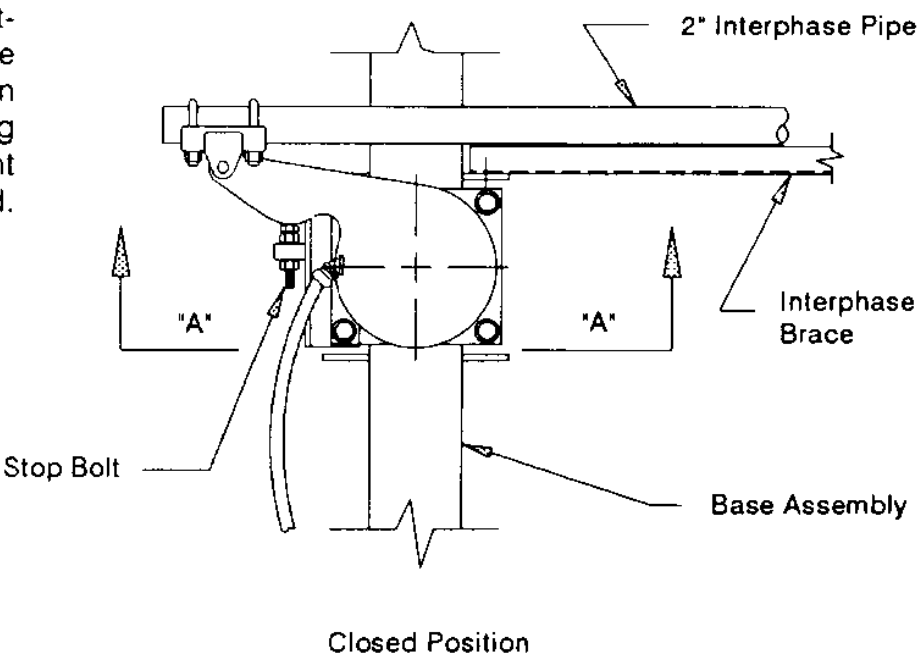


Figure 44 -- Stop Assembly

72-265-035-442

Final Adjustment and Inspection

Final Adjustment of Circuit Switchers Mounted on Customer Structures

- 1. With outboard bearing lever in full open position and pole units manually rotated to their limit in the green bands, mark group control pipe at bearing clamp. Measure 1 inch from this mark along group control pipe and mark pipe. This is shown in Figure 45.

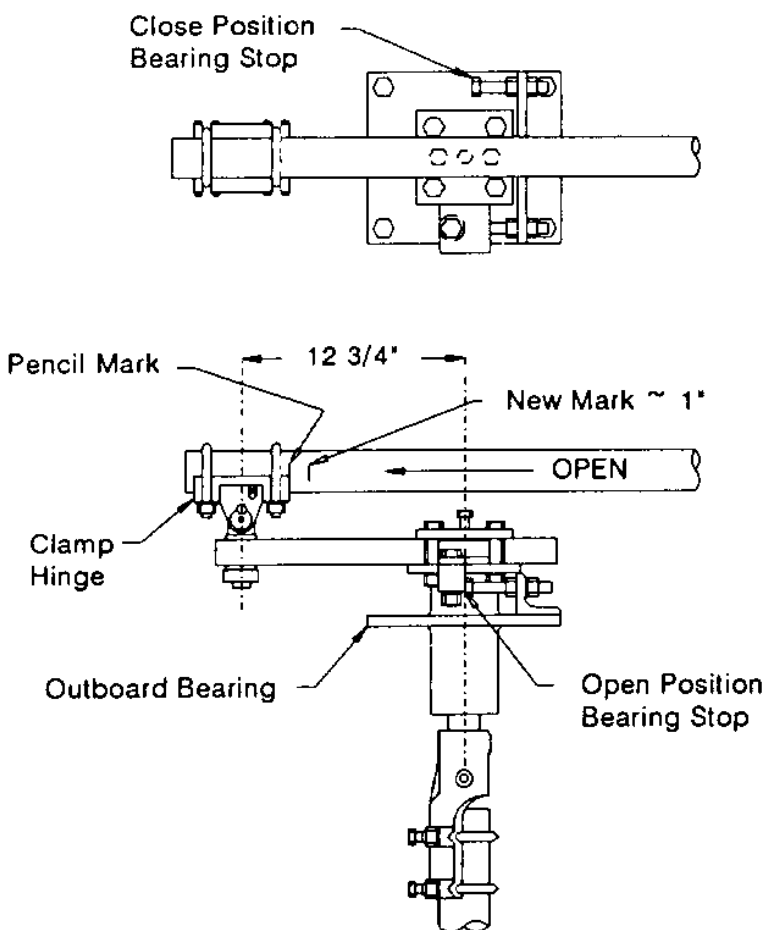


Figure 45 -- Group Control Pipe Adjustment
72-265-035-429


- 2. Hand crank towards close as group pipe slides in clamp hinge to above referenced mark. It is important that the group lever on the center pole and that the OB bearing lever does not move. Tighten U-bolts on clamp hinge equally and lightly set piercing screws.
- 3. Follow steps 1 through 19, pages 25-28, of preceding Final Adjustment Section.

Baseline Data

An effective maintenance program begins during installation of the circuit switcher. It is strongly recommended that a permanent record of each circuit switcher be established at the time of installation and maintained throughout the life of the equipment. Included in this log should be the complete records of all installation, inspection, maintenance and lubrication work performed.

It is particularly important to establish baseline data at the time of installation. The change of an operating parameter is normally more significant than the absolute value of the parameter.

Adherence to the procedures identified in the "Installation Checklist" which follows, and verification that the items checked are within the allowable tolerances, will assure a proper installation. This information can then be used as a base reference for future maintenance.

**CAUTION**

Improper operation of switcher may result in equipment damage.

To prevent:

Do not operate the switcher until all tests and inspections are done.

If the contact part time exceeds 6 cycles, the difficulty may be due to an excessive voltage drop in the DC control cable to the switcher.

Contact resistance should be measured terminal to terminal with a ductor, or equivalent 100 amp DC source. Record the contact resistance of each pole to provide a permanent baseline reference to which future measurements can be compared.

Establishing a baseline value is particularly important for contact resistance measurements. Small variations in the chemical makeup of alloys used in the interrupter are inevitable, and these can cause noticeable differences in the pole unit resistance. In diagnosing impending problems, the change in contact resistance with time is far more significant than the absolute value of resistance.

Final Adjustment and Inspection

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Checklist

Installation Date _____

1. Nameplate Data _____

1.1 Switcher Type _____

Rating: _____ kV _____ amp

Serial-S.O. _____

Instruction Book PB-3918

1.2 Mechanism Type CM-4

Instruction Book PB-3918

Control Diagram _____

Control Voltage _____

Motor and Heater Voltage _____

2. General Condition of Switcher when Received _____

NOTE: The following checks are to be made after the switcher has been installed on its permanent foundation.

3. Switcher bolted to its permanent foundation and shipping braces removed.

4. Grounding connections installed.

(left) _____

(right) _____

5. Control wiring installed.

6. Switcher filled with SF₆ (see Figure 47).

_____ psig

Ambient Temperature _____ °F

7. Final check of switcher for loose hardware.

8. Timing tests (At normal operating voltage).

8.1 Trip command until contacts part (maximum 6 cycles).

_____ milliseconds

8.2 Close command until contacts touch (8 seconds maximum).

_____ seconds

Final Adjustment and Inspection

9. Contact resistance terminal to terminal measured with ductor or equivalent 100 amp DC source. (Maximum for new contacts: 242 kV, 90 micro-ohms; 169 and 145 kV, 85 micro-ohms; 121 kV, 75 micro-ohms.)

(Pole 1) _____ micro-ohms
(Pole 2) _____ micro-ohms
(Pole 3) _____ micro-ohms
10. Operation counter reading as left

11. SF₆ gas pressure as left

_____ psig Ambient temperature _____ °F
12. Check all labels and nameplates attached to the switcher to be sure that they are securely fastened in place and are readable.

Final Adjustment and Inspection

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Inspection

The intent of this section is to identify the parameters which can be used to establish and carry out a proper program to assure reliability of the equipment.

Of primary importance in carrying out an effective program is that the individuals involved understand the equipment, how it is to function, and the potential problems should out-of-specification conditions exist.

It is desirable to maintain a permanent record of each circuit switcher. Included in this log should be the complete records of all installation, inspection, maintenance, and lubrication work performed. Installation, Periodic, 3 Year Inspection, 6 Year Inspection and Major Inspection Checklists should be included as well as information relative to the number of faults and associated current magnitudes the switcher has been required to interrupt.


Record keeping of this type will permit accurate evaluation of the conditions of the switcher at all times and assure reliable service if the suggested procedures are followed. In addition, it will permit the comparison of present-day values of such items as contact resistance and contact timing to previously obtained data.


Many of the tests which are made are diagnostic type tests which will provide information relative to potential problems. This is to say that when one analyzes the test results and compares the results with previous test data, it can be determined whether a change is normal or whether it is one which requires attention.

