INSTRUCTIONS
AND
RENEWAL PARTS

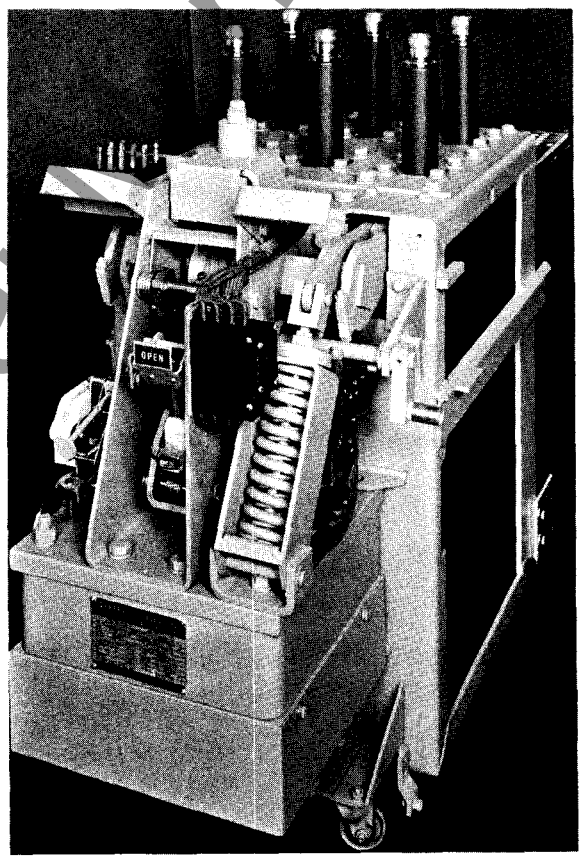
GEH-2054E
SUPERSEDES GEH-2054D

MAGNE-BLAST CIRCUIT BREAKERS

Types

AM-4.16-150A-4, -4S, -7S
AM-4.16-250A-4, -4S, -7S
AM-4.16-150-4 and -4ML
AM-4.16-150-4S and -4SML
AM-4.16-150-7S and -7SML
AM-4.16-250-4 and -4ML
AM-4.16-250-4S and -4SML
AM-4.16-250-7S and -7SML

with MS-13 and ML-11 Mechanisms



CONTENTS

SWITCHGEAR DEPARTMENT
GENERAL ELECTRIC
PHILADELPHIA, PA.

1. Secondary Coupler
2. Auxiliary Switch
3. Position Indicator
4. Opening Spring Unit
5. Operation Counter
6. Manual Trip
7. Control Device
8. Control Device Plunger Guide
9. Closing Solenoid
10. Plunger Interlock (Optional)

