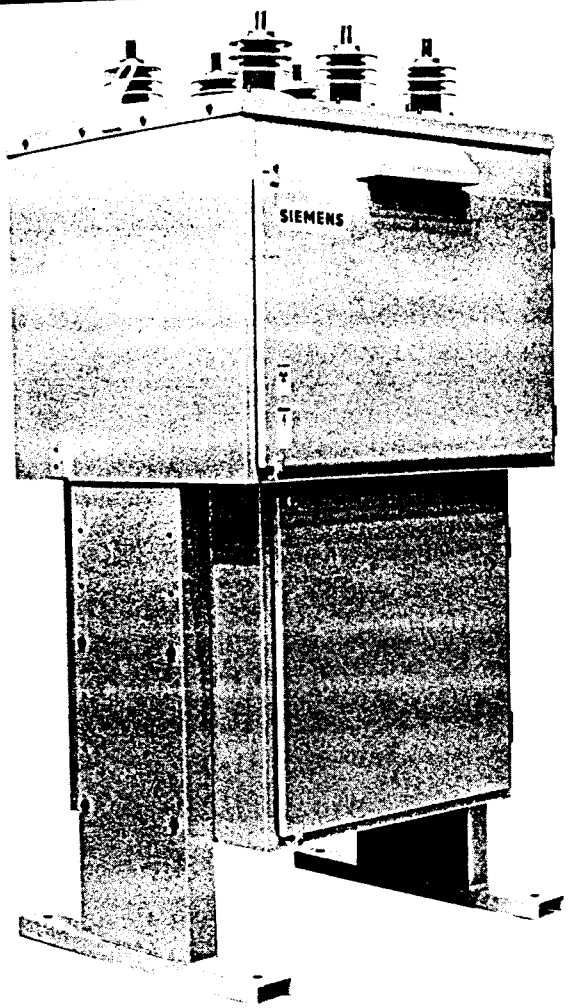
SIEMENS

Installation • Operation • Maintenance

Instructions



Type SDV-2
Power Circuit
Breaker 15, 25 & 38 kV
PB3768-02
Supersedes PB 3748-01 & PB3758-01

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

Siemens Energy & Automation, Inc.

CONTENTS

ILLUSTRATIONS

CONTENTS

TABLE OF CONTENTS

The instructions contained within this manual are necessary for the safe installation, maintenance and operation of this equipment. If this manual is misplaced or lost, replacement manuals are available through the local Siemens sales office.

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 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.

The contents of this instruction manual shall 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.

If drawings or other supplementary instructions for specific applications are forwarded with the manual or separately, they take precedence over any conflicting or incomplete information in this manual.

GENERAL

DIMENSIONS

Throughout this manual, metric values, when used, are shown as (XXX).

INTRODUCTION

Siemens outdoor circuit breakers are precision built devices designed to function efficiently under normal operating conditions. They are designed and manufactured to operate within the ANSI C37 standards applicable to the breaker rating.

The successful field performance of these breakers 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.

Factory adjustments are carefully made and the breaker is given rigorous mechanical tests after which the adjustments are re-checked. All control wiring is given a 1500 volt AC 1 minute withstand test. The current transformers are manufactured and tested according to the ANSI C57.13 standards.

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 breakers. 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 should be avoided. However, they are not intended to cover all details or variations that may be encountered in connection with the installation, operation and maintenance of this equipment.

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

ALERTS

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 death, severe personal injury or substantial property damage **will** result if proper precautions are not taken.

WARNING Indicates death, severe personal injury or substantial property damage **can** result if proper precautions are not taken.

CAUTION indicates minor personal injury or property damage **can** result if proper precautions are not taken.

⚠ DANGER

Hazardous voltage and mechanisms. Severe personal 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 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

The type SDV-2 circuit breaker is a three phase distribution type outdoor unit. The breaker is equipped with a trip-free stored energy operating mechanism and one vacuum interrupter per phase. This breaker offers dependable overload protection to connected equipment and lines. It should be installed only in circuits where it will operate within the range given on the breaker nameplate.

The physical arrangement of the circuit breaker comprises a high voltage compartment, an operator, relay and control power compartment and adjustable legs.

Current transformers are usually furnished with the circuit breaker. The standard breaker includes three current transformers, however, two standard type transformers can be supplied per bushing for a total of twelve transformers per breaker.

RECEIVING INSPECTION

The type SDV-2 circuit breaker is transported from the factory completely assembled and tested, and is carefully inspected and packed. The breaker is shipped with the contacts open, and both the closing spring and tripping springs are discharged.

Immediately upon receipt of a breaker, an examination should be made for evidence of any damage that may have occurred during shipment. If any damage or indication of rough handling is evident, immediately file a damage claim with the transportation company and notify the nearest Siemens representative.

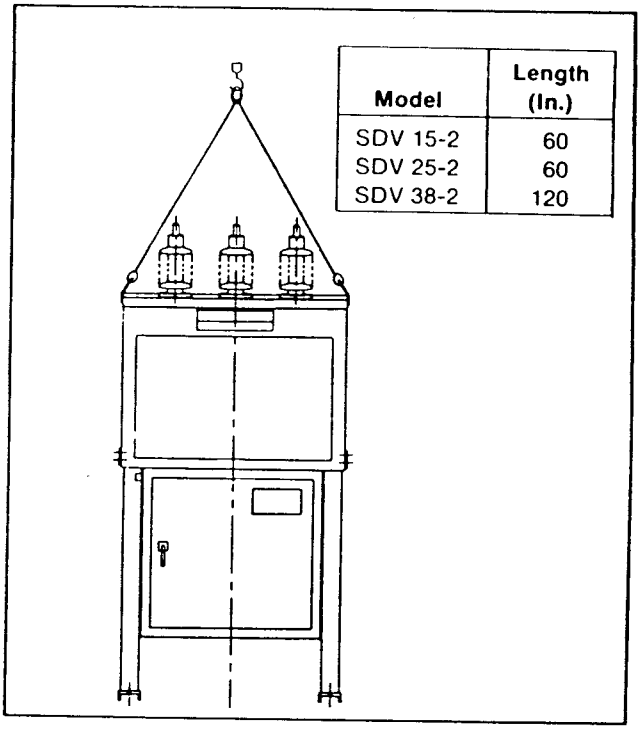
NOTE Damage claims must be processed within the time period specified by the carrier. Siemens cannot be held responsible for shipping damage, either external or internal, if the inspection is not made and claim forwarded within the set time limit.

Check the vacuum breaker against the shipping list and keep all identification tags and the instruction book so they are available. A pocket has been provided inside the control power compartment door that contains the instruction book and the schematic and connection diagrams. Retain all records and identification data since this must accompany any later inquiry concerning the breaker.

HANDLING

Handle the breaker by use of sling and lifting lugs or with forklift when breaker is on a skid. Lifting lugs are provided on each side of the breaker so that the unit may be lifted by use of a sling and hooks of the proper size. (Refer to the breaker nameplate for weight). Be sure that forklift blades pass completely under the breaker.

See Figure 1 for lifting of breaker with sling.



Model	Length (In.)
SDV 15-2	60
SDV 25-2	60
SDV 38-2	120

Figure 1. Lifting Vacuum Breaker

STORAGE

If the breaker is not to be connected in service immediately, it should be set on an adequate foundation, such as the permanent foundation, and the internal parts kept dry with the compartment heaters or other space heaters that will maintain the inside temperature of the breaker over the ambient. Prolonged outdoor storage without heaters could result in corrosion of internal parts. In any event, it is recommended that the breaker receive periodic inspection during storage.

TECHNICAL DATA

DIELECTRIC DATA

The SDV-2 uses the arc extinguishing ability of a vacuum to interrupt an arc.

The values of insulation level compiled in Table 2 are referred to sea level in accordance with ANSI C37.04-1987 consolidated standards. The higher the site altitude, the lower the insulating capacity of the air. The decrease in insulating capacity is neglected by standards for altitudes of up to 1000m above sea level. For higher altitudes, the values of power-frequency withstand voltage, lightning impulse withstand voltage and rated continuous current must be corrected in accordance with Table 1.

Table 1
Altitude Correction Factors, k

Altitude		Rated Maximum Voltage and Insulation Level	Rated Continuous Current
ft	(m)		
3300	(1000)	1.00	1.00
5000	(1500)	0.95	0.99
10 000	(3000)	0.80	0.96

NOTE: Interpolated correction factors shall be used in determining factors for intermediate altitudes.

Withstand test voltages apply to altitudes up to 1000 m above sea level. If a breaker is to be installed at a higher altitude, the appropriate test voltage and continuous current rating must be applied by a correction factor k (Table 1).

Table 2
Dielectric Ratings

SDV-2 Model			15	25	38
Rated power frequency withstand voltage (kV rms) at 60 Hz		kV	50	60	80
Rated lightning withstand voltage (1.2/50μs)		kV max.	110	150	170
Chopped wave 2μs	Breaker In Closed Position Only	kV	142	194	—
Chopped wave 3μs		kV	126	172	—

Normal Temperature Range

-30 . . . +40 Degrees C
-40 . . . +40 (Special)

ELECTRICAL DATA

SDV-2 Model		15	25	38
Rated max. voltage		**15.5**	**25.8**	**38**
Rated frequency	Hz	60		
Rated continuous current	A	See Nameplate		
Rated short-circuit current	kA	See Nameplate		
Transient recovery voltage under terminal fault conditions	—	As Per ANSI		
Rated making current	kA	1.6 x rated short-circuit breaking current		
Rated duration of short-circuit	S	3		
Rated duty cycle		0-0.3S-CO-15S-CO-15S-CO-15S-CO		

TECHNICAL DATA

MECHANICAL DATA

Operating Times

Minimum command duration	cycles	3
Closing time	cycles	5.0
Opening time	cycles	1.9
Arcing time at 60 Hz	cycles	1
Interrupting time at 60 Hz	cycles	3

Breaker Weights

Breaker, complete without relay package	SDV 15 kV	SDV 25 kV	SDV 38 kV
lbs.	1600	1700	1850

CONTROL DATA

Tripping and Closing Coils

Rated voltage	V d.c. [1]	48	125	250	V a.c. ①	115	230
Tripping coil	A	8.2	5.4	2.0	A	5.0	1.9
Closing coil	A	2.0	1.0	.5	A	.9	.4

[1] Voltage Range is in accordance with ANSI

Auxiliary Switch

Type		3SV9Z
Maximum rated voltage	V d.c.	500
Rated normal current	A	10
Making current	A	30
Breaking Capacity	Ohmic Load a.c. or d.c.	2200W
	Ind. Load at 220V d.c.	200W

Motor

Rated voltage	V d.c. [1]	48	125	250	V a.c. ①	115	230
Continuous current	A	6.0	2.5	1.5	A	4.5	2.5
Charging time	Sec	10.0	7.8	8.0	Sec	8.3	8.6

[1] Voltage Range is in accordance with ANSI

Heaters

High voltage compartment	W	220 ①
Control and relay compartment	W	100
Low temperature (Special -40° C)	W	540 ②

1 Thermostat controlled and set to turn off at 95° F.
2 Thermostat controlled and set to turn on at 10° F.

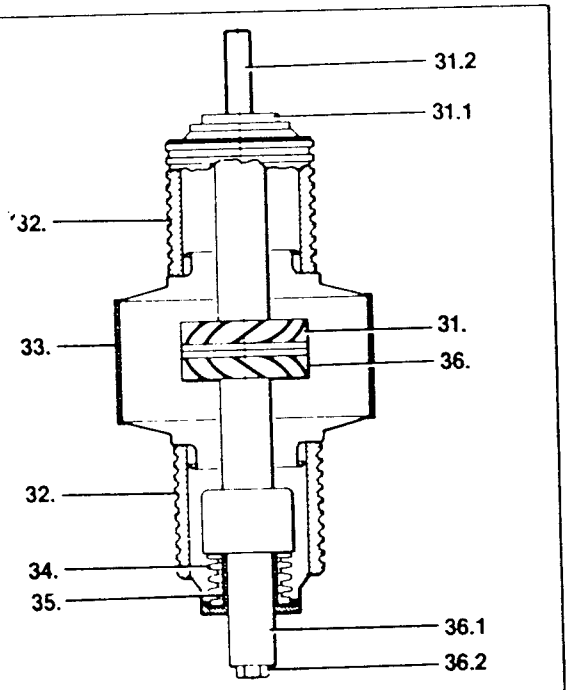
TERMINALS

Permissable conductor tension per connecting joint applied in any direction static + dynamic 100 LBS

ARC-QUENCHING MEDIUM VACUUM

Vacuum Interrupter

The basic construction of the interrupter can be seen from Figure 2. The moving contact 36 moves in guide 35. The metal bellows 34 follows the travel of the moving contact and seals the interrupter against the surrounding atmosphere.



31.	Fixed Contact	34.	Metal Bellows
31.1	Washer	35.	Guide
31.2	Terminal Post	36.	Moving Contact
32.	Insulator	36.1	Terminal
33.	Arcing Chamber	36.2	Mechanical Coupling

Figure 2. Section through a Vacuum Interrupter

The Arc-quenching Principle

When the contacts separate, the current to be interrupted initiates a metal vapor arc discharge and flows through this plasma until the next current zero. The arc is then extinguished and the conductive metal vapor condenses on the metal surfaces within a matter of microseconds. As a result, the dielectric strength in the break builds up very rapidly.

The contacts are designed so that the self-generated field causes the arc to travel. This prevents localized overheating when interrupting large currents.

The metal vapor arc discharge can only be maintained if a certain minimum current flows. A current that does not attain this level is chopped prior to current zero. This chopping current must be kept to a minimum in order to prevent unduly high overvoltages building up when inductive circuits are switched. The use of a special contact material ensures that current chopping is limited to 4-5A.

The rapid build-up of the dielectric strength in the break enables the arc to be safely extinguished even if contact separation occurs immediately prior to current zero.

The arc drawn in the vacuum breaker is not cooled. The metal vapor plasma is highly conductive and the resulting arc voltage only attains values between 20-200V. For this reason and because of the short arcing times, the arc energy developed in the break is very small. This also accounts for the long electrical life expectancy of the vacuum interrupter.

Owing to the high vacuum (less than 10^{-9} bar) in the interrupter, contact clearances of only about 6 to 20 mm are needed in order to attain a high dielectric strength.

GENERAL

A SDV-2 circuit breaker is shown in Figure 3. The breaker consists of three main sections: the high voltage compartment, the control and relay compartment, and adjustable legs.