An effective maintenance program begins during the installation of the equipment. A copy of an Installation Checklist follows the INSTALLATION section of this book. Adherence to the procedures identified on the Installation Checklist and verification that the items checked are within the allowable tolerances will assure a proper installation. This information is then to be used as a base reference for future maintenance. The checklists do not provide an in depth description of the checks and tests to be made. This information is contained in the text of this instruction book. Switchers installed in areas of severe environmental conditions may require more frequent inspection. It is recommended that frequent visual inspections be made by operators while touring the switchyard in order to observe any obvious abnormal conditions.

General

Thorough, periodic inspection is important to satisfactory operation. Inspection and maintenance frequency depends on installation site, weather and atmosphere conditions, experience of operating personnel and special operation requirements. Because of this, a well-planned and effective maintenance program depends largely on experience and practice.



**DANGER**

Hazardous voltage and mechanisms. Death or serious injury from electrical shock, burns, and entanglement in rapidly moving parts will result.

To prevent:

1. Do not service or touch until you have de-energized high voltage, grounded all terminals and turned off control voltage.
2. Never trip or close the switcher while working on it, since the parts move rapidly and can cause injury.
3. Discharge the switcher's mechanical systems before performing maintenance or inspection.
4. Switcher and its mechanism must be disconnected from all electrical power before performing maintenance or inspection. Grounding leads should be properly attached and framework grounded.
5. Only qualified personnel should work on or around this equipment after becoming thoroughly familiar with all warnings, safety notices, instructions and maintenance procedures contained herein. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation and maintenance.

Final Adjustment and Inspection



WARNING

Failure to properly maintain the equipment could result in death, serious injury, product failure, and prevent successful functioning of connected apparatus.

To prevent:

The instructions contained here should be carefully reviewed, understood and followed. The following maintenance procedures should be performed regularly.



WARNING

The use of unauthorized parts in the repair of the equipment could result in death, serious injury, or equipment damage.

To prevent:

Follow all safety instructions contained herein.

STEP 1

Be sure that the circuit switcher and its mechanism is disconnected from all electric power, both high voltage and control voltage, before it is inspected or repaired.

STEP 2

After the circuit switcher has been disconnected from power lines, attach the grounding leads properly before touching any of the circuit switcher parts.

STEP 3

Keep the motor operator clean.

STEP 4

Be sure the circuit switcher is well grounded.

STEP 5

See that bolts, nuts, washers, and all terminal connections are in place and tight.

STEP 6

At all inspections operate the circuit switcher by hand to see that the mechanism works smoothly and correctly before operating it with power.

THIS CHECKLIST DOES NOT REPRESENT AN EXHAUSTIVE SURVEY OF MAINTENANCE STEPS NECESSARY TO ENSURE SAFE OPERATION OF THE EQUIPMENT. PARTICULAR APPLICATIONS MAY REQUIRE FURTHER PROCEDURES. SHOULD FURTHER INFORMATION BE DESIRED OR SHOULD PARTICULAR PROBLEMS ARISE WHICH ARE NOT COVERED SUFFICIENTLY FOR THE PURCHASER'S PURPOSES, THE MATTER SHOULD BE REFERRED TO THE LOCAL SIEMENS SALES OFFICE.

Periodic Inspection Procedure

Periodic Inspections should be made at monthly and semi-annual intervals to assure continued satisfactory performance of the switcher. At the end of this section is a Periodic Inspection Checklist.

3-Year And 6-Year Inspection Procedure

An inspection should be made every 3 years and used as an additional guideline in determining the necessity of maintenance. This inspection includes checks which may be made externally. At the end of this section is a copy of a 3-Year and a 6-Year Inspection Checklist which identifies those items which can be checked without removing the gas from the switcher. By making the checks identified on the list, it can be verified whether or not the switcher is satisfactory for continued service without performing a Major Inspection.

Major Inspection

Major inspection is that which requires removal of the gas from the switcher to determine the condition of the interrupters, contacts, and other internal components. A Major Inspection should be performed when:

1. The accumulated interruptions equal 20-20kA faults.
2. After completing a year of daily capacitor switching duty.

This schedule should be modified based on the information obtained from the 3-Year and 6-Year Inspections, and on accumulated experience of switcher characteristics and duty.

Final Adjustment and Inspection

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Periodic Inspection Checklist

Station	Bus or Line
Date of Inspection	
1. Nameplate Data	
1.1 Switcher Type	Amp.
Serial-S.O.	I.B. PB-3918
1.2 Mechanism Type CM-4	I.B. PB-3918
Control Diagram	Control Voltage
Motor and Heater Voltage	

Monthly Checks

2. General Condition of Switcher:	
3. Operation Counter Reading	
4. SF ₆ Gas Pressure	SF ₆ Pressure psig
	Ambient Temperature °F

6 Month Checks

(In Addition to Monthly Checks)

5. Check all labels and nameplates attached to the switcher to be sure that they are securely fastened in place and are readable.	
-----------------------------------------------------------------------------------------------------------------------------------	--

Annual Check

(In Addition to Monthly Checks and 6 Month Check)

6. Time to close the switcher (8 seconds maximum)	
---------------------------------------------------	--

Final Adjustment and Inspection


3-Year Inspection Checklist

Station _____ Bus or Line _____


Date of Inspection _____

1. Nameplate Data

1.1 Switcher Type _____	Amp. _____
Serial-S.O. _____	I.B. PB-3918
1.2 Mechanism Type CM-4	I.B. PB-3918
Control Diagram _____	Control Voltage _____
Motor and Heater Voltage _____	



WARNING



Hazardous voltage.
Death or serious injury due to electrical shock could result.

To prevent:

Prior to performing inspection of the switcher, trip the switcher and open adjacent switcher disconnect switches, solidly ground all terminals to remove residual electrical charge and open all A-C and D-C switches.

2. General Condition of Switcher: _____

3. Switcher Hold Down Bolts Tight _____

4. Grounding Connections Tight (Left) _____

(Right) _____

Final Adjustment and Inspection

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CAUTION

Improper operation of switcher may result in equipment damage.

To prevent:

Do not operate the switcher until all tests and inspections are done.

5. Motor Operator

5.1 General Checks:

- 5.1.1 Condition of motor operator. Corrosion of hardware. Loose hardware.
- 5.1.2 Connections on terminal blocks, switches, and relays; tight and no corrosion.
- 5.1.3 Heater(s) operating properly.
- 5.1.4 Wiring: deteriorated or damaged insulation.
- 5.1.5 Check the hand crank and the interlock handle.

- 6. Contact resistance terminal-to-terminal measured with ductor or equivalent 100 amp d-c source (150 micro-ohms maximum for used contacts). If maximum micro-ohms values are greater than those listed a major inspection is required.

(Pole 1) _____ micro-ohms

(Pole 2) _____ micro-ohms

(Pole 3) _____ micro-ohms

- 7. Operation Counter Reading as Left
- 8. Check the disconnect live parts for any damage or corrosion.
- 9. SF₆ Gas Pressure as Left

SF₆ Pressure _____ psig

Ambient Temperature _____ °F

Final Adjustment and Inspection

6-Year Inspection Checklist

Station _____ Bus or Line _____

Date of Inspection _____

1. Nameplate Data

1.1 Switcher Type _____

Serial-S.O. _____

1.2 Mechanism Type SE-4A

Control Diagram _____

Motor Voltage _____


Amp. _____

I.B. PB-3918


I.B. PB-3918

Control Voltage _____

Heater Voltage _____



WARNING



Hazardous voltage.
Death or serious injury due to electrical shock could result.

To prevent:

Prior to performing inspection of the switcher, trip the switcher and open adjacent switcher disconnect switches, solidly ground all terminals to remove residual electrical charge, and open all AC- and D-C switches.

2. General Condition of Switcher: _____

3. Switcher Hold Down Bolts Tight _____

4. Grounding Connections Tight (Left) _____

(Right) _____

Final Adjustment and Inspection

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CAUTION

Improper operation of switcher may result in equipment damage.

To prevent:

Do not operate the switcher until all tests and inspections are done.

5. Motor Operator

5.1 Wire Check:

- 5.1.1 Inspect wiring for damaged or deteriorated insulation.
- 5.1.2 Inspect wiring for possible grounds or short circuit.
- 5.1.3 Connections on terminal blocks, switches, and relays; tight and no corrosion.
- 5.1.4 Heaters; electrical continuity and terminals not shorted to ground.

5.2 Condition of motor operator. Corrosion of hardware. Loose Hardware

6. Switcher Checks

- 6.1 Install manual operating device and check the mechanism linkage to make sure all connecting rods operate freely and without interference during a manual operation.

- 6.2 Final check for loose hardware. Remove manual operating device. Reconnect the power line connections.

Interrupter 1

Interrupter 2

Interrupter 3

Mechanism

Final Adjustment and Inspection

7. Timing Tests: (These tests are to be made at normal operating voltage and SF₆ fill pressure in the interrupters.

7.1 Trip coil energized until contacts part. (6 cycles). Pole simultaneity opening with shunt trip ≤ 12 msec.

_____ milliseconds

7.2 Close command until contacts touch. (8 seconds max.) Pole simultaneity closing ≤ 16 msec.

_____ seconds

8. Contact resistance terminal to terminal measured with ductor or equivalent 100 amp d-c source (150 micro-ohms max. for used contacts. If maximum micro-ohm values are greater than those listed a major inspection is required.)

