March, 1985

Manual 9886-1

Installation & Maintenance Manual

Type VAV Vertical-Lift Vacuum Circuit Breaker

• INSTALLATION • OPERATION • MAINTENANCE •

SQUARE D COMPANY

INSTRUCTION
MANUAL 9886-1

TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS

CLASS 9886

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TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS

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STATEMENT OF USE OF SURGE PROTECTION FOR VACARC CIRCUIT BREAKERS USED IN RETRO-FIT APPLICATIONS

"VACARC medium voltage vacuum circuit breakers are designed and tested in accordance with ANSI C37.04, .06, and .09. Used in conjunction with switchgear designed and tested to ANSI C37.20, circuit breakers can be applied as general purpose devices.

Users may elect to install VACARC circuit breakers over a wide range of applications and system parameters. Several IEEE publications are available to provide guidance to the user for industry practices (IEEE Color Book Series).

Special attention is suggested by the user when considering old or aging distribution systems. Distribution systems can be exposed to lightning or switching surges. Old or aging systems may be more susceptible to damage by reduced BIL levels.

Recognizing this, users are encouraged to consider adding metal oxide surge arrestors to the load side terminals of VACARC breakers used in retro-fit applications. Placement of the arrestor would be in the switchgear not on the circuit breaker.

Metal oxide arrestors limit the magnitude of prospective overvoltages but do not affect the rate of rise (di/dt) of surge transients. Surge capacitors can be considered for this additional protection."

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TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS

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IMPORTANT

READ BEFORE INSTALLING CIRCUIT BREAKER

RETROFIT INSTRUCTIONS

Since most TYPE VAV series breakers will be used either as retrofit equipment in existing switchgear or as breaker elements to be installed in cubicles manufactured by another company, it is most important that the user carefully assure proper interfacing of the breaker with the switchgear and make adjustments if necessary. ***IF THIS IS NOT DONE, SEVERE DAMAGE COULD BE INCURRED TO THE BREAKER OR SWITCHGEAR AND HAZARDOUS CONDITIONS OR BODILY INJURY COULD RESULT.***

When installing a TYPE VAV breaker into the switchgear for the first time, always follow these instructions:

1. Make sure that the ratings of the breaker match those of the switchgear section into which it is being installed.

2. Carefully roll the breaker into the switchgear.

3. Observe that the ground contact at the right rear of the breaker is aligned with the ground contact on the switchgear. If not, remove the breaker and adjust the ground contact on the switchgear as required for proper alignment.

4. Before lifting the breaker, observe that the lifting cradle in the switchgear is aligned with the lifting angles located on each side of the breaker.

5. Slowly raise the breaker in its cubicle but stop before insertion. Observe that the secondary disconnect (Figure 7, 10) on the breaker is aligned with the secondary coupler on the switchgear. If not, adjust the secondary coupler on the switchgear for proper alignment. Also observe that the six feed-thru bushings (Figure 4) are aligned and centered with the primary disconnects in the switchgear. If not, contact the factory before proceeding.

6. Observe that the spring discharge interlock (Figure 10, 1) and the lockout interlock (Figure 10, 14) are aligned with the respective cam plates on each side of the switchgear. If not adjust the cams on the switchgear as required.

7. Once all alignments have been assured, the breaker can be fully raised into the cubicle.

TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS

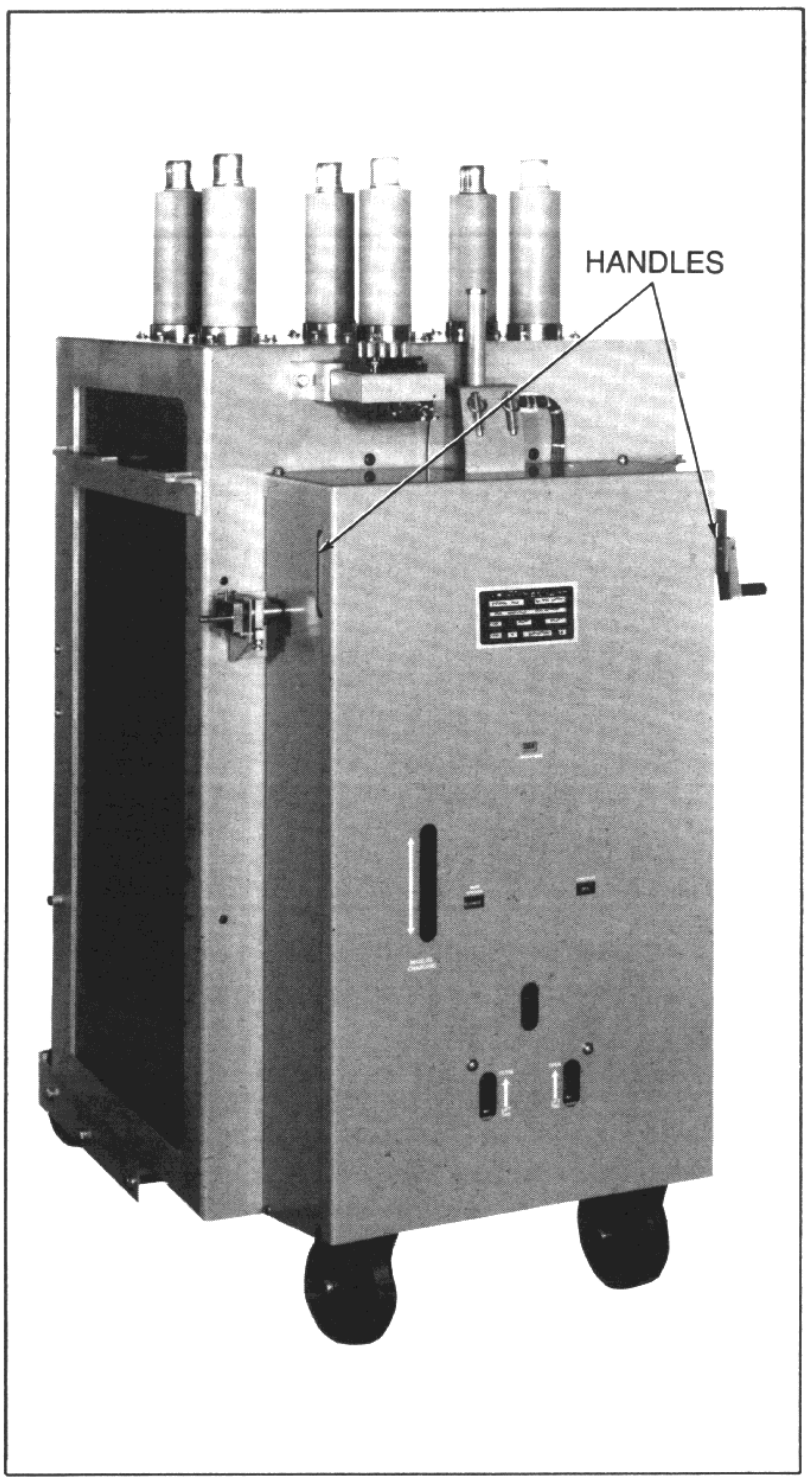


Figure 1

INTRODUCTION

This manual provides installation, operation and maintenance instructions for all models of this series of vertical lift vacuum circuit breakers. Available in all standard ratings and meeting or exceeding all applicable industry standards, these breakers provide three-cycle interruption, long switching life and ease of operation and maintenance.

Receiving

Upon receipt by the customer, the entire breaker should be inspected for damage that may have been incurred in transit (Figure 1). All items should be checked against the packing list provided. The transportation company and the manufacturer should be notified of damages or shortages.

Handling

Use care when uncrating and handling the breaker. NEVER USE THE BUSHINGS AS HANDLES. Roll and maneuver the breaker by grasping the handles on each side of the front mechanism cover. When using a fork lift or hoist, lift the breaker by the strong points of the frame to prevent damage.

Storage

If the breaker must be stored before it is put into operation, keeping it in a place that is clean, dry and free of corrosive elements and mechanical abuse is absolutely necessary. Coat all bare metal surfaces with grease to prevent rusting.

The manufacturer recommends that the breaker be put in its permanent location as soon as possible. If the breaker is to function in outdoor switchgear, install it only when power is available and heaters are operating.

Breakers that must be stored for prolonged periods should be inspected regularly for rusting and overall condition. Greasing should be performed when necessary.