HIGH VOLTAGE COMPARTMENT

The high voltage compartment supports six entrance bushings, and encloses the bushing current transformers, three vacuum interrupters supported by six stand-off insulators, current carrying bus bars and various current connections and operating linkage assemblies. It consists of a corrosion resistant enclosure with isolating phase barriers between phases and a dead front to the operating compartment and the control and relay compartment. The bushing mounting surface is sloped to provide for positive water run-off. Moisture control is provided by means of air flow and heaters. Each of the interrupters is operated through its own push rod assembly from the main operating shaft in the control compartment. Removable hinged doors are provided for ease in accessibility and maintenance.

WARNING

Hazardous voltage.
Can cause personal injury, death or damage to the circuit breaker.
To prevent:
Do not open high voltage compartment until you have de-energized the high voltage, grounded all terminals and turned off control power

CAUTION

Hazardous radiation.
Can cause personal injury.
To prevent:
To eliminate this hazard the low frequency withstand test must be performed with all covers on and doors closed.

CONTROL AND RELAY COMPARTMENT

The control and relay compartment consists of a separate weather-proof compartment isolated from the high voltage compartment by a dead front barrier. It contains the termination for the bushing current transformers, control power cut-off devices and customer wiring terminals. It also contains a swing out relay panel when required. The stored energy operator is also contained within the control compartment.

The breaker is equipped with two adjustable legs attached to the breaker cabinet at each side and serve to mount the breaker to the foundation. The legs are adjustable in 3" increments.

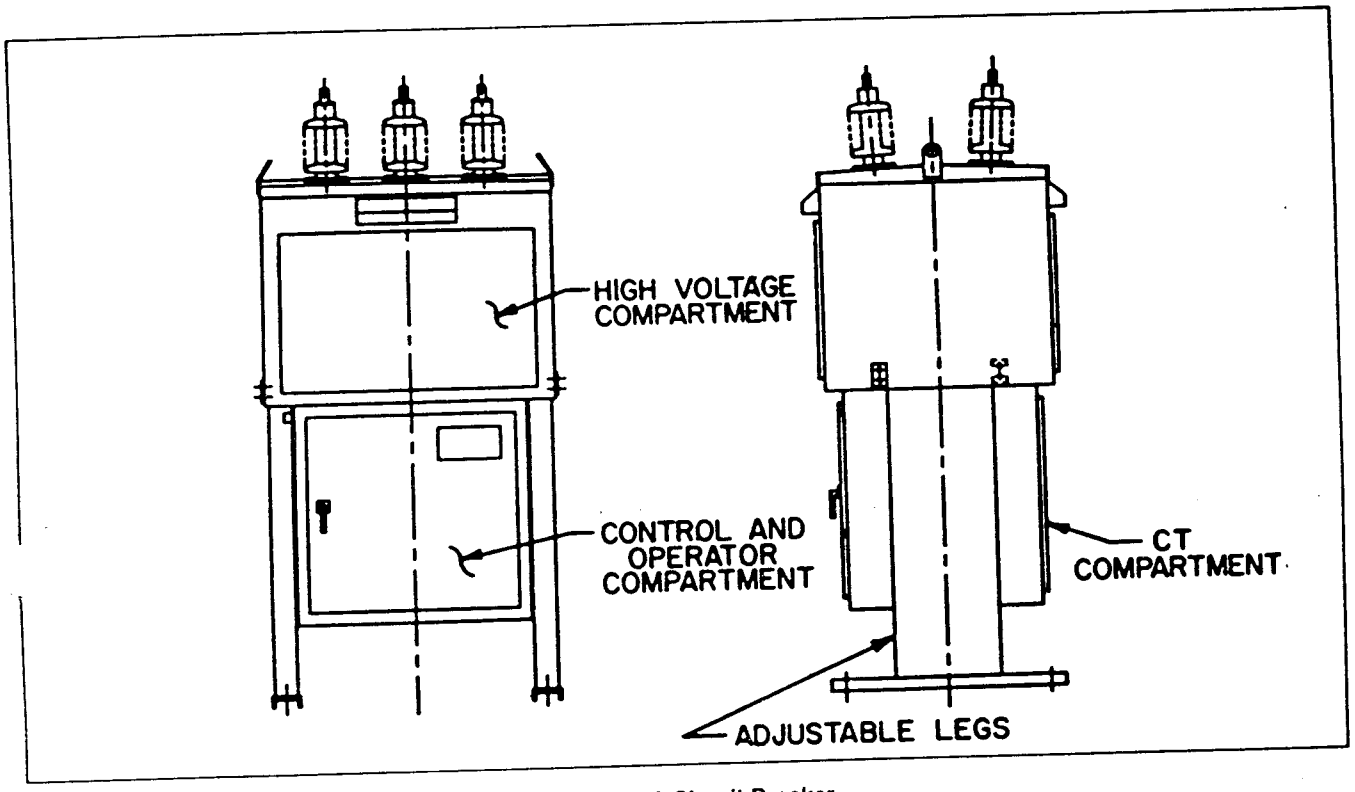


Figure 3. SDV-2 Circuit Breaker

PREPARATION FOR INSTALLATION

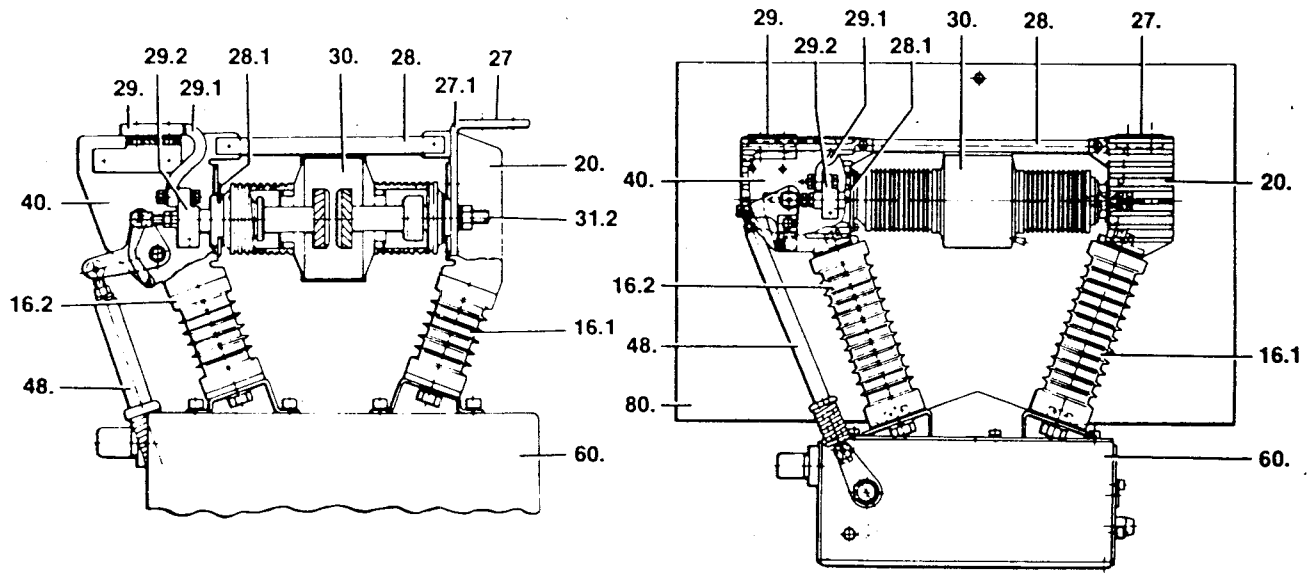
SDV-2 breakers without auxiliary cabinets are shipped with the legs positioned a half turn from the installed position. The legs must be removed, turned to the proper position and set to the desired height. Directions are given in the notice located at the top of each leg.

INTERRUPTING UNIT

Figure 4 shows a section through an interrupter unit. The vacuum interrupter 30 is rigidly fixed to the upper terminal 27 and pole support 20 by its fixed terminal post 31.2. The lower ceramic part of the interrupter is stabilized against lateral forces by a centering ring 28.1 on pole support 40. The external forces due to switching operations and the contact pressure are absorbed by the braces 28.

The current flows from the upper terminal 27 through the fixed contact terminal washer (Figure 2 items 31.1) the fixed contact (Figure 2 item 31) the movable contact (Figure 2 item 36) the movable contact terminal post (Figure 2 item 36.1), which is connected with the lower terminal 29 by terminal clamp 29.2, and flexible strap 29.1.

The vacuum interrupter is opened and closed by the movable contact (Figure 2 item 36) moving in guide (Figure 2 item 35). The metal bellows (Figure 2 item 34) follows the travel of the moving contact and seals the interrupter against the surrounding atmosphere.



16.1	Upper Insulator	28.	Brace	30.	Vacuum Interrupter
16.2	Lower Insulator	28.1	Centering Ring	31.2	Terminal Post
20.	Upper Pole Support	29.	Lower Terminal	40.	Lower Pole Support
27.	Upper Terminal	29.1	Flexible Strap	48.	Insulated Coupler
27.1	Terminal Angle	29.2	Terminal Clamp	60.	Mechanism Housing

Figure 4. Section through the 3AF Interrupting Unit

SWITCHING OPERATION

When a closing command is initiated the closing spring, which was previously charged, actuates the moving contact 36 through breaker shaft 63, lever 63.7, insulated coupler 48 and lever 48.6.

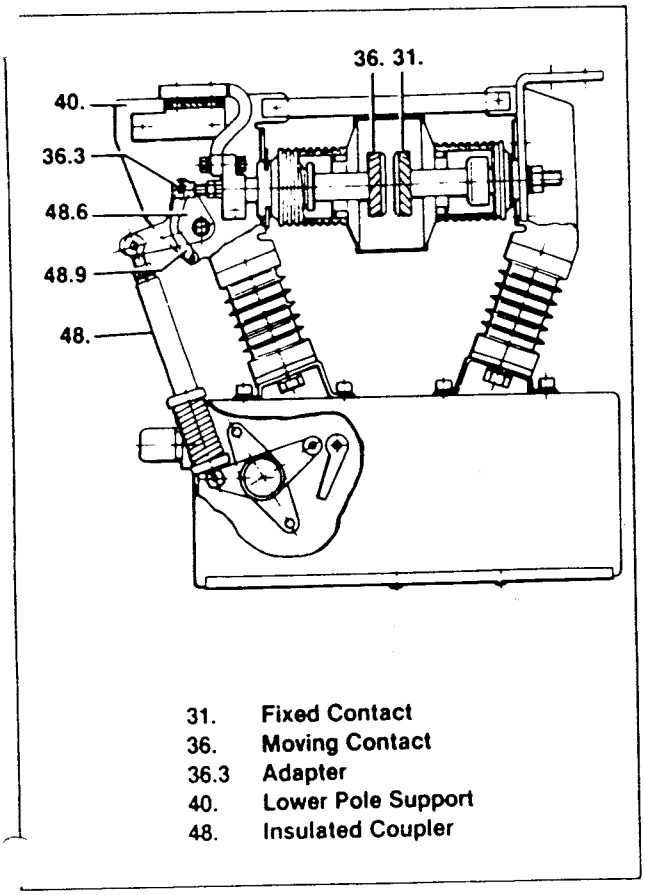
The forces that may occur when the movement of the insulated coupler is converted into the movement of the moving contact are absorbed by drive link 48.9 which pivots on pole support 40 and adapter 36.3.

During closing, the tripping spring and the contact pressure spring 49 are charged and latched by pawl 64.2.

The closing spring is recharged by the motor immediately after closing.

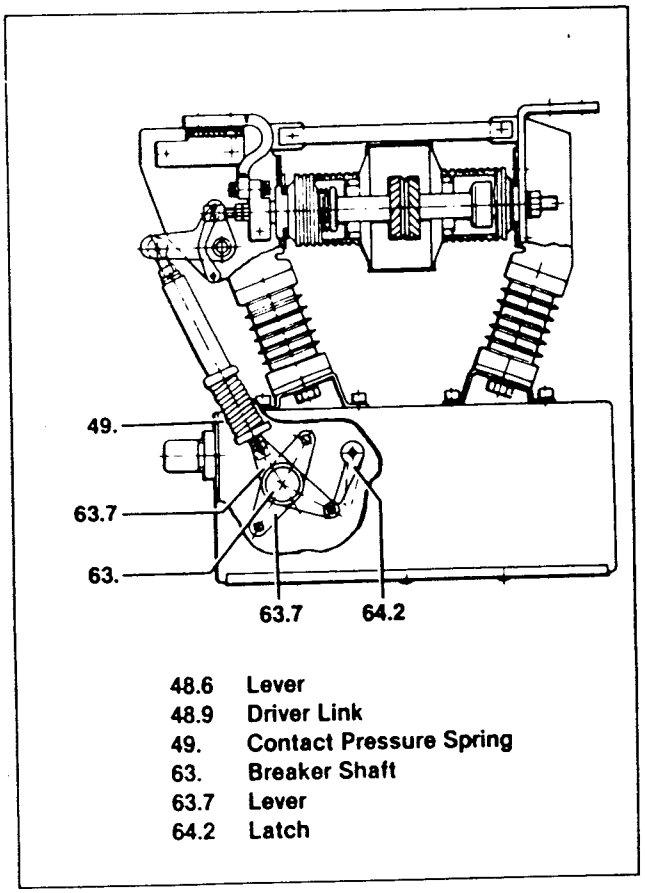
In the closed state, the necessary contact pressure is established by the contact pressure spring and the atmospheric pressure. The contact pressure spring automatically compensates for arc erosion, which is very small.

When a tripping command is given, the energy stored in the tripping and contact pressure springs is released by pawl 64.2. The opening operation is similar to the closing operation. The residual force of the tripping spring holds the moving contact 36 in the open position.



31. Fixed Contact
36. Moving Contact
36.3 Adapter
40. Lower Pole Support
48. Insulated Coupler

Figure 5a. Section through the 3AF Breaker in the Open Position.



48.6 Lever
48.9 Driver Link
49. Contact Pressure Spring
63. Breaker Shaft
63.7 Lever
64.2 Latch

Figure 5b. Section through the 3AF Breaker in the Closed Position.

OPERATING MECHANISM

The major components of the 3AF mechanisms are shown in Figures 6 through 10.

OPENING

(See Figures 6, 7 & 8)

When opening the breaker by hand, the spring is released by pressing the trip button 54. In the case of an electrical command being given, the tripping solenoid 52T (54.1) unlatches the tripping spring. The tripping spring turns the breaker shaft 63 via lever 63.5 the sequence being similar to that for closing.

CLOSING

(See Figures 6, 7, 8 & 9)

When the breaker is closed by hand, the spring is released by pressing CLOSE button 53. In the case of remote control the closing solenoid 52SRC (53.1) unlatches the closing spring.

