



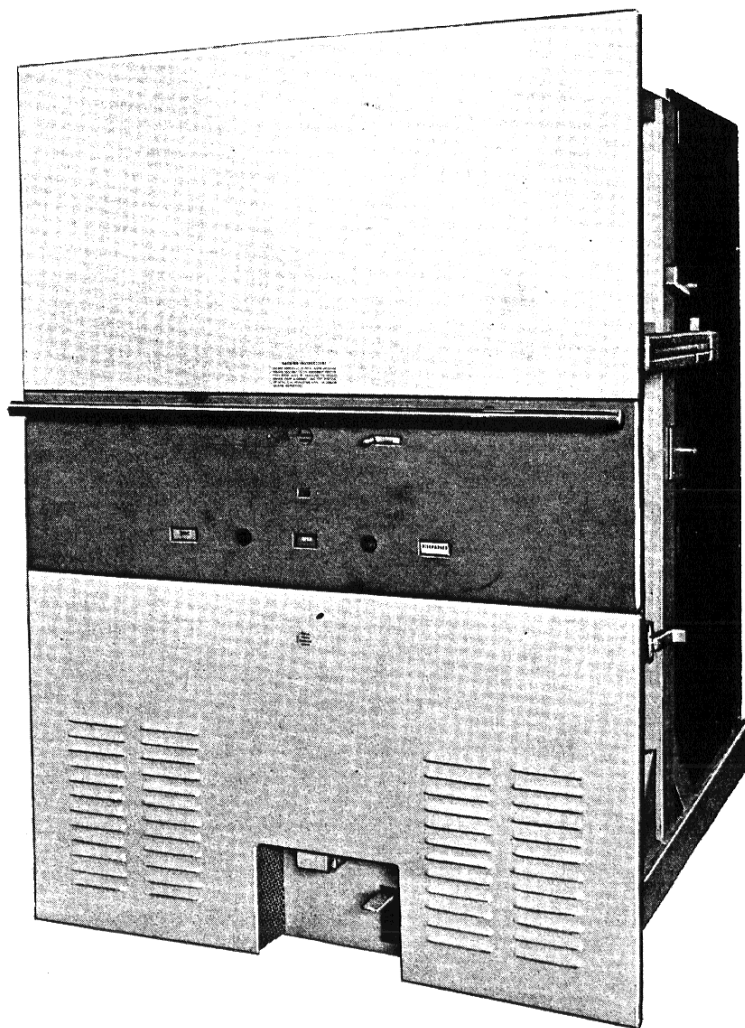
## INSTRUCTIONS

**GEK-7339C**  
Supersedes GEK-7339B

# Vacuum Circuit Breaker

**VH-34.5-1500**

**MODELS -OK, -1K AND OL**



**SWITCHGEAR PRODUCTS DEPARTMENT**

**GENERAL  ELECTRIC**

**PHILADELPHIA, PA.**

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# VACUUM CIRCUIT BREAKER

## VH-34.5-1500

### MODELS -OK, -1K AND OL

#### INTRODUCTION

The vacuum breaker is a removable and interchangeable interrupting element for use in horizontal drawout metal-clad switchgear to provide reliable control and protection of electrical apparatus and power systems.

The VH-34.5-1500 vacuum breaker is available with continuous current ratings of 1200 amperes, 2000 amperes, and 3000 amperes, in accordance with applicable industry standards. Refer to the breaker nameplate for complete rating information of any particular breaker. The nameplate also describes the control power requirements for that breaker. The application of a breaker must be such that its voltage, current and interrupting ratings are never exceeded. Since this book is written to include several ratings of the breaker as well as a number of design variations, the instructions will be of a general

character and all illustrations will be typical unless otherwise specified.

Proper installation and maintenance are necessary to insure continued satisfactory operation of the breaker. The following instructions provide information normally required for placing the breaker in service and for maintaining satisfactory operation.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in 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 General Electric Company.

#### RECEIVING, HANDLING AND STORAGE

Each breaker is carefully inspected and packed for shipment. Immediately upon receipt of the circuit breaker, an examination should be made for any damage sustained in transit. If injury or rough handling is evident, a damage claim should be filed immediately with the transportation company and the nearest General Electric Sales Office should be notified.

It is expected that due care will be exercised during the unpacking and installation of the breaker so that no damage will occur from careless or rough handling, or from exposure to moisture or dirt. Loose parts associated with the breaker are sometimes included in the same crate. Check all parts against the packing list to be sure that no parts have been overlooked.

##### Storage

It is recommended that the breaker be put into service immediately in its permanent location. If this is not possible, the following precautions must be taken to insure the proper storage of the breaker:

1. The breaker should be carefully protected

against condensation, preferably by storing it in a warm dry room. Circuit breakers for outdoor metal-clad switchgear should be stored in the equipment only when power is available and the heaters are in operation to prevent condensation.

2. The breaker should be stored in a clean location, free from corrosive gases, or fumes; particular care should be taken to protect the equipment from moisture and cement dust, as this combination has a very corrosive effect on many parts.
3. Unplated surfaces of rollers, latches, etc., should be coated with grease to prevent rusting.

If the breaker is stored for any length of time, it should be inspected periodically to see that rusting has not started and to insure good mechanical condition. Should the breaker be stored under unfavorable atmospheric conditions, it should be cleaned and dried out before being placed in service.

(Cover photo 8040294)

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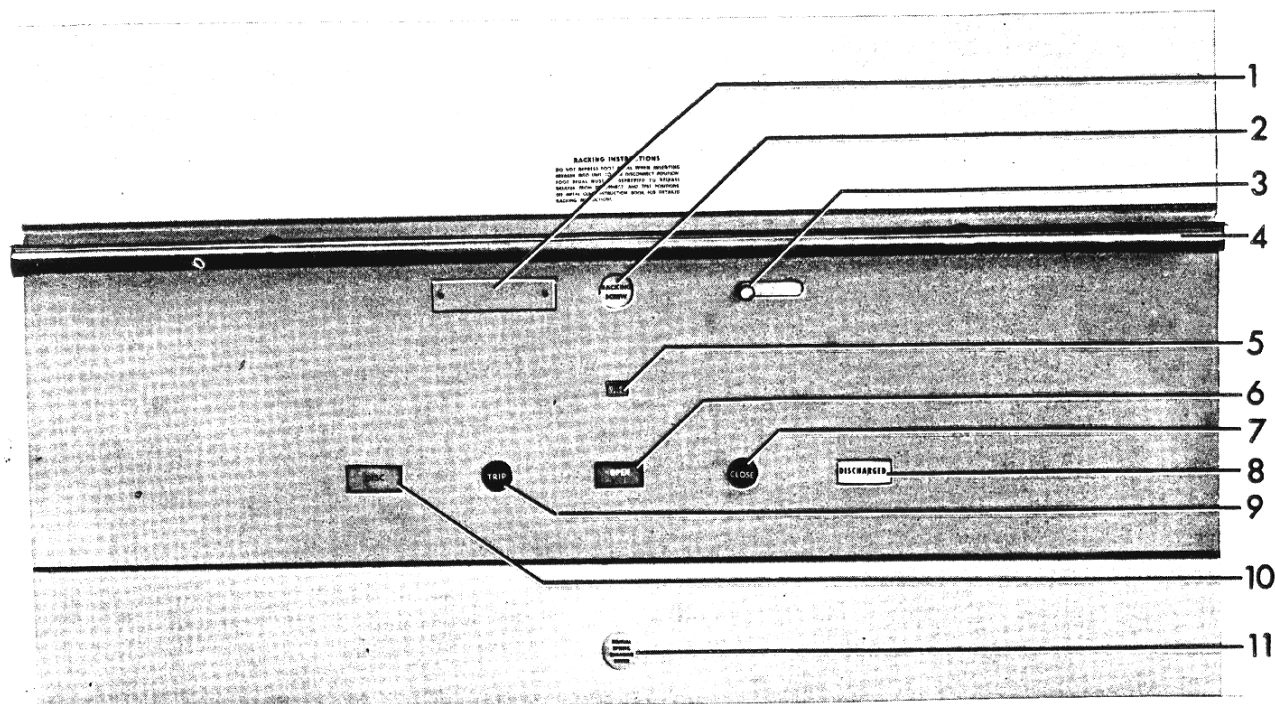


Figure 1. (8040291) Control Panel

- |                                     |   |
|-------------------------------------|---|
| 1. Removable Plate (for Padlocking) | 7. Manual Close Button                      |
| 2. Racking Screw Shutter            | 8. Spring Charge Indicator                  |
| 3. Shutter Operating Pin            | 9. Manual Trip Button                       |
| 4. Handle                           | 10. Position Indicator                      |
| 5. Operation Counter                | 11. Removable Cover for Spring Charge Shaft |
| 6. Open-Close Indicator             |   |

## INSTALLATION

- The breaker has been shipped with its primary contacts in the closed position by wiring the trip latch closed. Before inserting the breaker into a metal-clad unit the securing wire must be removed and the breaker tripped open.

Remove the top front cover, right and left side covers and remove the trip latch securing wire, which is identified with a shipping tag. The breaker can now be tripped open by pushing the manual trip button (9), Figure 1. Keep hands clear of moving parts of mechanism and breaker while removing the wire and opening breaker

The shipping information plate located at the top of the front cover can now be removed and discarded.

A complete visual inspection of the breaker and its operating mechanism should be made to ascertain they are in satisfactory condition.

- Charge the breaker closing spring using a 5/8" ratchet wrench to turn the manual

charging shaft (13) Fig. 5. Turning the shaft clockwise will advance the ratchet wheel and compress the spring. When the spring has reached the fully charged position the yellow indicator (8) Fig. 1 will read CHARGED and the ratchet handle will rotate freely. The spring blocking pin (3) Fig. 4 should be inserted through the frame and closing spring guide (2). Manually discharge the spring against the pin by pushing the manual close button (7) Fig. 1. The spring is now blocked and slow closing of the breaker can be accomplished by again turning the manual charging shaft with the ratchet wrench.

During the slow closing operation check to insure that the mechanism does not stick or bind during the entire stroke, that it latches securely in the closed position, and that it trips freely when the manually trip button is operated. The breaker should not be operated electrically until it has been operated several times manually to insure freedom of action. At this time, also check the following adjustments:

- a. Primary contact gap (Refer to page 12)
- b. Primary contact wipe (Refer to page 12)

DO NOT WORK ON EITHER THE BREAKER OR MECHANISM UNLESS THE CLOSING SPRING IS BLOCKED AND THE OPENING SPRING HAS BEEN DISCHARGED OR MECHANICALLY BLOCKED. THIS PRECAUTION IS REQUIRED TO PREVENT ACCIDENTAL CLOSING OR TRIPPING.

After the adjustments have been checked, the closing spring can be unblocked. Rotate the manual charging shaft until the springs are fully charged and the ratchet wheel can no longer be advanced. The spring blocking device can now be removed. The closing and opening springs can now be discharged by pushing first the close button (7) Fig. 1 and then the open button (9).

3. Attach the test coupler to the right hand secondary disconnect device of the circuit breaker, or insert the breaker into the housing to the test position and operate electrically several times. Check the control voltage as described under "Control Power Check", page 15.

If the breaker secondary wiring is to be given a hi-potential test at 1500 volts remove both motor leads from the terminal connection block. Failure to disconnect the motor from the circuit may cause damage to the winding insulation.

4. Remove the test coupler and replace the breaker covers. Hipot test the interrupters

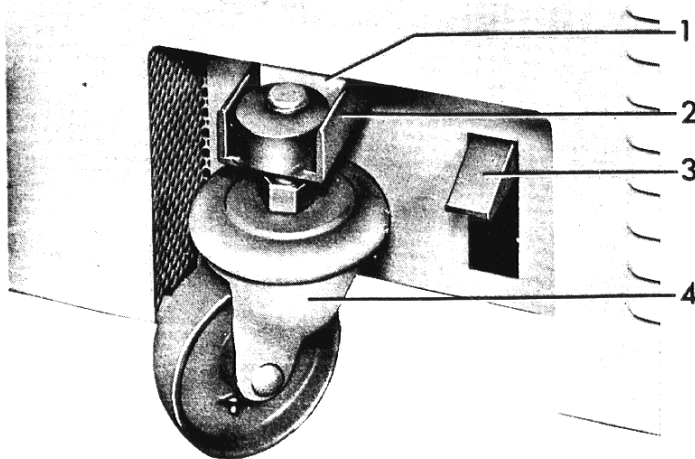
as described under "Hipot Testing of the Vacuum Interrupter", page 17.