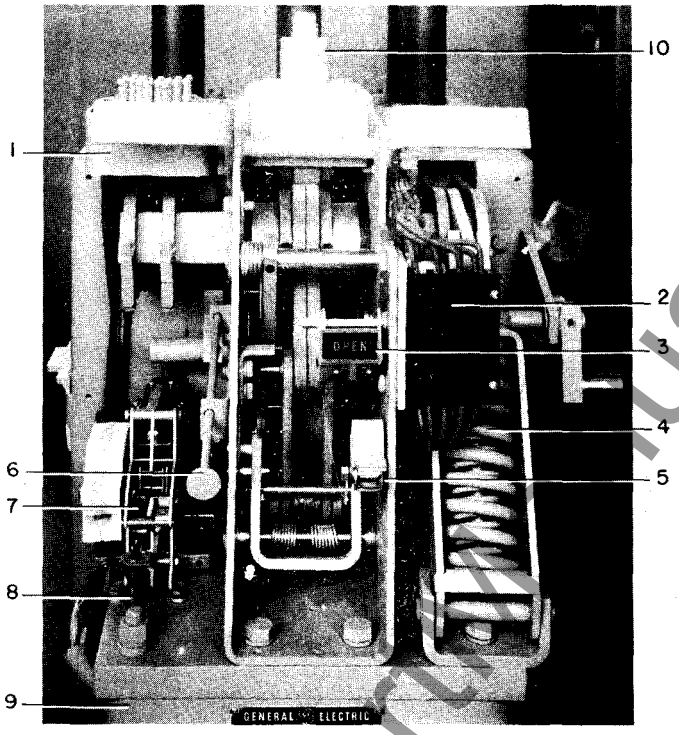
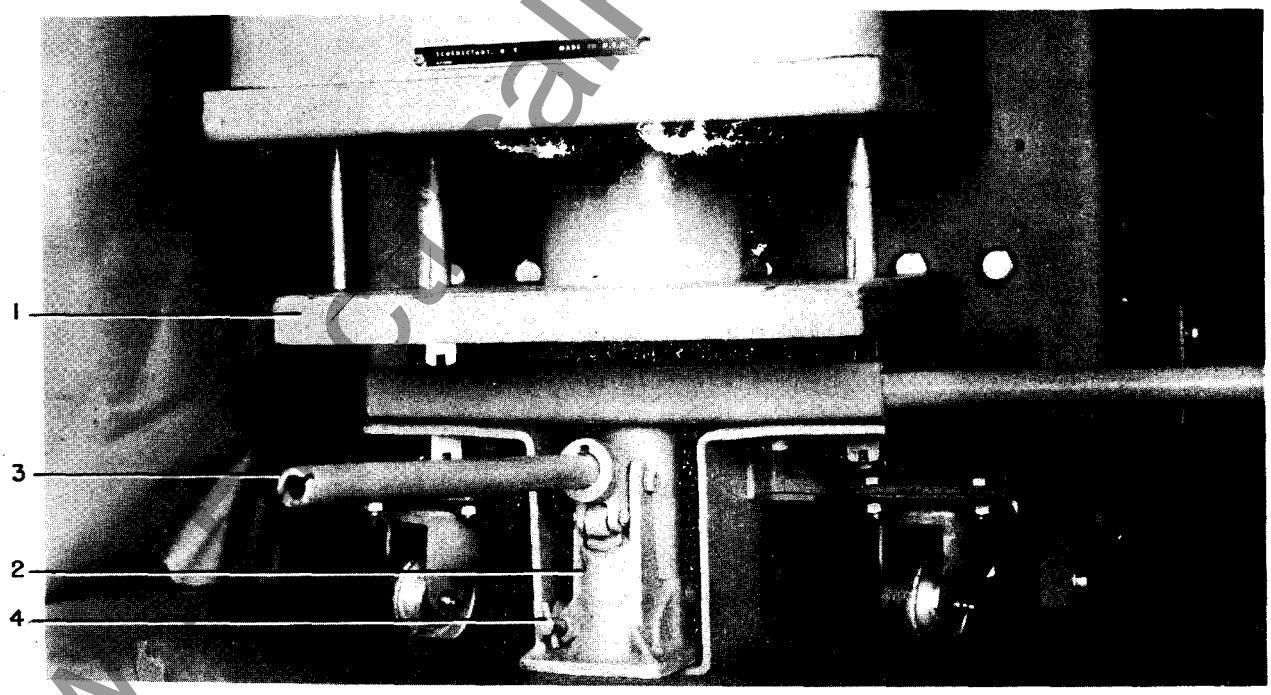


Fig. 1 MS-13 Operating Mechanism

Cover (802858 1)

Fig. 1 (8024599)



1. Closing Armature
2. Maintenance Operating Device
3. Handle
4. Release Valve

Fig. 2 Method of Mounting Maintenance Operating Device

Fig. 2 (8020882)

MAGNE-BLAST CIRCUIT BREAKERS

AM-4.16-150A-4, -4S; -7S **AM-4.16-150-4,-4S,-7S AND -4ML, -4SML, -7SML**

AM-4.16-250A-4, -4S; -7S **AM-4.16-250-4,-4S,-7S AND -4ML, -4SML, -7SML**

INSTRUCTION BOOK GEI-50143 SUPPLEMENTS THIS BOOK FOR BREAKERS WITH ML-11 STORED ENERGY OPERATING MECHANISM (INDICATED BY ML SUBSCRIPT IN TYPE DESIGNATION).

INTRODUCTION

The magne-blast circuit breaker is the removable interrupting element for use in vertical-lift metal-clad switchgear, to provide reliable control and protection of power systems. Among the many advantages of metal-clad switchgear are added protection to equipment and personnel, compactness, simplified installation and reduced maintenance. In keeping with these features the magne-blast breakers are designed for interchangeability and manueverability, together with reliability and low maintenance requirements.

The magne-blast circuit breaker operates on the principle that an arc can be interrupted in air by sufficiently elongating and cooling it. This is accomplished by means of a strong magnetic field that lengthens the arc and forces it into intimate contact with cool dielectric material.

The AM-4.16 magne-blast breaker is available in a number of current and voltage ratings. Refer to the breaker nameplate for the complete rating information of any particular breaker. The short circuit conditions to be imposed on the breaker must not exceed its rating, nor should it be called upon to operate at voltages or currents greater than those given on the nameplate. Since this book is written to cover several ratings of breakers that are of the same general design, all 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 will provide complete information for placing the magne-blast breaker in service and for maintaining satisfactory operation.

RECEIVING, HANDLING AND STORAGE

RECEIVING AND HANDLING

Each breaker is carefully inspected and packed by workmen experienced in the proper handling and packing of electrical equipment. 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 always 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. Machined parts of the operating mechanism, etc., should be coated with a heavy oil or 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, steps should be taken to dry out the breaker before it is placed in service.