Initial Breaker Preparation

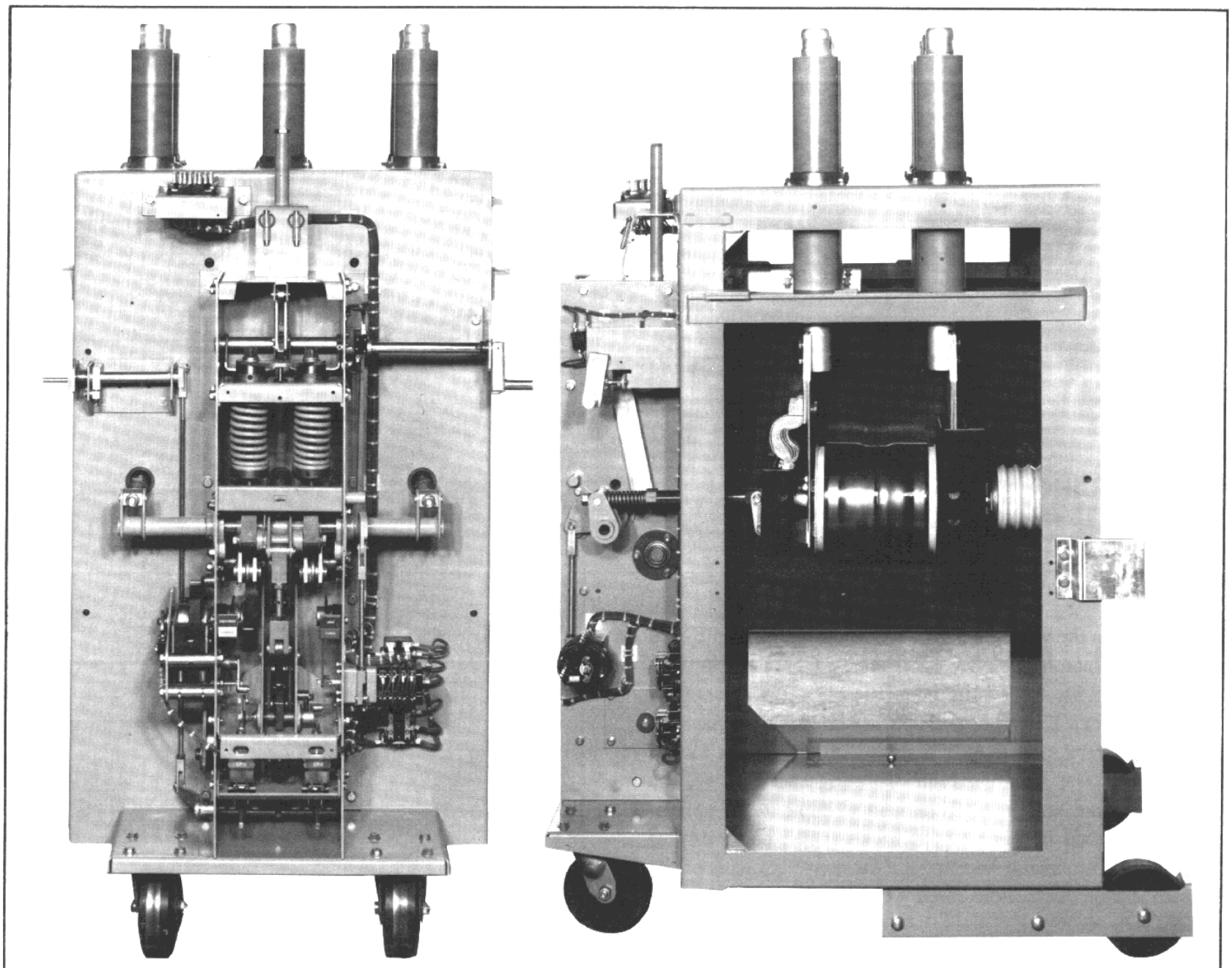
a) Examine the entire breaker (Figure 2).

b) Use a clean, dry cloth to remove dirt and moisture that may have collected on the outside of the vacuum interrupters and on all insulating parts.

c) Cycle the breaker manually several times and check for proper operation. This is accomplished by using the manual charging bar (supplied with the breaker) to move the manual charging arm up and down until the drive springs are fully charged. The drive springs are fully charged when the charge-discharge indicator reads "charged" and the manual charging arm can no longer be raised.

d) Electrically operate the breaker several times and check for proper operation.

TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS



BREAKER WITH FRONT COVER AND BARRIERS REMOVED

Figure 2

e) To assure that damage has not occurred during shipment, perform a hipot test on each vacuum interrupter while the breaker is in the open position. Gradually raise the voltage to the proper level. The hipot test voltage should be 36kV rms for a 7.2kV or 13.8kV class breaker. The contact gap should sustain this potential for one (1) minute. If the vacuum interrupter fails, it must be replaced. Observe the following instructions when performing the hipot test:

1. Do not exceed the above voltages.
2. Do not test interrupters with open gaps less than 1/2 inch.
3. All persons should stay at least 6 feet away from the breaker under test.
4. Perform tests only when all insulating parts are installed.
5. Discharge to ground the primary disconnects and vacuum interrupter mid-band ring before handling. These areas can retain static charge after a hipot test.

f) Insert the breaker into its cubicle by following any applicable instructions provided by the cubicle manufacturer. Check the alignment of the breaker and slowly raise it into position while observing the primary and secondary disconnects for proper alignment.

g) With the main power off, cycle the breaker several times and check for proper operation.

h) The breaker is now ready for normal operation.

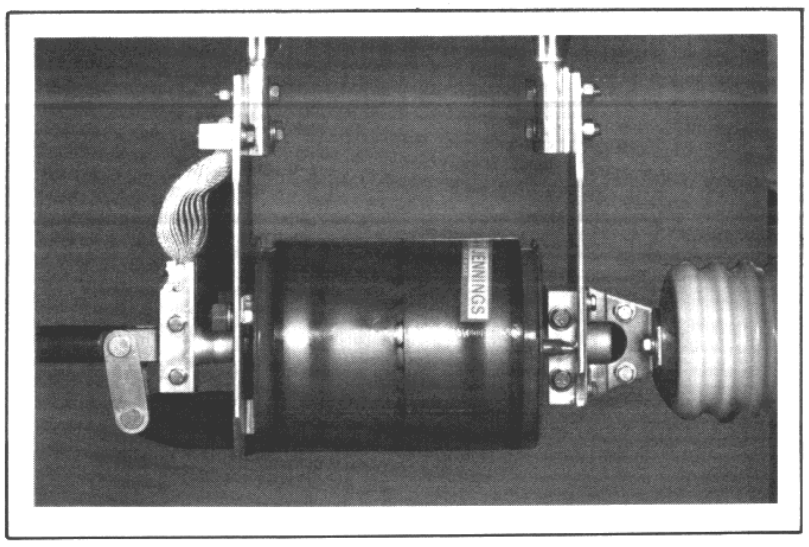


Figure 3

VACUUM CIRCUIT BREAKER - DESCRIPTION

Vacuum Interrupters

Interruption in the vacuum circuit breaker is performed by the vacuum interrupters mounted horizontally within the breaker frame (Figure 3). Consisting of a pair of butt contacts, one movable and one fixed, hermetically sealed in a high vacuum, these interupters require only a short contact gap for circuit interruption. The resulting high operating speed allows the entire operating sequence, from fault to clear, to be consistently performed in three cycles or less. The possibility of restriking is minimized because the dielectric strength of the vacuum gap recovers more rapidly than the rate of rise of the applied voltage.

Feed-Thru Bushings

The primary connections to the associated switchgear are made through the six feed-thru bushings mounted to the top of the breaker frame (Figure 4). These are adjusted at the factory for proper alignment. Care should be taken to insure that the feed-thru bushings do not receive rough treatment. NEVER USE THE FEED-THRU BUSHINGS AS HANDLES WHEN MANEUVERING THE BREAKER.