As the closing spring relaxes, the charging shaft 62.1 is turned by crank 62.2. The cam disc 62.3 at the other end of the charging shaft actuates the drive lever 62.6 with the result that breaker shaft 63. is turned by lever 63.5 via coupling rod 62.8. At the same time, the levers 63.1, 63.5 and 63.7 fixed on the breaker shaft operate the three insulated couplers for the breaker poles. Lever 63.7 changes the OPEN/CLOSE indicator over to closed. Lever 63.5 charges the tripping spring 64. during closing, and the breaker is latched in the closed position by lever 64.3 with pawl roller 64.3.1 and by pawl 64.2. Lever 63.1 actuates the auxiliary switch 68. through the linkage 68.1.

The crank 62.2 on the charging shaft moves the linkage 55.1 by acting on the control lever 55.2. The "Spring charged" in-

50.2	Charging
50.4	Motor
53.	Close Button
53.1	Closing Solenoid 52 SRC
53.2	Anti-Pump Relay 52Y
54.	Trip Button
54.1	Tripping Solenoid, 52T
55.	"Closing Spring Charged" Indicator
55.1	Linkage
58.	Open/Close Indicator
60.	Mechanism Housing
61.8	Shock Absorber
62.	Closing Spring
64.	Tripping Spring
68.	Auxiliary Switch
68.7	Pin Plug

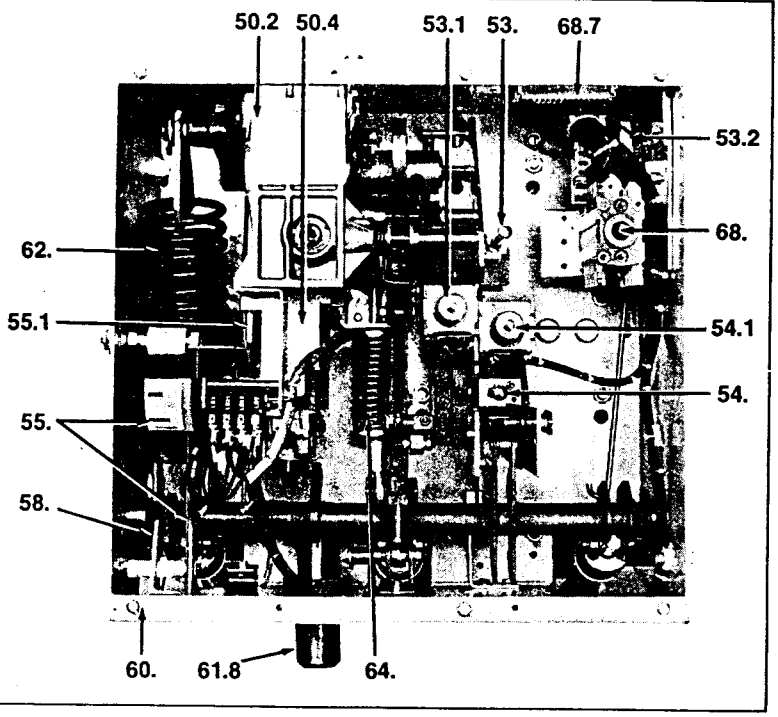


Figure 6. 3AF in the Closed Position with the Closing and Tripping Springs Charged.

dication is thus cancelled. The limit switches 50.4.1 switch in the control supply are actuated to the effect that the closing spring is recharged immediately.

53. Close Button
54. Trip Button
55. "Closing Spring Charged" Indicator
58. Open/Close Indicator
62. Closing Spring
62.5 Lever
62.5.1 Latch Roller
62.5.2 Latch
63. Breaker Shaft
64. Tripping Spring
64.2 Latch
64.3 Lever
64.3.1 Latch Roller

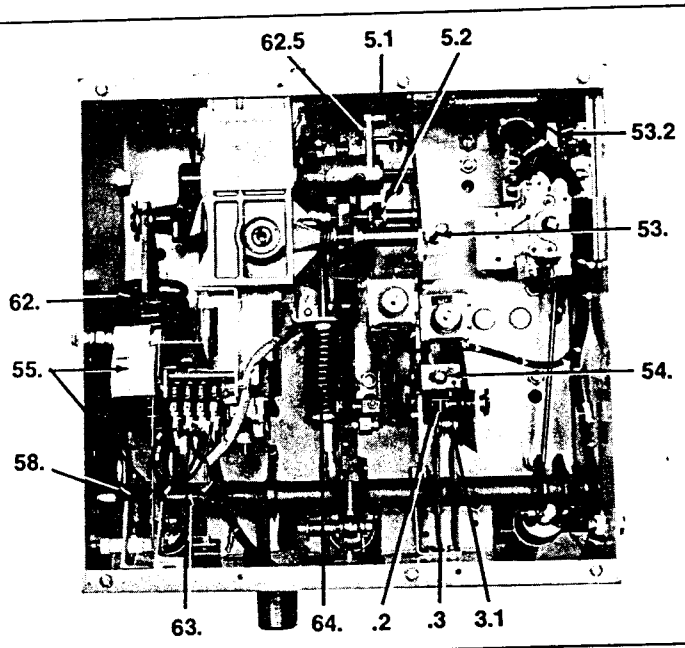


Figure 7. 3AF in Closed Position (Tripping Spring Charged and Latched)

48. Insulated Coupler
50.4.1 Limit Switch
54. Trip Button
63. Breaker Shaft
63.1 Lever
63.5 Lever
63.7 Lever
64.2 Latch
64.3 Lever
64.3.1 Latch Roller
68.1 Linkage

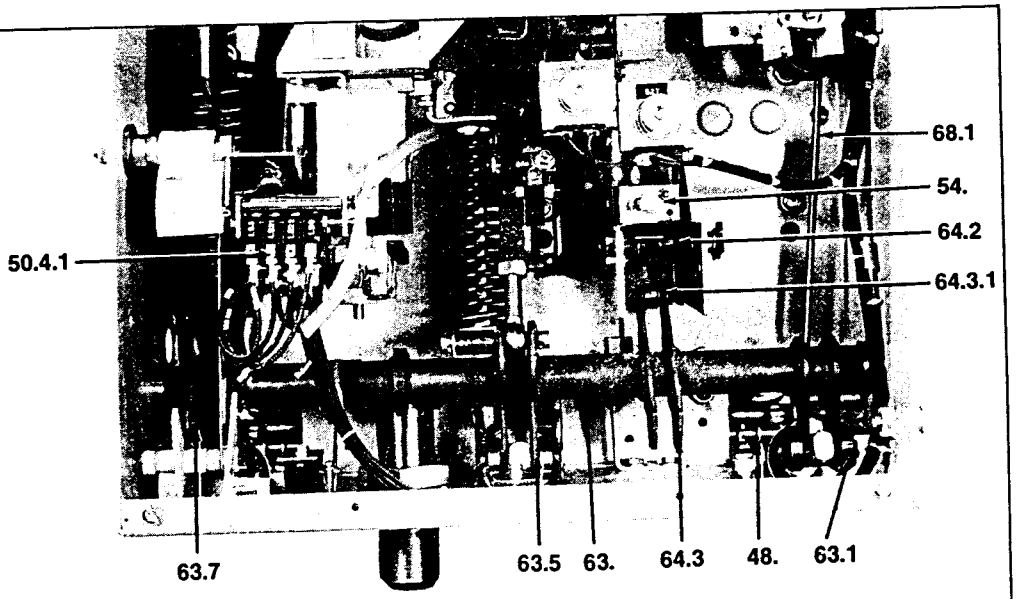


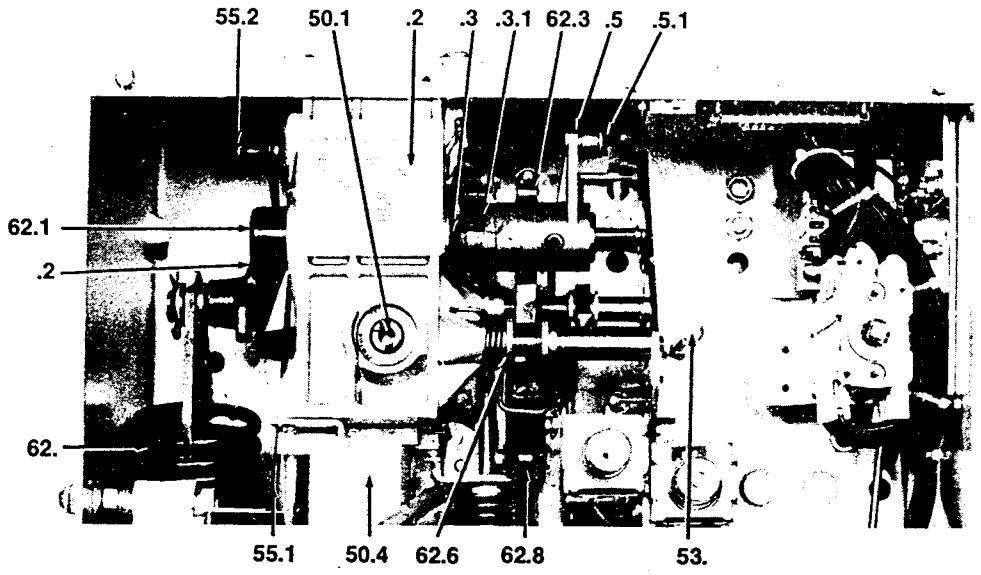
Figure 8. Breaker Shaft in the OPEN Position

CHARGING

(See Figures 7, 8, 9 & 10)

The charging shaft 62.1 is supported in the charging mechanism 50.2 but is not coupled mechanically with the charging mechanism. Fitted to it are the crank 62.2 at one end and the cam 62.3 together with lever 62.5 at the other.

When the charging mechanism is actuated by hand or by a motor, the flange 50.3 turns until the drive 50.3.1 locates in the cutaway part of cam disc 62.3, thus causing the charging shaft to follow. The crank 62.2 charges the closing spring 62. When this has been fully tensioned, the crank actuates the linkage 55.1 for the "Closing spring charged" indicator 55. via control lever 55.2 and also the limit switches 50.4.1 for interrupting the motor supply. At the same time, the lever 62.5 at the other end of the charging shaft is securely locked by the latching device. When the closing spring is being charged, cam disc 62.3 follows idly, and it is brought into position for closing. The spring may be charged manually by inserting the handcrank in opening 50.1.



50.1	Opening for Handcrank	62.	Closing Spring
50.2	Charging Mechanism	62.1	Charging Shaft
50.3	Charging Flange	62.2	Crank
50.3.1	Driver	62.3	Cam
50.4	Motor	62.5	Lever
53.	Close Button	62.5.1	Latch Roller
55.1	Linkage	62.6	Drive Lever
55.2	Control Lever	62.8	Coupling Rod

Figure 9. Closing Assembly with Slack Closing Spring

Legend Figures 10a-d

48 Insulated Coupler
53 Close Pushbutton
53.1 Closing Solenoid, 52SRC
53.2 Spring Release Latch
54 Trip Pushbutton
54.1 Tripping Solenoid, 52T
62 Closing Spring
62.1 Charging Shaft
62.2 Crank
62.2.2 Spring Mounting
62.3 Cam
62.5 Lever
62.6 Drive Lever
62.8 Trip Free Coupling
62.8.1 Spring Return Latch
62.8.2 Trip Free Link
62.8.3 Trip Free Lever
62.8.8 Trip Free Actuator (T4.5)
63 Breaker Shaft
63.1 Lever - Phase C
63.5 Lever - Phase B
63.7 Lever - Phase A
64 Tripping Spring
64.2 Pawl
64.2.1 Trip Latch Pin
64.3 Lever
64.5 Shaft

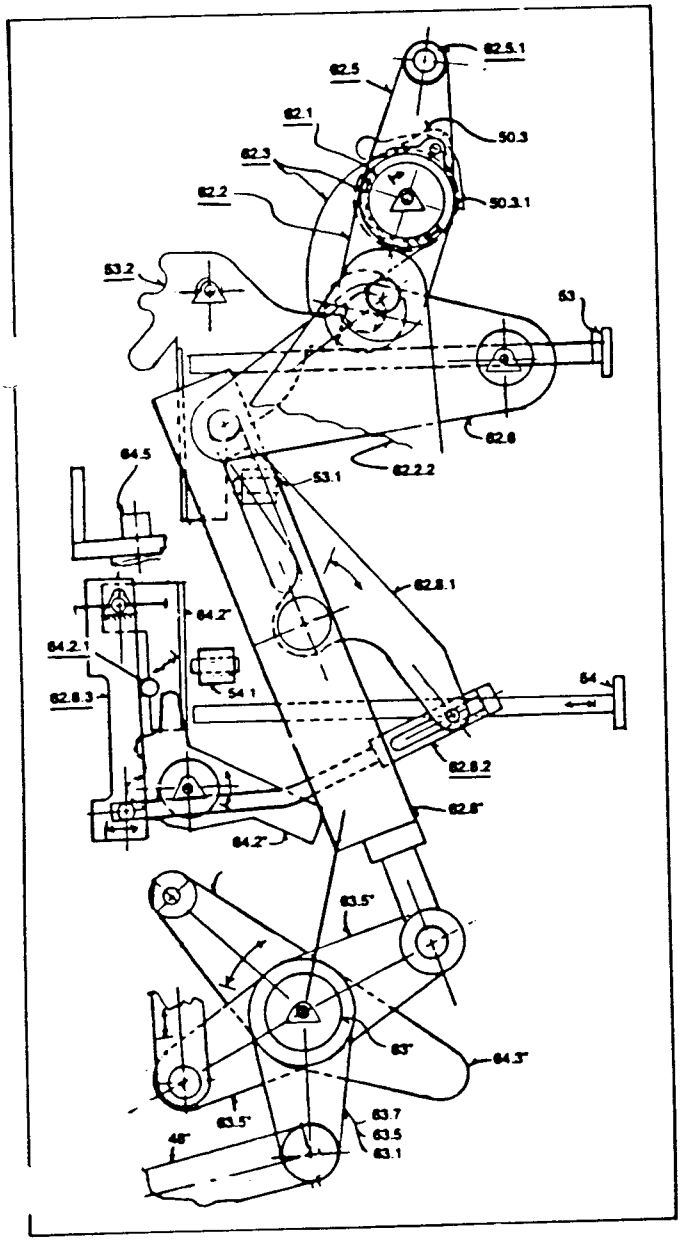


Figure 10a
Operating Mechanism Section Diagram
Operating Mechanism Open, Closing Springs Discharged

