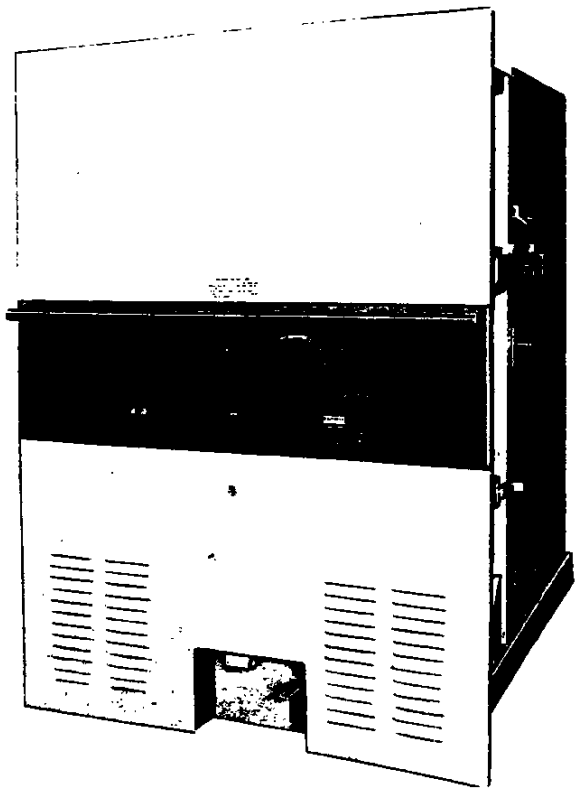
INSTRUCTIONS AND
RECOMMENDED PARTS
FOR MAINTENANCE

GEK - 49766

Vacuum Circuit Breaker

TYPE
VH-34.5-1500-2L



CONTENTS

SWITCHGEAR PRODUCTS DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

VACUUM CIRCUIT BREAKER
VH-34.5-1500
MODEL-2L

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.

SAFETY

Each user has the responsibility to instruct all personnel associated with his equipment on all safety precautions which must be observed.

The following are recommendations to be considered in a user's safety program. These recommendations are not intended to supplant the user's responsibility for devising a complete safety program and shall not be considered as such. They are rather suggestions to cover the more important aspects of personnel safety related to circuit breakers. General Electric neither condones nor assumes any responsibility for user practices which deviate from these recommendations.

GENERAL

1. All personnel associated with installation, operation and maintenance of power circuit breakers should be thoroughly instructed and supervised regarding power equipment in general and, also, the particular model of equipment with which they are working. Instruction books and service advices should be closely studied and followed.

2. Maintenance programs must be well planned and carried out consistent with both customer experience and manufacturer's recommendations including service advices and instruction books. Good maintenance is essential to breaker reliability and safety.

Local environment and breaker application must be considered in such programs, including such variables as ambient temperatures, actual continuous current, number of operations, type of interrupting duty, and any unusual local condition such as corrosive atmosphere or major insect problems.

3. The term "breaker" includes all equipment mounted on the circuit breaker frame.

SPECIFIC

1. DO NOT work on an energized breaker. If work has to be performed on the breaker, take it out of service.

2. DO NOT work on any part of the de-energized breaker until all control power has been disconnected.

3. All spring-charged mechanisms related to a breaker must be serviced only by skilled and knowledgeable personnel capable of releasing each spring load in a controlled manner. Particular care must be exercised to keep personnel clear of mechanisms which are to be operated or released. Information on construction of such mechanisms is provided in the instruction book for the particular breaker.

4. If there is any evidence of or suspected deterioration of breaker dielectric capability, the yard and adjacent areas should be promptly cleared of personnel. The breaker should then be de-energized by "back-ups" and isolated by disconnect switches.

5. Operational tests and checks should be made on a breaker after maintenance, before it is returned to service, to ensure that it is capable of operating properly. The extent of such tests and checks should be consistent with the level of maintenance performed.

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

To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but not such assurance is given with respect to local codes and ordinances because they vary greatly.

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.

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), Fig. 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 inch 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 manual 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

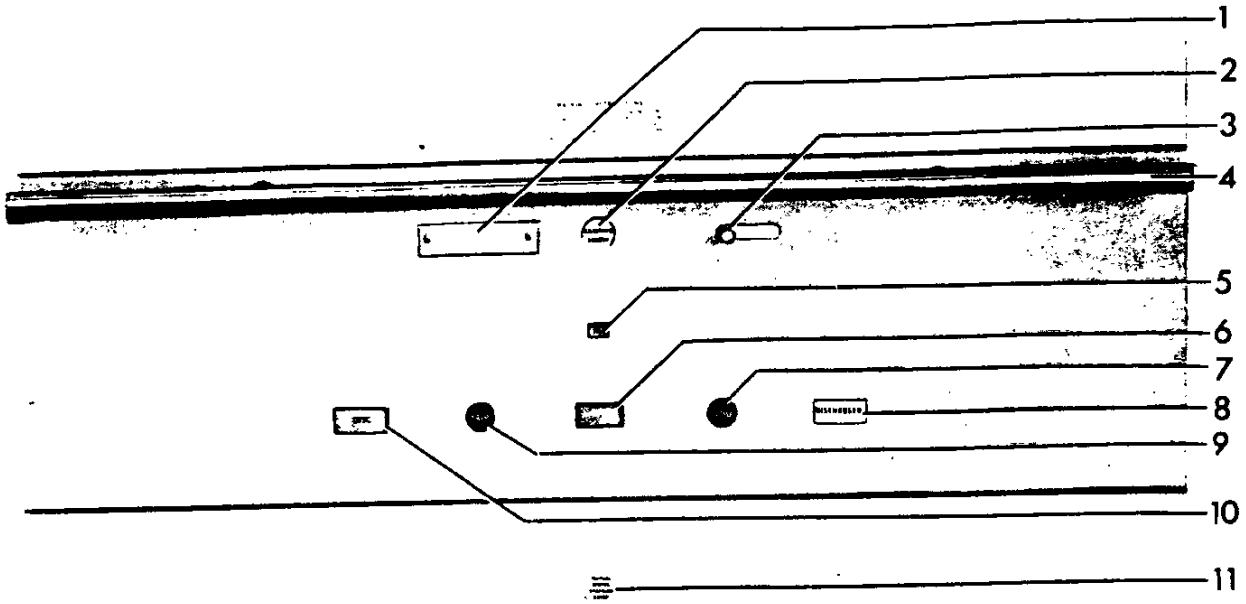
b. Primary contact wipe

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).

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.

If the breaker secondary wiring is to be given a high-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.



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

Figure 1. (8040291) Control Panel

Remove the test coupler and replace the breaker covers. Hipot test the interrupters as described under HIPOT TESTING OF THE VACUUM INTERRUPTER.

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.

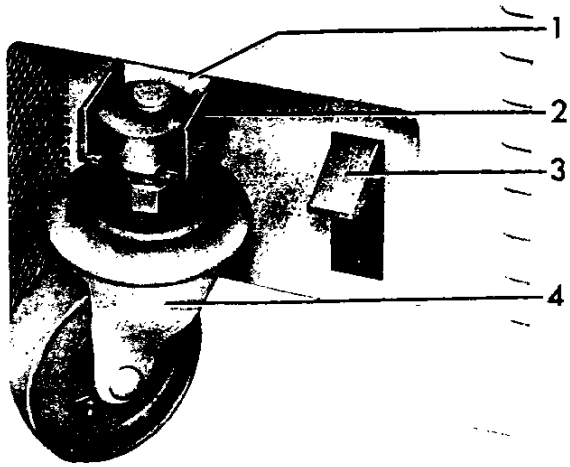
Refer to metal-clad instruction book GEK-7344 for final instructions, before inserting the breaker into the metal-clad unit.

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 chambers. The primary connections to the associated metal-clad switchgear are made through the primary disconnect device (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 (10), 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 a-c or d-c 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 crank (12), Fig. 5, 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 positions. Electrical operation of the breaker is also prevented by the interlock linkage.



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

Figure 2. (8040306) Transport Wheel

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 positions. 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 the 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 (1), Fig. 3, on the breaker.

An operator (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.

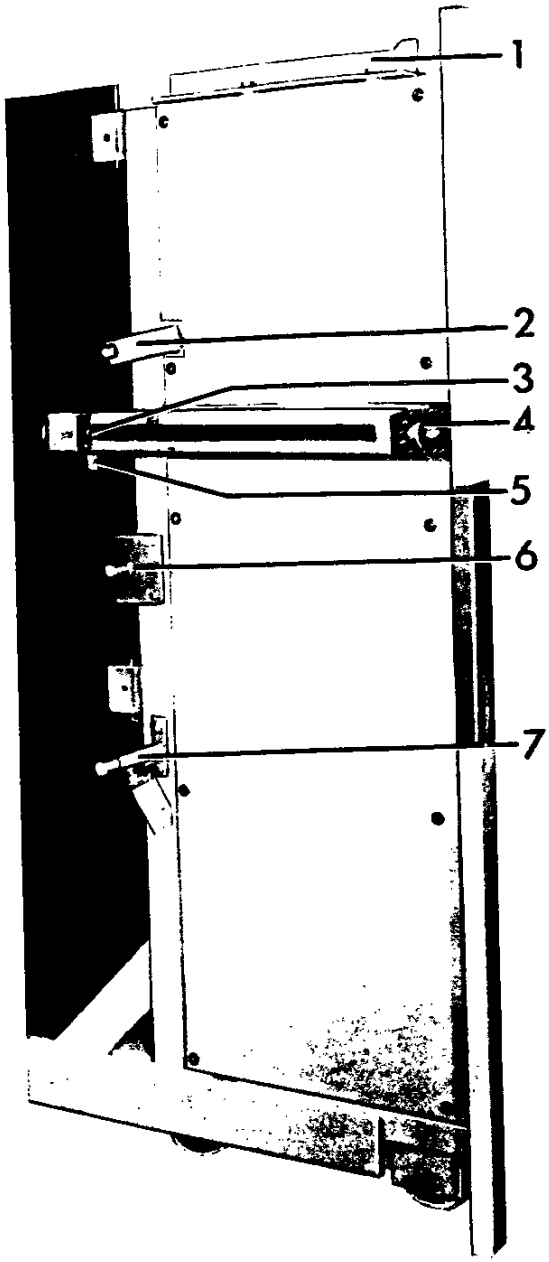
Spring Charging

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 (9), Fig. 8, that carries a spring-loaded driving pawl (8). The pawl advances the ratchet wheel (16) only a few degrees each stroke where it is held in position by the latching pawl (7). 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 inch 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 continue to charge the spring.