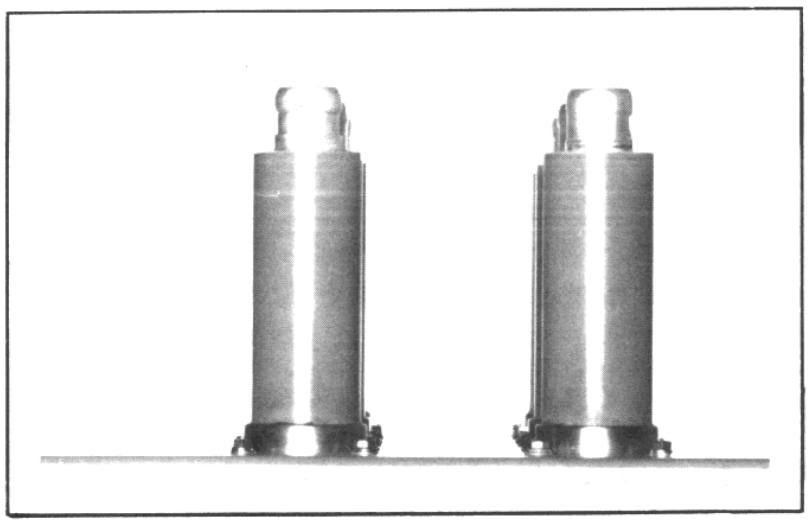


Figure 4

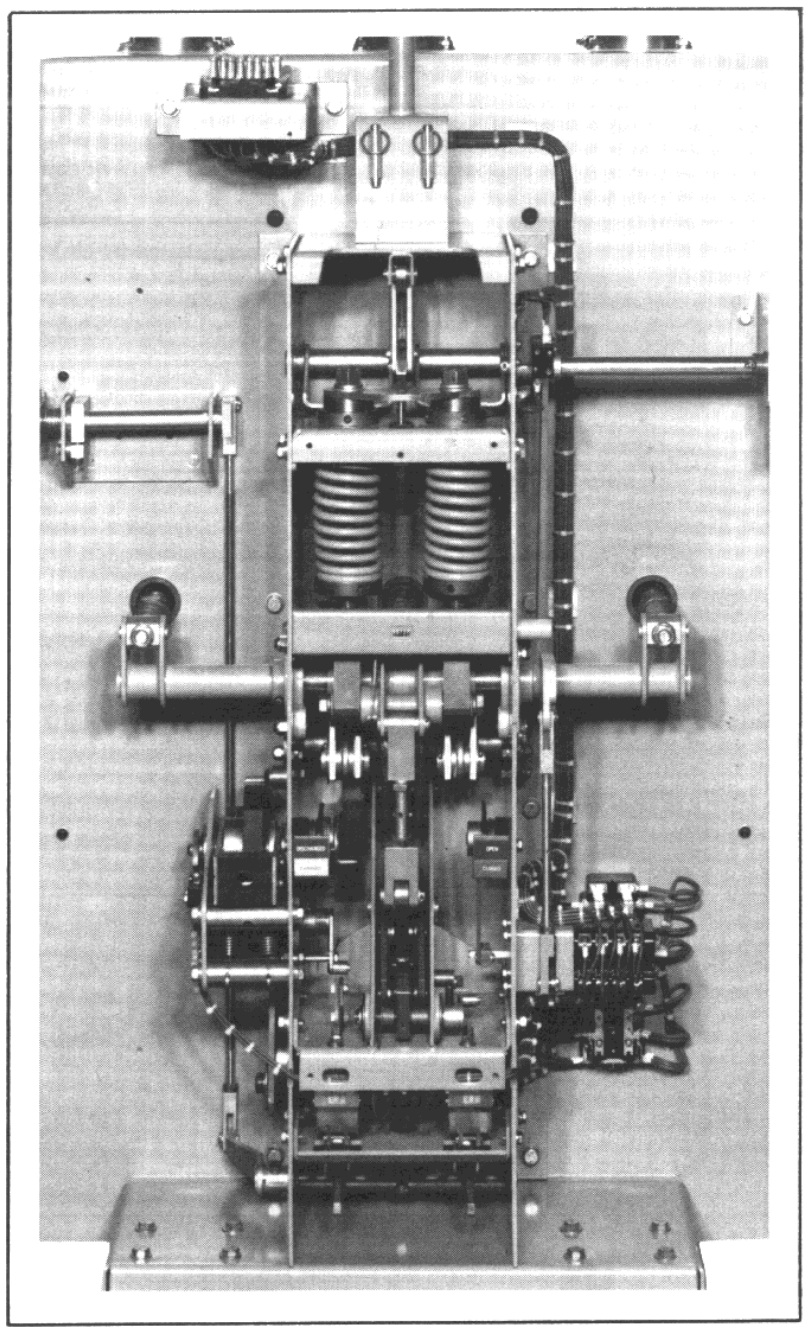
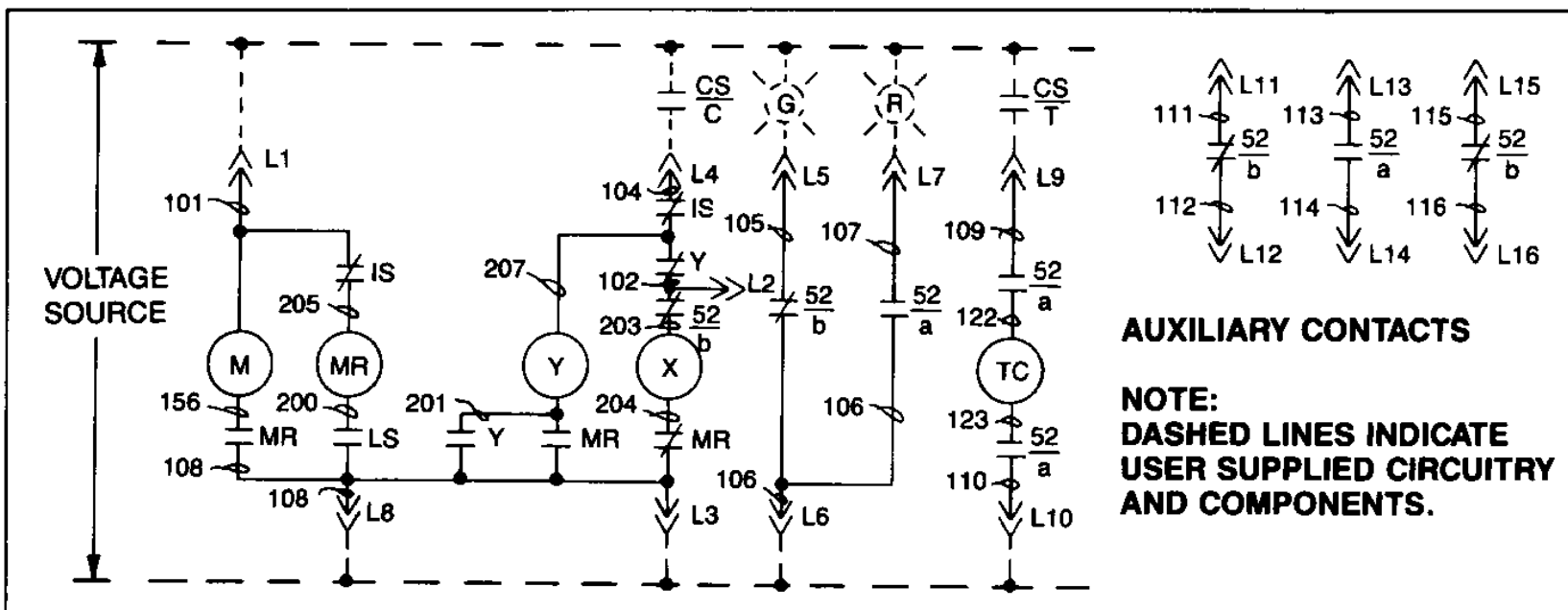


Figure 5

Operating Mechanism

The operating mechanism is of the stored energy type employing charged springs to perform breaker opening and closing functions (Figure 5). The operating mechanism contains all necessary controls and interlocks. It is mounted at the front of the breaker so that it can be easily accessed for inspection and servicing. Opening and closing can be performed electrically or manually.

TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS



SCHEMATIC DIAGRAM
CONTROL SCHEMATIC TYPE VAV CIRCUIT BREAKER, D.C. TRIP, D.C. CLOSED

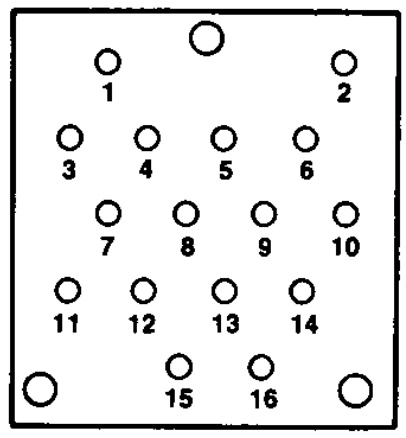
AUXILIARY CONTACTS

NOTE:
DASHED LINES INDICATE USER SUPPLIED CIRCUITRY AND COMPONENTS.

LEGEND

MR	MOTOR RELAY
CS	CONTROL SWITCH
G	GREEN INDICATING LIGHT
R	RED INDICATING LIGHT
Y	ANTI PUMP RELAY
SM	SPRING CHARGING MOTOR
TC	TRIP COIL (OPENING COIL)
X	SPRING RELEASE COIL (CLOSING COIL)
LS	SPRING CHARGING MOTOR LIMIT SWITCH
IS	INTERLOCK SWITCH
L	SECONDARY DISCONNECT CONTACT
<<	INDICATES SECONDARY DISCONNECT POINT
52	VACUUM CIRCUIT BREAKER
52/a	CLOSED WHEN BREAKER IS CLOSED
52/b	OPEN WHEN BREAKER IS CLOSED

SECONDARY DISCONNECT WIRING



(PIN SIDE OF CIRCUIT BREAKER DISCONNECT SHOWN)

CONTROL CIRCUITRY SCHEMATIC DIAGRAM

Figure 6

Breaker Operation

The following describes the operation of the various components of the control circuitry.