(Pole 1) _____ micro-ohms

(Pole 2) _____ micro-ohms

(Pole 3) _____ micro-ohms

9. Operation Counter Reading as Left

10. SF₆ Gas Pressure as Left

SF₆ Pressure _____ psig

Ambient Temperature _____ °F

Final Adjustment and Inspection

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Major Inspection Checklist

Station _____ Bus or Line _____

Date of Major Inspection _____

Installation Date _____

1. Nameplate Data


1.1 Switcher Type _____ Amp. _____

Serial-S.O. _____ I.B. _____ PB-3918


1.2 Mechanism Type _____ CM-4 I.B. _____ PB-3918

Control Diagram _____ Control Voltage _____

Motor and Heater Voltage _____



WARNING



Hazardous voltage.
Death or serious injury due to
electrical shock could result.

To prevent:

Prior to performing inspection of the
switcher, trip the switcher and open
adjacent switcher disconnect switches,
solidly ground all terminals to remove
residual electrical charge and open all
A-C and D-C switches.

2. General Condition of Switcher: _____

3. Switcher Hold Down Bolts Tight _____

4. Grounding Connections Tight (Left) _____

(Right) _____

Final Adjustment and Inspection



CAUTION

Improper operation of switcher may result in equipment damage.

To prevent:

Do not operate the switcher until all tests and inspections are done.

5. Motor Operator

5.1 Wire Check:

- 5.1.1 Inspect wiring for damaged or deteriorated insulation.
- 5.1.2 Inspect wiring for possible grounds or short circuit.
- 5.1.3 Connections on terminal blocks, switches, and relays; tight and no corrosion.
- 5.1.4 Heaters; electrical continuity and terminals not shorted to ground.

- 5.2 Condition of motor operator. Corrosion of hardware. Loose hardware.



WARNING

Hazardous arc products.
Death or serious injury could result.

To prevent:

Refer to PART REPLACEMENT Section for precautions to be observed when handling arced SF₆ gas.

ft.-lb.

Final Adjustment and Inspection

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6. Timing Tests: (These tests are to be made at normal operating voltage and SF₆ fill pressure in the interrupters.)

6.1 Trip coil energized until contacts part. (6 cycles). Pole simultaneity opening with shunt trip \leq 12msec.

_____ milliseconds

6.2 Close coil energized until contacts touch (8 seconds max.). Pole simultaneity closing \leq 16msec.

_____ milliseconds

7. Contact resistance terminal to terminal measured with ductor or equivalent 100 amp d-c source (150 micro-ohms maximum for used contacts.)

(Pole 1) _____ micro-ohms

(Pole 2) _____ micro-ohms

(Pole 3) _____ micro-ohms

8. Operation Counter Reading as Left

9. SF₆ Gas Pressure as Left

SF₆ Pressure _____ psig

Ambient Temperature _____ °F

Technical Data

Mechanical

Terminal Pad Loading

Tension/compression	
-- in line with terminals	300 lbs.
-- perpendicular to terminals	150 lbs.
Static weight	250 lbs.
Moment	625 in.-lbs.

Approximate Weights

Interrupter/driver	500 lbs [230] kg
Shunt trip unit	50 lbs [23] kg
One single pole (complete)	2700 lbs [1242] kg
Motor Operator	250 lbs [115] kg

Recommended Timing

Pole simultaneity opening (with shunt trip)	≤12 ms
Pole simultaneity closing	≤16 ms
Motor start to close position	8 sec.
Trip time without shunt trip	1 sec.

Electrical

Ratings

	Type CPS and CPS-VB
Max design voltages	72.5/121/145/169/242 kV
Frequency	60 Hz
Continuous current ratings	1200/1600A
Short circuit current	20 kA sym
Short-time current 10 cy.	108 kA peak
Close and latch current	40 kA sym
Interrupting time	6 cycle
Interrupter BIL's	350/550/650/750/900 kV

Operating Current Ratings

Device	@48 VDC	@125VDC
Motor Inrush Current	75A	33A
Motor Running Current	15A	7.5A
Trip Coil Currents	24A	24A
Reversing Contactor Coil	1A	.5A
Anti-Pump Relay Coil	0.2A	0.1A
Time Delay Relay Coil	0.2A.	1A
Motor Fuses	30A	15A
Heater Fuses	30A	15A

Shunt Trip Unit

125 V dc trip coil res.	15.5 ohm
48 V dc trip coil res.	5.7 ohm
Heater resistance	500 ohm

Note

AVOID ELECTRICALLY CLOSING INTO A MADE-UP TRIP CIRCUIT. Testing to simulate closing into a fault condition should be done by completing the trip circuit through a main interrupter contact. Although the interrupter and shunt trip units are designed to perform satisfactorily under actual trip-free conditions, discharging the shunt trip units prior to the closing action of the interrupter contacts causes the unexpended energy of the interrupter closing spring to be absorbed by the shunt trip unit. This unnecessarily creates conditions which can have an adverse affect on the operating life of the shunt trip units.



WARNING

Closing into a made-up trip circuit may result in equipment damage.

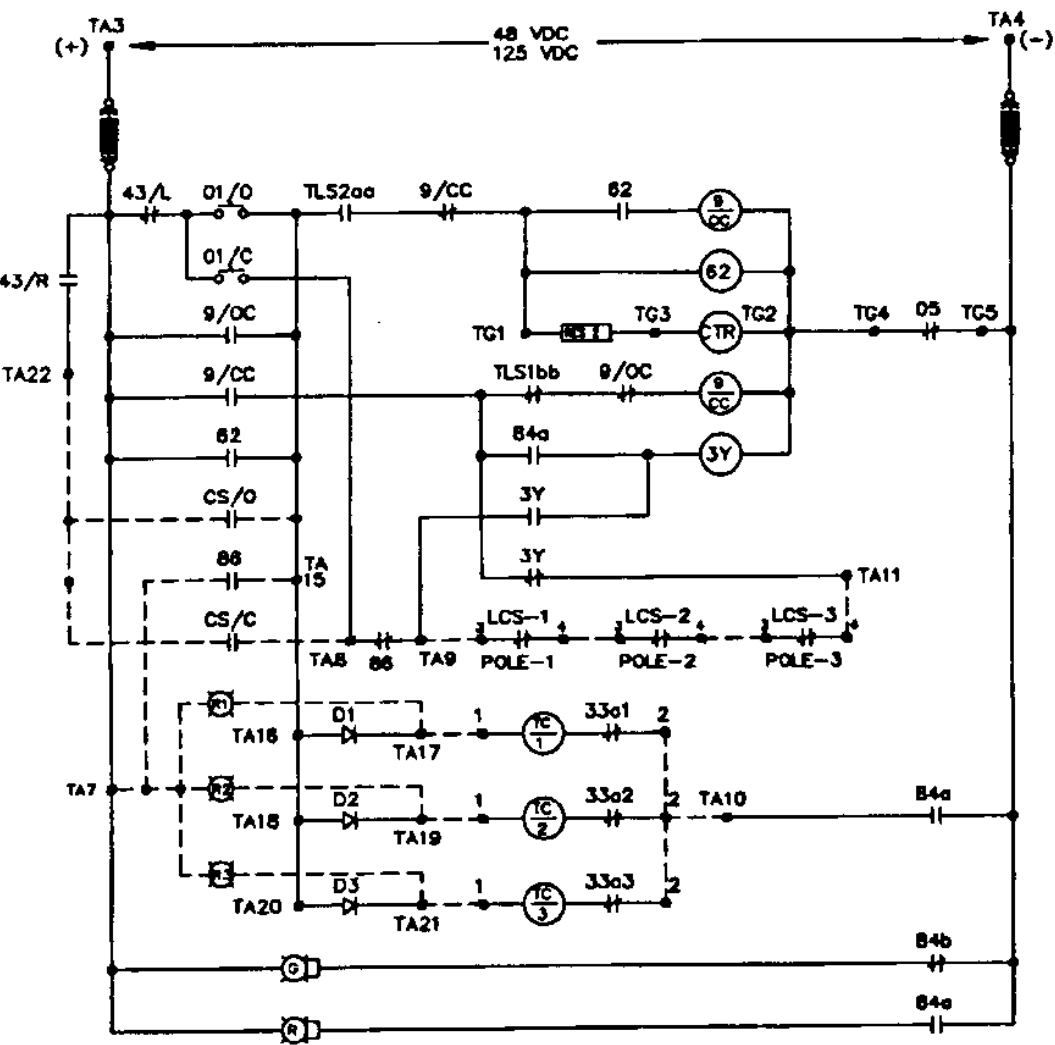
To prevent:

Trip tests should be made by completing the trip circuit through a main interrupter contact.

Technical Data

Control Schematics

The electrical diagrams shown (Figures 46a and 46b) are typical and are only for general information. Refer to drawing packet for drawings that apply to your installation.