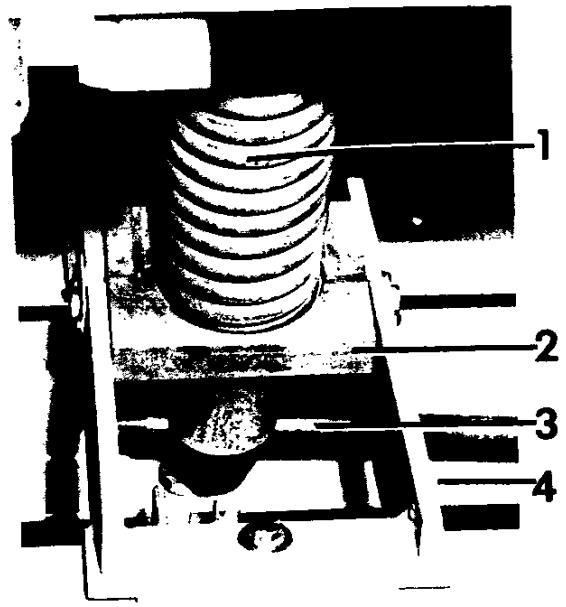
Closing Operation

Closing the breaker is accomplished by energizing the spring release coil (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.



1. Remote Position Cam
2. Position Stop
3. Racking Nut
4. Racking Screw
5. Racking Screw Lug
6. Metal-clad Shutter Operator
7. Position Indicator Crank

Figure 3. (8040293) Breaker-Left Side



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

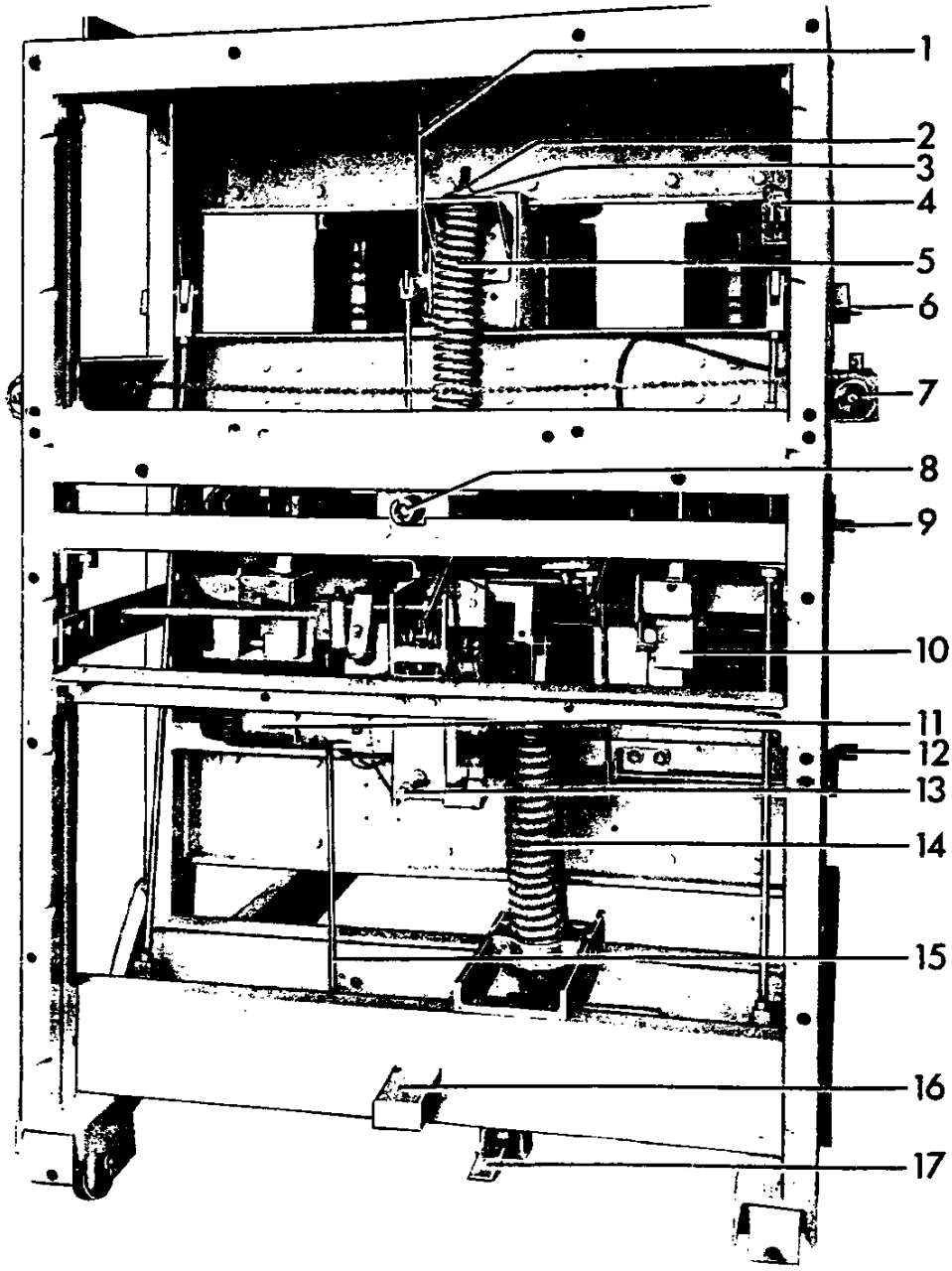
Figure 4. (8918290-E) Closing Spring

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 de-energized and upon completion of the opening operation, the operating mechanism is returned to its reset position, ready for closing.

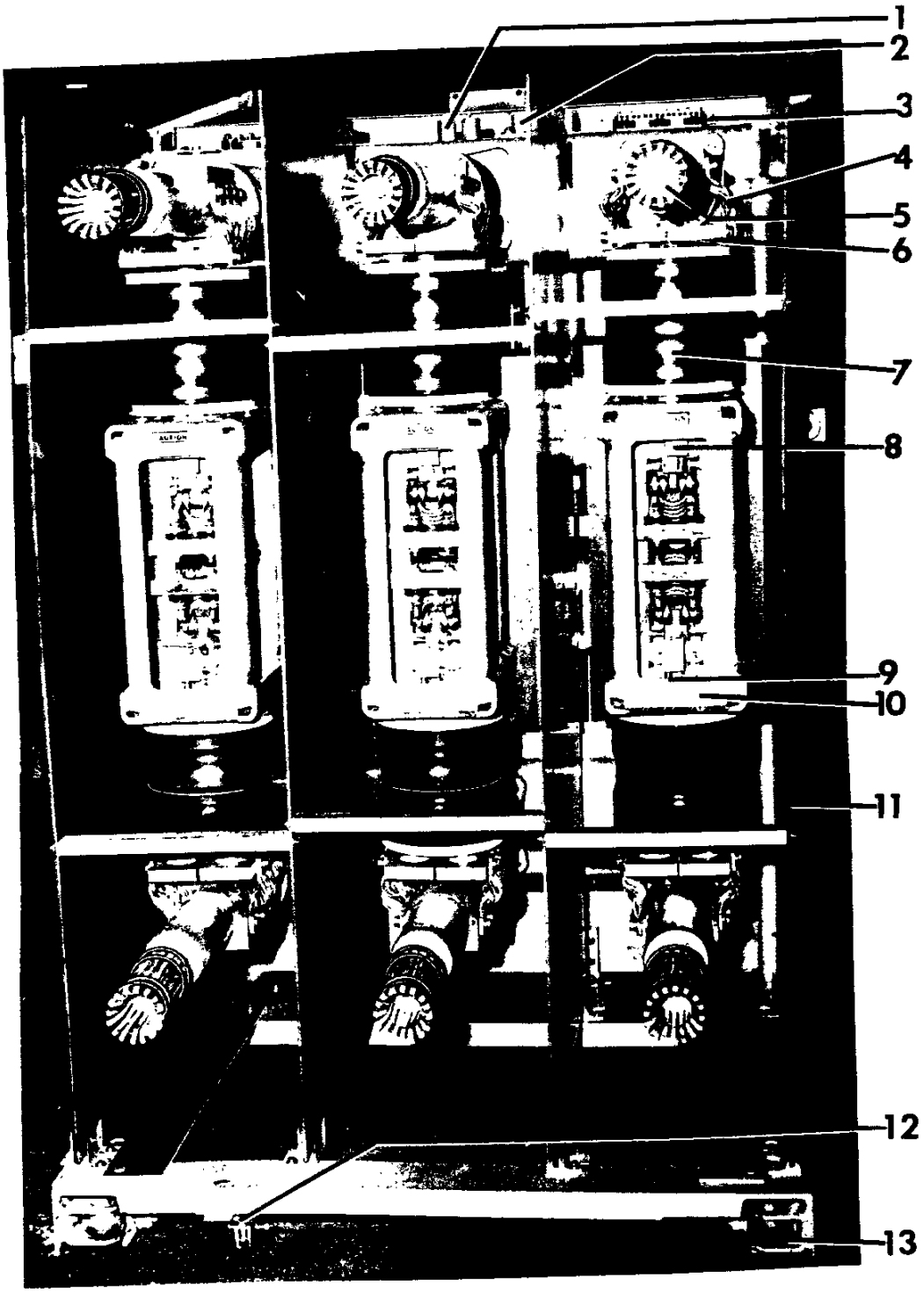
Trip-free Operation

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.