Auxiliary Switch

The auxiliary switch (Figure 7,7) is a multi-stage switch used to operate those circuits which are dependent upon the position of the breaker contacts. The schematic diagram indicates how each of the auxiliary switch stages are interconnected with the breaker circuitry.

Charging Motor Limit Switch

The charging motor limit switch (Figure 7,3) energizes the motor relay (Figure 7,8) when a drive spring charging operation is required and de-energizes the motor relay when the drive springs reach the fully charged position. As shown in the schematic diagram the charging motor limit switch (LS) is connected in the normally open position. Whenever the drive springs are not in the fully charged position, the charging motor limit switch cam (Figure 7,2) actuates the charging motor limit switch and allows the switch to assume its normally open position once the drive springs are fully charged.

Motor Relay

When energized by the closing of the spring charging motor limit switch (LS), the motor relay (MR) energizes the spring charging motor (M) through a pair of normally open contacts and disables the closing solenoid (X) through a pair of normally closed contacts.

TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS

1. SPRING INDICATOR
2. MOTOR LIMIT SWITCH CAM
3. CHARGING MOTOR LIMIT SWITCH
4. MANUAL CHARGING ARM
5. CLOSE LEVER
6. ANTI-PUMP RELAY
7. AUXILIARY SWITCH
8. MOTOR RELAY
9. OPEN-CLOSE INDICATOR
10. SECONDARY DISCONNECT

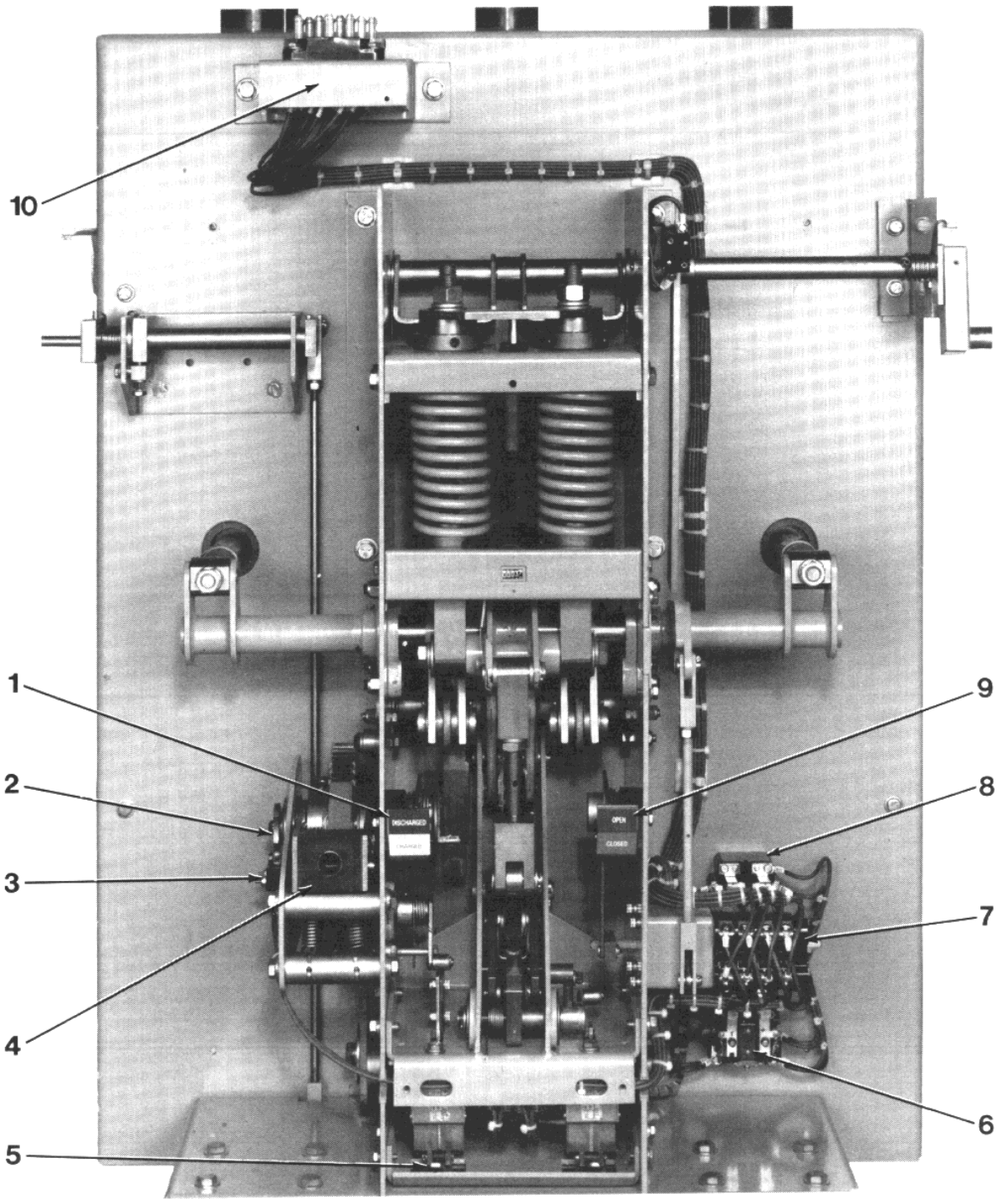


Figure 7

Anti-Pump Relay

The anti-pump relay (Figure 7,6) insures that should the control switch (CS/C), which energizes the closing solenoid, be continuously maintained in the closed position, the springs will not be continuously charged and discharged. The anti-pump relay performs this function by allowing the closing solenoid to be energized only if the control switch (CS/C) is closed *after* the drive springs have reached the fully charged position and the motor relay (MR) has been de-energized.

The anti-pump relay will be energized if the control switch (CS) is closed and the motor relay (MR) is energized. If the control switch is held continuously, the anti-pump relay will be latched in the energized position after the motor relay is de-energized by a pair of its own normally open contacts. When the anti-pump relay is energized, a pair of its normally closed contacts, in series with the closing solenoid, insure that the closing solenoid cannot be energized by the control switch. The closing solenoid cannot be energized unless the control switch is first opened (de-energizing the anti-pump relay); then closed again.

Latch Check Switch (Optional)

When specified, the latch check switch option (LC) places a set of normally open contacts in series with the closing solenoid coil. The latch check switch allows the closing solenoid to be energized only after the trip opening cam has returned to its normal position.

Indicators

Two indicators are provided on the operating mechanism. The open-close indicator (Figure 7,9) designates the position of the vacuum interrupter contacts. The charge-discharge indicator (Figure 7,1) displays the state (charged or discharged) of the drive springs.

Manual Charging Arm

The drive springs can be manually charged by using the manual charging bar (supplied with the breaker) to move the manual charging arm (Figure 7,4) up and down until the drive springs are fully charged. The drive springs are fully charged when the charge-discharge indicator (Figure 7,1) reads charged and the manual charging arm can no longer be raised.

Slow Closing Feature

For some maintenance functions it may be desirable to manually slow close the circuit breaker. For such purposes, the VAV operating mechanism provides a built-in slow closing feature.

Manual slow closing is accomplished as follows:

a) With the breaker in the open position and the drive springs charged, insert the drive spring blocking pins (supplied with the breaker) into the hole at the upper end of each drive spring center shaft. (Removal of the front mechanism cover is required.)

b) Discharge the drive springs against the blocking pins by raising the close lever (Figure 7,5).

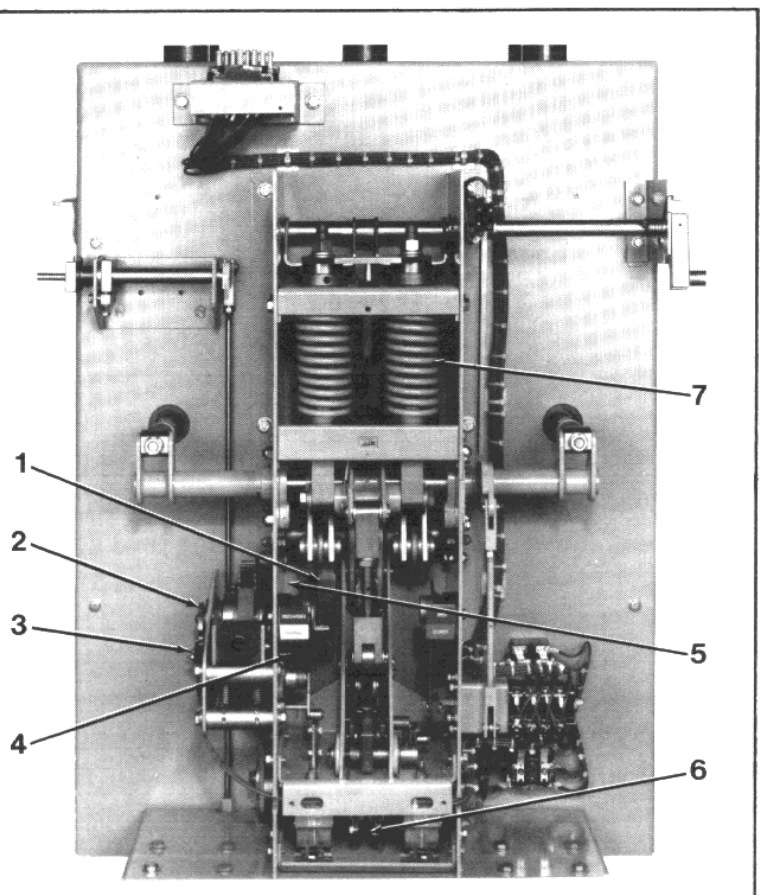
c) Using the manual charging handle, slowly charge the drive springs as described in Section Manual Charging Arm.