5. During normal high voltage operation a charge is acquired by the main shield of the interrupter, and may be retained after the breaker is removed from the housing. Therefore, the midband ring of the interrupter should be discharged to ground by a grounding stick or similar device before touching the interrupter.
6. Refer to metal-clad instruction book GEK-7344 for final instructions, before inserting the breaker into the metal-clad unit.
7. If an interrupter should lose vacuum while in service, and is subsequently called upon to interrupt fault current, breaker failure is probable because an arc will be drawn between the open contacts in air. For such situations, the vacuum interrupter chamber may or may not fracture depending on the magnitude and duration of the arc current through the interrupter. If the interrupter chamber used in the VH 34.5K model breaker is fractured, metal oxide arc product dust from an alloy which has some beryllium as a constituent can be released and should be considered as a potential health hazard or skin irritant. Therefore, a suitable dust mask to prevent inhalation and gloves to avoid skin irritation should be worn during initial inspection and clean-up, and the compartment and breaker should be wiped down with wet clothes to keep airborne dust to a minimum. Dust and dirt from cloths, gloves, etc. should be washed down a drain. Damaged interrupter parts should be sealed in a container for disposal.

## OPERATING PRINCIPLES

The vacuum breaker has two principle components, the breaker element and the operating mechanism. The breaker elements are three

similar units, the main element being two vacuum power interrupters (7) Fig. 6 in series whose contacts are hermetically sealed in high vacuum



1. Breaker Lifting Block
2. Wheel Support
3. Position Stop Release Pedal
4. Swivel Wheel

Figure 2. (8040306) Transport Wheel

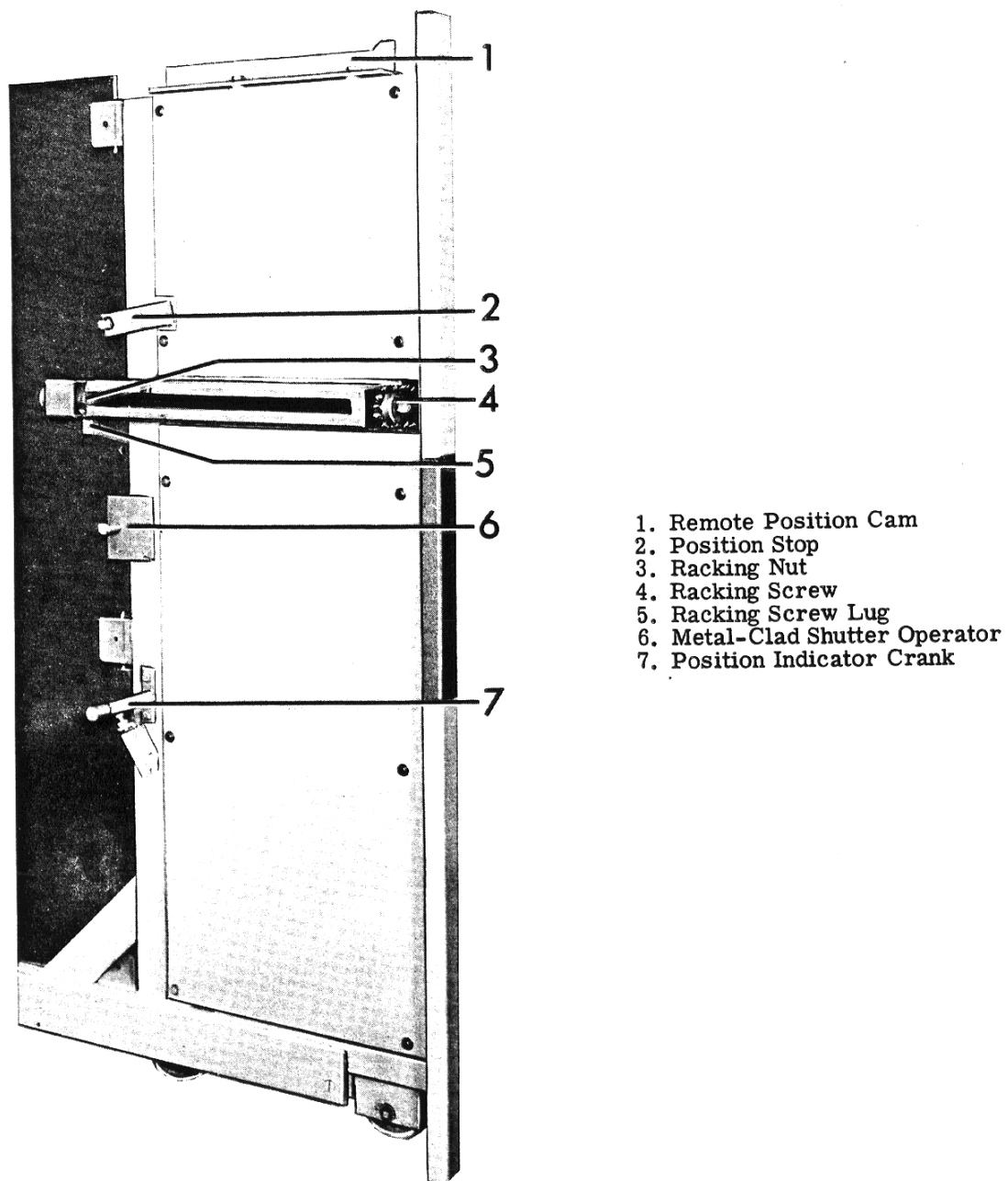


Figure 3. (8040293) Breaker-Left Side

chambers. The primary connections to the associated metal-clad switchgear are made through the finger contacts (5) in the back of the breaker. The operating mechanism moves a square cross shaft (4) Fig. 17 that closes the contacts of the interrupter through the contact springs (4) Fig. 13.

The ML-15A operating mechanism is of the stored energy type designed to give high speed closing and opening. The mechanism will operate on ac or dc voltage as indicated on the breaker nameplate. Closing and opening operations are controlled electrically by the metal-clad or remote relaying and mechanically by the manual close and trip buttons on the breaker. All secondary connections from the breaker to the metal-clad unit are made through the secondary disconnect devices (3) Fig. 6.

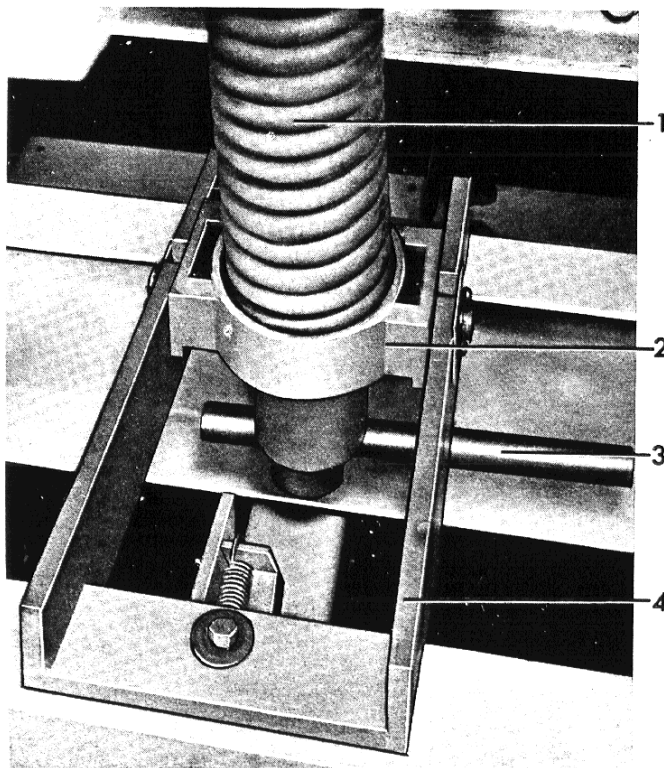
A positive interlock (6) Fig. 12 works with the racking screw shutter (2) Fig. 1 to prevent insertion or removal of the breaker when the contacts are closed. It also prevents closing the breaker except in the fully connected or test position. Electrical operation of the breaker is also prevented by the interlock linkage.

The spring release interlock (8) Fig. 10 trips open the breaker and discharges the closing spring whenever the breaker is inserted or removed from

the housing. Closing and opening springs are discharged automatically, as a safety precaution.

The position stop (2) Fig. 3 positions the breaker in the disconnected and test position. The breaker will stop in the disconnected position when it is pushed into the metal-clad. Before inserting the breaker, check the racking lugs (5) Fig. 3 and the position of the racking screw nut (3). The nut should be fully to rear of the racking screw travel; the left racking lug should be down and the right racking lug should be up. These positions should be corrected by inserting the racking screw wrench (2) Fig. 18 and turning it counterclockwise until it locks into position. After inserting the breaker to the disconnect position, turn the racking screw wrench approximately one quarter turn clockwise, then release the stop with the foot pedal (3) Fig. 2. The breaker can now be moved to the test position by turning the racking screw wrench until the position stop falls into place. Again releasing the stop with the foot pedal, the breaker can be moved to the fully connected position by turning the racking screw until it locks into position.

A position indicator (10) Fig. 1 will show the position of the breaker in the disconnect and test positions. Remote electrical position indication is accomplished by switches in the metal-clad actuated by a cam on the breaker (1) Fig. 3.



1. Spring
2. Closing Spring Guide
3. Spring Blocking Pin
4. Pivot Support

Figure 4. (8040307) Closing Spring



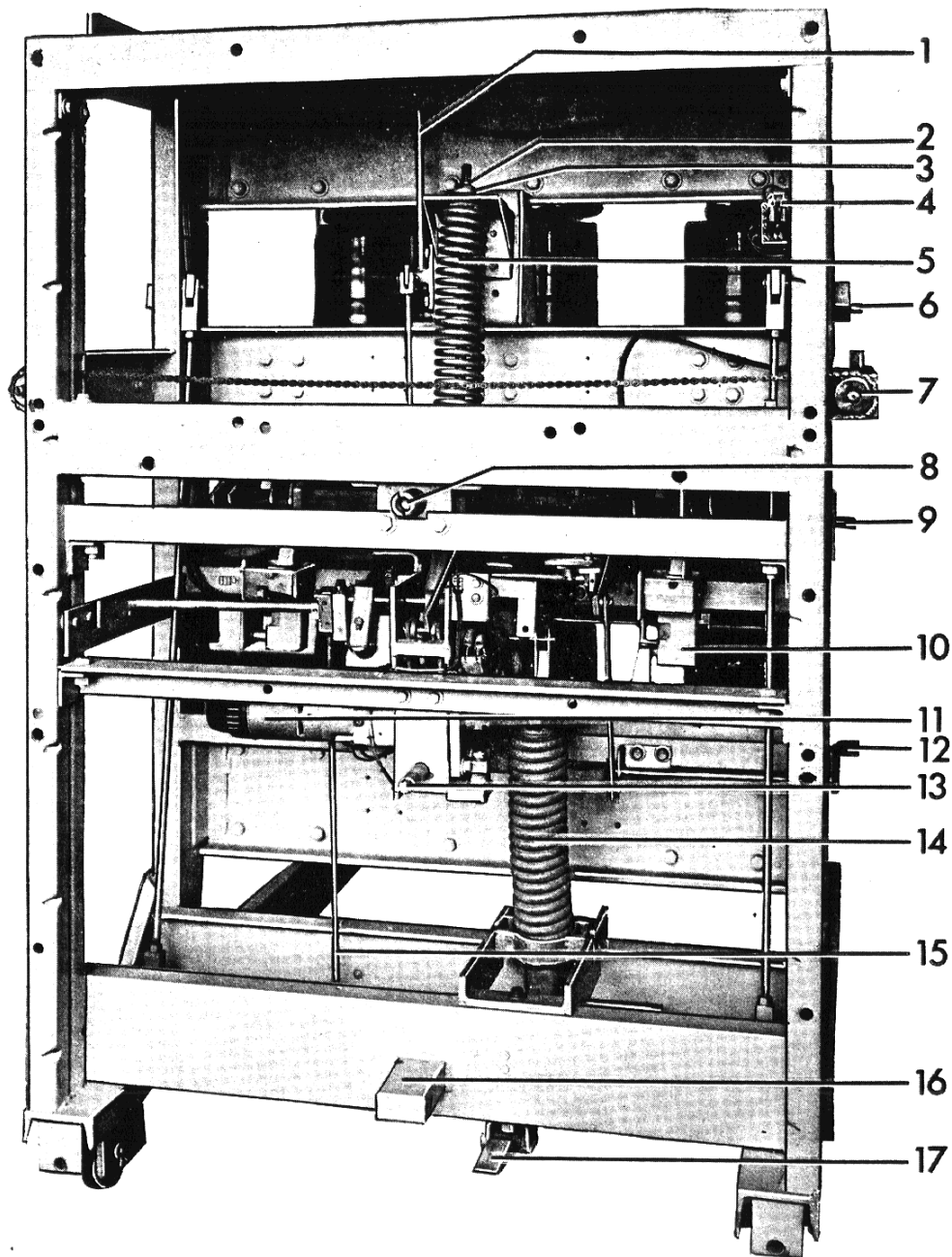


Figure 5. (8040311) Breaker-Front Covers Removed

- |  |                                 |
|--|---------------------------------|
| 1. Metal-Clad Auxiliary Switch Linkage | 10. Dashpot                     |
| 2. Opening Spring Locking Nut          | 11. Motor                       |
| 3. Opening Spring Adjusting Plate      | 12. Positive Interlock Crank    |
| 4. Relay                               | 13. Manual Spring Charge Shaft  |
| 5. Opening Spring                      | 14. Closing Spring              |
| 6. Position Stop                       | 15. Spring Release Linkage      |
| 7. Racking Screw                       | 16. Breaker Lifting Block       |
| 8. Racking Wrench Coupling             | 17. Position Stop Release Pedal |
| 9. Metal-Clad Shutter Operator         |                                 |