INSTALLATION

1. Remove box barrier and make a visual inspection to ascertain that the breaker is in satisfactory condition. Check all bearing surfaces of the mechanism for lubrication. Refer to the section on LUBRICATION (page 12).

2. Operate breaker manually using the maintenance closing device provided with the breaker. During the closing operation, check to insure that the mechanism and breaker 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 plunger is operated. The breaker should not be operated electrically until it has been operated manually to insure this freedom of action.

   The following adjustments should be checked at this point.

   a. Primary contact wipe (page 6).

   b. Primary contact gap (page 6).

   c. Prop clearance (page 8).

3. Attach test coupler to circuit breaker and operate electrically several times. The control voltage should be checked at the breaker as indicated under CONTROL POWER CHECK (page 11).

4. Remove test coupler and replace box barrier.

5. If breaker has been stored for a long period of time, it is recommended that the insulation be checked with the standard 60 cycle high potential test -- see INSULATION TEST (page 12).

6. Lubricate the silver portion of the primary disconnect studs by rubbing a small amount of contact lubraicant D50H47 to form a thin coating on the ball contact.

7. Refer to instruction book GEH-1802 for final instructions before inserting the breaker into the metal-clad unit.

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.

DESCRIPTION OF OPERATION

The magne-blast breaker is operated by either an MS-13 solenoid mechanism or ML-11 stored-energy mechanism. The breaker element comprises three similar pole units, each pole unit consisting of main and arcing contacts, an interrupter, and an enclosing box barrier that segregates the interrupting units from each other to provide insulation between phases as well as from each phase to ground. The primary connections to the associated metal-clad equipment are made through the primary disconnect studs.

The MS-13 operating mechanism shown in Fig. 1 is of the solenoid type designed to give high speed closing and opening. The closing operation is controlled by the control device (7). The control device also permits trip free operation (tripping the breaker at any time during the closing operation), and prevents solenoid pumping (reclosing) after a trip free operation. For a-c closing operation, rectifiers mounted elsewhere in the metal-clad unit are used to supply the direct current on which the closing coil operates. The breaker can be opened electrically by remote control, or manually, by means of the manual trip device (6). All secondary connections from the breaker to the metal-clad unit are made through the coupler (1).

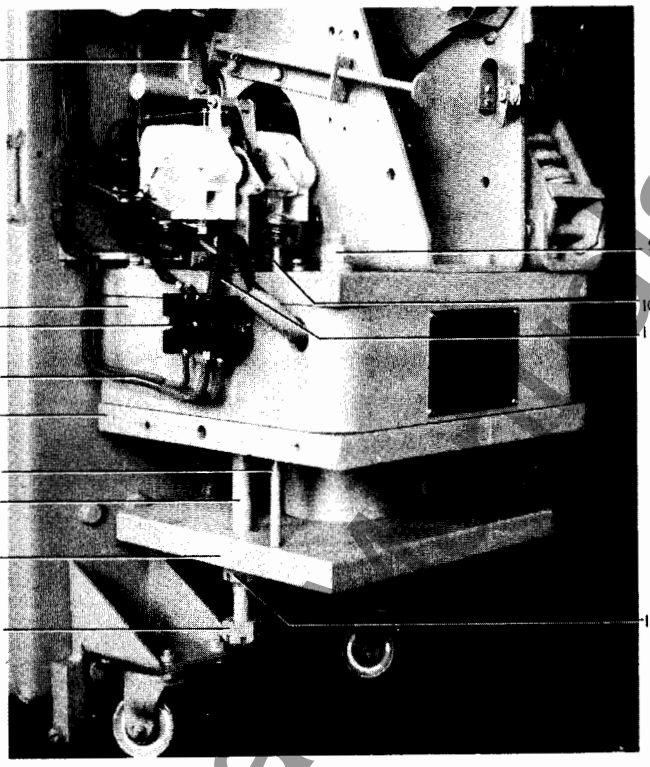
A positive interlock and interlock switch are provided between the breaker and metal-clad unit to prevent the raising or lowering of the breaker in the unit while in the closed position and to prevent a closing operation when the breaker is not in either the fully raised or lowered position. A plunger type interlock can also be provided to prevent the closing of two adjacent breakers at the same time or to operate an additional auxiliary switch mounted in the metal-clad unit.