OPERATING MECHANISM - DESCRIPTION OF OPERATION

The following is a description of the operation of the operating mechanism. This section will refer to the operating mechanism as the front of the breaker. The terms left and right will be used as if facing the operating mechanism. The terms clockwise and counterclockwise will be used as if facing the left side of the breaker.

Drive Spring Charging

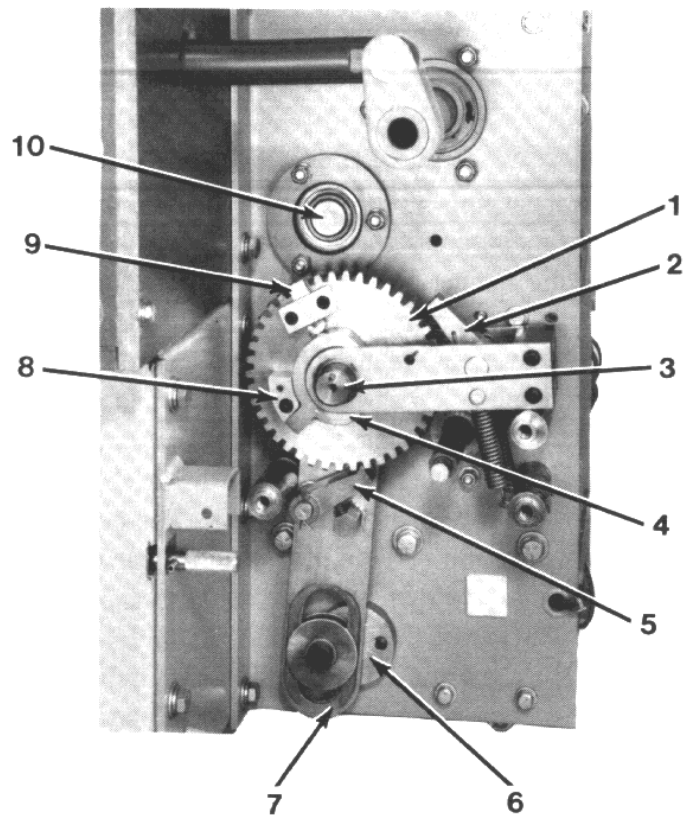
Assume that the interrupter contacts are in the open position and that the drive springs and the return springs (Figure 8,7) are discharged. When power is supplied to the breaker control circuitry, the charging motor (Figure 8,6) is energized. The motor eccentric (Figure 9,6), mounted on the charging motor shaft, drives the ratchet arm assembly (Figure 9,7) backward and forward. With each forward stroke of the ratchet arm, the spring loaded drive pawl (Figure 9,5), mounted on the ratchet arm, engages a tooth on the gear (Figure 9,1) and advances the gear a few degrees counterclockwise. The holding pawl (Figure 9,2) holds the gear in position while the drive pawl makes its reverse stroke to engage another tooth. The gear is free to rotate on the gear shaft (Figure 9,3). As the gear is advanced, the drive block (Figure 9,8), mounted on the outside face of the gear, engages the ear on the drive hub (Figure 9,4) and rotates the drive hub. A roll pin connects the drive hub to the gear shaft and drive lever assembly. The gear shaft and drive lever assembly thus rotates with the drive hub.



1. LIFT ARM
2. LIMIT SWITCH CAM
3. CHARGING MOTOR LIMIT SWITCH
4. CLOSING ROLLER
5. LIFTING ROLLER
6. CHARGING MOTOR
7. DRIVE & RETURN SPRING

Figure 8

TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS



1. GEAR
2. HOLDING PAWL
3. GEAR SHAFT
4. DRIVE HUB
5. DRIVE PAWL
6. MOTOR ECCENTRIC
7. RATCHET ARM ASSEMBLY
8. DRIVE BLOCK
9. PAWL LIFT SLIDE
10. DRIVE SHAFT

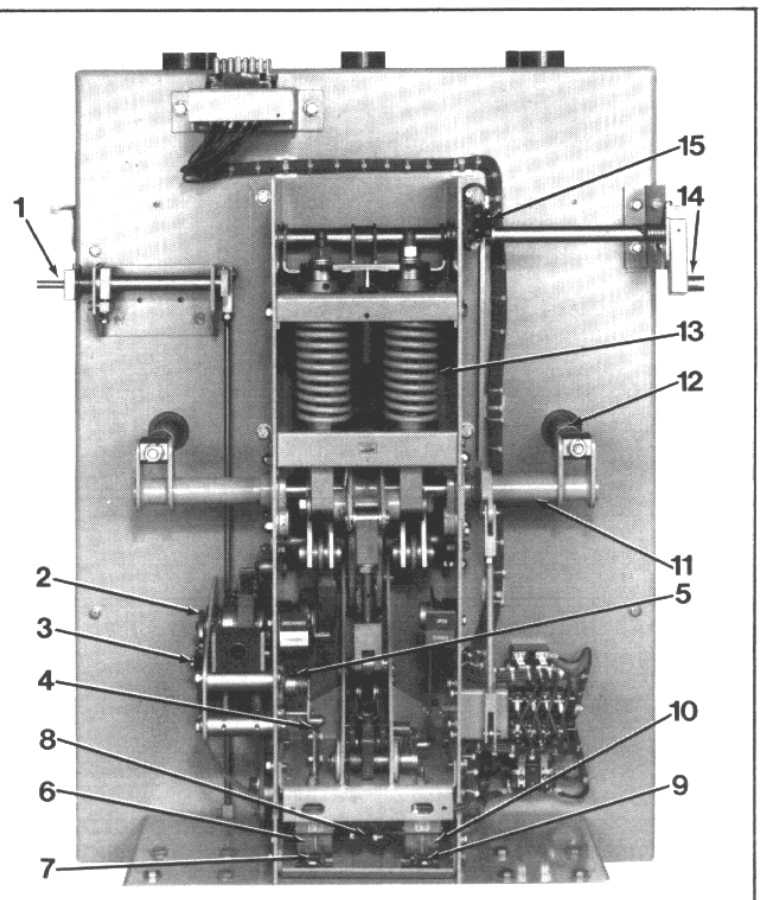
Figure 9

As the drive lever rotates, the lifting roller (Figure 8,5) on the drive lever contacts the left arm (Figure 8,1) on the drive shaft (Figure 9,10) and pushes the lift arm up rotating the drive shaft counterclockwise. The counterclockwise drive shaft rotation compresses the drive springs until the spring load against the drive lever passes top dead center and attempts to discharge. At this point, the drive lever rotates a few degrees until the trip closing roller (Figure 8,4) on the drive lever engages the trip closing cam. The drive lever can rotate no farther and the drive springs are held in this charged position until a closing operation is initiated.

When the drive springs reach the fully charged position, the charging motor limit switch cam (Figure 8,2) allows the charging motor limit switch (Figure 8,3) to open, de-energizing the charging motor. Simultaneously the pawl lift slide (Figure 9,9) is pushed forward by the cam lobe on the drive hub so that the drive pawl rides on the pawl lift slide and does not engage the gear. This arrangement allows the charging motor and ratchet assembly to coast smoothly to a stop.

Closing Operation

Once the drive springs (Figure 10,13) have been charged, the breaker can be closed by lifting the close lever (Figure 10,7) or by energizing the closing solenoid (Figure 10,6). Either method disengages the trip closing cam (Figure 10,4) from the trip closing roller (Figure 10,5) and allows the drive springs to discharge. The discharging drive springs rotate the drive shaft (Figure 9,10) clockwise. The clockwise rotation of the drive shaft gives the drive spring bearing (Figure 11,3) a downward motion. The drive spring bearing engages the toggle cam (Figure 11,1) rotating the front of the toggle cam up and the rear of the toggle cam down under the catch (Figure 11,2). The front of the toggle cam is connected to the main shaft (Figure 10,11) by the drive linkage (Figure 11,5). The upward motion of the front of the toggle cam thus rotates the main shaft counterclockwise and compreses the return springs.