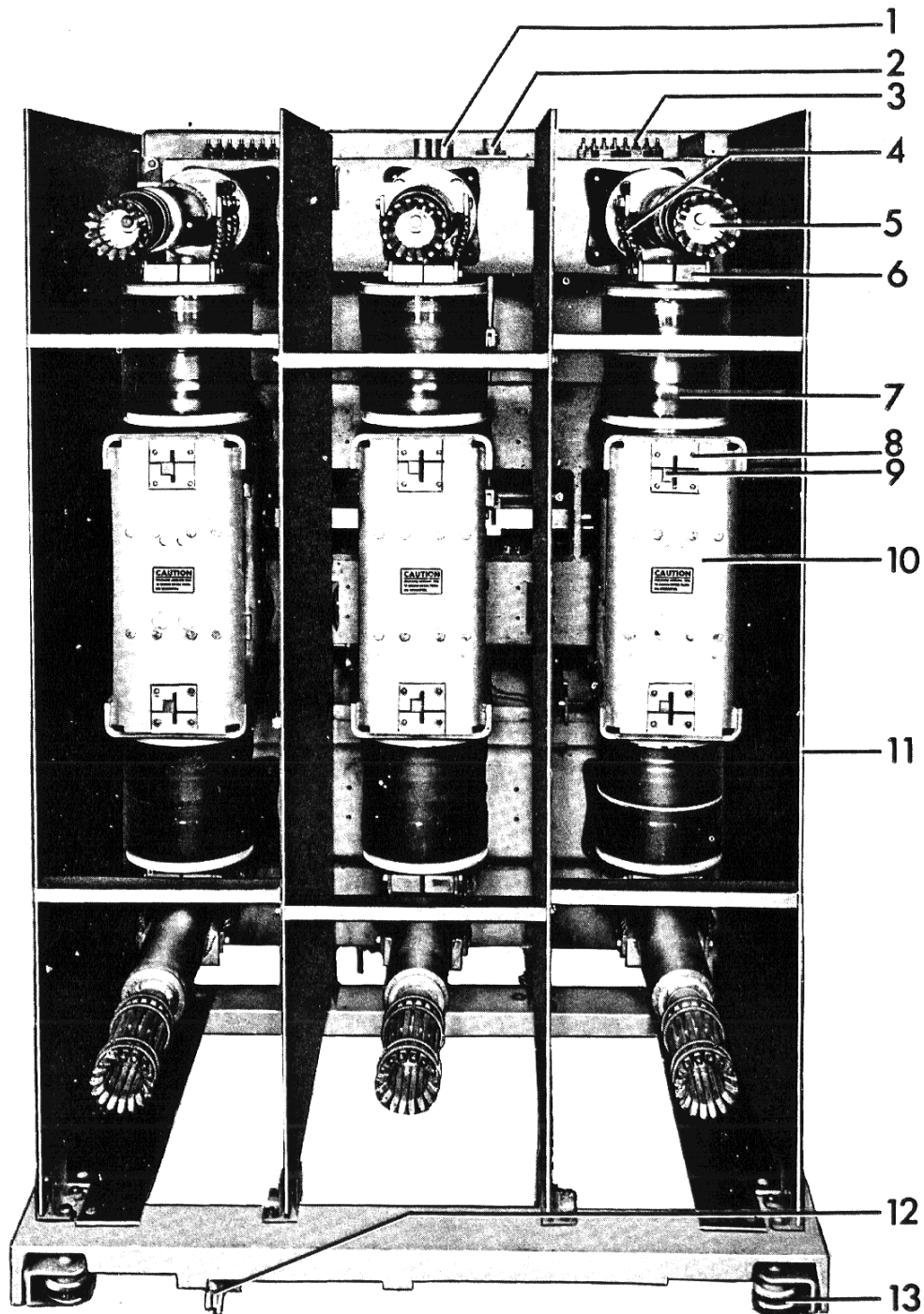


Figure 6. (8040295) Breaker-Rear View

- |   |                              |                         |
|---|------------------------------|-------------------------|
| 1. Top Guide Rollers                    | 5. Primary Disconnect Device | 10. Interrupter Support |
| 2. Metal-Clad Auxiliary Switch Operator | 6. Stationary Contact Block  | 11. Insulating Barrier  |
| 3. Secondary Disconnect Device          | 7. Power Vac Interrupter     | 12. Ground Shoe         |
| 4. Primary Braids                       | 8. Erosion Indicator Plate   | 13. Lower Guide Roller  |
|   | 9. Erosion Indicator         |                         |

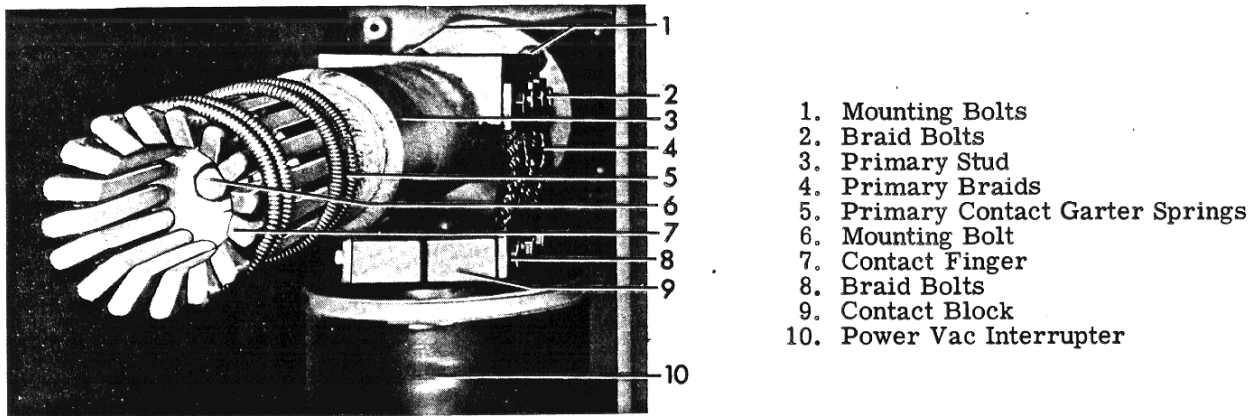


Figure 7. (8040298) Primary Stud

A plunger (2) Fig. 6 can be provided to operate additional auxiliary switch contacts provided in the metal-clad unit.

The breaker can be padlocked in either the fully connected or test positions so that it cannot be moved from that position. The lock can be applied after removing a cover (1) Fig. 1 on the control panel and secures the racking screw shutter preventing access to the racking mechanism. The breaker is fully operative in either position.

#### Spring Charging

The mechanism has a high speed gear motor that compresses a closing spring through the action of an eccentric, pawl and ratchet assembly. The rotary action of the motor (11) Fig. 10 is converted to a straight stroke pumping action through the eccentric (8) Fig. 8 that carries a spring loaded driving pawl (7). The pawl advances the ratchet wheel (16) only a few degrees each stroke where it is held in position by the latching pawl (6). When the ratchet wheel has been rotated approximately 180 degrees, the closing spring will be fully compressed. As the ratchet wheel continues to rotate, the spring load will shift over center and attempt to discharge. After only a few degrees of rotation, the closing roller (4) Fig. 11 will engage the closing latch (3) and the compressed spring will be held in repose until a closing operation is required. During the last few degrees of the ratchet wheel rotation, the motor and relay switches (17) Fig. 8 are released and the driving pawl is on a smooth portion of the ratchet wheel. This allows the motor and driving mechanism to coast to a natural stop expending all residual energy.

The closing spring may be charged manually if control voltage is lost. A 5/8" ratchet wrench can be used to rotate the manual charging shaft continuously in a clockwise direction until the yellow indicator reads CHARGED, and the ratchet

handle is free. In the event that control power is restored, the motor will take over again and continues to charge the spring.

#### Closing Operation

Closing the breaker is accomplished by energizing the closing solenoid (4) Fig. 10 or manually pressing the close button. In either case, the closing latch is removed from the spring blocking location allowing the spring to discharge. The energy of the spring moves the cam (2) Fig. 11 that closes the breaker through a simple linkage that remains trip-free at all times. A monitoring switch (4) Fig. 15 on the closing latch will start the spring charging motor when it is fully reset after a closing operation.

#### Opening Operation

The breaker can be opened either electrically by energizing the trip coil (9) Fig. 10 or manually by pushing the trip button. In each method the trip shaft and latch (5) Fig. 11 is rotated permitting the operating mechanism to collapse. The energy stored in the opening spring (5) Fig. 5 is released opening the breaker. At the end of the opening operation the dashpots (10) will stop the contacts and linkage and absorb any excess energy from the system thereby limiting contact rebound. During this operation, the trip coil is deenergized and upon completion of the opening operation, the operating mechanism is returned to its reset position, ready for closing.

#### Trip Free Operation

If the trip coil circuit is energized while the breaker is closing, the trip plunger will move the trip latch (5) Fig. 11 away from the trip roller (6) causing the mechanism linkage to collapse and the breaker to perform a close-open operation. The closing cam (2) will complete its closing stroke and the springs will recharge as in a normal closing operation.

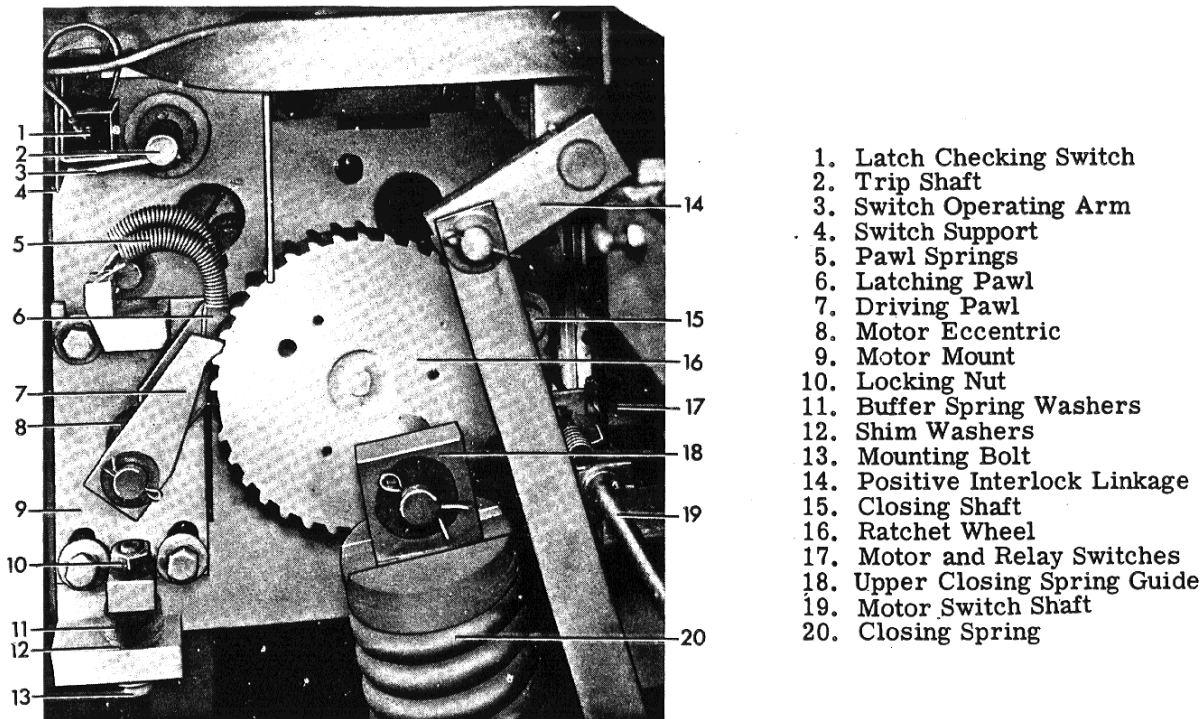


Figure 8 (8040305) Mechanism-Right Side

## ADJUSTMENTS

All adjustments should be checked during periodic inspections and whenever it becomes necessary to repair or replace parts that have become worn or defective while in service. First, remove the breaker from the metal-clad unit and remove the top front cover and the left and right side covers. The following adjustments are listed in the order in which they are to be checked.