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

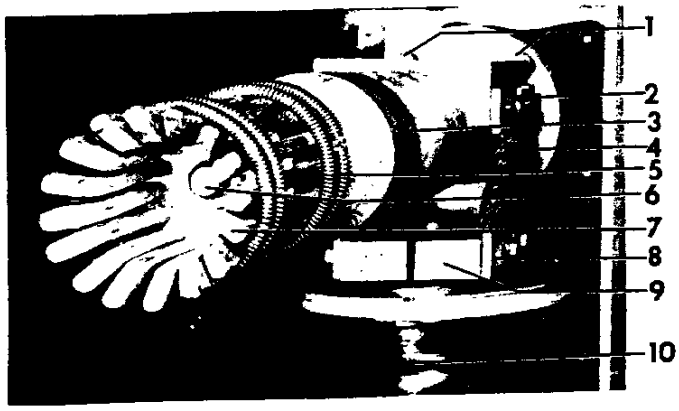
Figure 5. (8040311) Breaker-Front Covers Removed



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

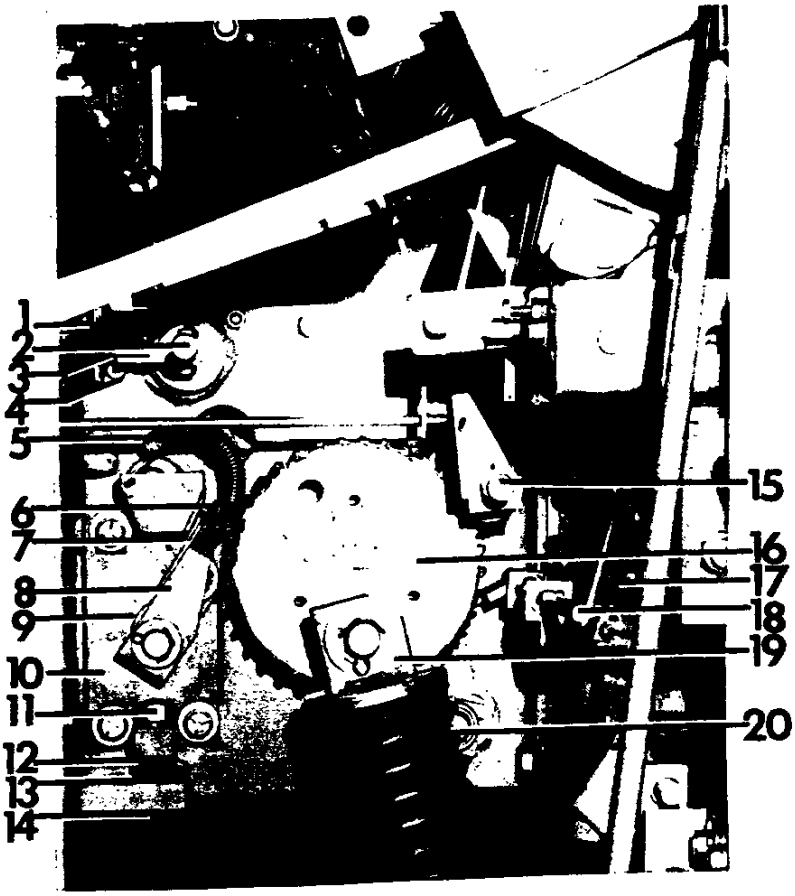
Figure 6. (8918290-C) Breaker-Rear View

*Registered Trademark of the General Electric Company



1. Mounting Bolts
2. Braid Bolts
3. Primary Stud
4. Primary Braids 0133C3954P001
5. Primary Contact Garter Springs
6. Mounting Bolt
7. Contact Finger
8. Braid Bolts
9. Contact Block
10. Power Vac* Interrupter

Figure 7. (8040298) Primary Stud



1. Latch Checking Switch
2. Trip Shaft 1121C3402P7
3. Switch Operating Arm
4. Switch Support
5. Driving Pawl Spring 195A4000-P4
6. Latching Pawl Spring 203A1458-P1
7. Latching Pawl 1121C3400-P1 G001
8. Driving Pawl " -P2 G002 G003
9. Motor Eccentric 1121C3411-P5
10. Motor Mount
11. Locking Nut
12. Buffer Spring Washer
13. Shim Washers
14. Mounting Bolt
15. Closing Shaft
16. Ratchet Wheel 1121C3406-G3
17. Motor and Relay Switches
18. Motor Switch Shaft
19. Upper Closing Spring Guide
20. Closing Spring

Figure 8. (8918290-G) Mechanism-Right Side

1. Main Drive Link
2. Trip Latch
3. Trip Shaft
4. Charging Pawl Spring
5. Trip Latch Roller
6. Stop Screw
7. Locking Nut
8. Motor
9. Locking Screw

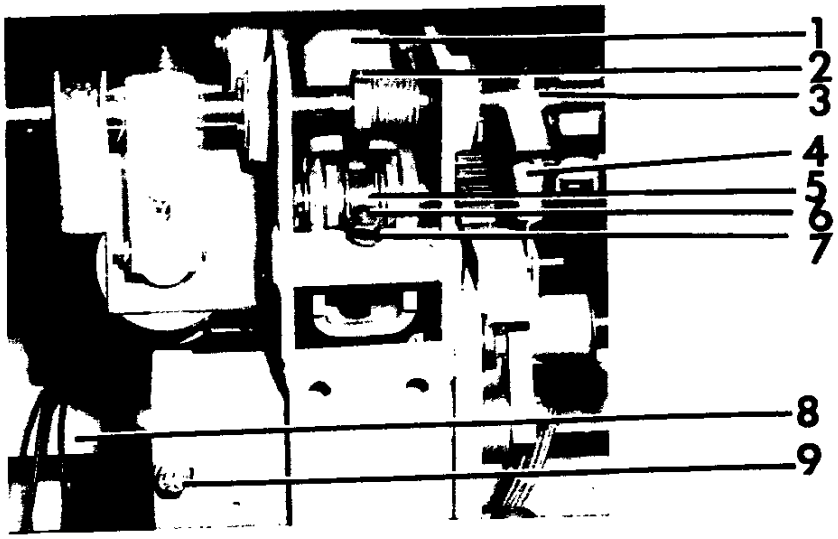


Figure 9. (8918290-F) Mechanism-Front Top (Breaker Open and Closing Springs Discharged)

1. Racking Clutch
2. Racking Chain Drive
3. Main Drive Link
4. Spring Release Coil
5. Trip Shaft
6. Armature Stop
7. Trip Coil Link
8. Spring Release Interlock
9. Trip Coil
10. Close Shaft
11. Motor
12. Manual Spring-charging Eccentric

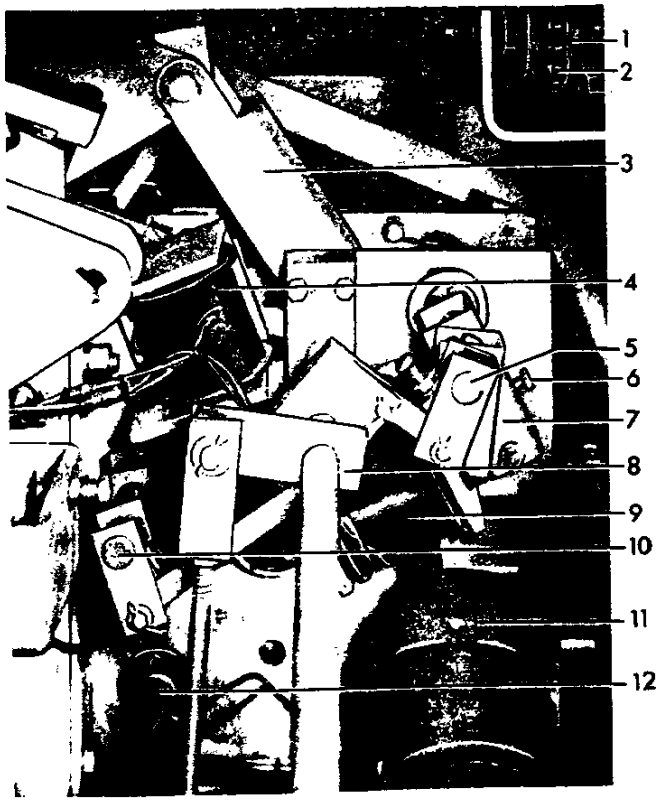
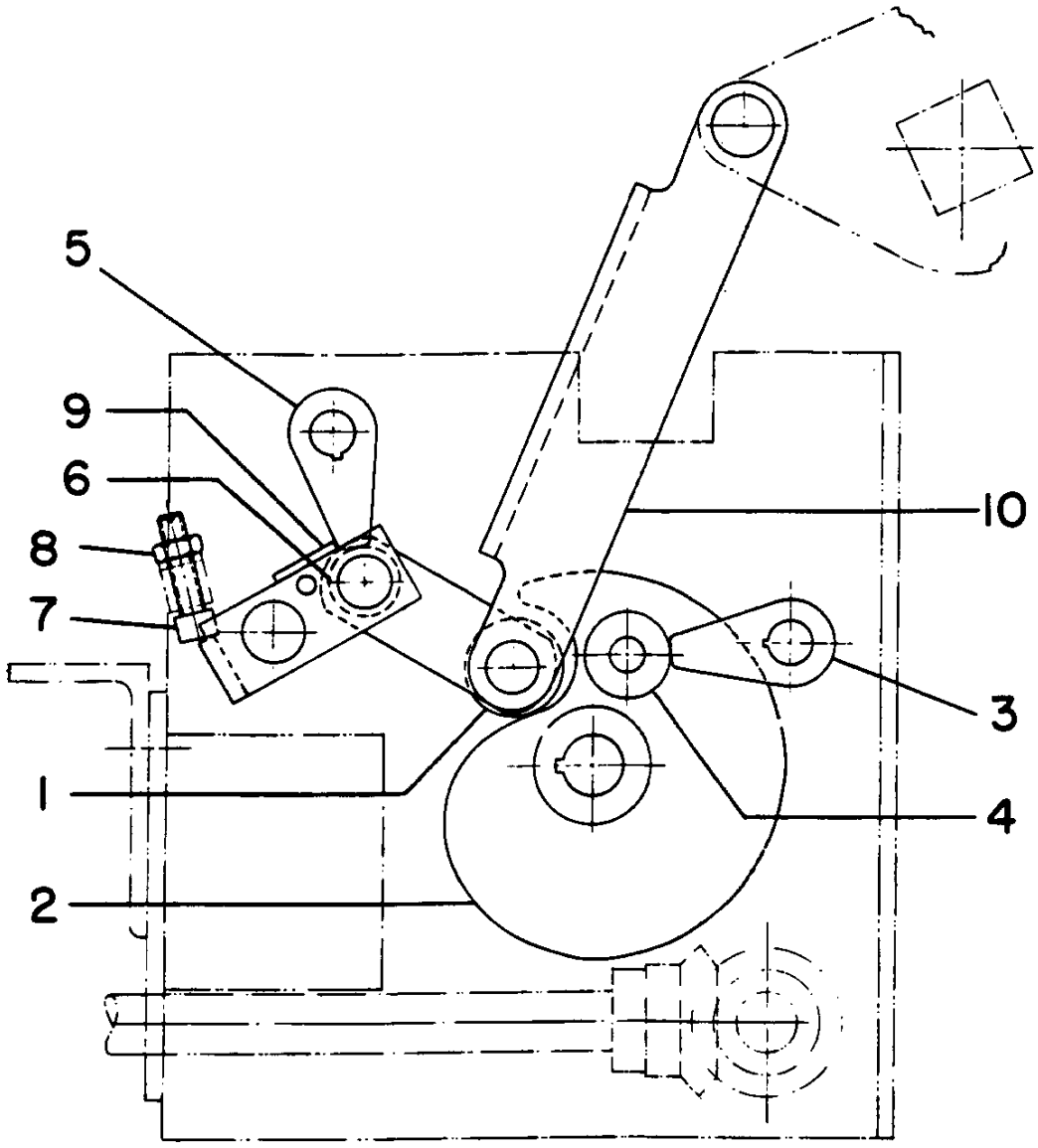