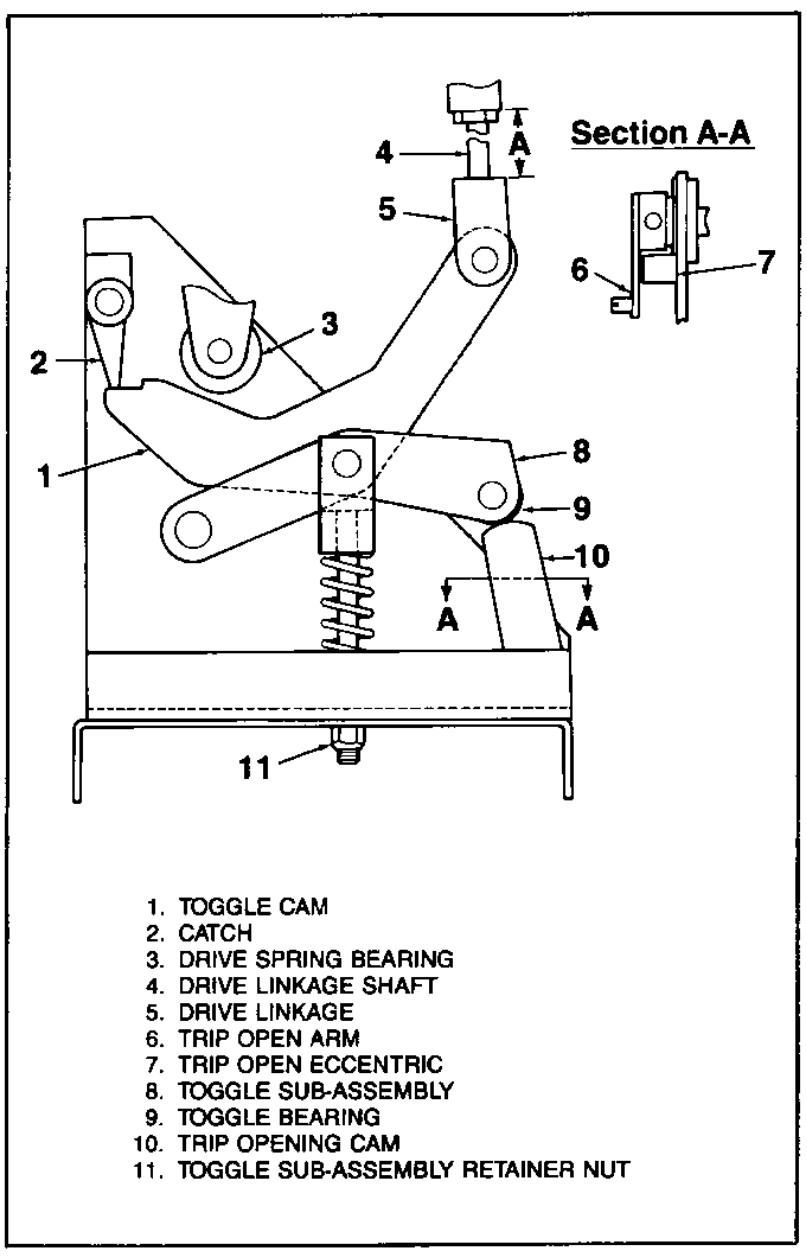


1. SPRING DISCHARGE INTERLOCK
2. LIMIT SWITCH CAM
3. CHARGING MOTOR LIMIT SWITCH
4. CLOSING CAM
5. TRIP CLOSING ROLLER
6. CLOSING SOLENOID
7. CLOSE LEVER
8. CHARGING MOTOR
9. OPEN LEVER
10. OPENING SOLENOID
11. MAIN SHAFT
12. DRIVE CONNECTING LINK
13. DRIVE SPRING
14. LOCKOUT INTERLOCK
15. INTERLOCK SWITCH

Figure 10

The drive connecting links (Figure 10,12) transform the rotary motion of the main shaft into a linear motion which closes the vacuum interrupter contacts. The trip opening cam (Figure 11,10) forces the entire toggle assembly (Figure 11) to remain latched in this position.

When the drive springs discharge, rotating the drive shaft in a counterclockwise direction, the descending lift arm rotates the drive lever such that the drive lever completes the remaining 360 degrees of rotation to its initial position where it can once again perform a drive spring charging operation. The gear shaft and drive hub rotate with the drive lever. The drive hub rotates out of contact with the drive block. Since the gear (Figure 9,1) rotates freely on the gear shaft, the gear remains stationary. The rotation of the drive hub is such that the pawl lift slide (Figure 9,9) follows the cammed surface of the drive hub until the pawl lift slide moves back below the gear teeth permitting the drive pawl (Figure 9,5) to engage the gear. The charging motor limit switch cam (Figure 10,2) rotates with the gear shaft and closes the charging motor limit switch (Figure 10,3) energizing the charging motor (Figure 10,8) which once again charges the drive springs.



1. TOGGLE CAM
2. CATCH
3. DRIVE SPRING BEARING
4. DRIVE LINKAGE SHAFT
5. DRIVE LINKAGE
6. TRIP OPEN ARM
7. TRIP OPEN ECCENTRIC
8. TOGGLE SUB-ASSEMBLY
9. TOGGLE BEARING
10. TRIP OPENING CAM
11. TOGGLE SUB-ASSEMBLY RETAINER NUT

Figure 11

Opening Operation

With the return springs (Figure 10,13) charged, the operating mechanism is now ready to perform an opening operation. If the open lever (Figure 10,9) is lifted or if the opening solenoid (Figure 10,10) is energized, the trip opening cam (Figure 11,10) will be rotated clockwise out from under the toggle bearing (Figure 11,9). The force of the charged return springs pushing down on the front of the toggle cam (Figure 11,1) will cause the toggle sub-assembly (Figure 11,8) to rotate clockwise. When the rear of the toggle cam clears the catch (Figure 11,2) the return springs will completely discharge, rotating the main shaft (Figure 10,11) and the toggle cam clockwise. The clockwise rotation of the main shaft is transformed to a linear motion by the drive connecting links (Figure 10,12). The drive connecting links are connected to the vacuum interrupters and their motion opens the vacuum interrupter contacts.

Spring Discharge Interlocks

The spring discharge interlock (Figure 10,1) on the left side of the breaker serves to mechanically trip open the breaker and discharge both the drive springs and the return springs whenever the breaker is raised or lowered in its cubicle. Discharging both springs provides operator safety and insures that the breaker cannot be raised or lowered while it is in the closed position.

Mechanical Lockout Interlock

The mechanical lockout interlock (Figure 10,14) on the right side of the breaker prevents the breaker from being raised or lowered in its cubicle while the breaker is in the closed position and insures that a closing operation cannot be performed when the breaker is in the process of being raised or lowered in its cubicle. If for some reason the drive springs should be discharged against the mechanical lockout interlock, the operating mechanism can be freed by lifting the trip lever (Figure 10,9).

Interlock Switch

The interlock switch (Figure 10,15) opens the closing coil circuit and the motor circuit, (See schematic diagram) whenever the breaker is in the process of being raised or lowered in its cubicle and thus electricaly blocks a closing operation if the breaker is not in either the fully raised or fully lowered position.

ADJUSTMENTS

All adjustments are factory set and need not be checked when placing a new breaker into operation.

During periodic inspections and when a breaker part is repaired or replaced, the following adjustments should be checked. To perform these adjustments, first remove the breaker from its cubicle, then remove the front mechanism cover.

WARNING

WHENEVER AN ADJUSTMENT IS TO BE CHECKED OR PERFORMED WITH THE DRIVE SPRINGS IN THE CHARGED POSITION, IT IS ABSOLUTELY NECESSARY TO BLOCK THE DRIVE SPRINGS BY PLACING THE BLOCKING PINS IN THE HOLES AT THE UPPER END OF THE DRIVE SPRING CENTER SHAFTS. (THE BLOCKING PINS ARE SUPPLIED IN THE ENVELOPE CONTAINING THE INSTRUCTION MANUAL, INSERTION REQUIRES REMOVAL OF THE FRONT MECHANISM COVER.)