**DO NOT WORK ON EITHER BREAKER OR MECHANISM UNLESS THE CLOSING SPRING IS BLOCKED AND THE OPENING SPRING HAS BEEN TRIPPED OPEN OR MECHANICALLY BLOCKED. THIS MEASURE IS REQUIRED TO PREVENT ACCIDENTAL CLOSING OR TRIPPING.**

### Cam Follower Roller Clearance

The cam follower (1) Fig. 11 must be adjusted to have a clearance of .030" to .060" to the cam (2). Since these parts are almost totally enclosed, it is very difficult to make this measurement. An easier method to assure the cam clearance dimension is to measure the clearance between the latch (5) and latch roller (6) when the stop screw (7) has been removed. With the stop screw backed off three or four turns, the linkage will shift until the cam follower and cam touch. At this time there should be a clearance of .170" to .200" between the latch and the latch roller.

This can be measured with the gauge (7) Fig. 18 in the maintenance kit.

If adjustment is necessary to obtain this clearance, loosen locking nut (2) Fig. 5 on the opening spring assembly and raise or lower the adjusting plate (3). When the clearance for the latch and latch roller is correct, tighten the locking nut on the opening spring assembly.

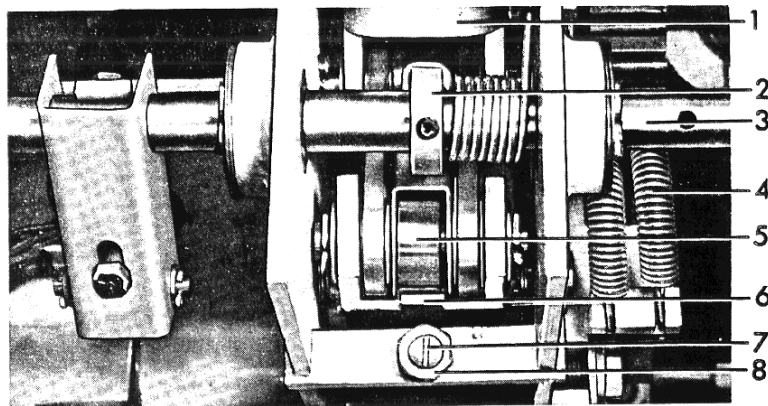
The trip latch and roller clearance can now be adjusted as described below. Be certain the latch is in its proper location on top of the latch stop and in line with the latch roller.

### Trip Latch Clearance

Refer to Fig. 9. With the breaker in the tripped position and the closing spring charged, check the clearance between the trip latch (2) and the trip roller (5). It should be .030" to .060" measured with the gauge (5) Fig. 18 from the maintenance kit. If adjustment is necessary, loosen locking nut (8) and adjust stop screw (7).

### Closing Latch Wipe

Refer to Fig. 11. The closing latch (3) should strike the closing roller (4) approximately in the center. Apply a thin film of grease to the end



1. Main Drive Link
2. Trip Latch
3. Trip Shaft
4. Pawl Springs
5. Trip Latch Roller
6. Trip Latch Reset Stop
7. Stop Screw
8. Locking Nut

Figure 9. (8039318) Mechanism-Front Top (Breaker Open & Closing Springs Discharged)

of the closing latch and charge and block the closing springs. Release the closing latch by pushing the close button. Inspect the end of the latch for proper wipe.

If adjustment is necessary, loosen switch (4) Fig. 15 and move for clearance. Loosen nut and adjust stop (2) until the proper wipe is obtained. Secure the locking nut and reset switch (4) as listed under Switch Adjustment below.

#### Primary Contact Gap

Before checking the primary gap of the interrupters, it is necessary to check that the contacts of both interrupters close within  $1/32''$  of each other. If they do not, one of the contacts must be adjusted. Insert a  $3/8''$  -16 bolt of sufficient length (11) Fig. 13 through the interrupter support (3) and thread into the connection block (10) of the lower interrupter. The bolt need not be tight, its purpose is to keep the contact rod from twisting when the locking nuts (1) are loosened or tightened. It may be necessary to partially slow close the contacts of the interrupters to allow the holes in the interrupter support and connection block to line up. After loosening the locking nuts of the lower interrupter, remove the bolt.

Close the breaker slowly using a ratchet wrench and  $5/8''$  socket on the manual charging shaft (13) Fig. 5 until the contacts of the upper interrupter touch. This can be checked using a continuity checking lamp or bell set. Rotate the hex adjustment screw (8) Fig. 13 of the lower interrupter until the contacts of both interrupters are touching within  $1/32''$ .

Trip open the breaker and again secure the contact block (10) with the  $3/8''$  - 16 bolt. Tighten the locking nuts (1), remove the bolt, and recheck the contact touching of both interrupters before proceeding with the contact gap adjustment.

The primary contact gap can be measured with the indicator (9) Fig. 6 that moves with the contact rod of the interrupters. Mark the indicator

plate (8) with a pencil where the pointer (9) indicates. Close the breaker with the manual closing wrench and measure the distance from the pointer to the pencil mark. The contact gap should measure  $1/2'' + 0 - 1/32''$  for K model breakers and  $3/4'' + 0 - 1/32''$  for L model breakers. To change the contact gap, the operating rod adjustment screw (9) Fig. 12 is used.

Loosen nuts (7) and turn the hex center of the double ended adjustment screw to increase or decrease the gap. One full turn will close or open the contact gap approximately  $1/8''$ . Tighten the locking nuts and remeasure the gap after closing and tripping the breaker.

#### Primary Contact Wipe

When the breaker is closed, the primary contact springs (4) Fig. 13 should be compressed  $9/32'' + 0 - 1/32''$ . This dimension will vary with breaker use and can be used without readjustment down to  $1/8''$ . The measurement can be made between the guide pin (7) and the stop nut (6).

**WHEN WORKING ON THE MECHANISM IN THE CLOSED POSITION KEEP FINGERS CLEAR OF THE LINKAGE AS ACCIDENTAL TRIPPING CAN CAUSE SEVERE INJURY.**

To adjust the contact wipe loosen the operating rod bolt (4) Fig. 12 can move the rod toward the square shaft to decrease wipe and away from the shaft to increase wipe. Be certain the serrated washers (3) are seated properly before tightening the bolt. Close the breaker and remeasure the gap at the guide pin.

#### Switches

The strikers for operating the motor switch (17) Fig. 8, positive interlock switches (2) Fig. 16, closing latch monitoring switch (4) Fig. 15 and trip latch checking switch (1) Fig. 8 should be adjusted to a clearance of  $1/64''$  to  $1/32''$  from the switch support. The switch supports should be loosened and the switch moved to obtain this

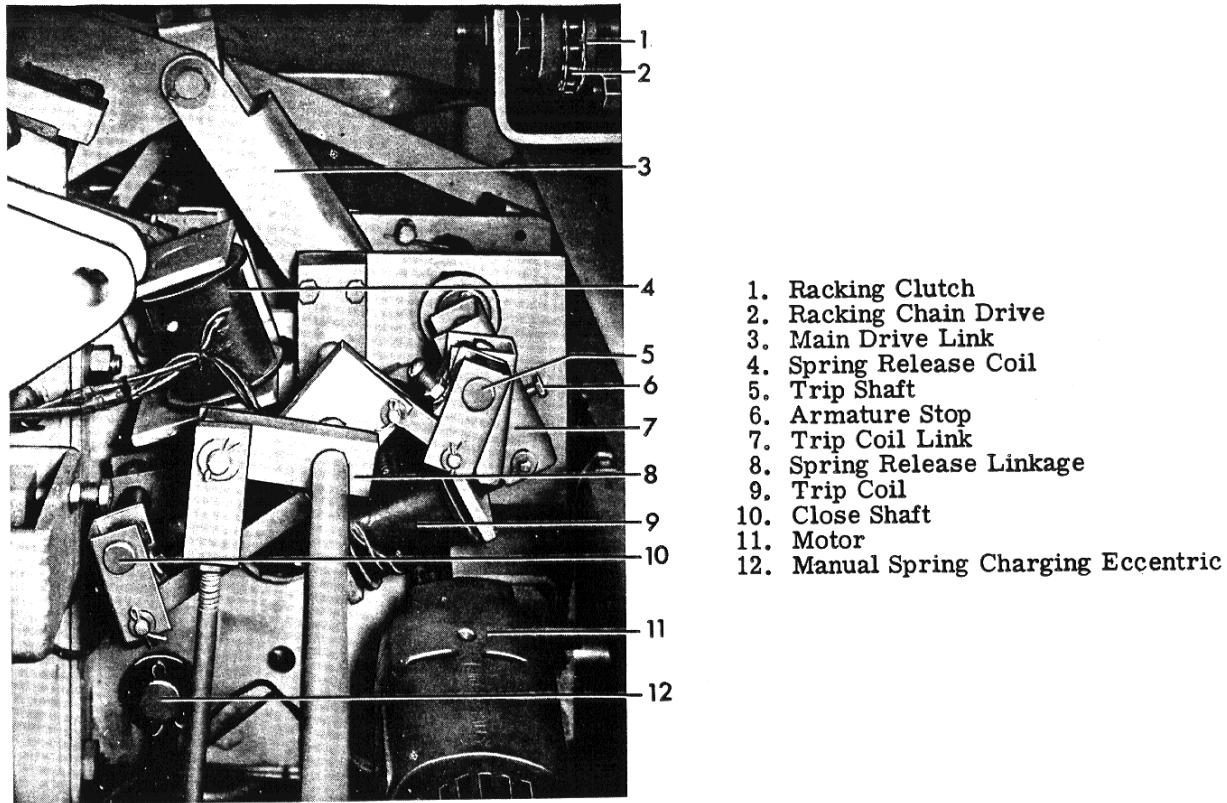


Figure 10. (8040319) Mechanism-Left Side

dimension.

#### Dashpot

The dashpots (10) Fig. 17 are adjusted to stop the contacts and linkage and limit overtravel to safe limits. The crank pin (5) should contact the actuating link of the buffer (6) 1/2" for K model and 5/8" for L model before the end of its travel. A position stop (7) on the dashpot support (8) can be adjusted to regulate the buffer.

The buffer has been adjusted at the factory and should require no checking or adjusting unless it has been removed from the breaker and replaced. The oil level of the dashpot should be checked if there is any indication of an oil leakage. The pipe plug (9) should be removed and dashpot grade oil as recommended in the lubrication chart should be added to the lower level of the hole. A suitable thread sealer, such as plumber's pipe thread tape, should be applied to the plug before replacing.

#### Driving Pawl and Motor Mount

The manual driving pawl (8) Fig. 16 must

advance the ratchet wheel sufficiently to allow the latching pawl (6) Fig. 8 to fall into the ratchet teeth. Since the latching pawl is an integral part of the motor mount, the entire mounting must be moved to allow a clearance between the latching pawl and the ratchet tooth of .020" to .040" when the manual driving pawl is fully advanced and the maximum load of the closing spring is on the ratchet.

After checking the pawl clearance and determining the amount of movement required in the motor mount, the locking nut (10) Fig. 8 and bolt (13) can be removed and the necessary shim washers (12) added to or removed from the assembly. Replace the bolt and tighten hand tight plus one half turn with a wrench. Hand wind the closing spring and again check the clearance with the closing spring load applied. Secure the bolt (13) by replacing nut (10) on the assembly.