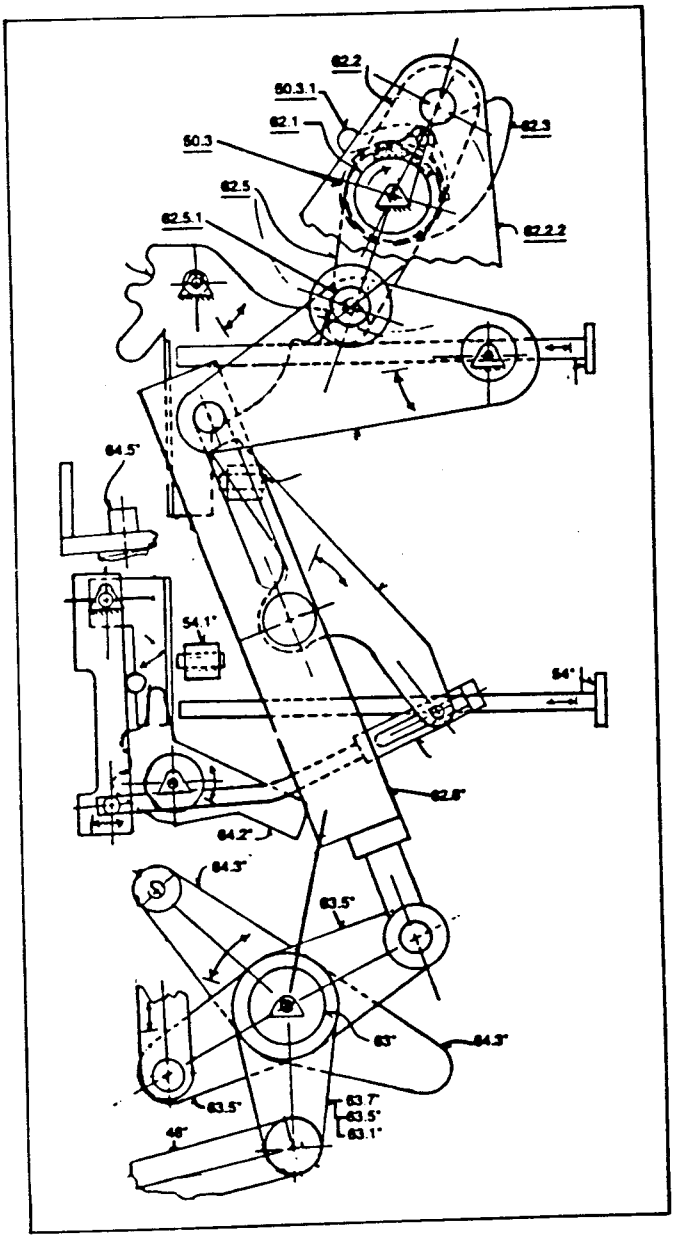


Figure 10b
Operating Mechanism Section Diagram
Operating Mechanism Open, Closing Springs Charged

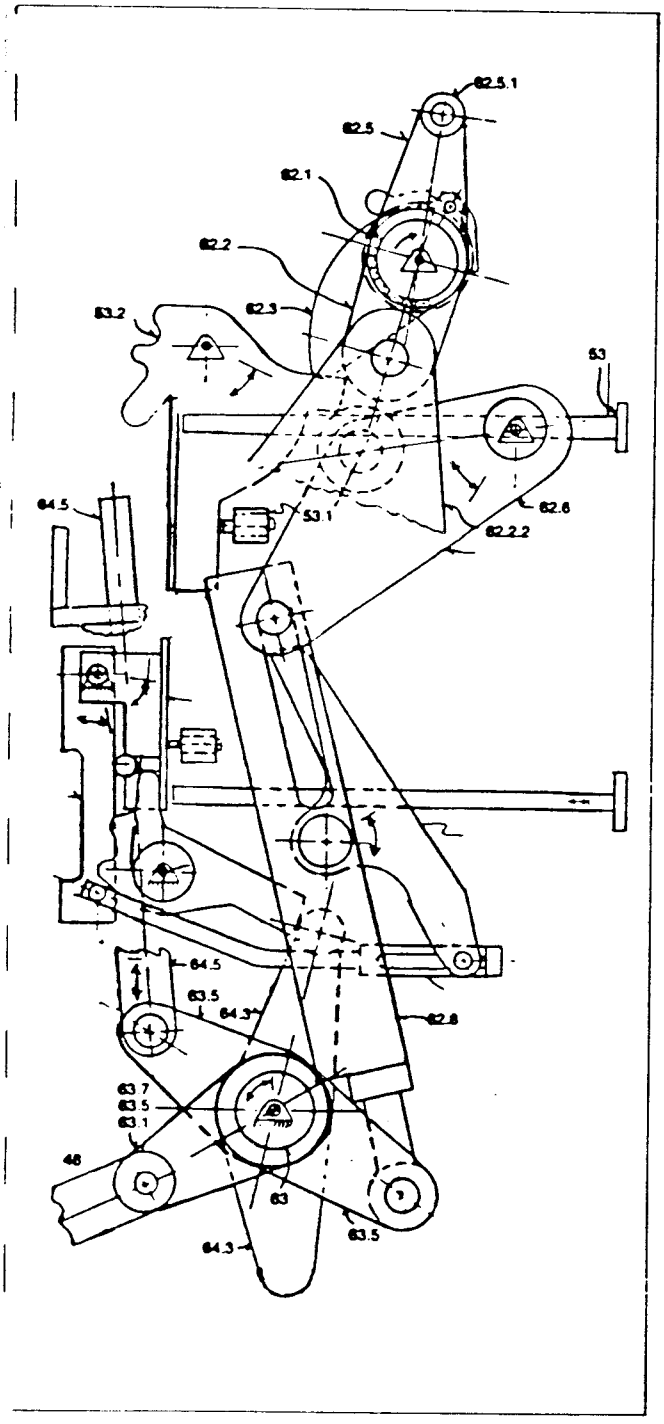


Figure 10c
Operating Mechanism Section Diagram
Operating Mechanism Closed, Closing Springs Discharged

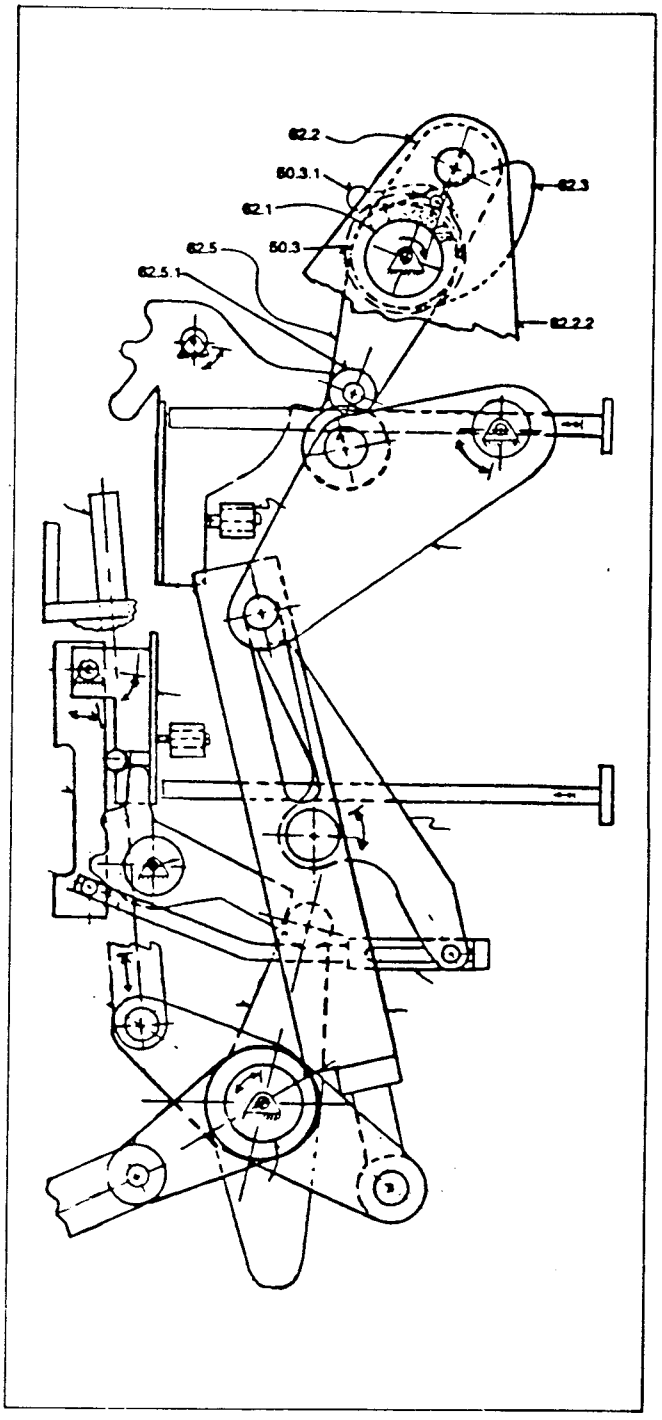


Figure 10d
Operating Mechanism Section Diagram
Operating Mechanism Closed, Closing Springs Charged

INSTALLATION

SHIPMENT AND STORAGE

Shipping and storage considerations were described in the GENERAL section of this manual. They should be reviewed again at the time of installation. The breaker should be checked again to ensure that all parts are proper. Review lifting instructions (Figure 1).

LOCATION

The breaker should be located so that it is readily accessible for manual operation and inspection, and it has ample clearance to other apparatus or structures. It is advisable to provide a cement pad into which are imbedded suitable oundation bolts. The foundation should be reasonably level and it is recommended that .75 inch diameter anchor bolts be used.

Place the breaker on the foundation, and tighten the hold down bolts. The breaker must be level but no special leveling procedures are required. The breaker is adjustable in height for flexibility and to meet the various electrical codes. While the breaker is being lifted into position, adjust the leg extensions to the specific height requirement. After the breaker has been secured on the foundation, the electrical connections can be made to the de-energized lines.

DANGER

Hazardous voltage
Will cause personal injury or death.
To prevent

The user must adjust the breaker height to insure compliance with safety codes for electrical clearance

The breaker is shipped in the open position with all springs discharged. No blocking is used to prevent closing or tripping.

PRIMARY LEAD CONNECTIONS

The primary leads should be brought down from above the breaker if possible, with adequate clearance to other parts, and with the proper supports so that the breaker bushings are not subjected to excessive strains. They should be sized to have a capacity at least equal to the maximum operating current of the circuit and within the rating of the breaker. Connections are to be made to the bolted terminals of the bushings and must be securely tightened to a clean bright surface to assure good contact.

GROUND CONNECTION

Diagonally opposite grounding pads are provided for connecting the mounting frame to ground using at least a 4/0 awg conductor. A good low resistance ground is essential for adequate protection.

SECONDARY AND CONTROL WIRING

A conduit panel opening is provided in the bottom of the relay and control power compartment for the connection of the control circuits. The control wires should be run separately from high voltage wiring to prevent inductive coupling between them and should be sized for full operating current to avoid a drop in voltage below that specified on the nameplate. All conduits should be sealed off at their entrance to the relay and control power compartment.

Terminal blocks are provided inside the relay and control power compartment for the connections necessary for the control wiring, bushing current transformers and relay panel when provided. Connection diagrams are supplied with each breaker to show the proper connections. These diagrams will be found in the pocket provided on the inside of the left hand door for this compartment.

FINAL INSTALLING INSPECTION

1. Make sure that the breaker is properly set up and level on its foundation.

2. Make a check for the tightness of all hardware on the cabinet, adjustable legs, bushings, bus bars and operating mechanism.

3. See that all bearing surfaces of the operating and breaker mechanism have been lubricated.

4. Inspect all insulated wiring to see that it has not been damaged, and test for possible grounds or short circuits.

5. See that all covers, doors and bolted connectors are securely fastened.

6. Retouch any paint that has been damaged during installation.

7. Check to see that all mechanisms are free of any packing and operate freely.

CAUTION

Styrofoam bracing between phase barriers.
Can damage circuit breaker.
To prevent:

Remove bracing before energizing breaker high voltage.

8. Examine the vacuum interrupter envelopes for damage, and wipe them and other insulating parts with a clean dry cloth.

9. Charge the closing spring manually and push the manual close to close the breaker. See page 29.

10. Observe the open-close position indicator and operation counter for operation with a manual open.

11. Energize the control circuits. The motor-gear unit should run to charge the closing spring then turn-off.

12. Close the circuit breaker electrically and verify that the breaker is closed and remains closed by checking the mechanical position indicator. Note that the motor-gear unit will immediately run to charge the closing spring.

13. Trip the breaker electrically.

14. Repeat the close and trip operations several times.

15. Check the tripping and closing times from coil energization to contact break or make.

16. Check the integrity of the vacuum interrupter by performing a hi-pot on each interrupter while in the open position. The interrupter hi-pot is to verify that damage has not occurred during shipment and is not intended as a verification of the breakers dielectric rating. The voltage should be raised gradually, and the contact gap should sustain 27 kV, 60 Hz AC for 1 minute or 38 kV DC for 1 minute. If it does not, the interrupter is faulty and must be replaced.

CAUTION

Hazardous radiation.
Can cause personal injury.
To prevent:

The low frequency withstand test must be performed with all covers on and doors closed.

Observe the following items when hi-potting the vacuum interrupters.

A) Test personnel should remain at least 6 feet (180 cm) away from the interrupter being tested.

B) Tests should be performed with normal metallic panels installed, and test personnel should position themselves to take advantage of the shielding provided by the metallic barriers.

C) The circuit breaker bushings and metallic midband on the interrupter may retain a static charge after the hi-pot test, so discharge with a grounded probe before handling.

DANGER

Hazardous voltage.
Can cause personal injury, death or damage circuit breaker.
To prevent:

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

NOTE With respect to X-radiation: (No hazardous X-radiation is produced with closed contacts or with open contacts with rated operating voltage applied to them.)

17. An alternate method to check the vacuum interrupters for vacuum is as follows:

    A) Isolate and open the breaker then detach the insulated coupler 48 from lever 48.6. See Figure 12.

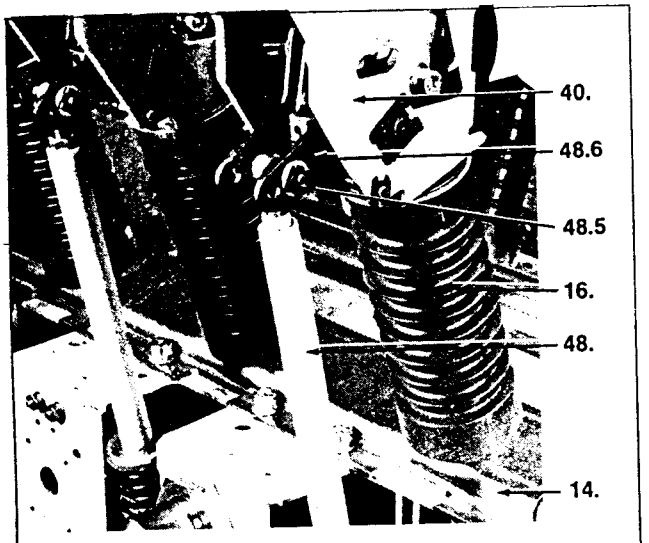
    B) The atmosphere pressure will force the moving contact of a hermetically sealed interrupter into the closed position, causing lever 48.6 to move into the position shown in Figure 12. An interrupter that has lost its vacuum will not move closed after being forced open.