Figure 10. (8040319) Mechanism–Left Side



1. Cam Follower Roller
2. Cam
3. Closing Latch
4. Closing Latch Roller
5. Trip Latch
6. Trip Latch Roller
7. Stop Screw
8. Locking Nut
9. Trip Latch Stop
10. Main Drive Link

Figure 11. (0121C8125) Sectional Side View Mechanism Linkage

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.

Trip Latch Roller Clearance

The clearance between the trip latch (5), Fig. 11, and the trip latch roller (6), Fig. 11, should be 0.030 inch to 0.060 inch. Gage (5), Fig. 18, is used to check this dimension. The breaker must be in the open position with the closing springs (14), Fig. 5, charged and blocked and the cam follower roller (1), Fig. 11, bearing against cam (2), Fig. 11. Be certain the latch is in its proper location, against the latch stop (9), Fig. 11, and in line with the latch roller.

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

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 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 SWITCHES below.

Primary Contact

The contacts of both interrupters assembled to each pole of the breaker should touch within 1/32 inch of each other. If they do not, one of the contacts must be adjusted. Close the breaker slowly using a ratchet wrench and 5/8 inch socket on the manual charging shaft (13), Fig. 5, until one of the two interrupter contacts just touch. On the opposite interrupter assembly remove pin (9), Fig. 13, loosen screws (5), Fig. 14, and rotate pivot (8), Fig. 13. Be sure the pivot is loose in the conductor clamp (4), Fig. 14, before rotating. Reassemble and tighten screws (5), Fig. 14, to 80-to-90 inch-pounds. Trip open the breaker and again recheck contact touching requirement.

Primary Contact Gap

The primary gap can be measured with the erosion indicator (7), Fig. 13, that moves with the contact rod of the interrupter. Measure from the underside of the interrupter support to one of the horizontal edges on the erosion indicator at the contact touching point. Trip the breaker and remeasure, the difference should give a contact gap of 23/32 inch to 3/4 inch. If it is necessary to correct the contact gap, adjusting screw (9), Fig. 12, is used. Loosen nut (7), Fig. 12, and coupling screw (10), Fig. 12, and turn the adjusting screw to open or close the contact gap. Tighten the nut and screw and remeasure the gap after closing and tripping the breaker. Closing springs should be charged when the primary gap is measured.

Primary Contact Wipe

When the breaker is closed, the primary contact springs (10), Fig. 13, should be compressed 9/32 inch to 5/16 inch. This dimension will vary with breaker use and can be used without readjustment down to 5/32 inch. The measurement can be made between the guide (11), Fig. 13, and the stop nut (12), Fig. 13. Closing springs (20), Fig. 8, should be charged when the primary contact wire is measured.

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, and 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.

OPENING STOP CLEARANCE

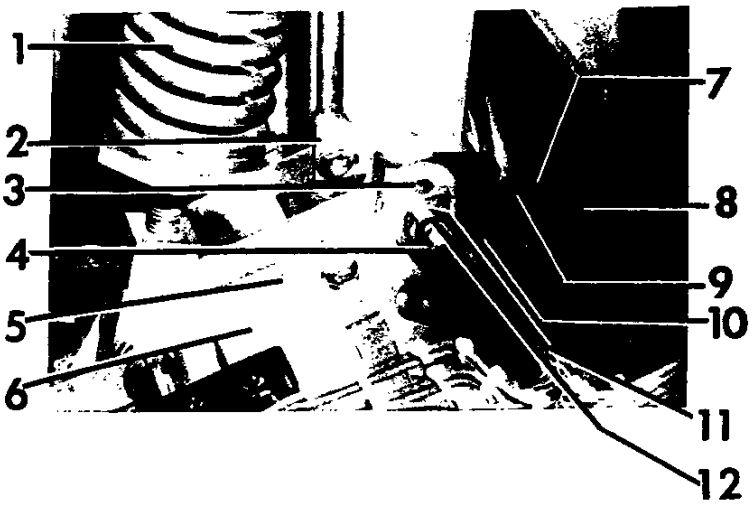
With the breaker in the open position measure the clearance between guide link (6), Fig. 14, and stop (7), Fig. 14. It should be 0.055 to 0.065 inch. If adjustment is necessary turn stop (7), Fig. 14, in adjusting nut (8), Fig. 14, maintaining height of spring washers (9), Fig. 14, by adjusting nut (8), Fig. 14. Closing springs (20), Fig. 8, should be charged when the opening stop is measured.

Switches

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

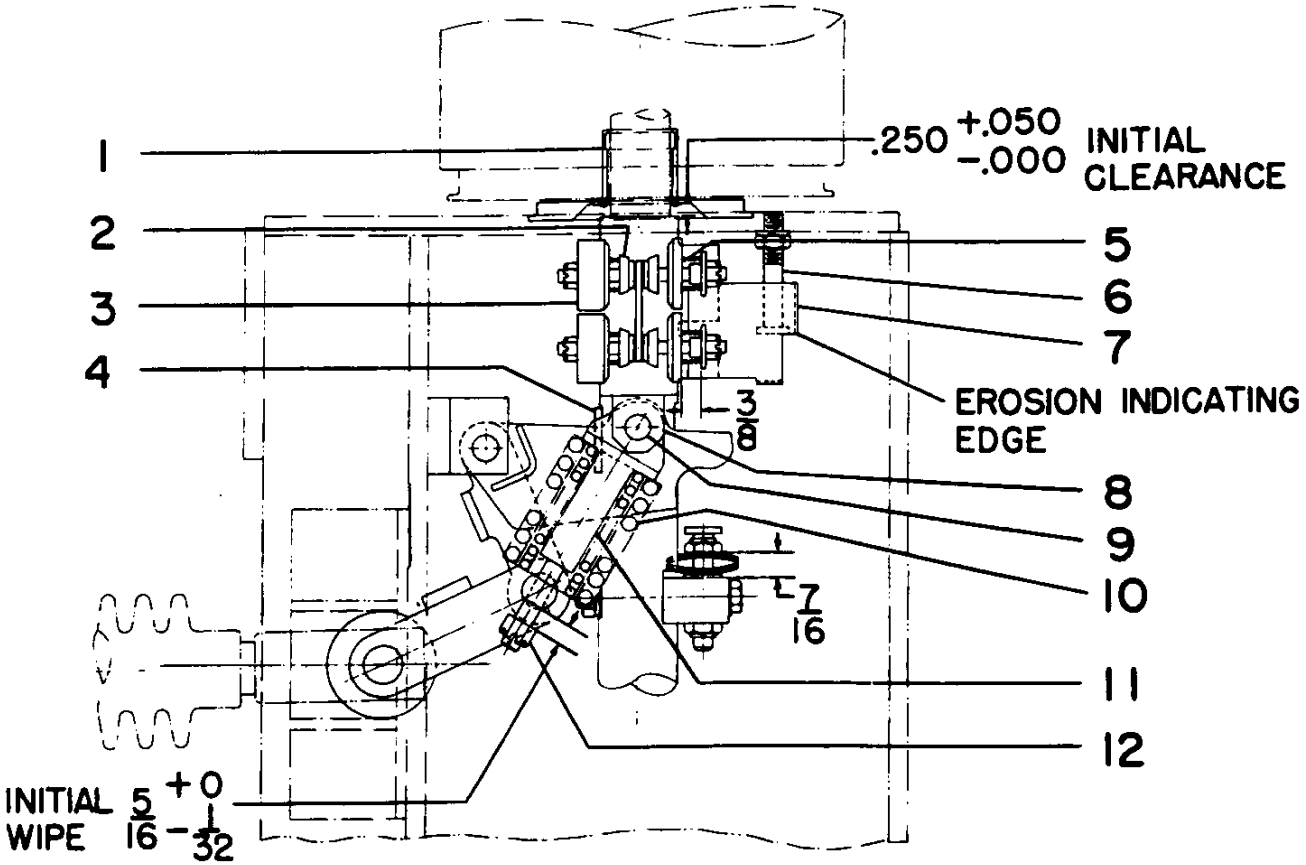
Dashpot

The dashpots (10), Fig. 17, are adjusted to stop 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 Nut
8. Operating Rod
9. Adjusting Screw
10. Coupling Screw
11. Nut
12. Lock Nut

Figure 12. (8918290-I) Operating Rod Crank



1. Primary Contact Guide
2. Inner Contact Rollers
3. Outer Contact Rollers
4. Roller Stops
5. Contact Roller Springs
6. Stationary Erosion Indicator
7. Moving Erosion Indicator
8. Pivot
9. Pin
10. Primary Contact Springs
11. Wipe Spring Guide
12. Stop Nut

Figure 13. (0934D0134SH.2) Interrupter Mechanism-Closed Position

1. Contact Block
2. Pinch-off Tube
3. Power Vac* Interrupter
4. Conductor Clamp
5. Conductor Clamp Screws
6. Guide Link
7. Stop
8. Adjustment Nut
9. Spring Washer
10. Operating Rod
11. Interrupter Support