#### Latch Checking Switch (When present)

The latch checking switch (1) Fig. 8 must make contact when the latch (2) Fig. 9 is within 1/16" of the latch stop (6). Rotate the trip latch away from the stop by pushing the trip



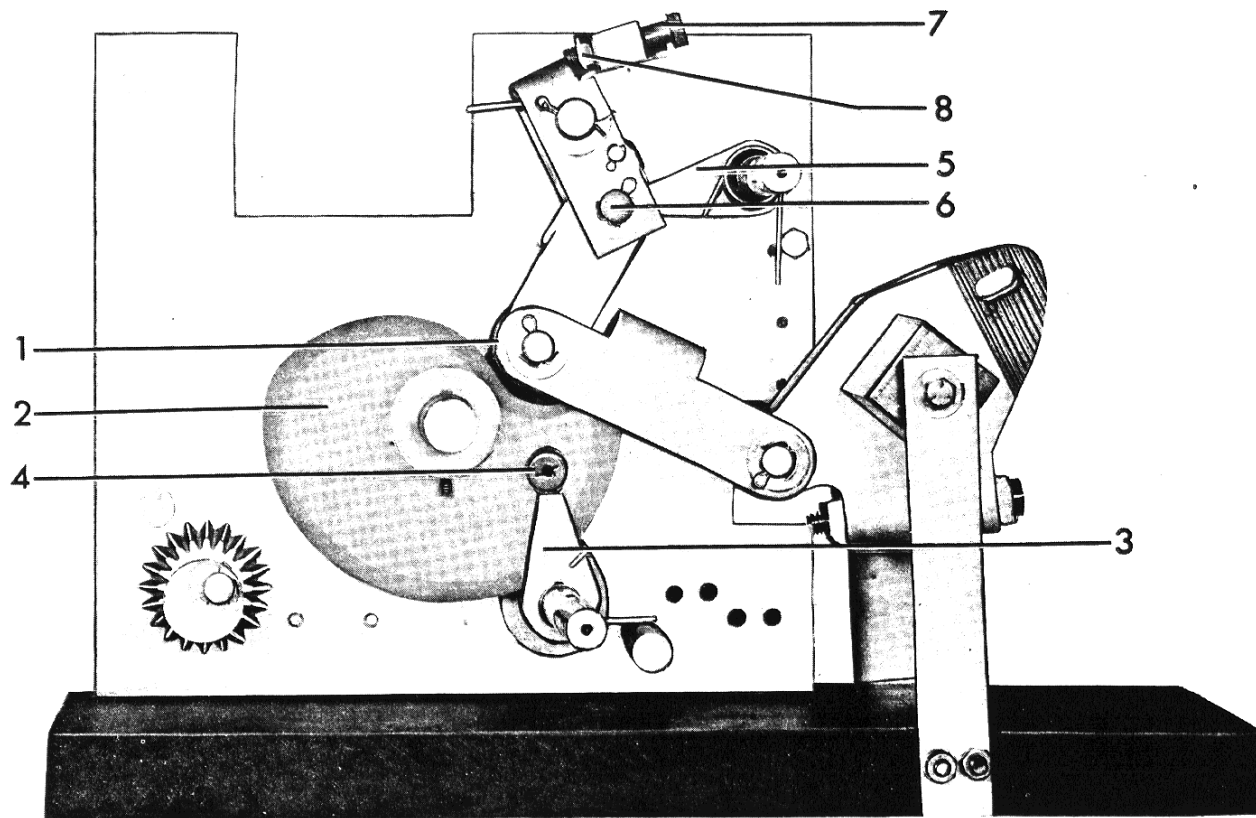


Figure 11. (8039445) Mechanism Linkage (Motor and Right Side of Mechanism Frame Removed)

- |                         |                         |
|-------------------------|-------------------------|
| 1. Cam Follower Roller  | 5. Trip Latch           |
| 2. Cam                  | 6. Trip Latch Roller    |
| 3. Closing Latch        | 7. Adjusting Stop Screw |
| 4. Closing Latch Roller | 8. Locking Nut          |

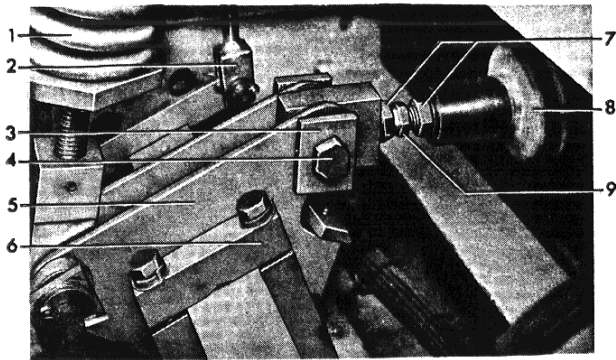
#### Spring Release Interlock

button (9) Fig. 1. Allow the latch to reset slowly until the switch contacts close. This can be checked by the use of a continuity checking lamp or a bell set. The dimension should be a maximum of 1/16" from the latch to the support. If adjustment is necessary, move the switch support (4) Fig. 8.

A spring release interlock (8) Fig. 10 will assure that the breaker contacts are open and the closing springs are discharged when the breaker is being inserted or withdrawn from the metal-clad unit, the release interlock will trip the breaker open and hold the mechanism in a trip-free position while discharging the closing springs.

### **INSPECTION AND TEST**

1. For ease in reviewing the adjustments, the following are recapitulated:
  - a. Cam follower roller clearance .030" to .060" (.170" to .200" at trip latch).
  - b. The trip latch clearance .030" to .060".
  - c. The closing latch is centered.
  - d. Primary contact gap 1/2" + 0 - 1/32" for model K breakers and 3/4" + 0 - 1/32" for model L breakers.
  - e. Primary contact wipe 9/32" + 0 - 1/32".
  - f. Switches - clearance from support 1/64" to 1/32".
  - g. Dashpot picks up 1/2" for K model and 5/8" for L model before end of crank travel.
  - h. Latching pawl clearance .020" to .040".
  - i. Latch checking switch contacts when the



1. Opening Spring
2. Metal-Clad Auxiliary Switch Linkage
3. Serrated Washer
4. Bolt
5. Operating Rod Crank
6. Positive Interlock Crank
7. Locking Nuts
8. Operating Rod
9. Adjusting Screw

Figure 12 (8040312) Operating Rod Crank

gap between the trip latch and stop is 1/16" max.

2. Check all nuts, washers, bolts, cotter pins, and terminal connections for tightness.
3. Inspect all wiring to make sure that no damage has resulted during installation, and test for possible grounds or short circuits.
4. See that all bearing surfaces of the mechanism have been lubricated. Refer to the section on LUBRICATION.
5. Operate the breaker slowly with the manual charging wrench and note that there is no excessive binding or friction and that the breaker can be moved to the fully opened and fully closed position.
6. See that any place where the surface of the paint has been damaged is repainted immediately.
7. Check the trip coil plunger and the release coil plunger to see that they move freely.

#### Control Power Check

After the mechanism has been closed and opened slowly several times with the maintenance closing wrench and the mechanism adjustments are checked as described, the operating voltage should be checked at the release coil, trip coil, and motor terminals. For electrical operation of the mechanism, the control power may be either alternating or direct current. The operating ranges for the closing and tripping voltages are given on the breaker nameplate. The following ranges are standard:

Rated Normal Voltage	Close		Trip	
	Min.	Max.	Min.	Max.
24 V dc	-	-	14 V	30 V
48 V dc	34 V	50 V	28 V	60 V
125 V dc	90 V	130 V	70 V	140 V
250 V dc	180 V	260 V	140 V	280 V
115 V ac	95 V	125 V	95 V	125 V
230 V ac	190 V	250 V	190 V	250 V

If the closed circuit voltage at the terminals of the coil or motor does not fall in the specified range, check the voltage at the source of power and line drop between the power source and breaker.

When two or more breakers operating from the same control power source are required to close simultaneously, the closed circuit voltage at the closing coil or motor of each breaker must fall within the specified limits.

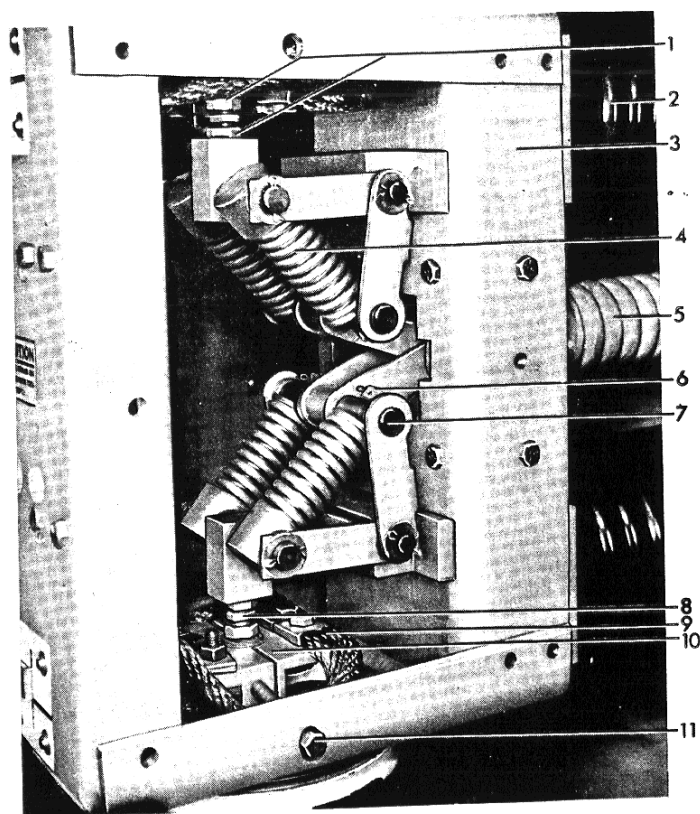
Electrical closing or opening is accomplished by merely energizing the closing or trip coil circuit. Control switches can be provided for this purpose on the metal-clad unit or control board. It is also possible to trip or close the breaker manually by pressing the manual trip button (9) Fig. 1, or the manual close button (7). When the breaker is closed, the close button is interlocked to prevent release of the closing spring.

#### Opening and Closing Speeds

The opening speed of the interrupter contacts should be from 6 to 7-1/2 ft./sec. and the closing speed from 3 to 4 ft./sec.

The opening speed is the average speed measured from contact parting to a 3/8" gap. The closing speed is the average speed measured over the last 1/4" before contact closing.





1. Locking Nuts
2. Insulator Support
3. Power Vac Interrupter Support
4. Contact Spring
5. Operating Rod
6. Stop Nut
7. Guide Pin
8. Adjusting Screw
9. Movable Primary Braid
10. Movable Contact Block
11. Assembly Fixture Bolt

Figure 13. (8040302) Contact Spring Assembly

## MAINTENANCE

### General

Safe and dependable service from electrical apparatus and power systems is contingent upon reliable performance of power circuit breakers. To obtain maximum reliability the breaker should be inspected and maintained on a regular schedule. The breakers are designed in accordance with applicable standards which require that they be capable of performing up to 2500 operations switching rated continuous current before any replacement of parts should be necessary. This requirement is based on the breakers being serviced, or maintained, at least every 1000 operations, or once per year, whichever comes first. If the breaker is also required to interrupt fault currents during this period of time additional maintenance and replacement of parts may be necessary.

Before any maintenance work is performed, make certain that all control circuits are opened and that the breaker is removed from the metal-clad unit. DO NOT WORK ON THE BREAKER OR MECHANISM WHILE IN THE CLOSED POSITION UNLESS THE TRIP LATCH HAS BEEN SECURELY WIRED OR BLOCKED TO PREVENT ACCIDENTAL TRIPPING, OR THE MECHANISM IS BLOCKED TO PREVENT OPENING. DO NOT

WORK ON THE BREAKER OR MECHANISM WHILE THE CLOSING SPRINGS ARE CHARGED UNLESS THEY ARE SECURED IN THAT POSITION BY THE MAINTENANCE SPRING BLOCKING DEVICE.