    C) A vacuum interrupter may be assumed to be intact if it shows the following characteristics:

        An applicable closing force has to be overcome when lever 48.6 is moved to the open position by hand. See Figure 13. When the lever is released, it must automatically return to the closed position and the contacts must be heard to close.

    After checking the vacuum, refit the lever 48.6 to the insulated coupler 48.

18. The vacuum breaker is now ready for normal operation.



14. Cross Arm **48.5 Pin**
16. Post Insulator **48.6 Lever**
40. Lower Pole Support **48. Insulated Coupler**

Figure 11. Lower Pole Support with Insulated Coupler

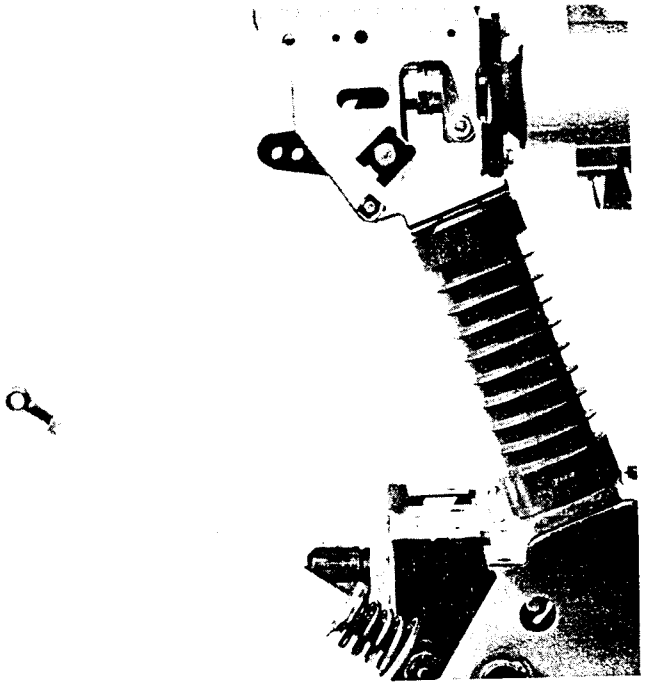


Figure 12. Procedure to Check Vacuum

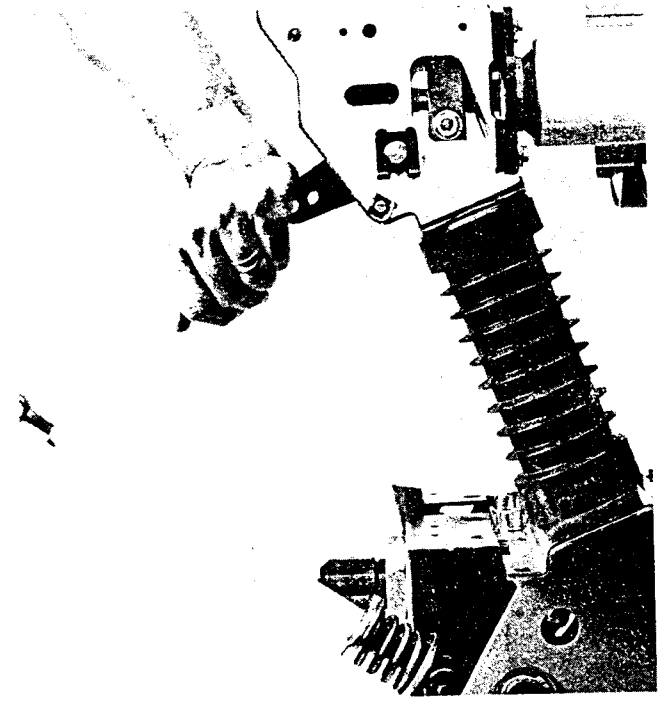


Figure 13. Procedure to Check Vacuum

TYPICAL SCHEMATIC

The controls for the SDV-15-2 breaker are mounted in the 3AF mechanism housing. The controls consist of the motor cutoff switch 50.4.1 (Figure 8), anti-pump relay directly below the pin plug 68.7 (Figure 6) and auxiliary switch 68 (Figure 6).

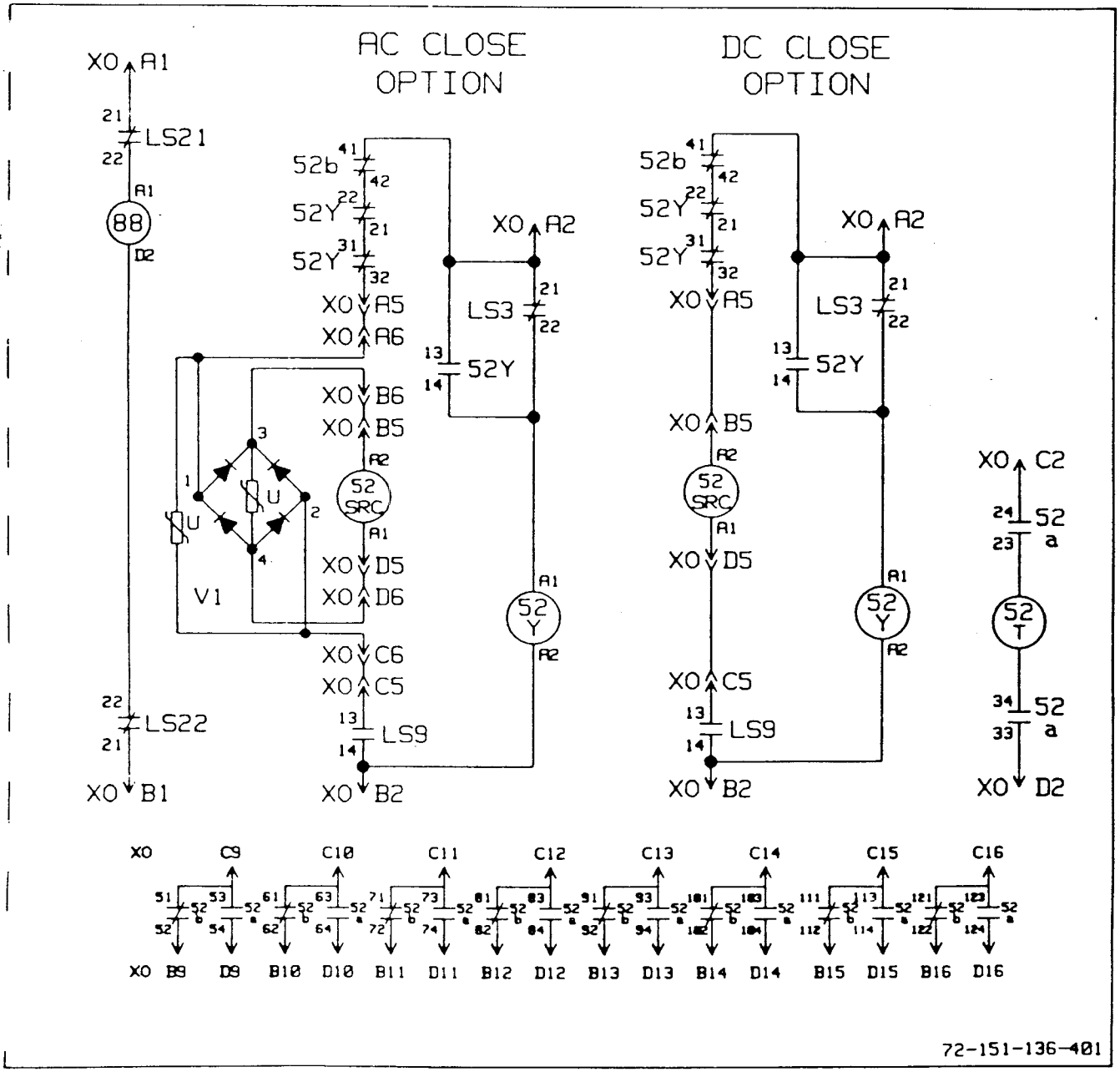


Figure 14. Typical Control Scheme for 3AF Operator

SPRING CHARGING

The spring charging power is supplied through plug terminals A1 and D16 (Figure 14). The LS21 and LS22 switches are shown with the closing springs discharged. When the control is energized, the motor 88 starts to charge the springs. The LS21 and LS22 switches are operated by control lever 55.2 (Figure 9) mounted on the charging mechanism 50.2 (Figure 3). The charging shaft revolves to the position of applying full tension, dead center, to the springs. Beyond this position the LS21 and LS22 switches are actuated and the motor is cutoff.

CLOSING

When the close command is given, the circuit from plug terminal A2 through 52b, two sets of 52y contacts, LS9 to plug terminal B2 energizes the closing coil 52 SRC.

As soon as the closing springs are discharged the LS3 switch contact closes to energize the 52Y relay. If the close control switch remains closed, the 52Y relay remains picked up through contact 52Y. The control switch has to be released to reset the close circuit for another closing operation. This forms the anti-pumping relay circuit which prevents the circuit breaker from reclosing immediately after a trip-free operation. If control power is momentarily lost during closing, upon re-energization, the 52Y relay picks up instantaneously through contact LS3 maintaining the anti-pumping relay circuit prior to complete spring charging.

TRIPPING

When the trip switch is closed the circuit from plug terminal C2 through 52a to plug terminal D2 energizes the trip coil 52T.

RECLOSING

The closing spring is recharged automatically as described above. Therefore, when the breaker is closed both its springs are charged (the closing spring charges the tripping spring during closing). As a result, the breaker is capable of an O-t-CO operating cycle (dead time "t" is 0.3 seconds).