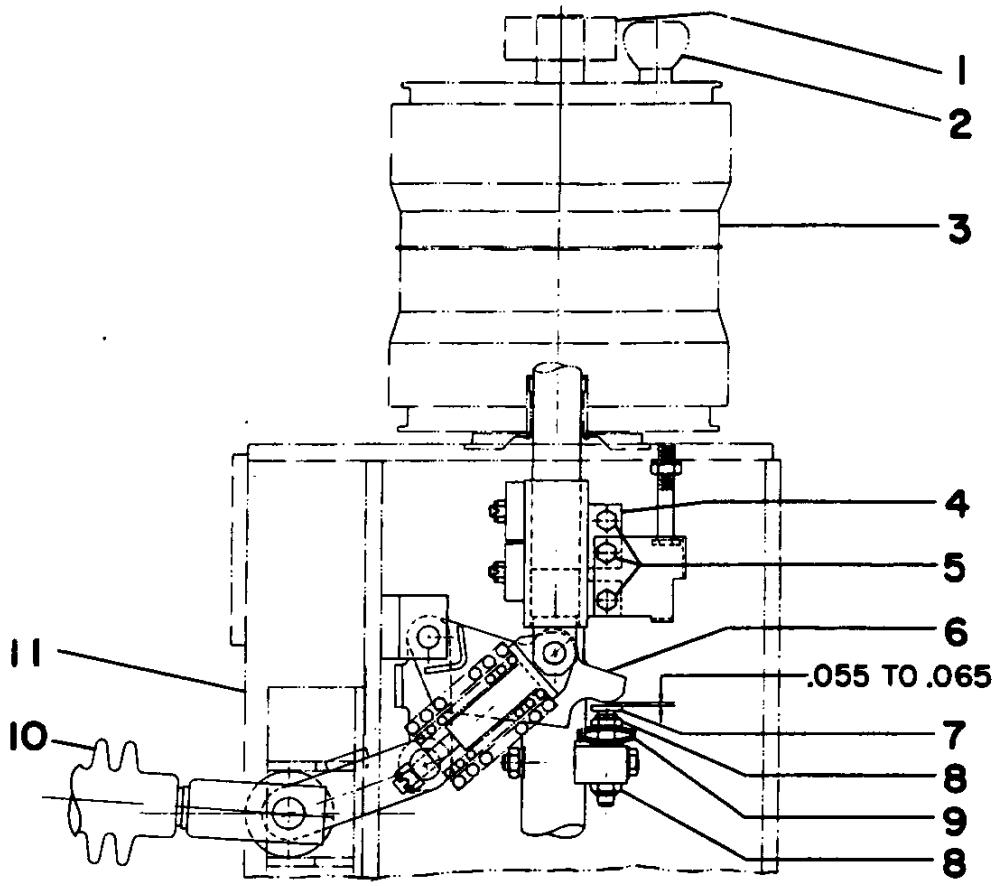


Figure 14. (0934D0134SH.1) Interrupter Mechanism-Open Position

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

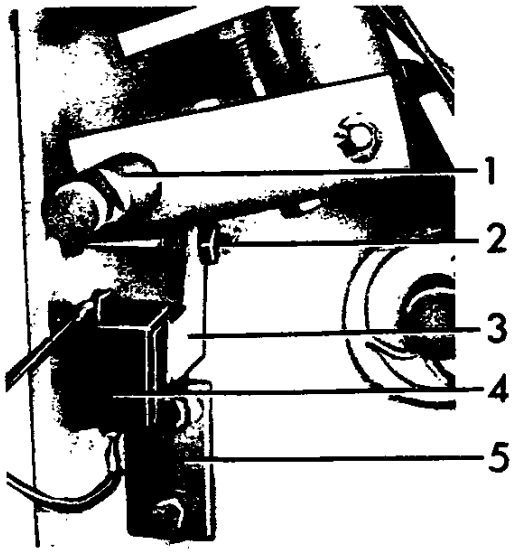
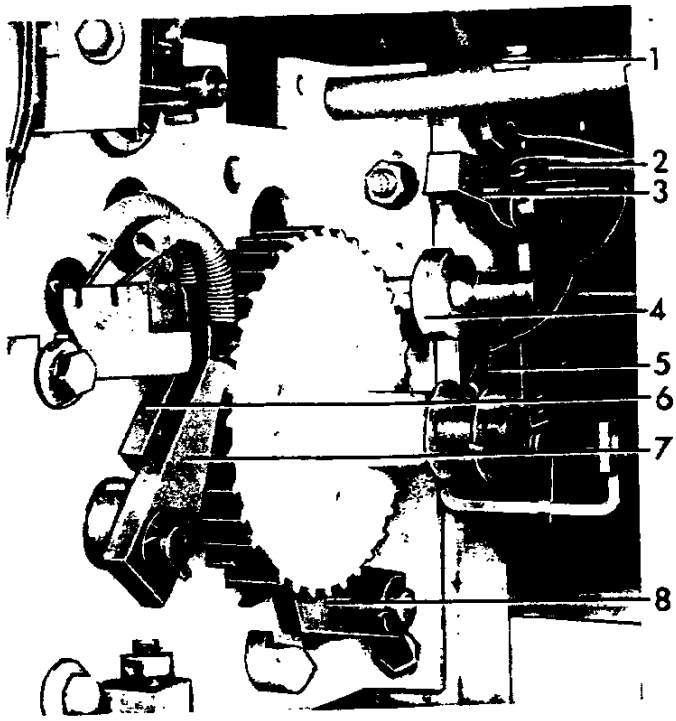


Figure 15. (8040359) Latch Monitoring Switch



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

contacts and linkage, limit the overtravel and rebound, and control the opening speed. They have been adjusted at the factory and should not be changed without benefit of an interrupter movable contact travel record. The oil level of the dahpot should be checked. If there is any indication of an oil leakage, the breaker should be partially closed to the point where dashpot strikers (6), Fig. 17, are fully reset and are resting against stop screw (7), Fig. 17. Remove breather cups (9), Fig. 17, and check the oil level. It should be into pipe reducer (12), Fig. 17. If the oil level is not in the pipe reducer add dashpot grade oil as recommended in the lubrication chart. Reassemble breather cups making sure breather hole is pointed away from the interrupters. A suitable thread sealer, such as plumber's pipe thread tape, should be applied to breather cup 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 0.020 inch to 0.040 inch when the manual driving pawl is fully advanced and the maximum load of the closing spring is on the ratchet.

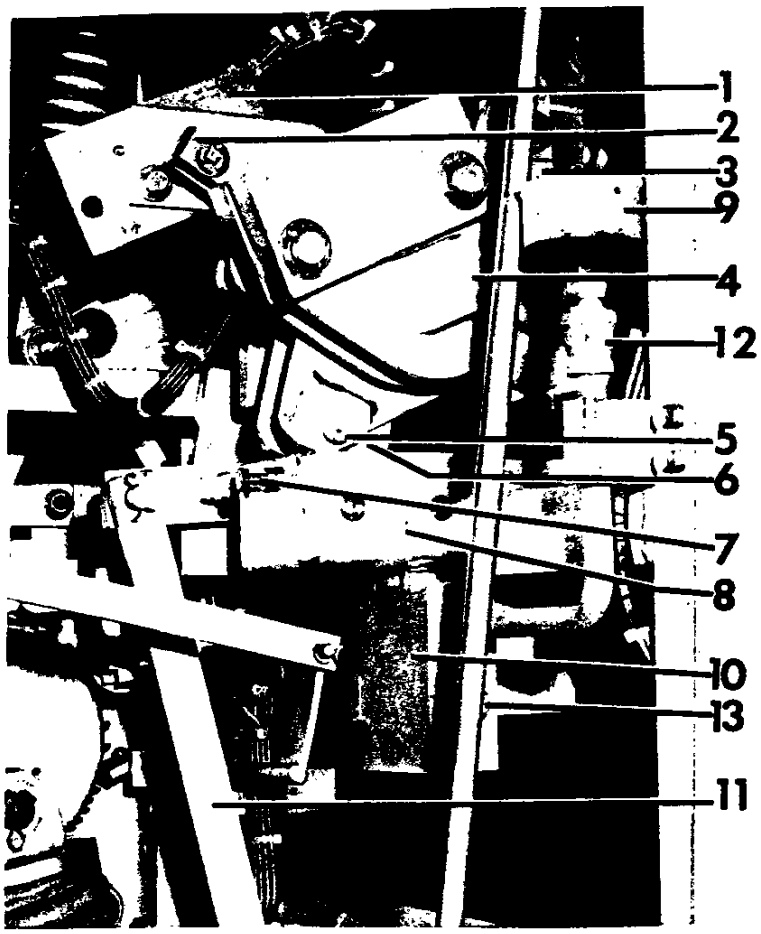
After checking the pawl clearance and determining the amount of movement required in the motor mount, the locking nut (11), Fig. 8, and bolt (14) can be removed and the necessary shim washers (12) added to or removed from the assembly. Replace the bolt and tighten hand tight plus one-half turn with a wrench. Hand wind the closing spring and again check the clearance with the closing spring load applied. Secure the bolt (14) by replacing nut (11) 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 inch of the latch stop (9), Fig. 11. Rotate the trip latch away from the stop by pushing the trip 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 inch from the latch to the support. If adjustment is necessary, move the switch support (4), Fig. 8.