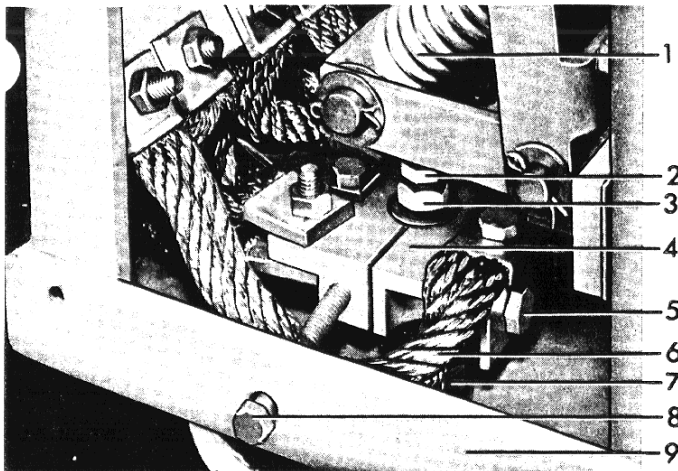
### Periodic Inspection

The frequency of periodic inspection should be determined by each operating company on the basis of the number of operations (including switching), the magnitude of currents interrupted, and any unusual operations which occur from time to time. Operating experience will soon establish a maintenance schedule which will give assurance of proper breaker condition. On installations where a combination of fault duty and repetitive operation is encountered, an inspection is recommended after several severe fault operations or at 1000 operation intervals. The following instructions list the main points to be included in an inspection and a number of general recommendations.

### The Breaker Element

The Power Vac\* interrupter used in this breaker is a reliable, safe, and clean interrupting element. Since the contacts are contained in a vacuum chamber, they remain clean and require no maintenance at any time. The metallic vapors eroded

\* Registered Trademark of General Electric Co.



1. Contact Spring
2. Adjusting Screw
3. Locking Nut
4. Movable Contact Block
5. Mounting Bolt
6. Primary Braid
7. Mounting Bolt
8. Assembly Fixture Bolt
9. Power Vac Interrupter Support

Figure 14 (8040300) Movable Braid Assembly

from the contact surfaces during high current interruption remain in the chamber and are deposited on metal shields thus insuring a high dielectric value of the vacuum and the walls of the glass container.

Only two simple checks are required to assure reliable interruption:

1. A maximum contact erosion of 1/8" is allowed. This is easily determined by checking the indicator (8) (9) Fig. 6 when the breaker is in the closed position. A red line 1/8" wide and an indicating pointer have been set at the factory so that the pointer is at the front edge of the line. As the contacts erode, the line will become visible. When the full 1/8" line is exposed the Power Vac Interrupter should be replaced.
2. A hipot test of the interrupter will determine the internal dielectric condition.

#### Hipot Testing of the Vacuum Interrupter

High potential testing, in addition to careful visual inspection, provides the best means of verification of the condition of the interrupter. Each interrupter should be given a 60 Hz ac high potential test of 36 kV rms for one minute across its open contacts before the breaker is put into service and the same test should be applied to the interrupters whenever the breaker is serviced.

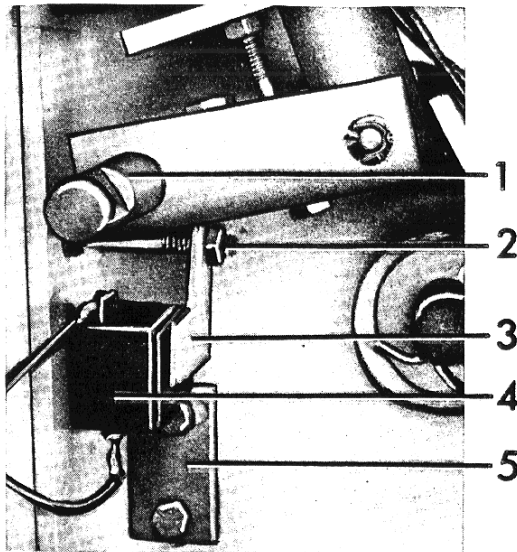
Prior to applying voltage to the interrupter, the surface of its insulating envelope should be wiped clean of any surface contaminants. Nor-

mally wiping with methanol poured on a clean cloth or with an industrial wiper will be sufficient.

A high potential voltage source is then connected across the open interrupter contacts and the voltage slowly increased to the test voltage. A withstand of 36 kV (rms) ac for one minute is adequate to establish that the interrupter is in serviceable condition.

**CAUTION:** Although the procedure for hipotting a vacuum interrupter is similar to that used for any other electrical device, there are two areas that require the exercise of extra caution.

1. During any hipotting operation the main shield inside the interrupter can acquire an electrical charge that usually will be retained even after the hipot voltage is removed. This shield is attached to the midband ring of the insulating envelope and a grounding stick should always be used to discharge the ring as well as the other metal parts of the assembly before touching the interrupter, connections, or breaker studs.
2. High voltage applied across open gaps in a vacuum can produce hazardous X-radiation if the voltage across the contacts exceeds a certain level for a given contact gap. Therefore, Do Not make hipot tests on an open breaker at voltages higher than the recommended 36 KV (r.m.s.) ac across each interrupter. During the hipot test the steel front panel and partial side panels should be assembled to the breaker and personnel



1. Close Shaft
2. Adjustable Latch Stop
3. Switch Operating Arm
4. Switch
5. Switch Support

Figure 15. (8040359) Latch Monitoring Switch

should stand in front of the breaker to take advantage of the shielding afforded by the panels. If this positioning is not practical, equivalent protection can be provided by limiting personnel exposure to 24 tests per hour (4 - 3 phase breakers) with the personnel not closer than three meters (9 ft. 10 inches) to the interrupters.

During equipment operation in the normal current carrying mode there is no X-radiation because there are no open contacts. When the contacts are open in normal, maximum rated 38 KV, service the patented internal shield on the G.E. Power Vacuum\* interrupter provides a measure of radiation shielding and the X-radiation at one meter (3 ft. 3 inches) front the interrupter through the metal equipment enclosure is well below the level of concern as a health hazard.

#### Insulation Test

Since all line to ground insulation except the operating rods is inorganic material a test of primary insulation is not considered necessary unless insulation has been repaired or replaced. If a primary insulation test is performed, caution should be exercised in hipotting across the vacuum interrupters because of the considerations outlined under "Hipot Testing of the Vacuum Interrupters" in the preceding paragraphs.

1. Hipot each vacuum interrupter at 36 kV (rms) ac for one minute to insure that

each is in good condition. During this part of the test, personnel should stand in front of the breaker or at least 3 meters (9 ft. 10 inches) from the interrupters.

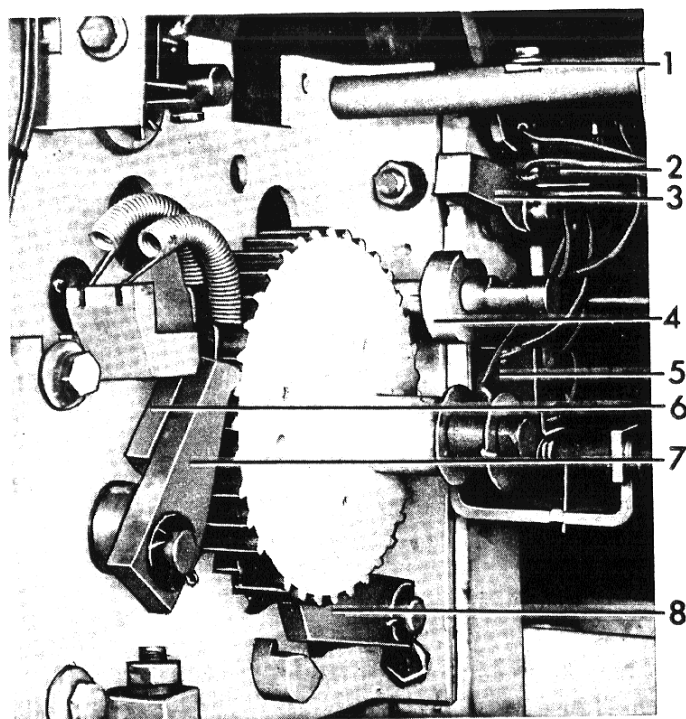
2. With the breaker in the open position, apply 60 kV (rms) ac for one minute two phases and the breaker frame. This checks the insulation from phase to phase and from phase to ground.

NOTE: Full scale insulation tests as described in steps 1, 2 and 3 above should be performed on no more than 4 breakers per hour by one man.

If the breaker secondary wiring is to be given a high-potential test at 1500 volts, remove both of the motor leads from the terminal board. Failure to disconnect the motor from the circuit may cause damage to the winding insulation.

#### Mechanism

A careful inspection should be made to check for loose nuts or bolts and damaged parts. All cam, roller, and latch surfaces should be inspected for any evidence of damage or excessive wear. Lubricate the mechanism as outlined below, then using the manual charging wrench, open and close the breaker several times to make certain that the mechanism operates freely throughout its stroke. Check the mechanism adjustments as specified under ADJUSTMENTS. Check all terminal connections.



1. Switch Operating Arm
2. Positive Interlock Switch
3. Closing Interlock Latch
4. Closing Interlock Cam
5. Motor Switch
6. Latching Pawl
7. Motor Driving Pawl
8. Manual Driving Pawl

Figure 16. (8040358) Mechanism-Right Side

### Insulator

The porcelain insulators should be wiped clean with a dry cloth or industrial wipers. A thorough inspection should be made and damaged insulators replaced.

### Lubrication

In order to maintain reliable operation, it is important that all circuit breakers be properly lubricated at all times. The required lubrication and the lubricants recommended for the purpose are detailed in Table I. The breakers and operating mechanisms have been properly lubricated, during assembly at the factory, using the finest grades of lubricants available. However, even the finest oils and greases have a tendency to oxidize with age, as evidenced by hardening and darkening in color. Elimination of the hardened lubricant is essential for the proper operation of circuit breakers. Also frequent operation of the breaker causes the lubricant to be forced out from between the bearing surfaces. A simple lubrication will often clear up minor disturbances which might be mistaken for more serious trouble.

A definite lubrication schedule should be set up taking into consideration the frequency of operation of the breaker and local conditions. Until such a schedule is worked out the breaker should be lubricated at each periodic inspection and also whenever it is overhauled, in accordance with the lubrication Table I. It is also recommended that all circuit breakers be operated at regular intervals to insure the user that the equipment is operating freely.

The lubrication Table I is divided into two methods of lubrication. The first method outlines the maintenance lubrication which should be performed at the time of periodic maintenance and requires no disassembly. The second method outlines a lubrication procedure similar to that performed on the breaker at the factory, but should be used only in case of general overhaul or disassembly for other reasons.

General Electric Lubricant D50H15 is available in 1/4 pound collapsible tubes. It is so packaged to insure cleanliness and to prevent oxidation.