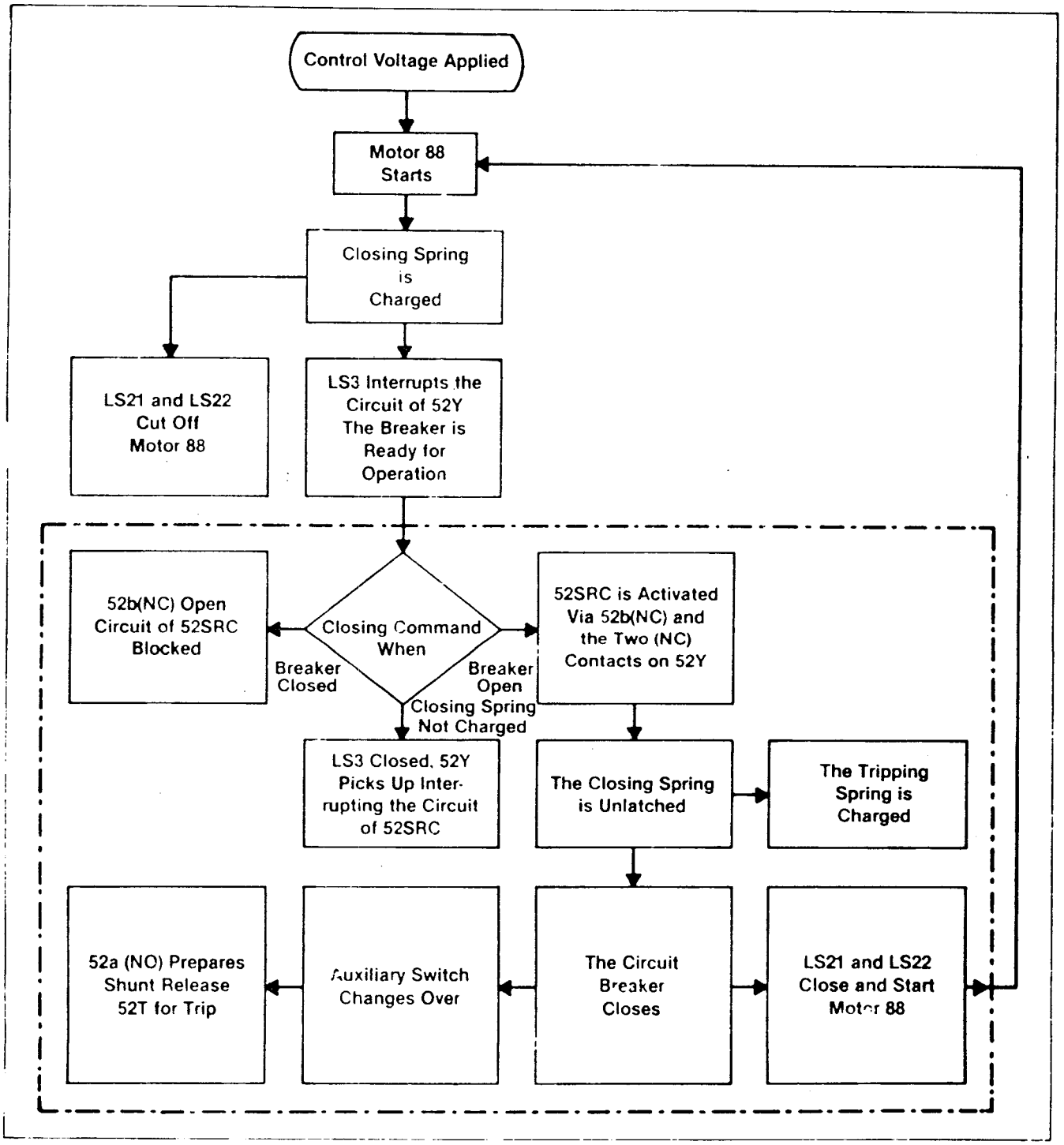


Figure 15. Complete Closing Sequence

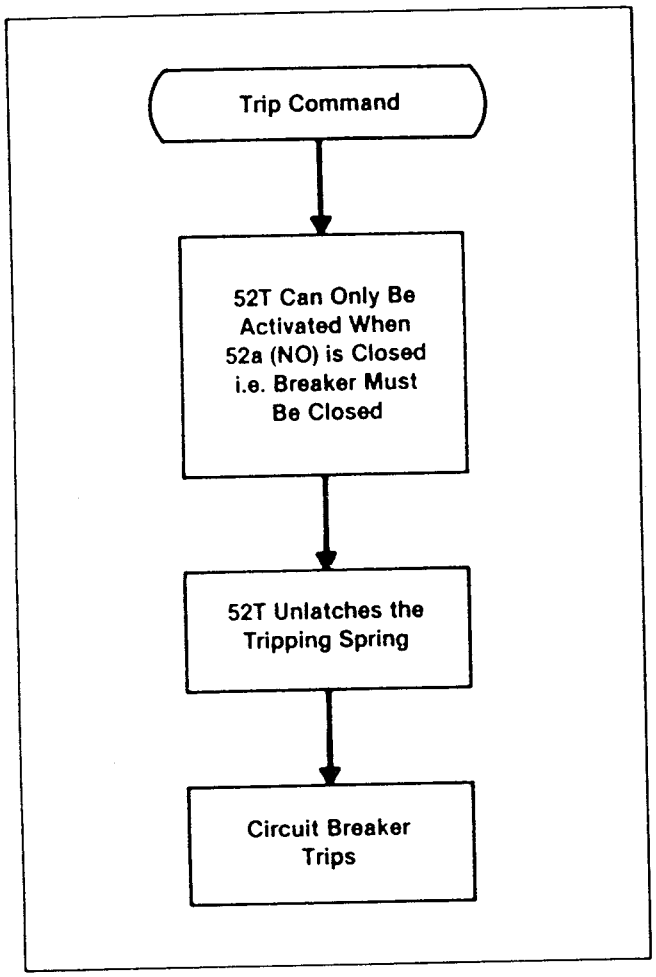


Figure 16. Complete Tripping Sequence

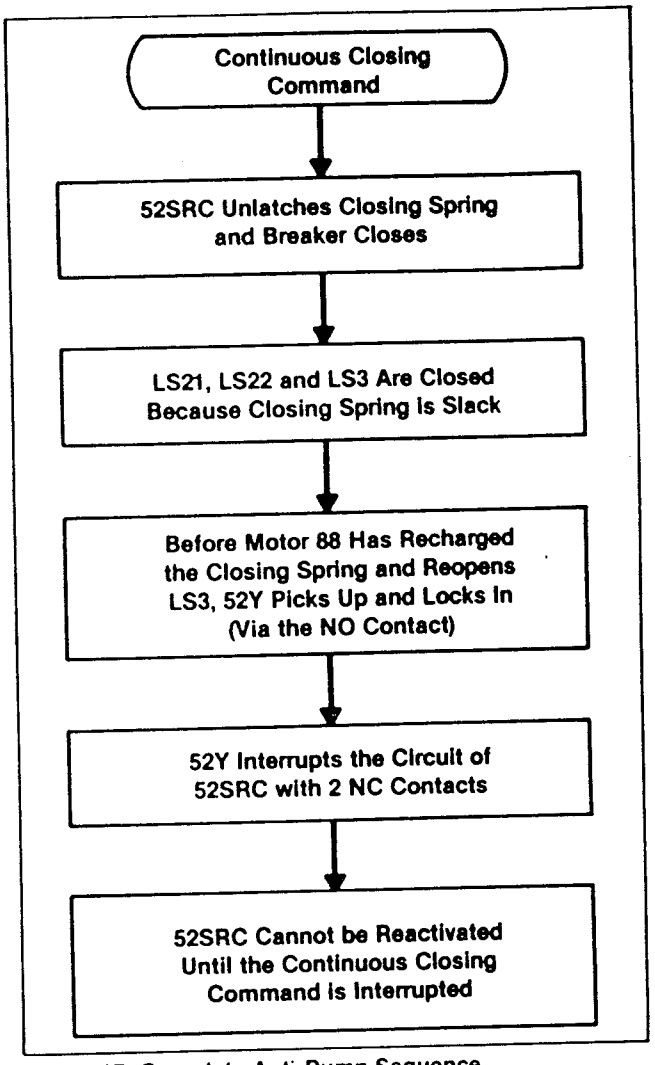


Figure 17. Complete Anti-Pump Sequence

ADJUSTMENTS

GENERAL

Adjustable items are factory set and checked before and after numerous mechanical operation on every breaker to insure correctness. No adjustment checking should be necessary on new breakers. If a malfunction occurs, check for hidden shipping damage.

The following will help you make the correct adjustments when replacing a broken or worn part.

CIRCUIT BREAKER TIMING

A comparison of circuit breaker timing at any period of maintenance with that taken when the breaker was new will indicate the operational condition of the breaker mechanism.

Closing Time	83 ms*
Spring Charging Time	15 s
Opening Time	32 ms*

*The value applies to the normal control voltage value.

Closing Time = The time from instant of command initiation until contacts are closed in all three poles.

Opening Time = The time from instant of command initiation until the contacts open in all three poles.

AUXILIARY SWITCH

The breaker is equipped with an 11 stage auxiliary switch. Each stage provides a 52a and 52b contact served by a common rotor. Two stages are used for the 52a contacts in the trip circuit and one stage for the 52b in the close circuit. The remaining eight stages contain a 52a and 52b contact with one common terminal (form c). All terminals of the eight contacts are wired to the pin plug, however only two terminals (either 52a or 52b) are normally wired to terminal blocks for use. These eight stages are normally wired to provide four 52a and four 52b contacts available to operate lights, for special control functions or customer use. The auxiliary switch also has an impulse contact that closes during an open or close operation for 10 ms. The impulse contact is normally not wired.

The individual contacts of the switch can not be adjusted. The only adjustment is to change the length of the switch's coupling rod which will effect the ON and OFF position of all switch stages. The switch need only be adjusted such that the contacts are operated before the limit positions of the breaker. The coupling rod length is changed by the adjustment screw at the lower end.

As a special feature the breaker can be fitted with a type Q-10 auxiliary switch with (10) stages. Each stage can be adjusted to be a 52a contact or 52b contact. Refer to Figure 17 for features of this switch.

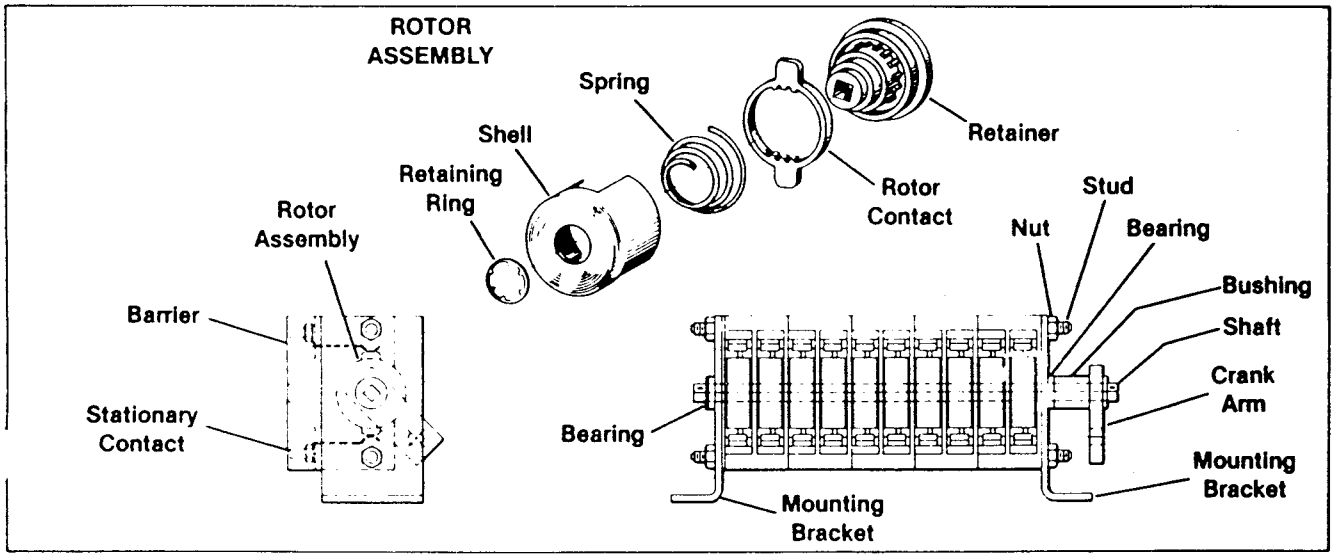


Figure 18. Type Q-10 Auxillary Switch

TRIP LATCH ADJUSTMENT

The opening solenoid is identified as Item 54.1 (Figure 6). To check the trip latch adjustment, follow the procedure given below.

1. With the breaker closed, slowly press the opening solenoid armature into the coil.
2. Note if the breaker trips before the solenoid armature bottoms out.
3. When properly adjusted the solenoid armature stroke will be .39 to .60 inch (10 to 15mm) when measured between the fully extended and bottomed positions (Figure 19a). Approximately 1 to 2mm overtravel should occur after the breaker has tripped.

   If the stroke is not within the limits in Step 3, adjustment should be made by using the trip latch adjusting screw located next to the trip button (Item 54, Figure 6). This is also shown in Figure 19b.

5. To adjust the opening solenoid stroke, loosen the adjustment screw locknut. Turn the screw clockwise to increase the stroke, or counterclockwise to decrease the stroke. Secure the adjustment by retightening the locknut.
6. Repeat Steps 1 through 3 to verify proper adjustment.
7. Locate the trip latch roller (Item 64.3.1, Figure 8) and latch (Item 64.2, Figure 8). With the breaker in the open position, wipe a film of grease on the face of the latch where it contacts the roller (see Figure 19c). Execute a close-open cycle and examine the face of the latch. The grease should show a roller wipe of 6 to 10mm as shown in Figure 19c.
8. If the wipe is incorrect, readjust the opening solenoid stroke adjustment screw (Step 5) clockwise to increase roller wipe or counterclockwise to decrease roller wipe.
9. Repeat the checks of Steps 3 and 7. **NOTE:** Both measurements should be within limits given to assure proper operation.

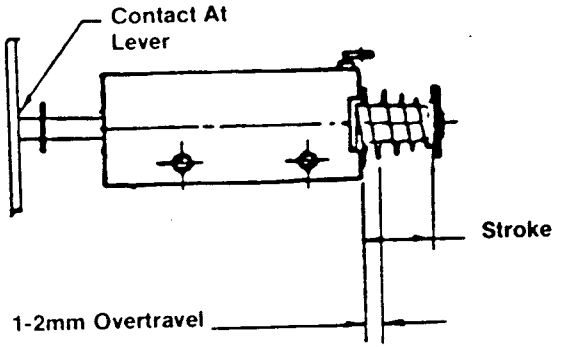


Figure 19a

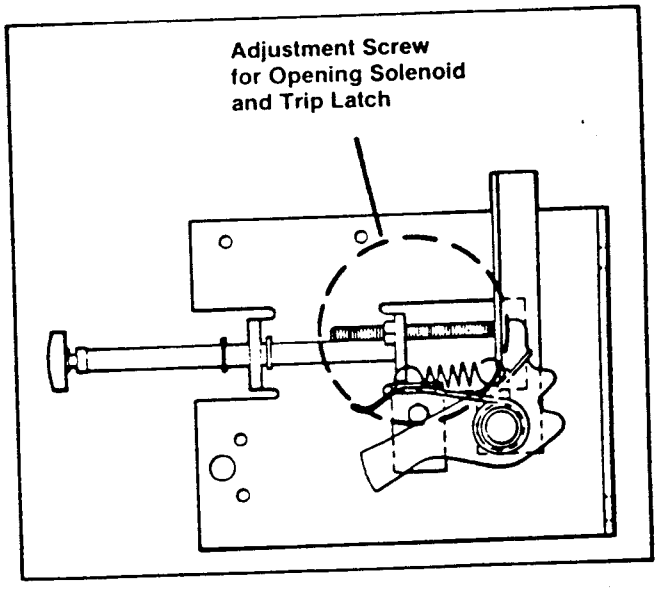


Figure 19b

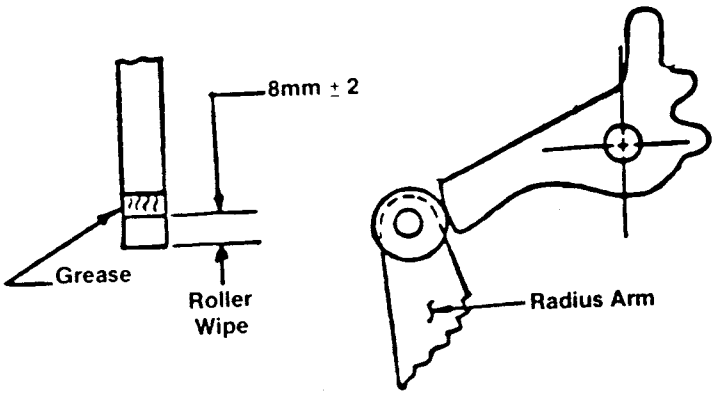


Figure 19c

CLOSE LATCH ADJUSTMENT

The close latch is not adjustable but may be checked for proper operation by following the procedure given below:

1. The closing solenoid is identified as item 53.1, Figure 6.
2. With the breaker open and closing spring charged, slowly press the closing solenoid armature into the coil and note if the breaker closes before the solenoid armature bottoms out.
3. When properly adjusted, the solenoid armature stroke will be .39 to .60 inch (10 to 15mm) when measured between the fully extended and bottomed positions (Figure 19a). Approximately 1 to 2mm of overtravel should occur after the breaker closes.

   Locate the latch roller (Item 62.5.1, Figure 7) and close latch (Item 62.5.2, Figure 7). With the breaker open and springs discharged, wipe a film of grease on the face of the latch where it contacts the roller (see Figure 20). Charge the closing spring and execute a close-open cycle and examine the face of the latch. The grease should show a roller wipe of 6 to 10mm as shown in Figure 20).
5. If the solenoid stroke and latch wipe are incorrect, look for loose, worn or damaged parts.

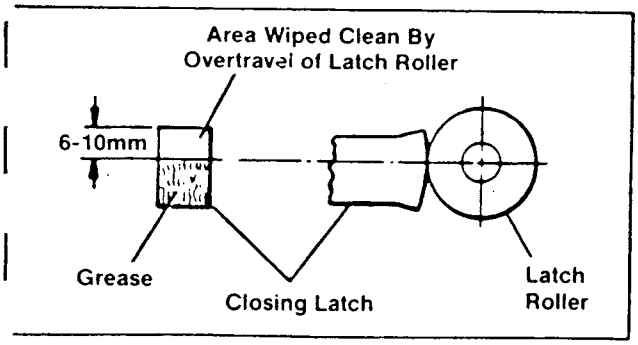


Figure 20. Closing Latch Measurement

MOTOR CUT-OFF & ANTI-PUMP CONTROL SWITCHES

The control lever that actuates the motor cut-off and anti-pump control switches is adjusted at the factory and should not require field adjustment. This same lever operates the Spring Charged—Spring Discharged indicator. However, adjustment of the actuation of these devices can be made by bending the metal tab on the control lever 55.2 (Figure 9) up or down.

VACUUM INTERRUPTER STROKE ADJUSTMENT

The final adjustment of the interrupter stroke must be made only after the interrupter has been operated a number of times no-load to set the interrupter's contacts. The standard number of open-close operations for a new interrupter is 300. Only after the mechanical operations should the interrupter stroke be set. See page 25 for dimensions.

New breakers will be shipped with a minimum of 300 mechanical operations logged on the operator and the stroke adjustment made. Replacement interrupters will be supplied with 300 mechanical operations to set the contacts.