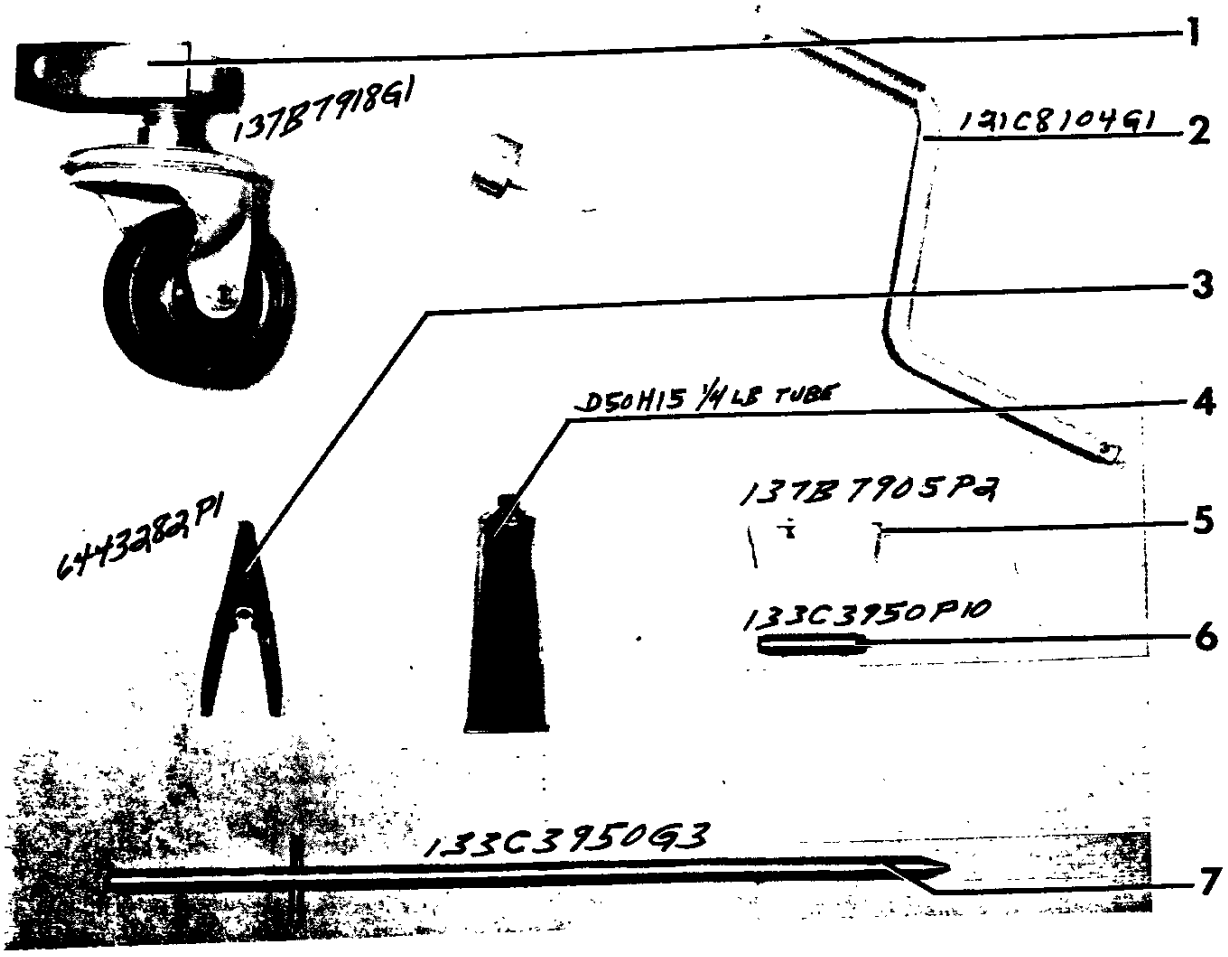
Spring Release Interlock

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.



1. Auxiliary Switch
2. Auxiliary Switch Linkage
3. Operating Rod Crank
4. Cross Shaft
5. Roller
6. Striker
7. Position Stop Screw
8. Support
9. Breather Cap
10. Dashpot
11. Positive Interlock
12. Pipe Reducer
13. Adjustable Orifice

Figure 17. (8918290-U) Dashpot



1. Swivel Wheel
2. Racking Screw Wrench
3. Retaining Ring Pliers
4. D50H15 Grease
5. Latch Roller Gage
6. Spring Blocking Pin
7. Spring Blocking Pin

Figure 18. (8040360A) Maintenance Kit

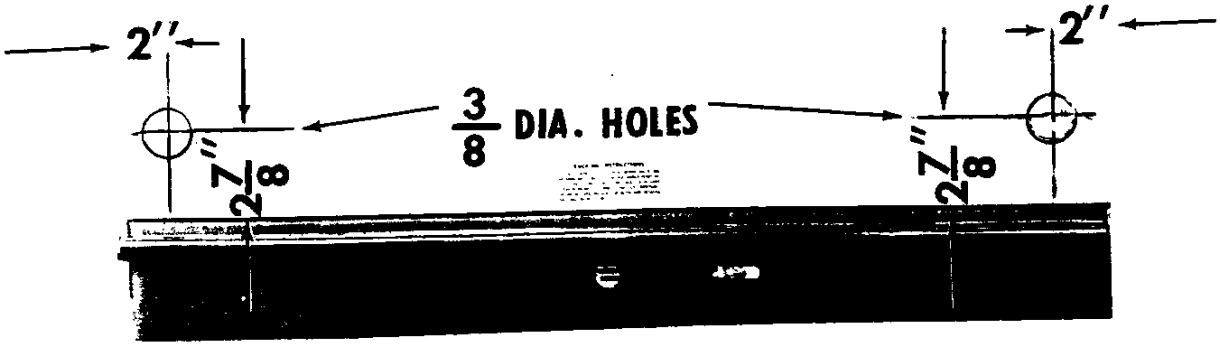


Figure 19. (8040292) Front Panel Drilling

INSPECTION AND TEST

1. For ease in reviewing the adjustments, the following are recapitulated:

   a. The trip latch clearance - 0.030 inch to 0.060 inch.

   b. The closing latch is centered.

   c. Primary contact gap - 3/4 inch + 0 - 1/32 inch.

   d. Primary contact wipe - 5/16 inch + 0 - 1/32 inch.

   e. Switches - clearance from support 1/64 inch to 1/32 inch.

   f. Latching pawl clearance - 0.020 inch to 0.040 inch.

   g. Latch checking switch contacts when the gap between the trip latch and stop is 1/16 inch maximum.

   h. Open stop clearance 0.055 inch to 0.065 inch.

2. Check all nuts, washers, bolts, cotter pins, snap rings 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 positions.

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 d-c	–	–	14 V	30 V
48 V d-c	34 V	50 V	28 V	60 V
125 V d-c	90 V	130 V	70 V	140 V
250 V d-c	180 V	260 V	140 V	280 V
115 V d-c	95 V	125 V	95 V	125 V
230 V a-c	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.

Minimum Energy Check

When the breaker is closed manually without benefit of the spring-charging motor (11), Fig. 5. There should be seven or more teeth on the ratchet wheel (16), Fig. 8, counting clockwise from the tooth against the latching pawl (6), Fig. 8, to, but not including, the half tooth.

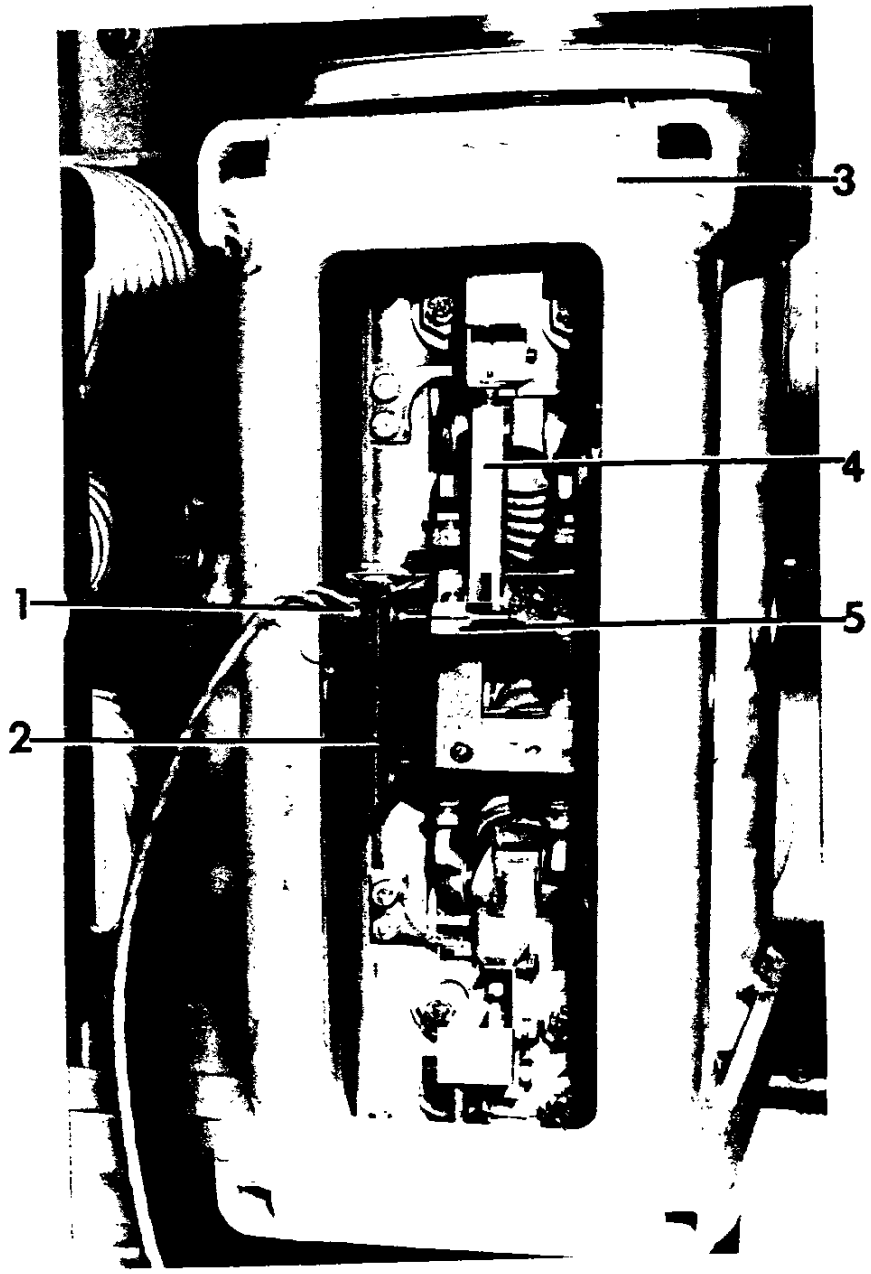
Contact Travel Requirements

The opening speed of the interrupter contacts should be from 6.5 to 8.0 feet-per-second and the closing speed from 3 to 4 feet-per-second.