### Method of Cleaning Bearings

Whenever cleaning is required, as indicated in the lubrication table, the following procedures

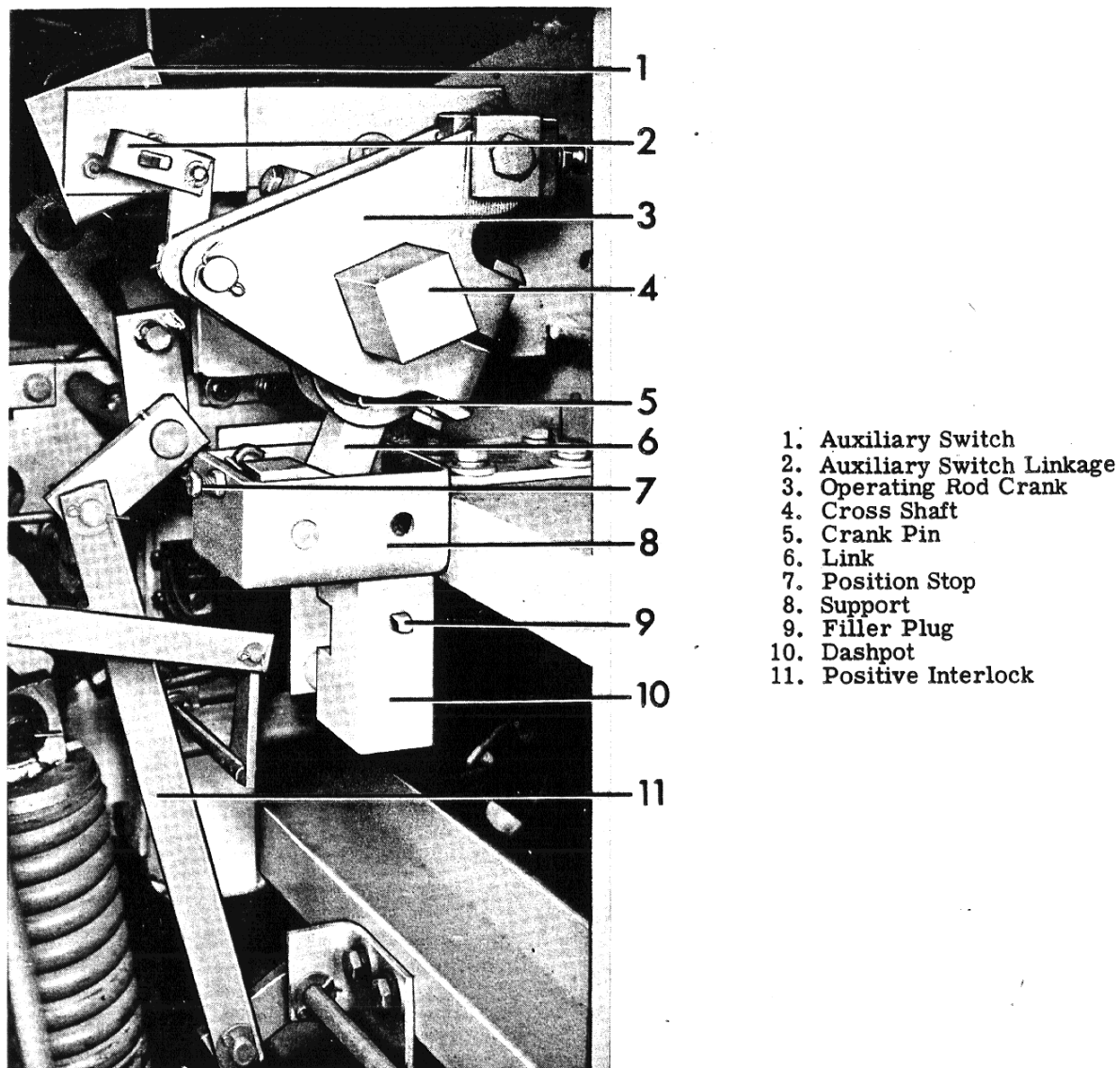


Figure 17. (8040301) Dashpot

are recommended.

### Sleeve Bearings

The sleeve bearings used throughout the linkage utilize Teflon\* surfaces and do not require lubrication. After a number of operations, the surface will acquire a thin black film. Do not remove this film unless there is evidence of outside contaminants, such as dry or hardened grease. If contaminants are present, they should be removed by immersing the link and bearing in clean petroleum solvent or similar cleaner and using a stiff brush. Do not remove the bearings from the links. DO NOT USE CARBON TETRACHLORIDE.

The main shaft bearings should be removed, cleaned, and lubricated with G-E D50H15 lubricant at general overhaul periods.

### Roller & Needle Bearings

The cam follower (1) Fig. 11 and latch roller bearings (6) should be first removed from the mechanism and the inner race disassembled. They should then be placed in a container of clean petroleum solvent or similar cleaner. DO NOT USE CARBON TETRACHLORIDE. If the grease in the bearings has become badly oxidized, it may be necessary to use alcohol (type used for thinning shellac) to remove it. Ordinarily, by agitating the bearings in the cleaning solution, and using a stiff brush to remove the solid particles, the bearings can be satisfactorily cleaned. Do not handle the bearings with bare hands as deposits from the skin onto the bearings are conducive to corrosion. If the bearings are touched, the contamination can be removed by washing in alcohol. After the bearings have been thoroughly cleaned, spin them in a clean new light machine oil until the cleaner or solvent is entirely removed. Allow this oil to drain off and then repack them immediately with G-E lubricant D50H15 being sure all metal parts are greased.

**NOTE:** If it becomes necessary to clean the bearings in alcohol (shellac thinner), be sure the alcohol is perfectly clean, and do not allow the bearings to remain in the alcohol more than a few hours. If it is desirable to leave the bearings in the alcohol for a longer time, an inhibited alcohol such as is used for antifreeze should be used. Even then the bearings should be removed from the alcohol within twenty-four hours. Precautions against the toxic effects of the alcohol must be exercised by wearing rubber gloves and by using the alcohol in a well ventilated room; excessive exposure to the fumes is sometimes unpleasant to personnel. Washing the bearings in the light oil and draining should follow immediately, then apply the lubricant. Bearings that are pressed into the frame or other members such as the bearings for motor eccentric (8) Fig. 8 cam shaft bearings and trip and close shaft bearings should

not be removed. After removing the shaft and inner race the bearing can usually be cleaned satisfactorily with petroleum solvent or a similar cleaner and a stiff brush. Follow the procedure outlined above using a light machine oil and G-E lubricant D50H15 before reassembling the inner race and shaft.

### Rolling Surfaces

The surfaces of the ratchet wheel, cam and pawls are lubricated with a baked-on, dry molybdenum disulfide coating. This requires no maintenance and should last the life of the breaker.

## **RECOMMENDED MAINTENANCE OF BREAKERS APPLIED TO NORMAL SWITCHING DUTY**

Vacuum breakers applied to normal operations should be serviced and maintained according to the following schedule:

- A. Every 1000 operations, or every year, whichever comes first, the following should be accomplished:
  1. Make a visual inspection of the breaker and remove dust and contaminants from the vacuum interrupters, porcelain, and operating rods.
  2. A high potential test should be applied to the vacuum interrupters as outlined in the "Hipot Testing of the Vacuum Interrupters", page 17.
  3. Check the Power Vac contact erosion indicator as described in the breaker element, page 16.
  4. Check the breaker and mechanism adjustments as summarized under INSPECTION AND TEST. The necessary readjustments should be made as described under ADJUSTMENTS.
  5. The breaker and operating mechanism should be carefully inspected for loose nuts, bolts, damaged parts, etc; all cam, latch, and roller surfaces should be inspected for damage or excessive wear.
  6. Lubricate the breaker operating mechanism in accordance with the table under LUBRICATION.
  7. Inspect all wiring for tightness of connections and possible damage to insulation.
  8. After the breaker has been serviced, it should be slowly closed and opened, as described in INSTALLATION, to



be sure there is no binding or friction and that the movable contact on the interrupter can move to the fully opened and fully closed positions. Its electrical operation should then be checked using either the test position of the metal-clad or the test couplers.

B. Every 5000 operations or Approximately Every Five Years, whichever comes first, the following should be accomplished:

1. At this time the breaker should be given a general overhaul and all excessively worn parts in both the mechanism and breaker replaced. Such wear will usually be indicated when the breaker cannot be adjusted to instruction book tolerances. This overhaul and inspection is more detailed and will require disassembly of mechanism and breaker operating parts.
2. All roller and needle bearings in the operating mechanism should be disassembled, cleaned, and repacked with G-E lubricant D50H15 as described under LUBRICATION.
3. The breaker and operating mechanism should be serviced as described for every 1000 operations and properly adjusted before being put back into service.

## REPAIR AND REPLACEMENT

The following information covers in detail the proper method of removing various parts of the breaker in order to make any necessary repairs. This section includes only those repairs that can be made at the installation on parts of the breaker that are most subject to damage or wear.

**IMPORTANT: UPON COMPLETION OF ANY REPAIR WORK, ALL BREAKER AND MECHANISM ADJUSTMENTS MUST BE CHECKED.**

Refer to the section on INSTALLATION, paying particular attention to ADJUSTMENTS.

The listed terms "Right" and "Left" apply when facing the panel end of the breaker.

### Primary Disconnect Fingers

Refer to Fig. 7. To remove the primary disconnect fingers remove bolt and retainer (6). Slide the front spring (5) to the rear into the contact groove of the finger. The finger cage can now be pulled to the rear.

When the cage has been replaced the spring must be returned to its proper place on the finger. This can be accomplished by carefully working the spring into its normal position with a screw-

driver and holding in place with your hand. Be careful not to scratch or mar the silver contact surface of the stud.

### Interrupters

Refer to Fig. 7. To replace an interrupter, it is necessary to remove the adjacent primary stud and braids. The following steps should be followed carefully.

1. Remove the adjacent primary stud (3), braids (4), and connection block (9) by removing 4 bolts from the stud support (1) and 2 bolts (8) from the connection blocks. It is recommended that only one stud be removed at a time so that dimensions from adjacent studs can be used for repositioning.
2. Insert a 3/8 - 16 bolt of sufficient length (8) Fig. 14 through the interrupter support (9) and thread into the connection block (4). The bolt need not be tight, its purpose is to keep the contact rod from twisting when the locking nut (3) is loosened or tightened. It may be necessary to partially slow close the contacts of the interrupter to allow the holes in the interrupter support and connection block to line up. After loosening the locking nut, remove the bolt.
3. Remove 2 bolts from the movable connection block (4).
4. Remove 4 nuts (7) from the interrupter mounting studs.
5. Turn adjusting screw (2) until interrupter is free and remove.
6. Insert new interrupter and replace movable contact block (4), stationary contact block (9) Fig. 7 and stud (3). Do not tighten locking nut (3) Fig. 14 until the contacts have been aligned as described in Primary Contact Gap, page 11. Also be certain to insert a 3/8 - 16 bolt (8) in the contact block (4) before tightening locking nut.
7. Before putting breaker into service, operate approximately 100 times and recheck the contact gap and wipe. Some small changes sometimes occur during the first operations due to seating of contacts. Readjust if necessary.

**CAUTION: IF THE INTERRUPTER TO BE REPLACED HAS THE ENVELOPE BROKEN, SPECIAL PRECAUTIONS SHOULD BE OBSERVED. READ INSTALLATION ITEM 7. PAGE 5 CAREFULLY.**

### Primary Contact Studs

If it becomes necessary to remove the stationary contact studs, they should be removed one



at a time. This will allow measurements to be made to adjacent studs for proper realignment.

Remove the braid contact bolts (2) Fig. 7, and the four mounting bolts (1), the stud can now be removed.

In replacing the stud on the breaker, it is necessary to align the contact finger end with respect to the other studs. This is accomplished

by properly tightening the mounting bolts (1). The base of the stud and the mounting support on the insulator have a spherical seat that will allow the stud to be adjusted over a wide range. Tighten each bolt in turn until all four bolts are tight and the contact end of the stud is in the correct position.