Schematic Legend	
CTR	Operations Counter
D	Diodes
01/O	Push Button Open
01/C	Push Button Close
3Y	Anti-Pump Relay
TC	Trip Coil
33a	TC Cutoff Switch (Closed when S.T. charged)
LCS	Latch Check Switch (Closed when S.T. charged)
Ø	Terminal Block Points in Motor Operator
Q	Terminal Block Points Shunt Trip Units
43 L/R	Local Remote Switch
R	Red Light
G	Green Light
05	Hand Crank Interlock Switch
9/CC	Close Contactor
9/OC	Open Contactor
23	Thermostat
62	Time Delay (Fixed) Relay
84M	Motor Mechanism
84 a&b	Internal Auxiliary Switch
TLS-1aa	Limit Switch, Open Except in Mech. Final Closed Position
TLS-1bb	Limit Switch, Closed Except in Mech. Final Closed Position
TLS-2aa	Limit Switch, Open Only in Mech. Final Open Position
TLS-2bb	Limit Switch, Closed Only in Mech. Final Open Position
86	Customer L.O.R

Figure 46a -- Typical Control Circuit

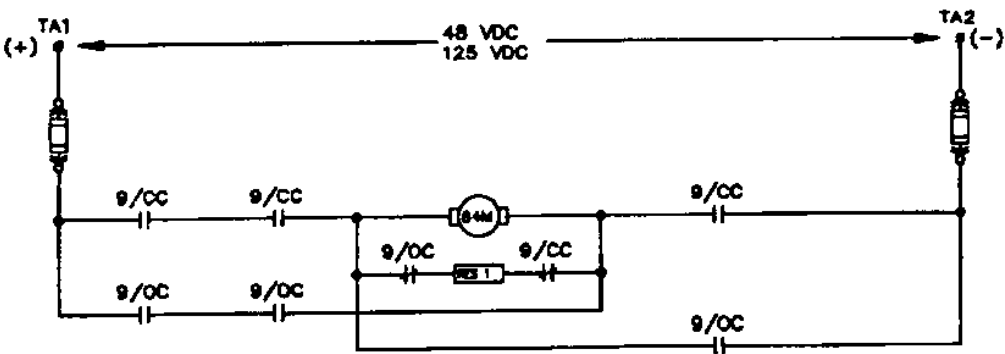


Figure 46b -- Typical Motor Circuit

Technical Data

Sulfur Hexafluoride

Arc-Quenching Medium (SF₆)

Approximate Quantity per pole	3.2 lbs.
Approximate Volume per pole	1.26 cu. ft.
Rated Pressure at 20°C 169kV and Below	81 psig
Rated Pressure at 20°C 242kV Only	86 psig

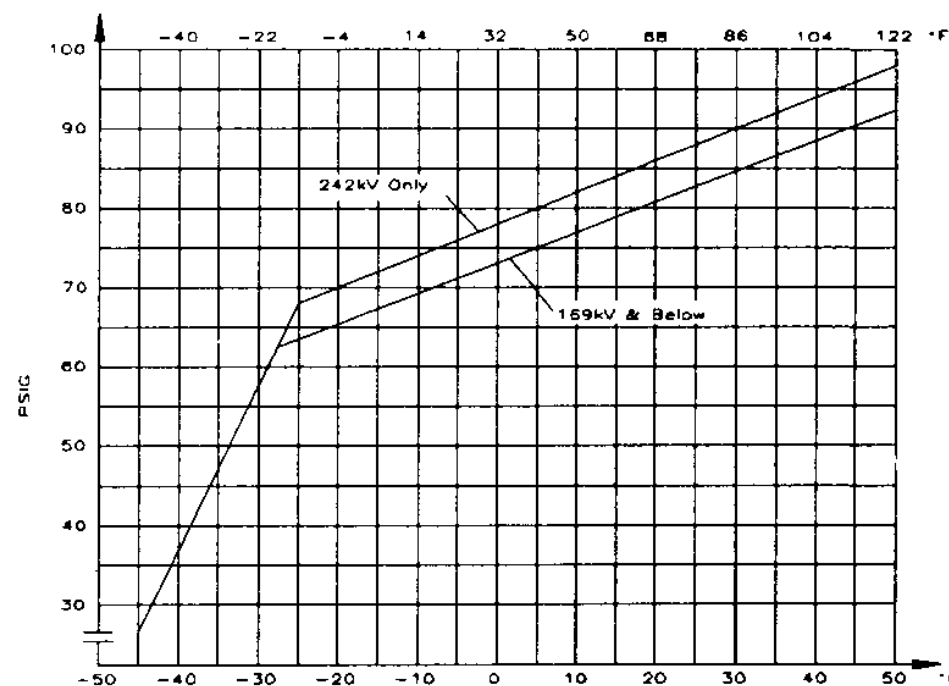


Figure 47 -- Pressure Vs. Temperature Curve

72-265-035-436

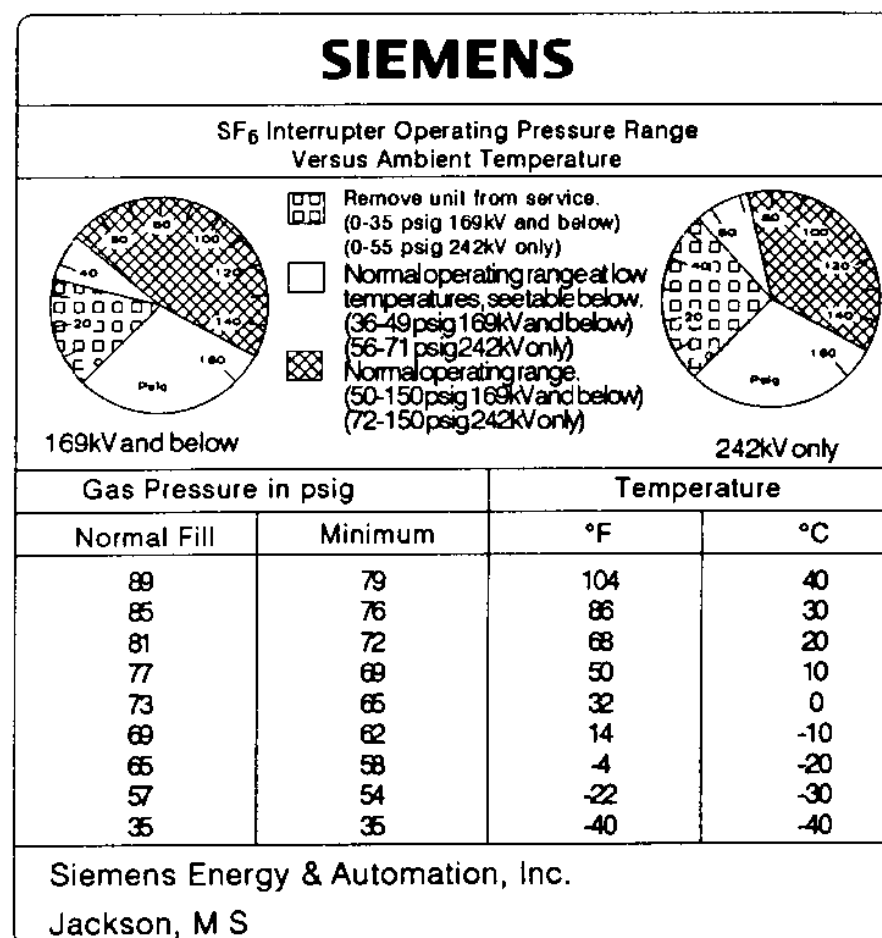



Figure 48 -- SF₆ Operation Pressure Range Vs. Temperature


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Optional Equipment

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Refer to the contract drawings, i.e. equipment list, mechanical control arrangement, electrical diagrams, etc. for specific details of the equipment supplied. The contract drawings take precedence over descriptions and technical data included in this manual.

**WARNING**



Hazardous voltage.
Contact could result in death or serious injuries from electrical shock.

To prevent:

Do not contact energized parts when cover is removed.

The contact position of each auxiliary switch is adjustable in 15° steps through 360° so the auxiliary switch will register the position of the circuit switcher when fully open, fully closed, or at some intermediate position. Adjust the auxiliary switch as follows:

1. Set the circuit switcher to the position to be registered.
2. Back the circuit switcher off from this position about 15°.
3. Grasp auxiliary switch rotor contact with pliers, and lift the rotor contact against the spring. The entire contact ring will be disengaged from the gear teeth.
4. Rotate rotor contact to "contact" position, see Figure 49b.
5. Release rotor contact. Be sure gear teeth reengage.
6. Reset the circuit switcher to the desired position. The adjusted rotor should still be in "contact" position.
7. Connect appropriate wires to terminals.

Auxiliary Switch

Some Circuit Switcher installations will require an auxiliary switch operated by the vertical control pipe. Mounting location will be shown on the control arrangement drawing. Refer to Figure 49a.