The opening speed is the average speed measured from contact parting to a 9/16 inch gap. The closing speed is the average speed measured over the last 1/4 inch before the contact closing.

Overtravel and rebound of primary contacts when primary contacts are tripped to the open position should be 1/16 inch or less.

A travel record may be obtained by electrical means using a potentiometer and mounting as shown in Fig. 20. By properly connecting the potentiometer, an electrical signal can be displayed on an ocilligraph proportional to the position of the primary contacts. From this trace or display along with a timing trace, such as a 60 hertz wave, the speed of the contacts, their overtravel and rebound can be determined.



1. Potentiometer
2. Support
3. Moving Erosion Indicator
4. Link
5. Link

Figure 20. (8918290-B) Potentiometer Mounting

There are two dashpot adjustments that can be used to control speed, overtravel and rebound of the interrupter contacts during a trip operation. The adjustable orifice (13), Fig. 17, essentially controls overtravel and rebound with some effect on speed. The orifice is gradually closed by rotating the screw clockwise until it is completely sealed. From the completely sealed position the screw may be rotated three complete turns counterclockwise to fully open the orifice. The screw is normally set at one turn from the fully closed position. The striker adjustment is controlled by a stop screw (7), Fig. 17. It is normally set by slowly closing the breaker until the opening spring (5), Fig. 5, has moved 25/32 inch. The stop screw is then adjusted to allow striker (6), Fig. 17, to just touch roller (5), Fig. 17. The 25/32 inch dimension may be varied ± 3/32 inch. The adjustment essentially controls the speed with some effect on overtravel and rebound.

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 1500 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 combinatin 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 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 inch is allowed. This is easily determined by checking the moving erosion indicator (7), Fig. 13, when the breaker is fully closed. The horizontal edge of the moving erosion indicator is set level with a stationary erosion indicator (6), Fig. 13, when the Power Vac* Interrupter is new. As the contacts erode the red erosion indicator screw is exposed and when it reaches 1/8 inch 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 hertz a-c 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. Normally 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 a-c 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 rms a-c across each interrupter. During the hipot test the steel front panel and partial side panels should be assembled to the breaker and personnel 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 (four three-phase breakers) with the personnel not closer than three meters (9 feet 10 inches) to the interrupters.

TABLE I

LUBRICATION

PART	LUBRICATION AT MAINTENANCE PERIOD	ALTERNATE LUBRICATION (REQUIRES DISASSEMBLY)
Sleeve Bearings – main crank shaft, operating rod, opening spring connection 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 SAE20 or SAE30.	Clean per instructions and repack with D50H15 lubricant.
Ground surfaces such as cams, ratchet teeth, etc. (Surfaces coated with MoS_2)	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 required	Check for oil level – add dashpot grade oil D50H27 as required
Silver Plated Contact Rollers and Conductor Bars	Apply D50H15 lubricant	Remove rollers and wipe clean and apply D50H15 lubricant

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 Vac* interrupter provides a measure of radiation shielding and the X-radiation at one meter (3 feet 3 inches) from 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 a-c 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 feet 10 inches) from the interrupters.

2. With the breaker in the open position, apply 60 kV rms a-c for one minute to the top stud of Phase 1 with the bottom stud grounded. Repeat for Phases 2 and 3. This checks the insulation across the open break. During this part of the test, personnel should stand in front of the breaker or at least 3 meters (9 feet 10 inches) from the interrupters.

3. Close the breaker and apply 60 kV rms a-c for one minute to the top stud of Phase 1 with the top studs of Phases 2 and 3 and the breaker frame grounded. Repeat for Phases 2 and 3 each time grounding the other 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 four 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

*Registered Trademark of General Electric Co.

operates freely throughout its stroke. Check the mechanism adjustments as specified under ADJUSTMENTS. Check all terminal connections.

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 by lubricated at each periodic inspection and also whenever it is overhauled, in accordance with the lubrication table, 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, 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 are recommended.

Sleeve Bearings

The sleeve bearings used throughout the linkage are bronze and require lubrication. If there is evidence of outside contaminants, such as, dry or hardened grease, they should be removed by immersing the link and bearing in clean petroleum solvent or similar cleaner and using a stiff brush. When links are reassembled a liberal application of G-E D50H15 should be applied to the bearings. DO NOT USE CARBONTETRACHLORIDE.

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

Roller and Needle Bearings

The cam follower (1), Fig. 11, and latch roller (6) bearings 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 CARBONTETRACHLORIDE. 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 inducive 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 (9), 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, porcelains, and operating rods.

2. A high potential test should be applied to the vacuum interrupters as outlined in HIPOT TESTING OF THE VACUUM INTERRUPTERS.

3. Check the Power Vac* contact erosion indicator as described in THE BREAKER ELEMENT.

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. The breaker's 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 the 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 (6) and retainer. 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 screwdriver and holding in place with your hand. Be careful not to scratch or mar the silver contact surface of the stud.

Interrupter

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. Carefully measure the location of primary stud (3), Fig. 7, adjacent to the interrupter to be removed. Measure from adjacent studs so that the removed stud can be repositioned after the new interrupter has been installed.

2. Remove stud (3), Fig. 7, and contact block (9), Fig. 7, from the interrupter.

3. On breakers showing no erosion of interrupter primary contacts slow close breaker until opposite interrupter to the one being removed just makes contact. Then block opening springs (5), Fig. 5.

   On breakers showing erosion of interrupter primary contacts slow close breaker until moving erosion indicator (7), Fig. 13, edge is 1/32 inch from being level with stationary erosion indicator (6), Fig. 13. Stationary erosion indicator will not show over the moving erosion indicator edge in this position. Then block opening springs (5), Fig. 5.

4. Remove outer contact rollers (3), Fig. 13, and roller stops (4), Fig. 13. On those breakers showing primary contact erosion measure distance from center of pin (9), Fig. 13, to inside interrupter support (11), Fig. 14.

5. Remove conductor clamp screws (5), Fig. 14, and moving erosion indicator (7), Fig. 13.

6. Remove pin (9), Fig. 13, from pivot (8), Fig. 13.

7. Note positional relationship of the interrupter pinch-off tube (2), Fig. 14, with conductor clamp (4), Fig. 14. The same relationship or 180 degrees from that position can be used when installing the new interrupter.

8. Proceed to remove the interrupter by removing the four mounting nuts and carefully pull the interrupter away from support (11), Fig. 14. Inner contact rollers (2), Fig. 13, may be removed at this time.

9. Spread conductor clamp (4), Fig. 14, slightly to insure free rotation on the interrupter moving contact. Proceed to remove pivot (8), Fig. 13, and conductor clamp. Then remove the primary contact guide (1), Fig. 13.

10. Install the primary contact guide into the new interrupter. Itmay be necessary to center the interrupter moving contact before inserting the primary contact guide. This may be accomplished by threading the conductor clamp onto the interrupter moving contact. Part contacts slightly and position interrupter moving contact to center of interrupter. Assemble conductor clamp onto interrupter noting position of pinch-off tube and 0.250 $^{+0.050}_{-0.000}$ inch. Clearance as shown in Fig. 13. Install pivot into conductor clamp.

11. Install interrupter onto breaker support making sure contact block (1), Fig. 14, will clear interrupter pinch-off tube.

12. Assemble inner contact rollers (2), Fig. 13.

13. Connect pivot (8), Fig. 13, to wipe spring guide (11), Fig. 13, and guide link (6), Fig. 14, using pin (9), Fig. 13, making sure top and bottom interrupter contacts are touching. This is accomplished by rotating pivot in wipe spring guide until they touch.

    On breakers showing erosion of interrupter primary contacts, set pivot (8), Fig. 13, to previously measured distance under Item 3. Connect pivot (8), Fig. 13, to wipe spring guide (11), Fig. 13, and guide link (6), Fig. 14, using pin (9), Fig. 13. The opposite interrupter pivot (8), Fig. 13, will have to be adjusted until both top and bottom interrupter primary contacts are just touching. This is necessary to insure making of primary contacts within 1/32 inch.

14. Assemble erosion indicator (7), Fig. 13, to conductor clamp and tighten the conductor clamp screws to 80-to-90 inch-pounds.

15. Assemble outer contact rollers with wipe spring's (5), Fig. 13, height set to 3/8 inch as shown in Figure 13.

16. Assemble contact roller stops (4), Fig. 13.

17. Remove block on opening springs and check adjustments, wipe, gap, clearance to stops (7), Fig. 14, and make corrections if necessary.

18. Install contact block (1), Fig. 14, primary studs and braids.

19. Operate breaker approximately 100 times and recheck the contact wipe, gap and stop settings and re-hipot.

20. Reset erosion indicator by moving stationary erosion indicator level with moving erosion indicator edge as shown in Fig. 13 when breaker is fully closed.

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 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.