#### Spring Release and Trip Coils

The spring release coil (4) Fig. 10 and the

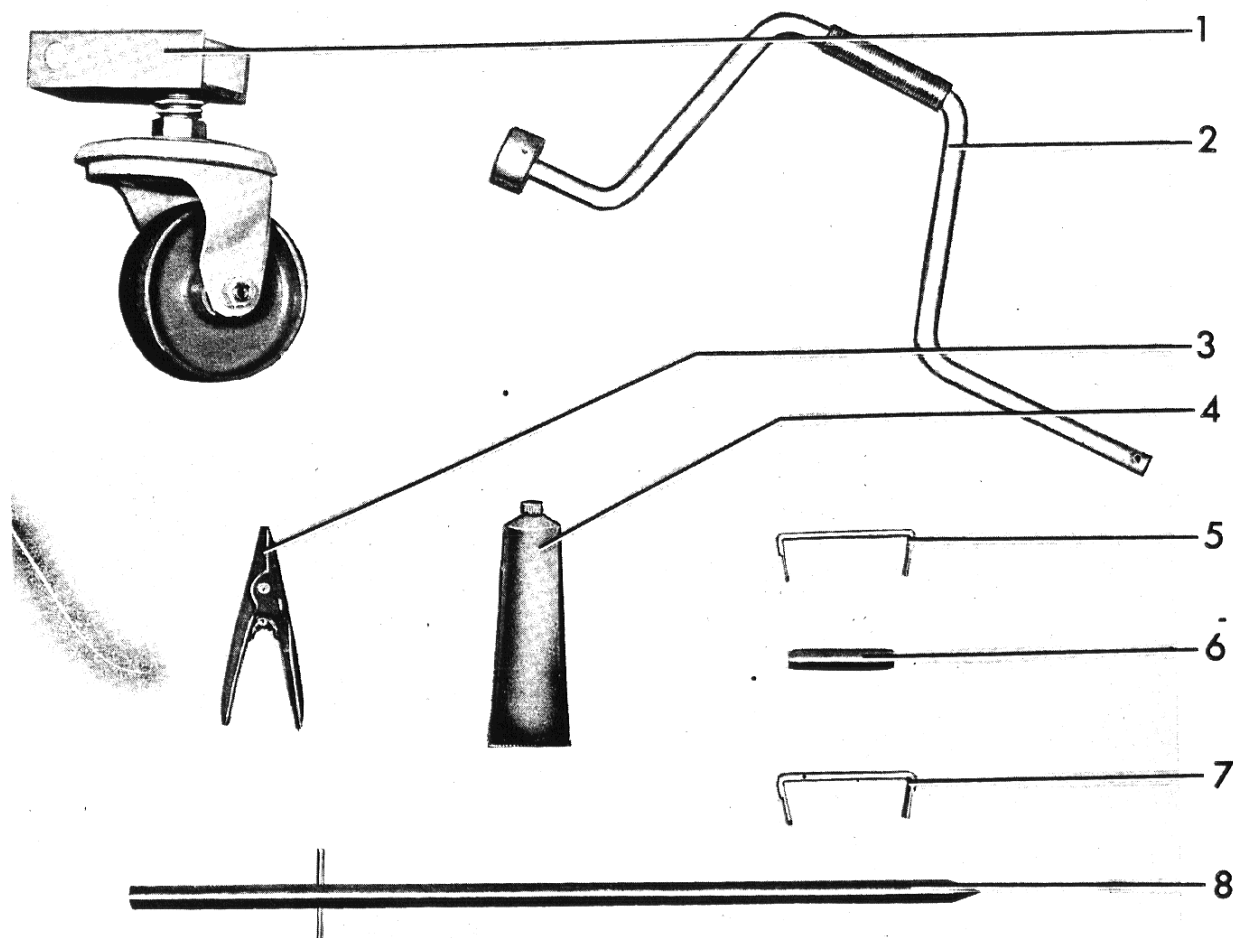


Figure 18. (8040360) Maintenance Kit

1. Swivel Wheel
2. Racking Screw Wrench
3. Retaining Ring Pliers
4. D50H15 Grease

5. Latch Roller Gage
6. Spring Blocking Pin
7. Cam Follower Gage
8. Spring Blocking Pin

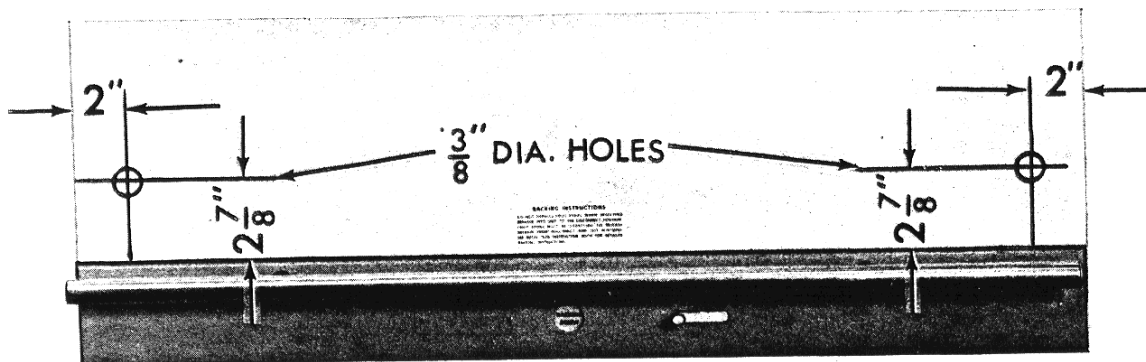


Figure 19. (8040292) Front Panel Drilling

trip coil (9) can be replaced as follows:

1. Cut the wires close to the coil.
2. Remove armature stop (6) and nut.
3. Remove two Coil Support Mounting Bolts.
4. When replacing the coil be sure to assemble the correct fiber spacers at the ends before bolting supports in place.
5. Adjust armature stop (6) and nut to allow approximately  $1/8$ " of freedom for link.
6. Be certain armature is centered in the coil and is not binding.
7. Butt connect wires and check operation of solenoid electrically and mechanically.

#### Racking Screw Chain Drive

The racking screw chain drive has been set at the factory and should require no maintenance. The main driving element is a friction clutch (1) Fig. 10 that is adjusted to slip at 20 foot-pounds. This is to protect elements of the breaker and metal-clad equipment from damage if misalignment occurs or the breaker is improperly inserted.

If slippage is evident while the breaker is being racked in or out of the metal-clad equipment, the torque of the clutch should be checked. This can be done by turning the racking wrench counterclockwise until the racking nut (3) Fig. 3 is against the stop at the rear of the racking screw box. Insert a suitable drive coupling (similar to the end of the racking wrench) into the racking mechanism and turn counterclockwise with a torque wrench. The value should be approximately 20 foot-pounds. If adjustment is necessary, loosen the set screw on the clutch hex adjusting nut and tighten nut slightly. Do not raise the torque value higher than the recommended 20 foot-pounds or the pro-

tective value of the clutch will be lost. If slippage of the clutch occurs after the torque value has been correctly set, check for interference or misalignment of the breaker and metal-clad equipment.

If the breaker is completely in the metal-clad equipment and the clutch slips so the breaker cannot be removed, or the chain drive becomes disconnected so that the jack screws cannot be turned, emergency measures must be taken to remove the breaker. Two  $3/8$ " holes should be drilled in the upper front cover as shown in Fig. 19. The two jack screws can now be turned with screw drivers inserted into the slots in the ends of the screws. Both jack screws should be turned simultaneously so that the breaker will remain in alignment as it is removed.

#### Closing Spring Removal

If it becomes necessary to remove the closing spring the following procedure should be followed:

1. Fully charge the spring (electrically or manually)
2. Insert short spring blocking pin (6) Fig. 18.
3. Discharge spring against the blocking pin by pushing the close button (7) Fig. 1.
4. Push the trip button to collapse the mechanism linkage and turn the manual charging shaft (13) Fig. 5 until the ratchet wheel (16) Fig. 8 has raised the upper closing spring guide (18) to the highest point.
5. The closing spring (1) Fig. 4 and closing spring guide (2) can now be lifted from the pivot support (4), turned 90 degrees, and lowered until it is released from the upper spring guide (18) Fig. 8.

## RENEWAL PARTS

It is recommended that sufficient renewal parts be carried in stock to enable the prompt replacement of any worn, broken, or damaged parts. A stock of such parts minimizes service interruptions caused by breakdowns, and saves time and expense. When continuous operation is a primary consideration, more renewal parts should be carried, the amount depending upon the severity of the service and the time required to secure replacements.

Renewal parts which are furnished may not be

identical to the original parts, since improvements are made from time to time. The parts which are furnished, however, will be interchangeable.

The Renewal Parts List covers the following types of breakers:

VH-34.5-1500-OK, -1K and -OL 1200A., 2000A. & 3000A.

NOTE: The listed terms "Right" and "Left" apply when facing the panel end of the breaker

## ORDERING INSTRUCTIONS

1. Always specify the complete nameplate data of both the breaker and the mechanism.
2. Specify the quantity, catalog number (if listed), reference number (if listed), and description of each part ordered, and this bulletin number.
3. Standard hardware, such as screws, bolts, nuts, washers, etc. is not listed in this bulletin. Such items should be purchased locally.
4. For prices or information on parts not listed in Table II, refer to the nearest office of the General Electric Company.

TABLE I

## ALTERNATE LUBRICATION

PART	LUBRICATION AT MAINTENANCE PERIOD	ALTERNATE LUBRICATION (REQUIRES DISASSEMBLY)
Sleeve Bearings - main crank shaft, operating rod, opening spring connection, pawls, Mechanism links, etc.(Bronze)	Light application of machine oil SAE20 or SAE30.	Remove bearings or links, clean per instructions and apply D50H15 lubricant liberally.
Roller and Needle Bearings	Light application of machine oil SAE 20 or SAE30.	Clean per instructions and repack with D50H15 lubricant.
Ground surfaces such as cams, ratchet teeth, etc. (Surfaces coated with MoS <sub>2</sub> )	No Lubrication Required	No Lubrication Required
Ground surfaces such as latches, rollers, etc.	Wipe clean and apply D50H15 lubricant.	Wipe clean and apply D50H15 lubricant.
Silver Plated Primary Disconnect Studs and Fingers	Wipe clean and apply D50H47	Wipe clean and apply D50H47
Dashpot	Check for oil level - add dashpot grade oil D50H27 as req'd.	Check for oil level - add dashpot grade oil D50H27 as req'd.

TABLE II

AMPERE RATING	TYPE	CATALOG NO.	NO. REQ.	DESCRIPTION
All	-OL	195A4040 P-4	6	Power Vac Interrupter
1200	-OK	208A9454 G-1	6	Power Vac Interrupter
2000	-OK	208A9454 G-2	6	Power Vac Interrupter
All	-1K	208A9454 G-2	6	Power Vac Interrupter
All	All	133C3952 G-1	3	Operating Rod
All	All	121C8139 G-1	6	Interrupter Support Insulator
All	All	121C8139 G-2	6	Stud Insulator
1200	All	208A9427 G-1	6	Primary Disconnect Finger Asm.
2000	All	208A9427 G-2	6	Primary Disconnect Finger Asm.
3000	All	208A9427 G-3	6	Primary Disconnect Finger Asm.
All	All	195A4055 G-1	2	Secondary Disconnect Asm.
All	-OK	195A4000 P-4	2	Driving and Latching Pawl Springs
All	-1K,-OL	195A4000 P-4	1	Driving Pawl Spring
All	-1K,-OL	208A9458 P-1	1	Latching Pawl Spring
All	All	121C8188 G-1	1	Motor 48 V dc
All	All	121C8188 G-2	1	Motor 115 V ac - 125 V dc
All	All	121C8188 G-3	1	Motor 230 V ac - 250 V dc
All	All	137A7575 P-4	1	Relay 48 V dc
All	All	137A7575 P-1	1	Relay 125 V dc
All	All	137B7910 G-1	1	Relay 250 V dc
All	All	137A7575 P-5	1	Relay 115 V ac
All	All	137A7575 P-2	1	Relay 230 V ac
All	All	6174582 G-12	1	Potential Trip Coils 24 V dc
All	All	6174582 G-34	1	Potential Trip Coil 48 V dc
All	All	6174582 G-40	1	Potential Trip Coil 110-125 V dc
All	All	6174582 G-41	1	Potential Trip Coil 220-250 V dc
All	All	6174582 G-10	1	Potential Trip Coil 115 V ac
All	All	6174582 G-14	1	Potential Trip Coil 230 V ac
All	All	6174582 G-34	1	Spring Release Coil 48 V dc
All	All	6174582 G-40	1	Spring Release Coil 110-125 V dc
All	All	6174582 G-41	1	Spring Release Coil 220-250 V dc
All	All	6174582 G-10	1	Spring Release Coil 115 V ac
All	All	6174582 G-14	1	Spring Release Coil 230 V ac
All	All	456A866 P-5	5	Switches Normally Open
All	All	456A866 P-6	1	Switch Normally Closed
All	All	137A9192 G-11	1	Auxiliary Switch

# GENERAL ELECTRIC INSTALLATION AND SERVICE ENGINEERING OFFICES

## FIELD SERVICE OFFICE CODE KEY

- \* Mechanical & Nuclear Service
- † Electrical & Electronic Service
- ‡ Marine Service
- X Transportation

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\* † Birmingham 35205 ... 2151 Highland Ave.  
\* † Mobile 36609 ... 1111 S. Beltline Highway

**ALASKA**  
† Anchorage 99501 ... 115 Whitney Rd.

**ARIZONA**  
\* † Phoenix 85012 ... 3550 N. Central Ave.  
† Tucson 85716 ... 151 S. Tucson Blvd.

**ARKANSAS**  
† North Little Rock 72119 ... 120 Main St.

**CALIFORNIA**  
\* † Los Angeles 90054 ... 212 N. Vignes St.  
† Palo Alto 94303 ... 980 San Antonio Rd.  
† Sacramento 95808 ... 2407 J St.  
† San Diego 92103 ... 2560 First Ave.  
\* † San Francisco 94119 ... 55 Hawthorne St.  
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\* † New Orleans 70125 ... 4747 Earhart Blvd.  
† Shreveport 71104 ... 2620 Centenary Blvd.  
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† Saginaw 48607 ... 1008 Second National Bank Bldg.

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\* † Minneapolis 55416 ... 1500 Lilac Drive So

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\* † St. Louis 63101 ... 1015 Locust St.

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† Butte 59701 ... 103 N. Wyoming St.

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\* Wilmington  
Reigelwood 28456 ... P.O. Box 186

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