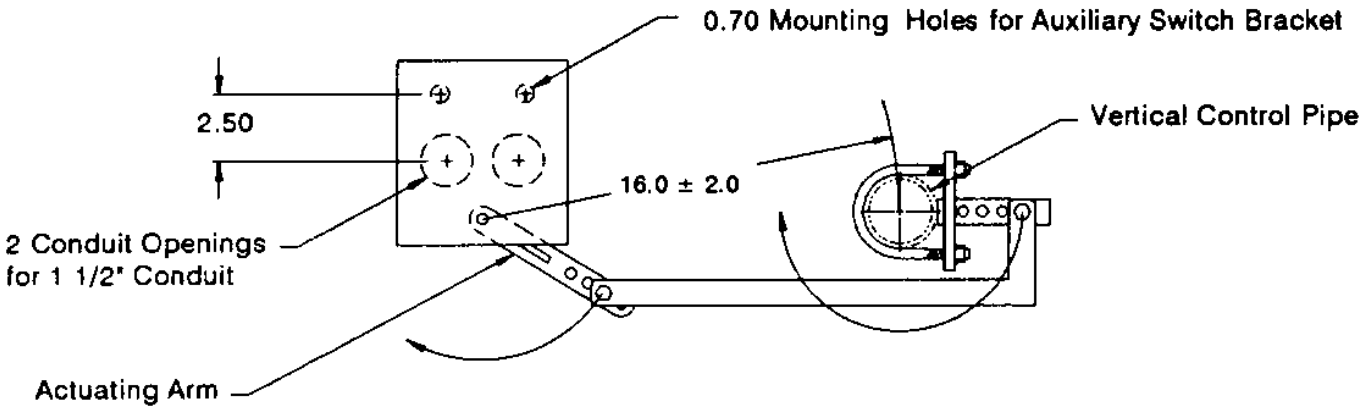


Figure 49a -- Auxilliary Switch Mounted on Control Pipe, Top View

72-265-035-438

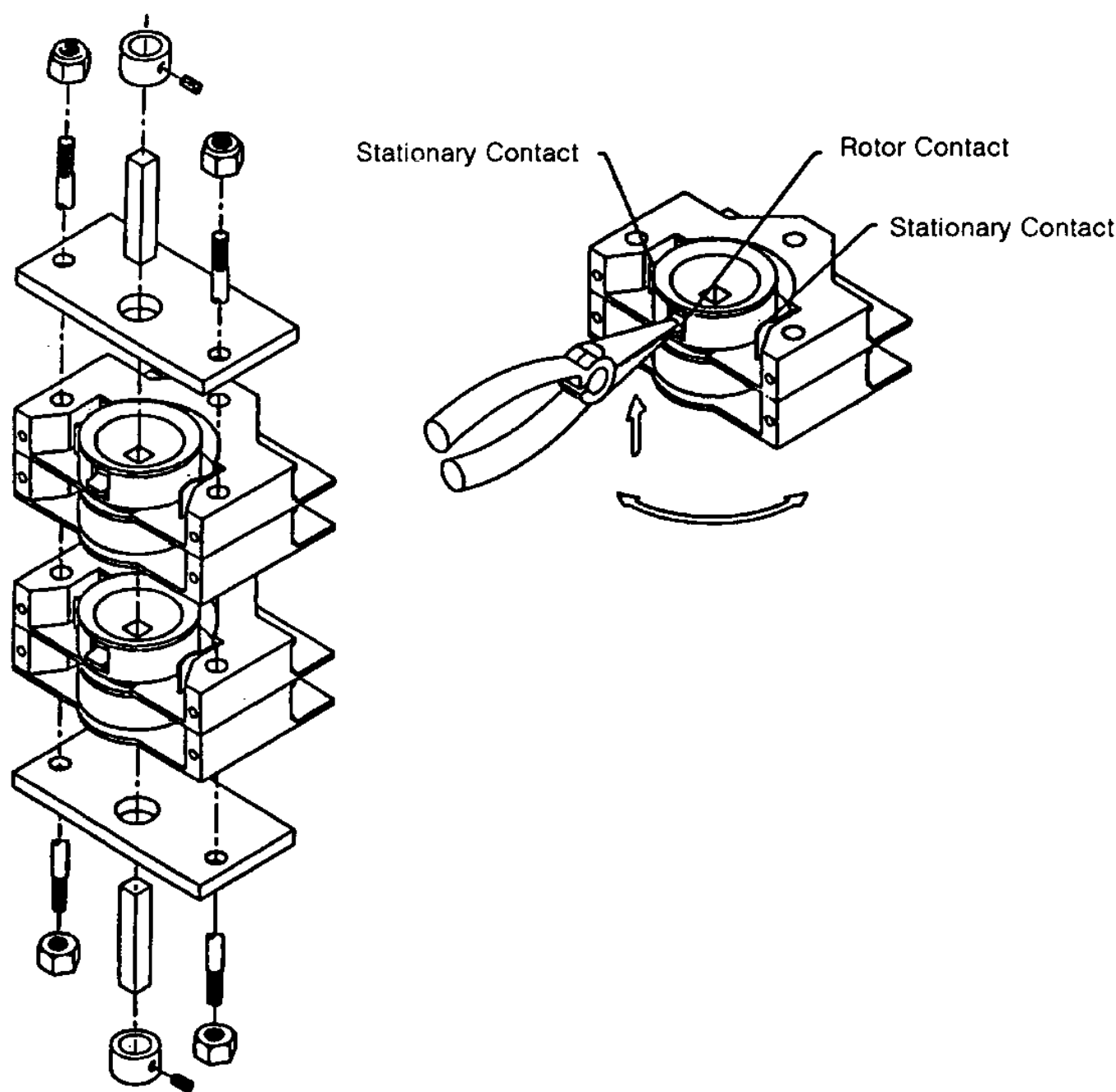


Figure 49b -- Auxillary Switch -- Exploded View

72-265-035-440

Optional Equipment

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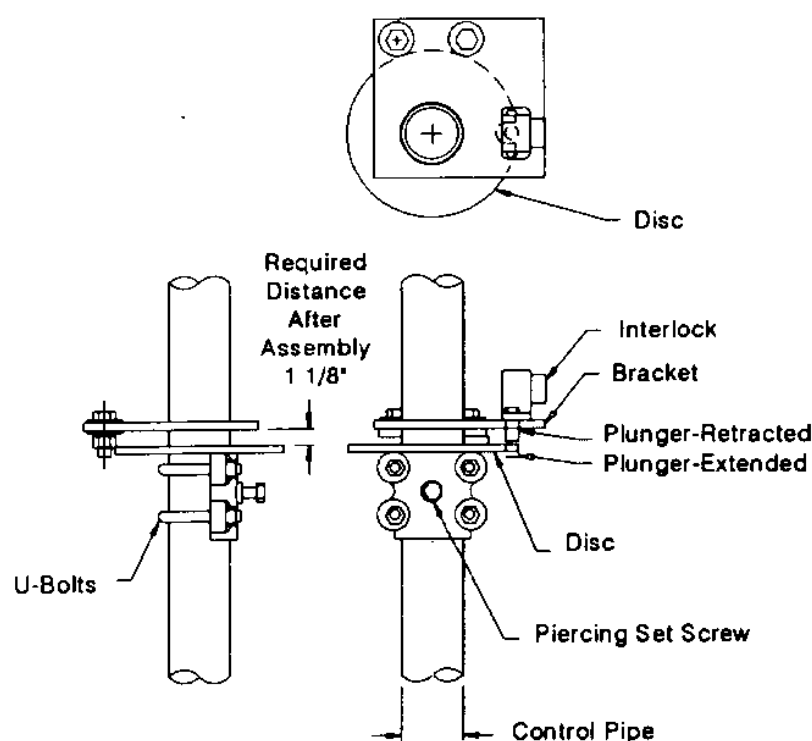


Figure 50 -- Key Interlock

72-265-035-039

Key Interlock

Installation and adjustment of a key interlock, when required, are given in the following steps. Refer to Figure 50.

1. Bolt mounting bracket with interlock to structure in position shown.
2. Slip disc on control pipe under bracket. Attach loosely with U-bolts. Do not set piercing set screw.
3. Set switch to be locked in lock position. Turn disc freely on control pipe until slot is under plunger. Extend plunger into slot.
4. Tighten U-bolts. Retract plunger. Operate switch and return to lock position. Extend plunger again.
5. Repeat operations until interlock operates easily.
6. Tighten piercing set screw until head of screw is against clamp.

Optional Equipment

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Mobile Substation Applications

The following procedures are necessary to assure proper Circuit Switcher operation when moving and setting up the Mobile Substation for service at a new location. The interphase control pipe and interphase braces must be disconnected and then reinstalled without changing any of the setup adjustments.

For Road Transit:

1. Disconnect source and load side conductors to substations following accepted safety practices.
2. Close the Circuit Switcher.
3. Pull down the hand crank interlock handle in the motor operator and trip the Circuit Switcher. This leaves the switch blades in the closed position, interrupters discharged, and shunt trip units discharged. Linkages and pins are unloaded in this position.
4. Remove pins joining the clamp hinges and adjustable clevis of the interphase pipe to the switch operating levers. It may be necessary to slightly hand crank the motor operator to remove any pin load that might remain. Do not change the setting of the adjustable clevis.
5. Remove interphase brace channels between poles.
6. Outside switch poles are now ready to retract inboard towards the center pole.

To Set Up For Service:

1. Extend outside switch poles as described by mobile substation manufacturer.
2. Install interphase brace channels noting color coding so that same channel positions are maintained between poles.
3. Install interphase control pipe again noting color coding.
4. Hand crank Circuit Switcher to full open position and verify that shunt trips have required 1/8" gap.
5. As final check, close and open Circuit Switcher with motor operator before placing into service.