Trip Open Eccentric

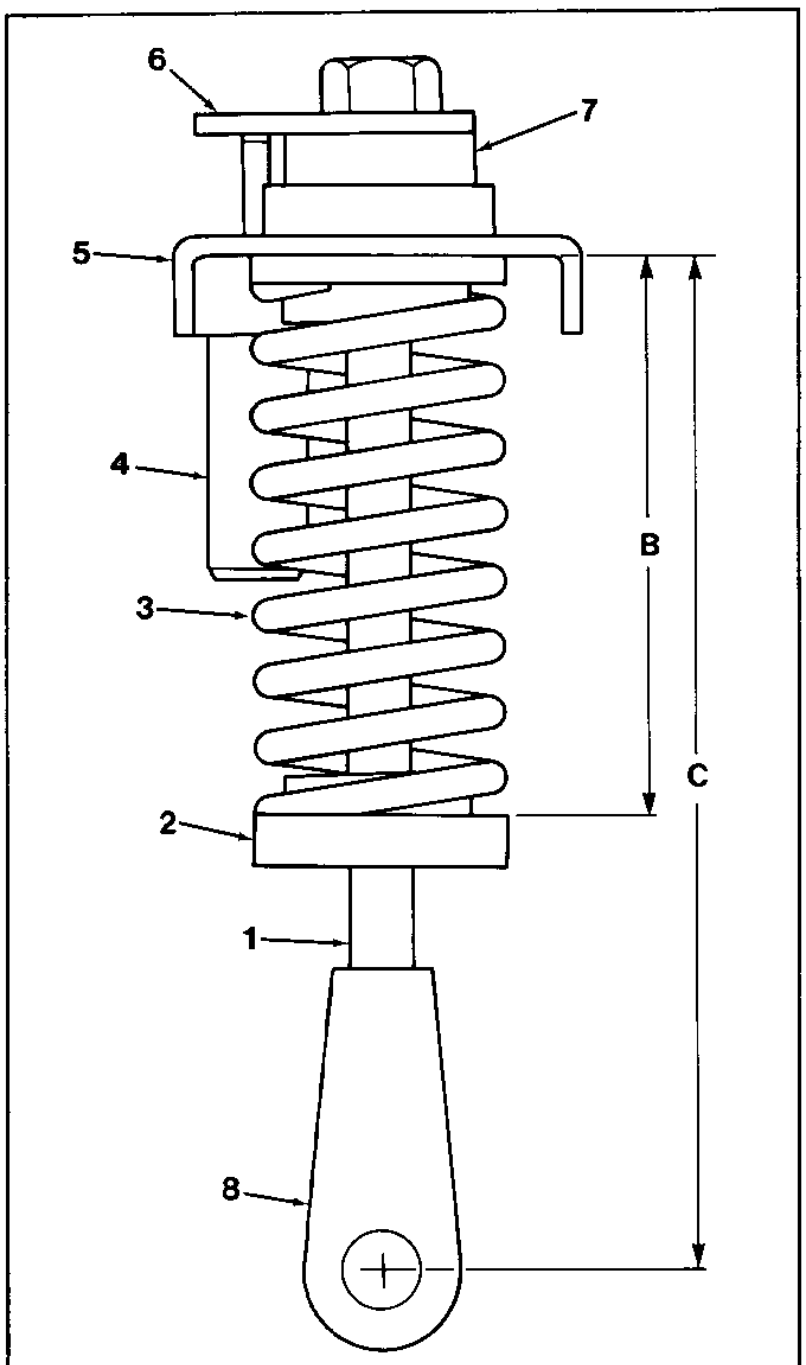
With the breaker in the open position and the drive springs charged, the verticle free movement in the opening solenoid plunger (Figure 10,10) before engaging the trip open arm (Figure 11,6) should be 1/8″ ± 1/16″. Rotate the trip open eccentric (Figure 11,7) to achieve the proper gap. (If a latch check switch is supplied, this adjustment is not required).

Toggle Bearing Clearance

With the breaker in the open position and drive springs charged, the clearance between the toggle bearing (Figure 11,9) and the trip opening cam (Figure 11,10) should be 1/32″ - 0, +1/32″. If adjustment is necessary, the toggle subassembly retainer nut (Figure 11,11) should be adjusted clockwise to increase clearance, counterclockwise to decrease clearance.

Charging Motor Limit Switch

Actuated by the charging motor limit switch cam (Figure 10,2) the charging motor limit switch (Figure 10,3) serves to energize the charging motor (Figure 10,8) during a drive spring charging operation and de-energize the charging motor when the drive springs reach the fully charged position. The charging motor limit switch is properly adjusted if its contacts are open when the drive springs are in the fully charged position and closed when the drive springs are discharged. The position of the charging motor limit switch contacts can be determined by using a continuity tester. If adjustment is necessary, loosen the two screws which hold the charging motor limit siwtch in place and move the switch up or down as required. Tighten the two screws.



1. RETURN SPRING SHAFT
2. RETURN SPRING ADJUSTABLE RETAINER
3. RETURN SPRING
4. SHOCK ABSORBER
5. RETURN SPRING MOUNTING BOX
6. SHOCK ABSORBER PAD
7. RETURN SPRING STOP
8. RETURN SPRING CONNECTING BLOCK

Figure 12

TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS

Adjustments Affecting the Vacuum Interrupters

THE FOLLOWING ADJUSTMENTS NEED ONLY TO BE CHECKED WHEN A VACUUM INTERRUPTER IS REPLACED. These adjustments are listed in the order in which they should be performed.

Drive Linkage

Distance "A" (Figure 11) for the drive linkage should be 2-5/8″ ± 1/16″. If adjustment is performed, be certain to tighten the jam nut when completed.

Spring Overtravel

When the breaker is in the closed position, with the drive springs charged, spring overtravel Distance "E," (Figure 13) for a new vacuum interrupter assembly should be .250″ ± 0.030″. Adjustment is performed as follows:

When the breaker is in the closed position with the drive springs charged, check the spring overtravel. If adjustment is necessary, remove the nut (Figure 13, 6) at the end of the drive connecting link. Insert the T-handle adjustment tool #T-1 into the slots in the end of the erosion indicator (Figure 13,1) and turn the erosion indicator clockwise to shorten or counter-clockwise to lengthen the overtravel. THIS ADJUSTMENT IS FACTORY SET AND SHOULD ONLY BE PERFORMED WHEN INSTALLING A NEW VACUUM INTERRUPTER AS DIMENSION "E" PROVIDES AN INDICATION OF CONTACT EROSION. NOTE: Special tool #T-1 can be ordered from the factory.

Primary Contact Gap

With the breaker in the open position, the primary contact gap for a new vacuum interrupter should be 1/2″ - 0″, +1/8″ for a 500MVA rated circuit breaker and 5/8″ - 0″, +1/8″ for a 750MVA rated circuit breaker. To determine the primary contact gap, measure distance "D" (Figure 13) with the breaker in the open position, then with the breaker in the closed position. The difference between these two measurements is the primary contact gap.