CONTACT EROSION MEASUREMENT

Siemens vacuum breakers are provided with a factory reference dimension for each interrupter. This factory dimension is recorded on a decal in proximity to the interrupter, along with the serial number of the interrupter. The reference dimension is measured from the outer edge of the moving pole support (Figure 4, Item 40) to the flat surface of the terminal clamp (Figure 4, Item 29.2), with the breaker in the closed position. To determine the amount of contact wear, measure this distance with depth micrometers or a caliper (breaker closed). If the measured dimension exceeds the factory dimension by more than 0.090 inch, the interrupter should be replaced.
See Figure 21.

CONTACT PRESSURE SPRING STROKE

The contact pressure spring stroke has been preset at the factory and cannot be adjusted.

CONTACT TRAVEL MEASUREMENT

Before checking and adjusting the contact travel, perform the contact erosion measurement to be sure the contact erosion is within the limits given above. Then proceed as follows:

Step #1 Set breaker in the open position with opening and closing springs discharged. Remove all electrical power from breaker controls.

Step #2 With the manual slow closing hand lever close the breaker.

Step #3 Measure the distance from the outer edge of the pole support to the flat surface of the terminal clamp as described and shown in Figure 21. Record this measurement.

Step #4 Open the breaker.

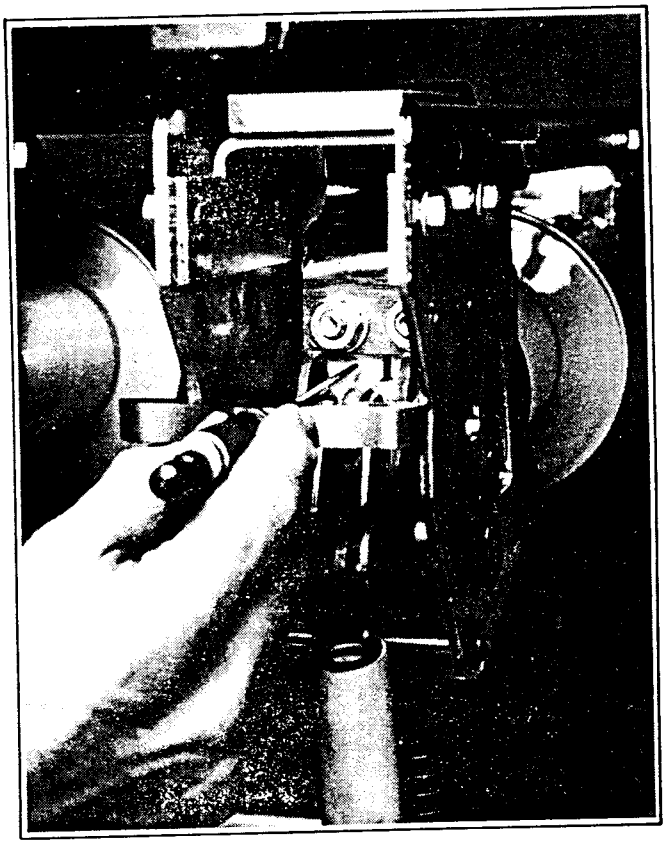


Figure 21. Erosion and Travel Measurement

Step #5 Repeat the measurement as described in Step #3, with the breaker open. Record this measurement.

Step #6 Subtract the measurement in Step #5 from the measurement in Step #3. The difference is the interrupter stroke.

Step #7 Should the stroke not be within the limits given in the Adjustment Summary Table, the eyebolt on the end of the coupling rod may be screwed "in" to increase or "out" to decrease stroke. Retighten the locknut.

CLOSING CAM CLEARANCE

The closing linkage of the 3AF operator is shown in Fig. 21a. roper operation of the mechanism requires the cam earance to be set to the value shown in the 'igure. The following procedure is to be used to establish o check this clearance.

tep #1 The operating mechanism must be in the open position, with the closing springs cha:ged.

tep #2 Insert a long .005 inch feeler gauge between the cam 62.3 and drive lever 62.6 where the clearance "A" is formed between the cam and drive lever roller. If the clearance is correct, there will be a slight drag on the feeler gage as it is moved in and out of the clearance. If the clearance is correct, no further adjustment is necessary. If the clearance is incorrect, proceed with the following steps.

Step #3 If the clearance is excessive, remove the hinge pin from the rod end and loosen the jam nut. Turn the rod end counterclockwise (out) one half turn. Retighten the jam nut and check the clearance at "A". Repeat this procedure in half-turn increments until the .005 in. clearance is established.

Step #4 If the clearance is too small and the feeler gage cannot be inserted, remove the hinge pin from the rod end and loosen the jam nut. Turn the rod end clockwise (in) one half turn. Retighten the jam nut and check the clearance at "A". Repeat this procedure in half-turn increments until the .005 inch clearance is established.

Step #5 Replace the hinge pin retaining clips. Operate the breaker several times to be sure it is operating properly.

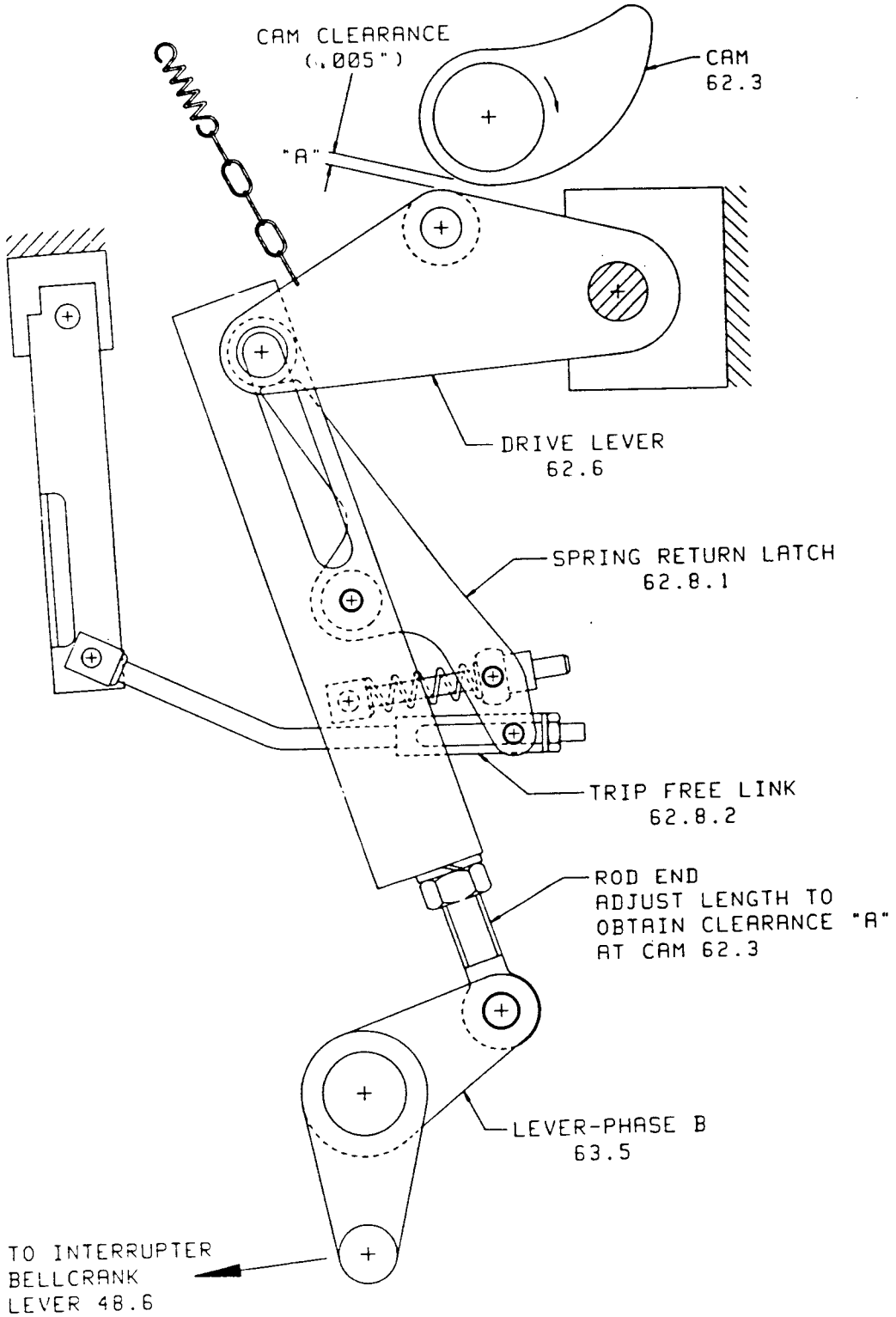


Figure 21a Closing Linkage

DUAL TRIP COILS

Occasionally a breaker equipped with dual trip coils will fail to latch closed upon command. To correct and or isolate the cause of this problem, check the adjustment of the dual trip coil.

Dual Trip Coil Adjustment Procedure

This adjustment procedure applies to SDV and SDV-2 vacuum circuit breakers equipped with the dual trip option 72350123.

1. Place the circuit breaker in the OPEN position, and be sure that the springs are discharged. Refer to Figure 21b for all adjustments.

2. Move the lever, Item 1, until it is in contact with the roller, Item 2. Maintain this position and check the clearance between the stop screw, Item 4, and lever, Item 1. This clearance should be .031-.049 inch.

3. If adjustment is necessary, loosen the locknut, Item 3, and turn the stop screw, Item 4, in or out to establish the proper clearance of .031-.049 inch. Tighten the locknut, being careful to maintain the clearance setting.

4. Loosen the locknut, Item 5, and back out the adjusting screw, Item 6, until a clearance is established between the end of the plunger, Item 7, and the adjusting screw, Item 6.

   NOTE: The plunger should be retracted into the case and latched in the position shown in the figure.

5. Slowly turn the adjusting screw clockwise until it makes light contact with the end of the plunger. Continue rotation for another 1.5 turns. Tighten the locknut, being careful to maintain the setting just established.

6. This completes the adjustment procedure.

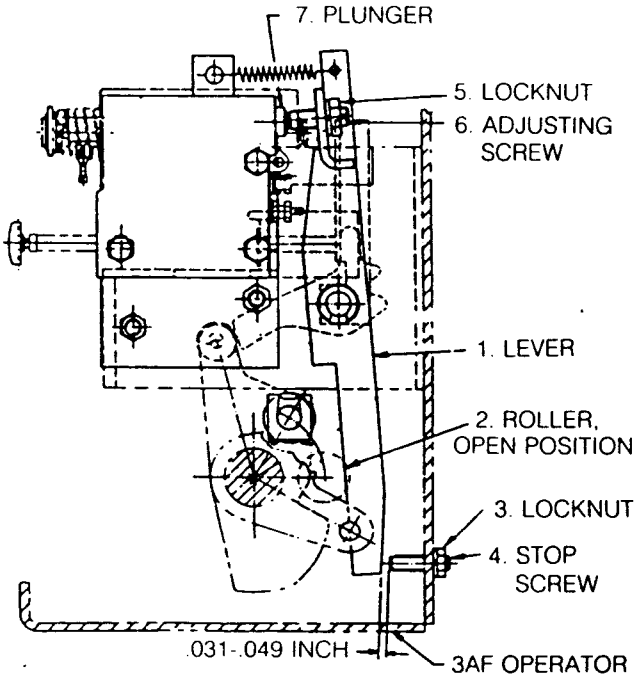


FIGURE 21b
Dual Trip Coil Adjustment

ADJUSTMENT SUMMARY

	Setting			Adjustment
Model SDV-2	15 kV	25 kV	38 kV	
Vacuum Interrupter Stroke, In.	.63 ± .04	.63 ± .04	.78 ± .04	Coupling rod length
Circuit Breaker Timing: Closing Time Spring Charging Time Opening Time	83 ms 15s 32 ms			None None None
Auxiliary Switch: Type 3SV9Z (Part of Operator)	52a 52b			Individual contacts not adjustable. Switch's coupling rod length changed to effect "ON" and "OFF" position of all stage
Type Q-10 (Special Feature)	52a 52b			Individual contacts adjustable in 15 degrees increments
Close Latch	.31 in.			None
Motor Cut-Off Switch	Open with spring charged. Close with spring discharged			Bend tab on control lever
Contact Pressure Spring	Factory Setting			None
Contact Erosion	Measurement			None
Trip Latch	See page 23A			
Dual Trip Coil	See page 25B			

GENERAL

Thorough, periodic inspection is important to satisfactory operation. Inspection and maintenance frequency depends 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 depend largely on experience and practice.

DANGER

Hazardous voltage and mechanisms. Severe personal 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.

Failure to properly maintain the equipment can result in severe personal injury, product failure and prevent successful functioning of connected apparatus. 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 breaker 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 breaker has been disconnected from power lines, attach the grounding leads properly before touching any of the circuit breaker parts.

STEP 3
Inspect the operating mechanism periodically and keep the bearing surfaces of the toggles, rods and levers adequately lubricated where required.

STEP 4
Keep the mechanism clean.

STEP 5
Be sure the circuit breaker is well grounded.

STEP 6
See that bolts, nuts, washers, cotter pins and all terminal connections are in place and tight.

STEP 7
Inspect the bushing (insulator) supports, as the vibration due to the operation of the circuit breaker may cause the bushings to move slightly and result in loose hardware.

STEP 8
Clean the bushings at regular intervals where abnormal conditions such as salt deposits, cement dust or acid fumes, prevail to avoid flashovers resulting from the accumulation of foreign substances on bushing surfaces.

STEP 9
Clean and, if necessary, dry the insulating materials across the interrupter and to ground or parts of different potential.

STEP 10
At all inspections operate the circuit breaker by hand to see that the mechanism works smoothly and correctly before operating it with power.

STEP 11
When servicing, be certain to ground the opposite ends of the interrupter and the midband rings following the removal of the circuit breaker from service or following dielectric testing before attempting to handle interrupters.

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.

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

INSPECTION SCHEDULE

Always inspect a breaker which has interrupted a heavy fault current. All current carrying joints should be inspected to be sure all contact surfaces are free of protrusions or loose hardware.

Once a year, a general visual inspection must be carried out and, if necessary, the outer insulating parts wiped down.

Breaker Mechanism: The operating mechanism must be oiled and lubicated every year or after open-close operations. This may be altered to suit local conditions as experience dictates.

Vacuum Interrupters: The life expectancy (number of open-close operations) of the interrupters is a function of the breaking current. They must be replaced after 30,000 mechanical operations or when the contacts have eroded by the maximum amount.

CONTACT EROSION

A visual check of the erosion mark "A", see Figure 22, on the movable member of the vacuum interrupter will indicate the contact erosion. The contact wear is still within the permissible limits as long as this mark can be seen when the contacts are closed.

INTERRUPTER VACUUM

A hi-pot test should be applied to the open interrupter contacts of each phase.