Maintenance

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Frequency

The Circuit Switcher device has been designed to operate with low maintenance. An annual checkout is recommended - more to exercise the equipment in most instances than to maintain. After about 20 full fault interruptions or a year of daily capacitor switching duty, maintenance should be considered.

General

Thorough, periodic inspection is important to satisfactory operation. Inspection and maintenance frequency depend on installation site, weather and atmospheric conditions, experience of operating personnel and special operation requirements. Because of this, a well-planned and effective maintenance program depends largely on experience and practice.



WARNING

Failure to properly maintain the equipment could result in death, serious injury or product failure, and can prevent successful functioning of connected apparatus.

To prevent:

The instructions contained herein should be carefully reviewed, understood, and followed. The following maintenance procedures should be performed regularly.

STEP 1

Be sure that the Circuit Switcher and its operator are disconnected from all electric power, both high voltage and control voltage, before it is inspected or repaired.

STEP 2

Make sure that the springs have been discharged before working on the Circuit Switcher or operator.

STEP 3

After the Circuit Switcher has been disconnected from power lines, attach the grounding leads properly before touching any of the Circuit Switcher parts.

STEP 4

Keep the mechanism clean.

STEP 5

Be sure the Circuit Switcher and operator are well grounded.

STEP 6

See that bolts, nuts, washers, cotter pins and all terminal connections are in place and tight.



DANGER

Hazardous voltage and mechanisms. Death or serious injury due to electrical shock, burns and entanglement in moving parts, or property damage will result if safety instructions are not followed.

To prevent:

1. Do not service or touch until you have de-energized high voltage, grounded all terminals, and turned off control voltage.
2. Never trip or close the Circuit Switcher while working on it since the parts move rapidly and can cause injury.
3. Discharge the Circuit Switcher's energy storage system before performing maintenance or inspection.
4. Circuit Switcher and its operator must be disconnected from all electrical power before performing maintenance or inspection. Grounding leads should be properly attached and framework grounded.
5. Only qualified personnel should work on or around this equipment after becoming thoroughly familiar with all warnings, safety notices, instructions, and maintenance procedures contained herein. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation, and maintenance.



Inspection Checks

THE FOLLOWING CHECKLISTS DO NOT REPRESENT AN EXHAUSTIVE SURVEY OF MAINTENANCE STEPS NECESSARY TO ENSURE SAFE OPERATION OF THE EQUIPMENT. PARTICULAR APPLICATIONS MAY REQUIRE FURTHER PROCEDURES. SHOULD FURTHER INFORMATION BE DESIRED OR SHOULD PARTICULAR PROBLEMS ARISE WHICH ARE NOT COVERED SUFFICIENTLY FOR THE PURCHASER'S PURPOSES, THE MATTER SHOULD BE REFERRED TO THE LOCAL SIEMENS SALES OFFICE.

1. Measure and keep a record of interrupter contact resistances. New units will not exceed 90 microhms. An upper limit before concern is about 150 microhms.
2. Check SF₆ gas pressure and correlate reading with Temperature Vs. Pressure Curve given in Figure 47.
3. Check and record contact simultaneity between poles on opening and closing. Timing range is given in the Technical Data Section.
4. Check for proper blade to jaw alignment and excessive contact wear, pitting or overheating.
5. Latch indicator positions on the drivers should be within the red band in the closed position, and within the green band in the open position.
6. Check for functioning space heaters in the shunt trips and motor operator.
7. Check for proper roller-to-latch clearance in the shunt trips.
8. A light coating of dry chain lubrication or motor oil is needed for the motor operator drive chain.
9. Check the motor operator door gasket for sealing effectiveness.
10. All hardware should be checked for tightness.

Repair Procedures

Access to or replacement of main component assemblies should be done by referring to the following sections.

The use of unauthorized parts in the repair of the equipment, tampering by unqualified personnel, or incorrect adjustments can result in dangerous conditions which could cause serious personal injury or equipment damage. Follow all safety instructions contained herein.

Shunt Trip Coil Exchange

Refer to Figures 11, 12a, and 12b on pages 9 and 10 in the Operation section.

1. The Circuit Switcher should be in the full open position.
2. Remove the three 5/16-18 bolts on the cover of the shunt trip unit.
3. Cover may now be lifted vertically and propped into position.
4. Trip coil may now be replaced.
5. Upon reassembly, check for proper location of gasket in groove of shunt trip base plate before replacing cover.

Shunt Trip Exchange

Note Prior to beginning, match mark positions of shunt trip and lever (or levers if center pole) so re-assembly will be exactly the same.

1. Hand crank Circuit Switcher from full open position towards close about 6 turns. This is to remove shunt trip load from control linkages.
2. If original shunt trip unit is in discharged position, lift cover of new unit and with screw driver actuate solenoid plunger to discharge new unit (see Figures 12a and 12b on page 10).
3. Remove flexible conduit and leads from terminal block junction box.
4. Remove two opposite bolts on bottom of insulator stack and loosen the other two about 1/8 inch.
5. Remove two opposite bolts in bottom of shunt trip unit.
6. Place a sling around the metal collar between the driver and interrupter porcelain and put a strain on the sling.
7. Remove the other two bolts in the bottom of the shunt trip.
8. Lift up on the driver until the shunt trip is about 1/8 inch above the lever.

Maintenance

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- 9. Remove the two remaining bolts from the bottom of the insulator stack.
- 10. Slide out old-style unit and replace with new one.
- 11. Put bottom bolts in first, then lower the insulator stack leaving a 1/8 inch gap to align holes so insulator flange bolts can be started.
- 12. Readjust Circuit Switcher per Final Adjustment section of instruction book with particular attention given to shunt trip gap requirements.

Disconnect Blade Removal

- 1. Open the Circuit Switcher fully.
- 2. Mark position of blade in blade clamp.
- 3. Loosen bolts on blade clamp and relieve clamping pressure by wedging action until blade can be removed from clamp.

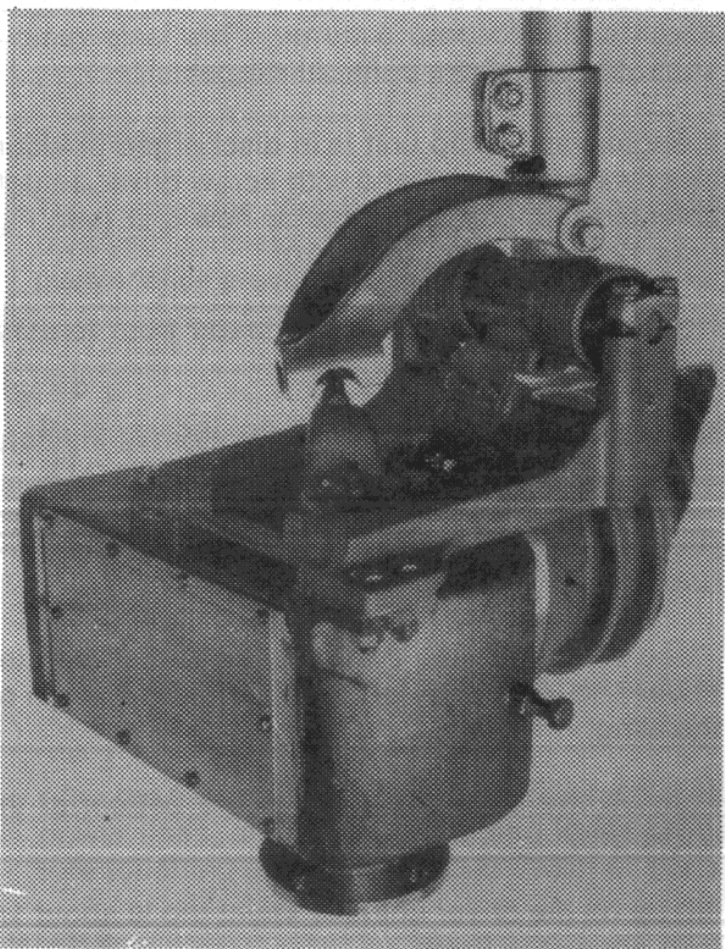


Figure 51 -- Hinge Mechanism

Crank Arm Removal

- 1. Remove the disconnect blade as previously described (see Disconnect Blade Removal section).
- 2. Open the switch fully. Unscrew the set screws locking "C" and "D" adjusting screws (see Figure 52). Loosen the "C" and "D" screws to release the fork from the ball stud.
- 3. If equipped with an ice shield, unscrew the cap nut from the screw in the center of the main driver shaft and remove the ice shield.
- 4. Remove the snap ring and washer from the main shaft.
- 5. Loosen the "A" and "B" screws (see Figure 52) and lift the crank arm off the main shaft.