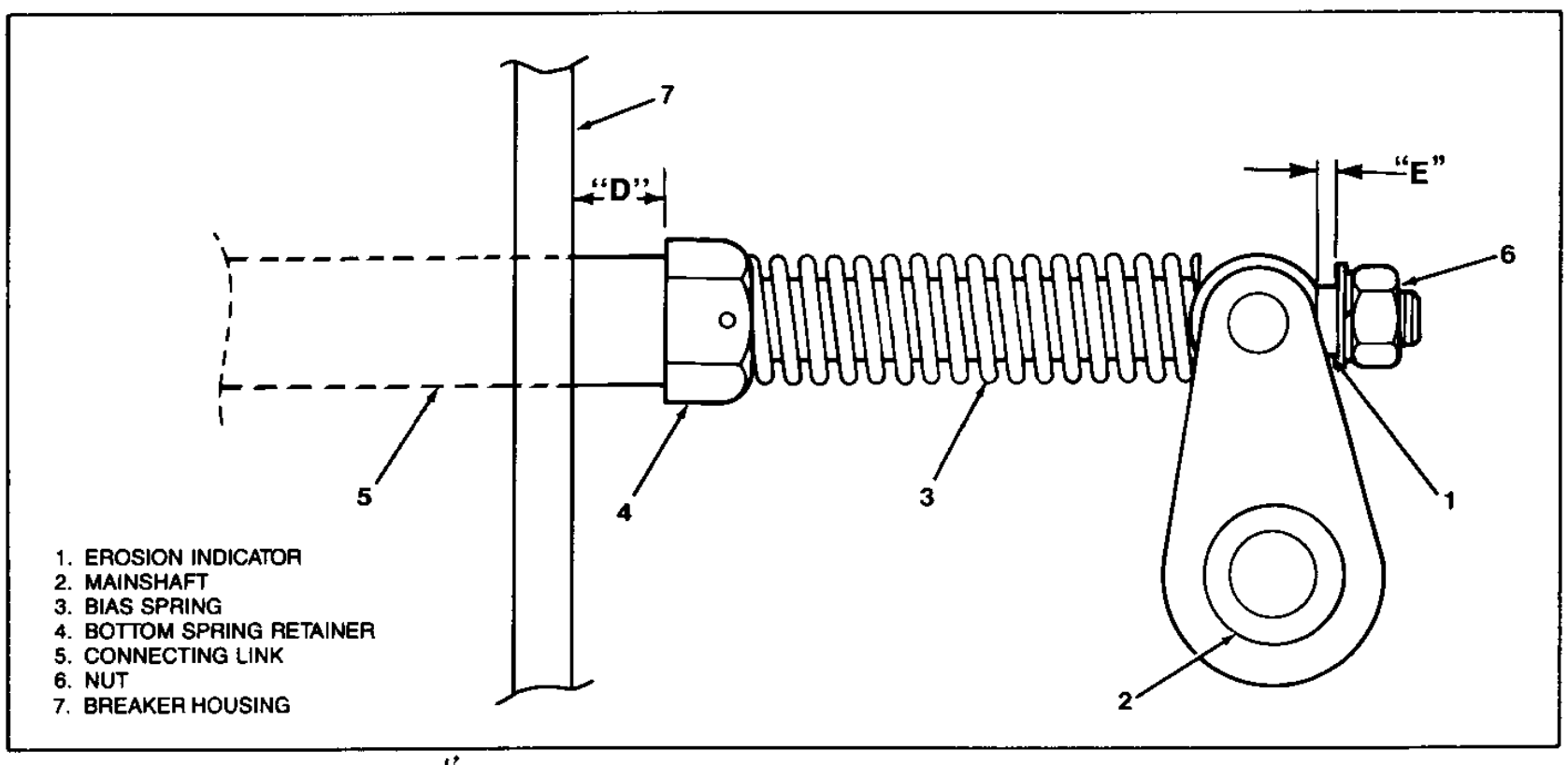


Figure 13

To adjust the primary contact gap, use the return spring stops (Figure 12,7). Turn the stops clockwise (viewed from above) to decrease the primary contact gap and counterclockwise to increase the primary contact gap. It should be noted that both stops must be adjusted simultaneously and equally. The return spring stops can be turned easily if the locking nut is loosened and the breaker is in the closed position. Exercise caution since the return springs (Figure 12,3) are in the charged position. After performing the adjustment, tighten the locking nuts against the stops. Open and close the breaker, then remeasure the primary contact gap. Repeat the procedure until the correct primary contact gap is obtained. (To facilitate this adjustment after return spring replacement has been performed, the initial setting of distance "C" (Figure 12) should be approximately 9-3/4″ with the breaker in the open position.

Return Spring Pre-load Setting

The return spring pre-load setting is determined by distance "B" shown in (Figure 12). With the breaker in the open position distance "B" should be 5-3/4″ ± 1/8″. To adjust distance "B", turn the adjustable retainers (Figure 12,2) clockwise (viewed from above) to increase distance "B" and counterclockwise to decrease distance "B".

Shock Absorber

All shock absorber (Figure 12,4) adjustments and settings have been made at the factory. No adjustments should be necessary. If, however, they are required, consult the factory.

Contact Compression

Once the above adjustments have been performed, cycle the breaker open and closed 25 times to compress the contacts of the new vacuum interrupter(s) which has been installed. After cycling the breaker, remeasure adjustments and perform these adjustments again if required.

MAINTENANCE

FOR SAFETY, ALWAYS DISCHARGE OR BLOCK THE RETURN SPRINGS (FIGURE 10,13) AND THE DRIVE SPRINGS, LOCATED BEHIND THE RETURN SPRINGS, BEFORE PERFORMING ANY MAINTENANCE OR REPAIR WORK.

Because of the wide variations in operating uses and environments, each operating company should develop a maintenance schedule, based on operating experience, which will provide assurance of proper breaker condition. Until such a schedule is determined, it is recommended that breakers be inspected after one (1) year or every 2,000 operations, whichever occurs first. It is also recommended that breakers be inspected after severe fault operation and notation of any contact erosion be recorded.

Vacuum Interrupters

To assure reliable interruption, perform the following two checks:

a) *Contact Erosion:* Any contact erosion will result in a reduction of the spring overtravel. Contact erosion can therefore be determined by closing the breaker and measuring the spring overtravel. The difference between this measurement and the original spring overtravel setting of .250″ represents contact erosion. When the contacts have eroded 1/8″, the vacuum interrupter must be replaced.

b) *Hipot Tests:* Hipot test each interrupter in accordance with the instructions previously stated.

Insulating Surfaces

Using a clean, dry cloth, remove all dirt and moisture from the outside of the vacuum interrupters (Figure 3) and from all insulating parts.

Mechanism

The entire breaker and operating mechanism should be inspected for loose hardware and worn or broken parts. All wiring should be checked for loose connections and damaged insulation. Inspect all bearings and contact surfaces for damage or excessive wear. Examine the shock absorber for evidence of leakage. Verify proper mechanism adjustments as specified previously.

Lubrication

It should be noted that all bearings used in this series of vacuum circuit breakers are sealed and do not require lubrication.

The lubrication chart provides the location of all lubrication points, the type of lubrication required and the two methods of lubrication. Method I is the periodic lubrication required after 2000 operations or one year, whichever occurs first. Method II is the lubrication procedure to be used whenever the breaker is overhauled or disassembled. Severe operating conditions may warrant different lubrication intervals and procedures. Variations should be based on the experience of the operating company.

It is recommended that the breaker be manually operated several times after lubrication and observed for proper operation.

TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS

LUBRICATION CHART

LUBRICATION POINT	METHOD I Lubrication at Maintenance Period	METHOD II Lubrication at Overhaul
Gear teeth and pawls.	Wipe clean and apply lubricant.*	Disassemble, wipe clean, and apply lubricant.*
Contact surfaces on lift arm (Figure 8,1), toggle cam (Figure 11,1), return spring connecting block (Figure 12,8) catch (Figure 12,1), etc.	Wipe clean and apply lubricant.	Disasemble, wipe clean and apply lubricant.
Gear shaft (Figure 9,3) and drive shaft (Figure 9,10)	No lubrication required.	Disassemble, wipe clean, and apply lubricant to contact surfaces.
Contact and pivot points of all linkages.	Wipe clean and apply lubricant.	Disassemble, wipe clean, and apply lubricant.
Drive spring assembly.	No lubrication required.	Do not disassemble. Wipe clean and apply lubricant to center shaft.
Motor eccentric (Figure 9,6) and eccentric roller.	Wipe clean and apply lubricant to slot in ratchet arm.	Disassemble, wipe clean, and apply lubricant.
All shafts, sleeves, spacers, and bushings.	No lubrication required.	Disassemble, wipe clean, and apply lubricant.
Silver plated primary disconnect (Figure 4) contacts, grounding contact, secondary contacts.	Wipe clean and apply a high quality conductive contact lubricant, such as G.E. #D50H47.	Wipe clean and apply a high quality conductive contact lubricant, such as G.E. #D50H47.

** It is recommended that a high grade, heavy duty lubricant, such as Texaco Multifac EP2 or Chevron SRI Grease, be used.*

Overhaul

After every 10,000 operations,it is recommended that the breaker be given a thorough overhaul and that all components which have been excessively worn be replaced. Overhaul may require disassembly of the operating mechanism. For breaker lubrication, follow Method 2 in the lubrication chart. Check all bearings and replace if necessary.

RENEWAL PARTS

Recommended Renewal Parts

Sufficient renewal parts should be maintained in stock to insure prompt replacement of worn, broken or damaged parts. A list of factory recommended renewal parts is provided in the table on the following page.

TYPE VAV VERTICAL LIFT VACUUM CIRCUIT BREAKERS

Because of the wide variations in operating uses and environments, the Recommended Renewal Parts Table is presented only as a minimum requirement. Each operating company should develop its own renewal parts stock, based on operating experience, which will provide assurance of proper breaker condition.

Ordering Instructions

When ordering renewal parts:

a) Always specify the complete rating plate information.

b) Specify part number, description of part, figure number (if provided) and the catalog number from which this information is taken.

c) For electrical components, specify operating voltage.

d) Standard hardware components are not listed and should be purchased locally.

Special Tools

The only special tool required for the VAV series of circuit breaker is the #T-1 T-handle adjustment tool.

DESCRIPTION	QTY/BKR	MINIMUM STOCK RECOMMENDED	FIGURE NUMBER
Spring Charging Motor (SM)	1	1	8, 6
Motor Relay (MR)	1	1	7, 8
Anti-Pump Relay (Y)	1	1	7, 6
Opening Solenoid (TC)	1	1	10, 10
Closing Solenoid (X)	1	1	10, 6
Motor Limit Switch (LS)	1	1	8, 3
Auxiliary Switch (AS)	1	1	7, 7
Vacuum Interrupter Assembly	3	1	3

**Minimum Recommended Requirements*

SQUARE D COMPANY
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