An alternate method to check the vacuum within the interrupters is to observe if atmospheric pressure will force the moving contact shut.

CAUTION

Hazardous radiation.
Can cause personal injury.
To prevent:

The low frequency withstand test must be performed with all covers on and doors closed.

HYDRAULIC SHOCK ABSORBER

The 3AF mechanism is equipped with a hydraulic shock absorber and a stop bar that functions when the breaker opens. See item 61.8 Figure 6. The shock absorber should require no adjustment. However, at maintenance checks, the shock absorber should be examined for evidence of leaking. If evidence of fluid leakage is found, the shock absorber must be replaced to prevent damage to the vacuum interrupter bellows.

INTERRUPTER REPLACEMENT

Replacement interrupters are furnished as a complete assembly. They have been completely tested and dielectrically and mechanically conditioned. The interrupters, when installed, do not require that they be operated no-load a set number of times or voltage tested to condition the contacts.

Before starting any work the breaker should be isolated, short-circuited and grounded. Disconnect the auxiliary supply and open and close the breaker by hand until both springs have been discharged.

It is recommended that one interrupter be removed and replaced completely rather than removing two or more interrupters at a time. The following is a step-by-step procedure for exchanging an interrupter.

1.0 Removing an Interrupter

(Figures 4, 5a, 5b & 11)

1.1 Loosen the bolt on terminal clamp 29.2.
1.2 Remove pin 48.5 from insulated coupler 48 and levers 48.6.
1.3 Remove the pin from adapter 36.3.
1.4 Remove the bolts on struts 28 at the upper pole support 20.
1.5 Remove the centering ring 28.1.
1.6 Remove the large bolt of pole support 20 at insulator 16.1.
1.7 Lift off the complete pole support 20 together with the vacuum interrupter 30.
1.8 Remove the nut on terminal post 31.2 and detach the vacuum interrupter 30 from the pole support 20.

Installing an Interrupter

(Figures 2, 4, 5a, 5b & 11).

NOTE The replacement interrupter will be equipped with adapter 36.3 that has been adjusted at the factory. Do not alter the adapter setting.

2.1 All copper contact-making surfaces should be conditioned before assembly. This is done by rubbing the surfaces vigorously with criss-crossing strokes until bright metal shows. Wipe off any metal dust with a clean rag, apply a film of acid-free vaseline to the surface and then bolt them together immediately. Make sure that the steel brush employed is used only for copper. The silverplated surfaces must be wiped off with a clean rag only and not wire brushed.

2.2 Position the vacuum interrupter 30 in the pole support 20 with the evacuation nipple on the center section of the interrupter facing the mechanism housing 60. Then screw the nut (complete with flat washer and lock washer) on to terminal post 31.2 finger-tight.

2.3 Insert vacuum interrupter 30 together with the upper pole support 20 in the lower support 40. Slip the terminal clamp 29.2 into position and screw pole support 20 on the post insulator 16.1, making a finger-tight joint.

2.4 Refit the struts 28 to pole support 20 without tightening the screws.

2.5 Couple levers 48.6 and drive links 48.9 to adapter 36.3 using the pin supplied with the interrupter.

2.6 Push terminal clamp 29.2 against the locking ring on the moving terminal 36.1 and position interrupter 30 so that its groove faces the connecting surface of flexible strap 29.1. Tighten the bolt of terminal clamp 29.2 with a torque of 40 Nm, taking care to see that the copper terminal of the interrupter is not subjected to an undo bending moment. This is achieved by tightening the bolt in the manner shown in Figure 23. Use a corresponding wrench to hold the nut.

2.7 Align pole support 20 correctly and tighten the bolt on insulator 16.1 and those on struts 28.

2.8 Tighten the nut on terminal post 31.2, holding the vacuum interrupter firmly and operate levers 48.6 by hand to see whether the moving contact of the interrupter moves freely. If need be, undo the nut on terminal post 31.2 and adjust the interrupter in pole support 20 by turning and moving it slightly.

2.9 Press centering ring 28.1 against the interrupter neck and bolt on.

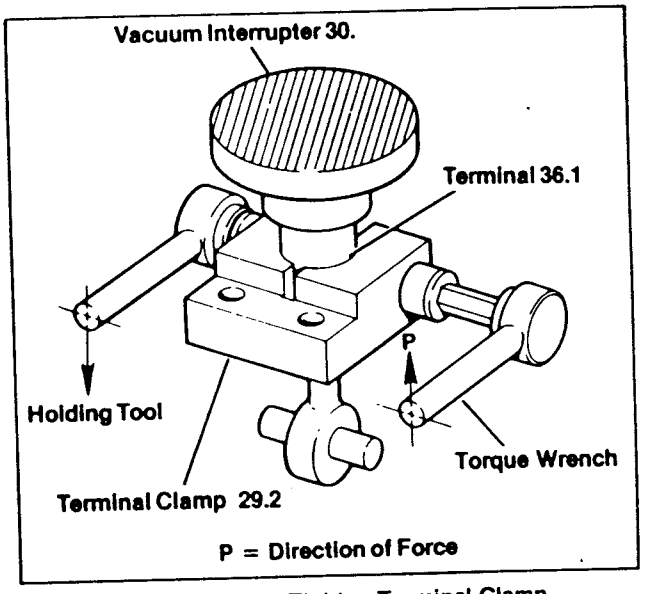


Figure 22. Procedure to Tighten Terminal Clamp

2.10 Link insulated coupler 48 and lever 48.6 together by means of pin 48.5 and lock the pin in position.

2.11 Open and close the breaker several times no-load and then check to see that all the screwed joints are tight.

3.0 Checking the Contact Stroke

3.1 Trip the breaker.

3.2 Remove pin 48.5 as described in step 2 under adjustments. The interrupter contacts must now close automatically.

3.3 Measure the distance between the lower edge of the lateral cutout in pole support 40, and the lower edge of terminal clamp 29.2, using Vernier calipers.

3.4 Press the lever 48.6 back to the open position and reinsert pin 48.5 and repeat the above measurement. Note that the pin can be only reinserted in the hold it was removed from.

3.5 Determine the difference between the dimensions taken in steps 3.3 and 3.4. The stroke must be between .59 to .67 inches (15 to to 17mm). The setting can be adjusted by altering the setting of the eyebolt on the insulated coupler 48. If the stroke is excessive turn the eyebolt out and if it is too short, turn the eyebolt in. Recheck the stroke after each adjustment.

Points	Lubricants
Ⓑ	Beacon 325
Ⓓ	Dexron II

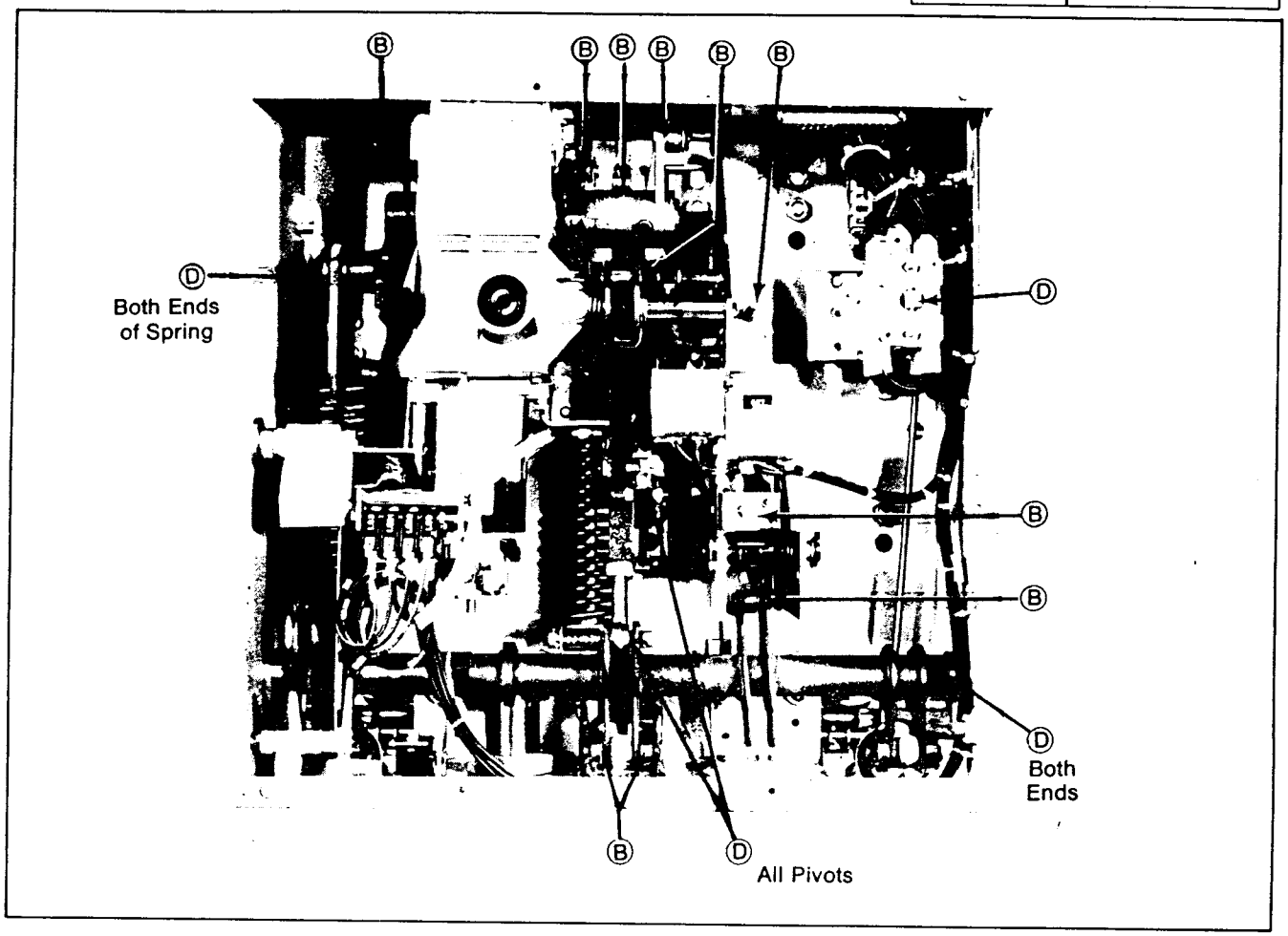


Figure 23. Points To Be Lubricated

RE-LUBRICATING

The main points to be lubricated with Beacon 325 (Siemens number W-962-030) are all bearings and sliding surfaces indicated in figure 23. All points not marked (bearings, articulated joints and auxiliary switch) should be treated with Dexron II.

To relubricate the mechanism, detach its cover. Lubricate all the appropriate points, starting at the top left and working through systematically. Parts that are not rigidly fixed should be moved slightly to and fro to let the oil penetrate. Following this, operate the breaker several times to test it.

SPECIAL TOOLS

In addition to the usual maintenance tools required for breaker maintenance there are two special devices available. One is a hand crank to manually charge the closing spring and the other is a hand lever to manually slow close the breaker.

The hand crank is used to charge the closing spring without control power. To use the hand crank insert the end with the roll pin into the opening provided 50.1 on the charging mechanism 50.2 (Figure 9). A total of fifty clockwise turns is required to completly charge the closing spring. The spring cannot be over charged with the hand crank and will not engage with counter clockwise turns.

The manual slow close hand lever is used to close and open breaker without using the closing spring. To use the hand lever insert the square end, with bend pointing down, between the long brass pin on lever 63.5 and breaker shaft 63 (Figure 7 and 8). A slow downward motion on the end

of the lever will rotate the breaker shaft thereby closing the breake . A full rotation of the shaft is required for the trip latch 64.2 and latch roller to engage (Figure 8).

These devices are listed and can be obtained from the factory.

Hand Crank	**72-151-064-501**
Hand Lever	**72-150-745-002**

REPLACEMENT PARTS

A list of replacement parts is sent with the breaker. A supply of these parts may be kept on hand so that the emergency repairs can be made without waiting for a shipment from the factory. Orders for replacement parts should be addressed to the nearest Siemens sales office and should include:

1. Breaker Serial Number.
2. Type and rating of breaker from the nameplate.
3. Control voltage (if applicable) from the nameplate.
4. Description of part.
5. Instruction book number, figure number and reference number. If none exists, a description or sketch should accompany the order.
6. Quantity required.

The breaker has a combination of inch and metric hardware. All the hardware used within the operator and interrupter mounting is metric, while all the remaining hardware used on the bushing and bus mounting and cabinet assembly, is inch Avoid using the wrong tools when replacing any hardware.

BUSHING

Bushings should be cleaned at regular intervals where abnormal conditions prevail. The bushing can be replaced by removing the bus to bushing stud hardware and clamping nuts on bushing mounting flange without affecting any other breaker part or adjustment. The breaker can be equipped with three bushing types. Refer to breaker approval drawing for bushing type provided and dimensions.

1. Oil Filled Porcelain
   This bushing is equipped with an upper porcelain housing, an oil sight gauge, a cast aluminum mounting flange and ground sleeve and cast epoxy lower housing. The oil level in the transparent oil reservoir will vary with temperature as shown:

Oil Level	Oil Temperature
High	65 Degrees C (149 Degrees F)
Normal	25 Degrees C (77 Degrees F)
Low	-40 Degrees C (-40 Degrees F)

   Since the temperature-pressure relation for the oil and the expansion space was established at 25°C, the bushing fill plug should be removed and oil added only at 20°C-25°C.

2. Dry Type Porcelain
   This bushing is a one piece porcelain with a center through conductor. The mounting flange is part of the porcelain structure and mounted with a two part clamping flange.

3. Cycloaliphatic Epoxy
   This bushing is a solid cast epoxy unit with a cast in center conductor. The mounting flange is part of the epoxy structure. The ground sleeve and flange area is covered with an aluminum spray finish.

BUSHING CURRENT TRANSFORMER

The high voltage bushings extend through bushing current transformers mounted in the cover of the high voltage compartment. Three transformers are standard on each vacuum breaker, however, the BCT nameplate should be checked for the exact number, location and rating. Space is available for 12 BCT's per breaker. The bushing current transformer connections are wired to separate terminal blocks located in the control and relay compartment.

DANGER

Hazardous voltage.
Will cause personal injury, death or damage circuit breaker.
To prevent:

Current transformers must not be operated with an open circuit and must be either connected to a burden or short circuited and grounded at the terminal blocks.

RELAY PANEL

The breaker can be equipped with a relay panel when required. A relay package can be supplied on a hinged panel mounted in the front of the control compartment. The following items can be accommodated on the swing out panel:

1. Breaker control switch with red and green indicating lights
2. Three overcurrent phase relays
3. One overcurrent ground relay
4. Three ammeters
5. One automatic reclosing relay

Refer to the wiring and schematic diagrams, and other instruction literature shipped with the breaker for additional specific relay requirements.

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