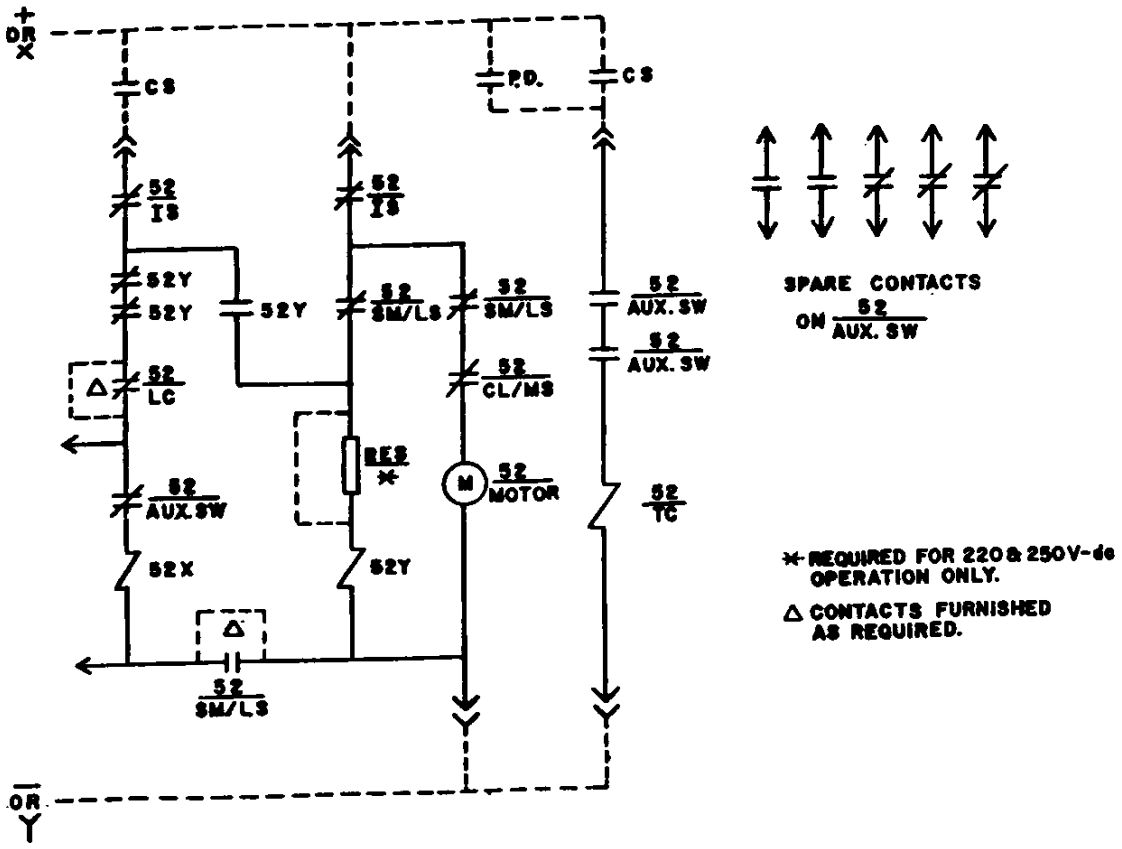


	FIG. NO.	REF. NO.	DESCRIPTION
52 / AUX SW	17	1	AUXILIARY SWITCH
52X	10	4	CLOSING COIL (SPRG. REL. SOL'D)
52Y	5	4	CONTROL RELAY
52 / TC	10	9	TRIP COIL
52 / IS	16	2	INTERLOCK SWITCHES
52 / CL/MS	15	4	CLOSING LATCH MONITORING SWITCH
52 / SM/LS	8	17	POWER SWITCHES
52 / LC	8	1	LATCH CHECKING SWITCH
52 / MOTOR	5	11	SPRING CHARGING MOTOR

Figure 21 (0165B7906-O) Typical Elementary Wiring For Vacuum Circuit Breaker

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 inch 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 protective 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 inch holes should be drilled in the upper front cover as shown in Fig. 19. The two jack screws can now be turned with screwdrivers 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 (19) 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 (19), Fig. 8.

Spring-charging Motor

To replace the motor (11), Fig. 5, remove electrical wires and insulating sleeve over the wires. Remove the two screws holding the motor in place and the connection shaft screwed on the motor output shaft. Assemble the connection to the motor output shaft and insert into the motor mount (10), Fig. 8, making the connection with the motor eccentric (9), Fig. 8. Position the motor so that the motor mount locking screw will fit into the hole in the motor. Clamp the motor to the motor mount by applying a torque of 11-to-13 foot-pounds to the clamping screw. Cover lead wires with the existing sleeve, and make the electrical connection.

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, <u>more</u> 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-34.5-1400-2L 1200 amperes, 2000 amperes and 3000 amperes.

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 ths bulletin number.

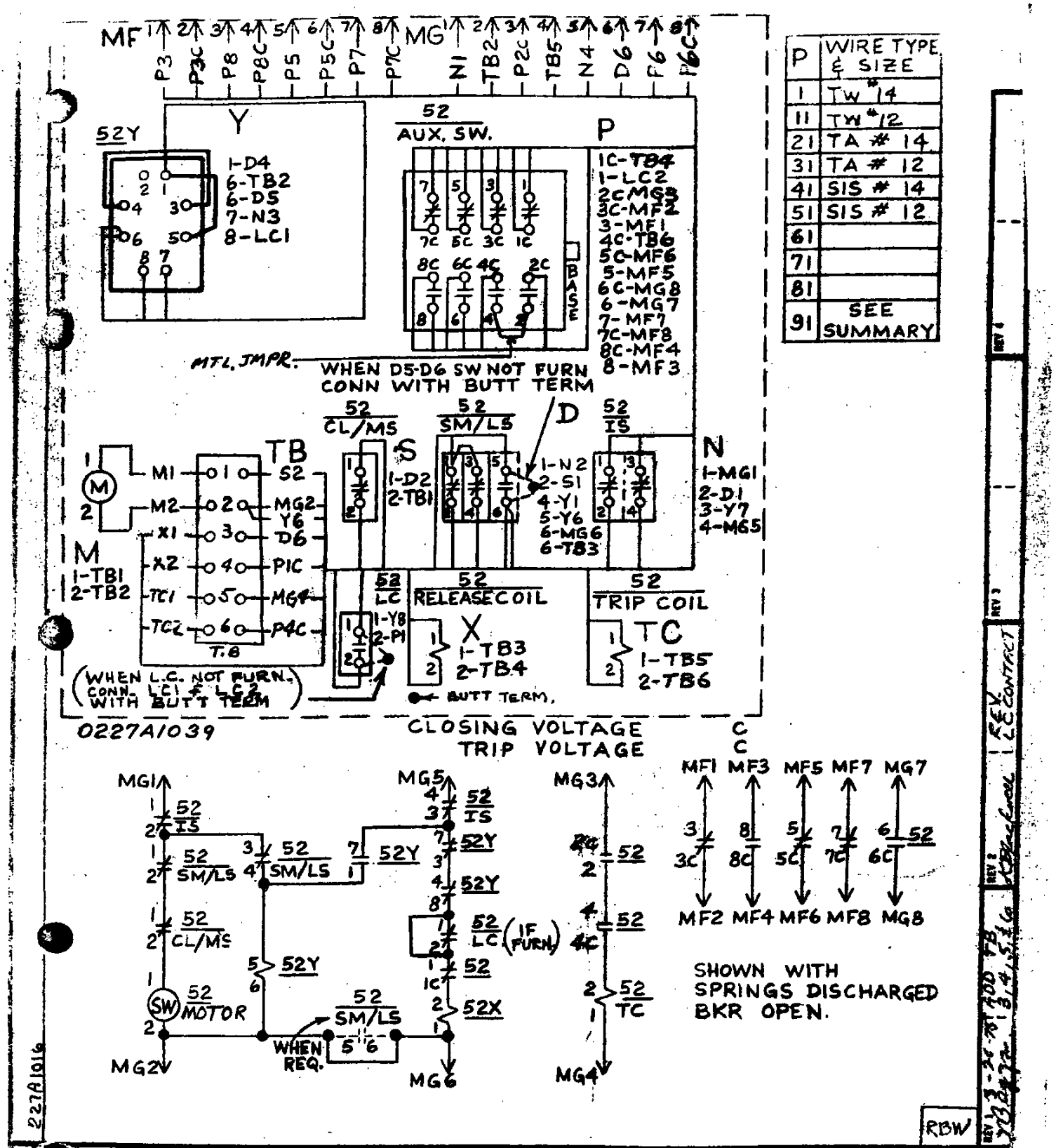
3. Standard hardware, such as screws, bolts, nuts, washers, etc. is not listed in this bulletin. Such items should be purchased locally.

4. For prices or information on parts not listed in Table II, refer to the nearest office of the General Electric Company.

TABLE II

AMPERE RATING	CATALOG NO.	NO. REQ.	DESCRIPTION
All	0195A4040P004	6	Power Vac* Interrupter
All	0133C3998G001	3	Operating Rod
All	0121C8139G001	6	Interrupter Support Insulator
All	0121C8139G002 ⓒ	6	Stud Insulator
1200	0208A9427G001	6	Primary Disconnect Finger Assembly
2000	0208A9427G002	6	Primary Disconnect Finger Assembly
3000	0208A9427G003	6	Primary Disconnect Finger Assembly
All	0195A4055G001	2	Secondary Disconnect Assembly
All	0195A4000P004	1	Driving Pawl Spring
All	0208A9458P001	1	Latching Pawl Spring
All	0121C8188G001	1	Motor-48 volt d-c
All	0121C8188G002	1	Motor-115 volt a-c – 125 volt d-c
All	0121C8188G003	1	Motor-230 volt a-c – 250 volt d-c
All	0137A7575P004	1	Relay-48 volt d-c
All	0137A7575P001	1	Relay-125 volt d-c
All	0137B7910G001	1	Relay-250 volt d-c
All	0137A7575P005	1	Relay-115 volt a-c
All	0137A7575P002	1	Relay-230 volt a-c
All	006174582G012	1	Potential Trip Coil-24 volt d-c
All	006174582G034	1	Potential Trip Coil-48 volt d-c
All	006174582G040	1	Potential Trip Coil-110-125 volt d-c
All	006174582G041	1	Potential Trpi Coil-220-250 volt d-c
All	006174582G010	1	Potential Trip Coil-115 volt a-c
All	006174582G014	1	Potential Trip Coil-230 volt a-c
All	006174582G034	1	Spring Release Coil-48 volt d-c
All	006174582G040	1	Spring Release Coil-110-125 volt d-c
All	006174582G041	1	Spring Release Coil-220-250 volt d-c
All	006174582G010	1	Spring Release Coil-115 volt a-c
All	006174582G014	1	Spring Release Coil-230 volt a-c
All	0456A866P005	5	Switch-Normally Open
All	0456A866P006	1	Switch-Normally Closed
All	0227A5340P001	1	Auxiliary Switch

ⓒ SUPS BY G003 9/15/73



P	WIRE TYPE & SIZE
1	TW # 14
11	TW # 12
21	TA # 14
31	TA # 12
41	SIS # 14
51	SIS # 12
61	
71	
81	
91	SEE SUMMARY

REV 1 REV 2 REV 3 REV 4

		GENERAL ELECTRIC SWITCHGEAR PRODUCTS DEPARTMENT PHILADELPHIA	TITLE: STANDARD VACUUM BREAKER WIRING
MADE BY J. S. McFarren — May 26, 1973			VH34.5-1500 SPRING CHARGED 0227A1039
ISSUED APR 25 '73	REV.		