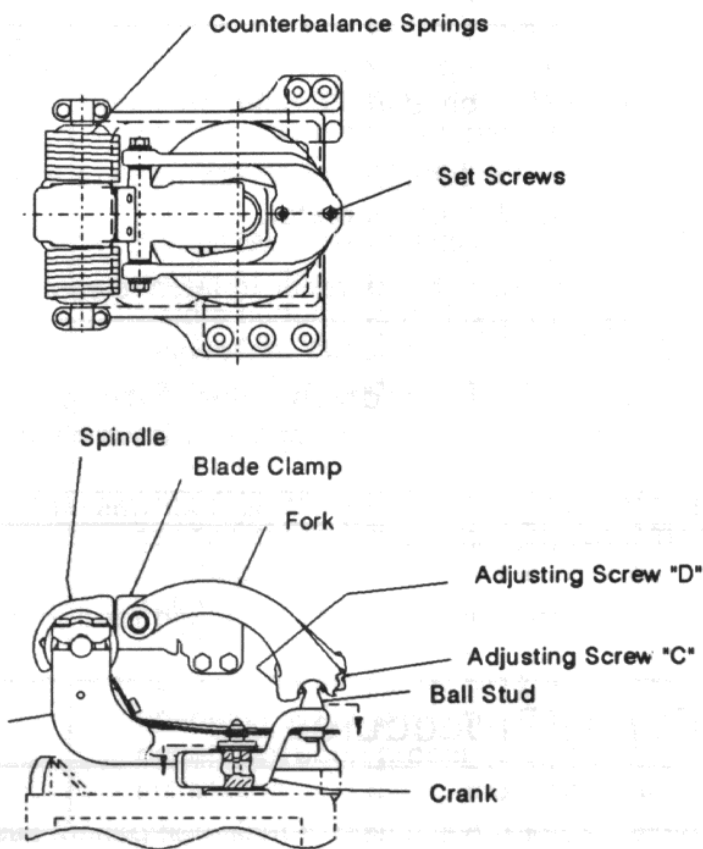
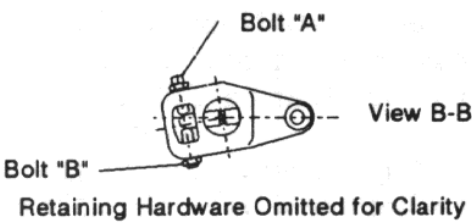


Figure 52 -- Hinge Mechanism Detail

72-265-035-404

Hinge Mechanism Replacement

1. With Circuit Switcher in the open position remove old hinge and crank arm assembly. Install new crank arm on driver shaft and bolt new hinge assembly to driver casting using an electrical joint compound on the joint interfaces. An anti-seize compound should be used on the threads of all stainless steel bolts and nuts.
2. Install blade in blade clamp using electric joint compound.
3. With fork disconnected from ball joint of crank arm by backing out "C" and "D" screws, close blade by hand to check contact alignment. Adjust jaw end insulator column if necessary. Refer to Figure 52.
4. Place blade back in vertical position and reconnect fork leaving ball stud centered in slot in fork.
5. For remainder of hinge adjustments refer to step 4 of the Final Adjustment section on page 25 for Methods A and B.

Interrupter/Driver Removal

1. Remove gas by using charging hose assembly. Refer to Figure 56.
2. Hand crank Circuit Switcher about 8 turns from the full open position towards the close position. (This is to remove shunt trip load from control linkage.)
3. Remove conductors from line terminals.
4. Sling the interrupter/driver assembly as shown in Figure 53.
5. Remove bolts at top of insulator columns, then lift the unit.

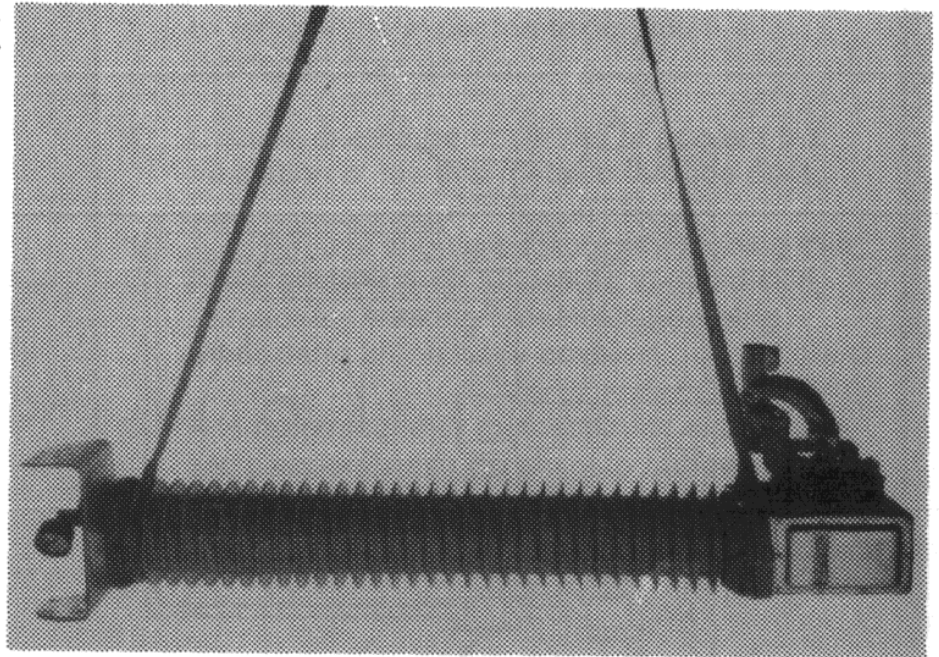


Figure 53 -- Lifting of Interrupter/Drive Unit



WARNING

Pressurized porcelain housing.
Rupture of the housing could cause death, serious injury, or damage to the units.

To prevent:

Do not strike, shock, or strain housing in any way.

Maintenance

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Removal of Driver from Interrupter

1. Interrupter/driver unit should be in the open position.
2. Remove interrupter/driver unit from support insulators and place on flat surface being careful to protect porcelain housing. Refer to the Interrupter/Driver section.
3. Remove window cover on the side of the driver.
4. With reference to Figure 54:

Remove air vent and louver, items 1 and 2. In the full open position, Item 3 should line up with the holes from which the vent and louver were removed. Using a 1/8" drift punch, drive out both spiral pins, item 4, from bushing link assemblies, item 5. Remove pins, item 3, through vent holes.

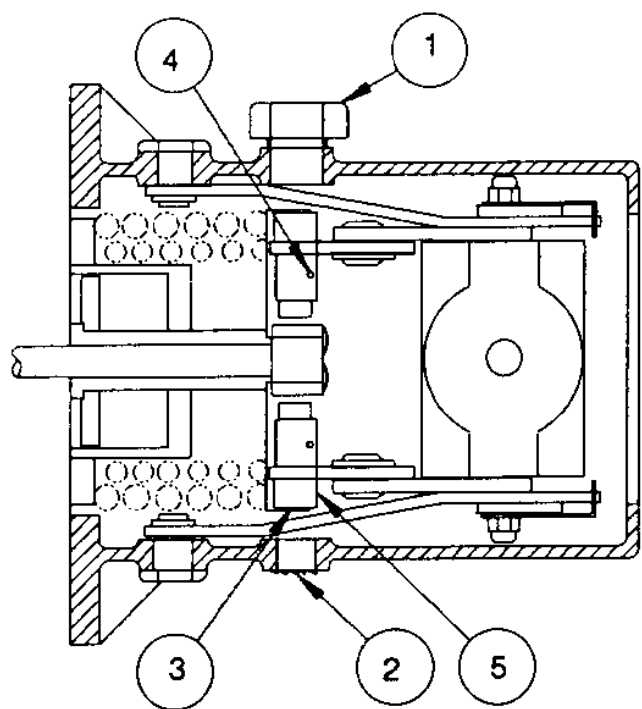


Figure 54 -- Internal Driver Detail

72-265-035-417

5. With reference to Figure 55:

Remove the four bolts, item 1. Remove the two stainless nuts, item 2, on driver side only.

6. Follow reverse procedure to install driver to interrupter.

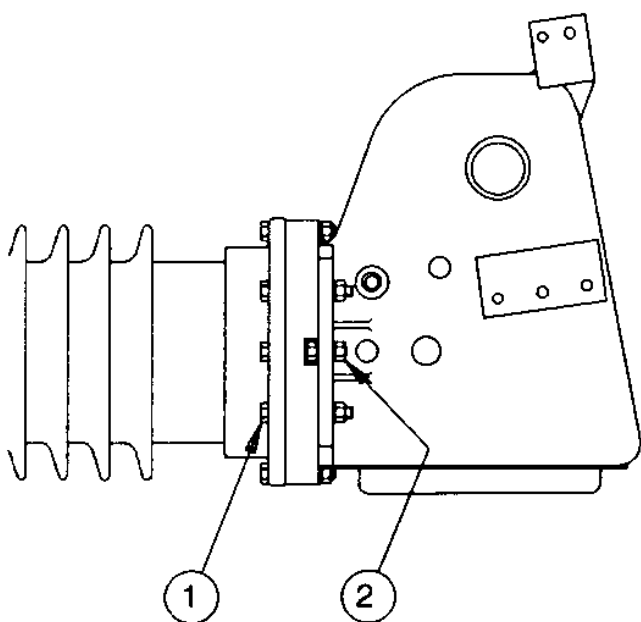


Figure 55 -- Driver/Interrupter Joint

72-265-035-413

Filling a De-Energized Pole Unit with SF₆

Each pole unit is shipped with a positive pressure of approximately 5 psig of SF₆; therefore, evacuation is not required before filling. Before filling with SF₆, check the pressure gauge to confirm that pressure has not been lost due to damage or leakage. If pressure is reduced to 0 psig it will be necessary to find and repair the cause of the leakage and then pull a vacuum to 2mm of hg before filling with SF₆. Before the pole unit is operated or placed into service, it must be filled with sulfur hexafluoride gas to the proper pressure taking into consideration the ambient temperature. (See Pressure Vs. Temperature Curve in Technical Data section, Figure 47.



WARNING

Hazardous SF₆ gas byproducts from arcing could result in serious injury.

To prevent:

1. Do not breathe gas containing these toxic products, especially within a few minutes after the covers have been removed or until the decomposition products are safely diluted with fresh air.
2. The absence of any detectable odor or nasal irritation should indicate safe working conditions.
3. Molecular sieves are incorporated in all SF₆ circuit switchers. This filter material is used to remove the expected toxic gases produced from arcing.
4. Caution should be observed to prevent the inhalation of the fine metallic fluoride dust.
5. A dust mask should be worn while doing this work, and it is also advisable to avoid skin irritation by wearing gloves and keeping other parts of the body covered.
6. It is recommended that workmen exposed to arc powders wash carefully to remove the metal salts from their skin.

Maintenance

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Equipment required:

- 1. SF₆ pressure regulator (preferred) or the SF₆ cylinder adapter (72-180-624-501) -- supplied with the Circuit Switcher fill kit.
- 2. Hose (W-136-005) -- supplied with the fill kit.
- 3. Female quick disconnect fitting (40-43B-97G-02) -- supplied with the fill kit.
- 4. Thermometer for ambient temperature measurement.

Maximum 3 lbs. of SF₆ will be required to completely fill each pole unit. To fill, proceed as follows:

- 1. Remove cap from the SF₆ cylinder fitting and attach the SF₆ pressure regulator or the special adapter.
- 2. Attach and tighten hose to regulator or adapter.
- 3. Attach female quick disconnect to the end of hose loosely.
- 4. "Crack" SF₆ cylinder valve and allow SF₆ gas to flow through hose exhausting at the loose fitting, thereby purging air from hose.
- 5. Shut off cylinder valve and tighten quick disconnect to the hose.
- 6. Remove cap from the pole unit fill valve fitting and attach the quick disconnect with hose.
- 7. Open SF₆ cylinder valve slowly and fill to proper SF₆ pressure determined by ambient temperature measurements and referred to Pressure Vs. Temperature Curve (Figure 56).
- 8. After proper pressure is obtained, shut cylinder valve and disconnect the female disconnect from the pole unit fill valve fitting first before any other fitting is loosened. Replace the cap on the circuit switcher fill valve.

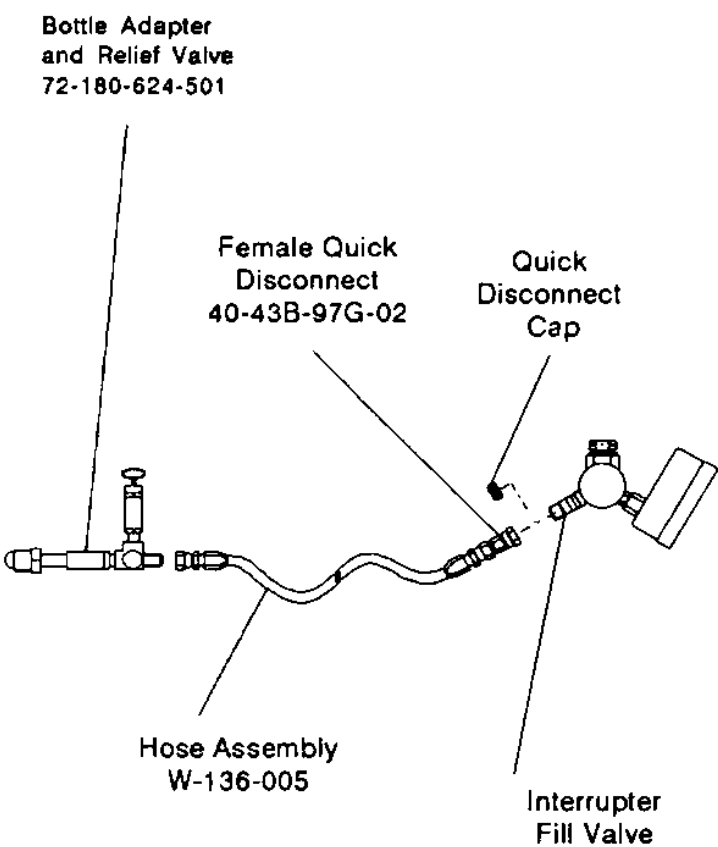



Figure 56 -- SF₆ Fill Kit **72-265-035-406**

The moisture content of the SF₆ should be no higher than 300 ppmv. If the interrupters have not been opened or exposed to a humid atmosphere, it will not be necessary to check for moisture after filling from an SF₆ bottle. If there is reason to suspect high moisture, do not use the rubber filling hose for checking. Use stainless steel tubing for this purpose.

If an interrupter should lose some gas pressure over an extended period of time and pressure has not reached 0 psig, adding gas is permissible to maintain service. When the leak rate is high (days instead of months), the interrupter should be exchanged.

Limit Switches

During routine maintenance, proper limit switch actuation should be checked. It is important that overtravel of the roller lever takes place after the operating point of the limit switch occurs. This overtravel should be about 3/32 inch after an audible "click" can be discerned when the roller lever is actuated by the cam. This is the operating point of the limit switch. It is necessary to hand crank the motor operator to make this check. The limit switch mounting bracket is adjustable to control the amount of overtravel. See Figure 17.

**WARNING**


Rupture of interrupter may result from over pressurization and could cause death or serious injury.

To prevent:

Use safe procedures for handling pressurized interrupter and do not overpressurize.

Replacement Parts

Contact your Siemens representative. Always refer to the S.O. number on the nameplate or the original purchase order number. See Figure 57 for the recommended spare parts list.



WARNING

The use of unauthorized parts in the repair of the equipment, tampering by unqualified personnel, or incorrect adjustments will result in dangerous conditions which could cause death, serious injury or equipment damage.

To prevent:

Follow all safety instructions contained herein.

Factory Repair

If the interrupter/driver assembly must be returned to the factory for inspection or repair, contact your Siemens representative for instructions. Reference the S.O. number shown on the Circuit Switcher name plate.

The shipping container should be constructed so that the interrupter/driver assembly will not be damaged in transit.

Note

Remove ALL SF₆ gas from interrupter before shipment. This is a Department of Transportation requirement, unless special shipping documentation accompanies shipment.

Part Description	Recommended Quantity Per Circuit Switcher	
	1-2 Units	3 or More
Interrupter/Driver Assembly	1	2
Disconnect Switch Contacts		1
Shunt Trip Coil (specify voltage)	1	2
Shunt Trip Assembly (specify Voltage)		1
Contactor		1
Anti-Pump Relay		1
Time Delay Relay		1
Motor		1
Limit Switch		1

Figure 57 - Recommended Spare Parts

Troubleshooting Guide

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Apparent Problem	Possible Solutions
An Outside Pole Does Not Close	<p>Insufficient shunt trip gap in the open position. Adjust for 1/8" gap with the shunt trip charging bolt. Screwing in on the charging bolt to obtain more gap reduces rotation into the green band. Correction by charging bolt adjustment may require more open direction rotation.</p> <p>Insufficient rotation into the green band. Adjust for 1/2 to 3/4 travel into the band with the adjustable coupling at the center pole. This adjustment must be coordinated with solution #1 above.</p> <p>Insufficient rotation into the red band. Correct by adjusting for more close direction rotation on the adjustable coupling.</p>
Center Pole Does Not Close	<p>Check for above conditions. Increasing amount of rotation is done on either the group control pipe or the outboard bearing radius. See steps 4 and 5 in the Final Adjustment section for Methods A and B. Either of these adjustments will change the adjustments on the outside poles.</p>
Motor Does Not Run To Close Circuit Switcher	<p>Latch check switch sensing a discharged shunt trip unit. Hand crank close about five turns while observing the red band indicators on the shunt trip housing. If the bands do not stay in line, insufficient shunt trip gap exists in the full open position to permit resetting of a discharged shunt trip unit. Adjust charging bolt to provide gap requirement.</p> <p>Sticking trigger and/or main trip latch in shunt trip. Clean and lubricate to ensure resetting of latches.</p>
One Pole Delayed Opening	<p>Check trip circuit continuity and trip coil resistance on delayed pole.</p>
Circuit Switcher Opens 1 Second After Trip Initiation	<p>Trip circuit electrical problem. Check continuity.</p>
Low SF ₆ Pressure	<p>Check for leak at gauge end of interrupter. Can be field repaired. Otherwise, replacement unit recommended.</p>
Inconsistent Pole Simultaneity	<p>Check for loose hardware on rotating insulator, interphase brace channels and all interphase pipe clamps.</p>

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