The operating mechanism used on those breakers designed for MI-6 metal-clad equipment differs somewhat from those designed for M-26 equipment but its operation is principally the same. These breakers are identified by the "A" suffix in the breaker nomenclature thus: (AM 4.16-150A-4). The solenoid mechanism is controlled by a relay scheme mounted in the metal-clad unit and a cut-off switch located on the breaker instead of the control device. Two seven-terminal secondary couplers also replace the one sixteen-terminal coupler. The positive interlock between the breaker and metal-clad unit is replaced with a trip interlock that trips the mechanism before raising or lowering of the breaker can be accomplished. A fork-type lever can be furnished to operate an auxiliary switch mounted in the metal-clad unit.

CLOSING OPERATION OF MS-13 SOLENOID OPERATED BREAKER

See GEI-50143 for description of ML-11 stored-energy mechanism operation.

The closing operation of the breaker is controlled by the control device, Fig. 4, mounted on the operating mechanism. The closing sequence is initiated from a control switch mounted on the door of the metal-clad unit or at a remote operating station. Operation of the closing control



1. Solenoid Pot
2. Terminal Board
3. Wire Strap
4. Bottom Plate
5. Control Device Trip Plunger Rod
6. Guide Studs
7. Armature
8. Stop Nuts
9. Front Stud Nuts
10. Plunger Guide
11. Closing Coil Leads
12. Stop Nuts
13. Stop Bar

Fig. 3 (8022045)

Fig. 3 Closing Solenoid Assembly

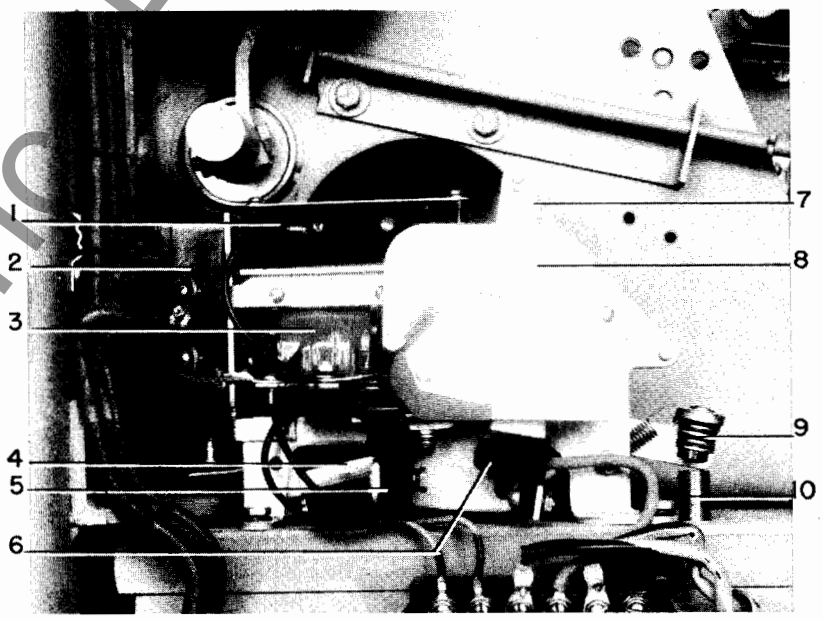


Fig. 4 (8024603)

1. Shunting and Anti-Pump Switch
2. Seal-in Switch
3. Operating Coil
4. Crank
5. Stationary Contact Assembly
6. Movable Contact Assembly
7. Arm
8. Arc Chute
9. Trip Lever
10. Plunger Guide

Fig. 4 Control Device

switch energizes the pickup coil of the control device. As the control device picks up, contacts in a seal-in switch close and shunt the contacts of the closing control switch. This allows the control switch contacts to open without affecting the overall closing operation and assures complete closing of the breaker with only momentary contact of the closing control switch.

Operation of the control device energizes the breaker closing coil by closing the main control device contacts (5 and 6), Fig. 4. Once the control device contacts are picked up, they are electrically held in the closed position until the breaker closing operation is completed. Energizing the breaker closing coil raises the armature (6), Fig. 5 which in turn lifts the closing roller (4) through plunger (14). This motion is transmitted through the mechanism linkage and rotates the main crank (1), closing the breaker contacts. As the armature reaches the end of its travel, the prop (12) rotates beneath the pin (11) latching the breaker in the closed position. During the closing operation, the opening springs (9 and 10) are compressed in readiness for an opening operation. A rubber buffer above the armature absorbs the energy of the mechanism as it approaches the end of its stroke.

When the solenoid armature is near the end of its stroke the control device plunger (5), Fig. 3, mechanically trips the main control device contacts, de-energizing the closing coil and allowing the armature to return by gravity to its original position. The control device plunger also mechanically trips the seal-in switch, de-energizing the control device coil if the closing control switch is not closed. If the closing control switch is held in the closed position through and after the breaker closing operation, the control device linkage will remain picked up and be unable to reset to prepare for another breaker closing operation. This arrangement insures that "pumping" of the breaker will not occur during a trip-free operation.

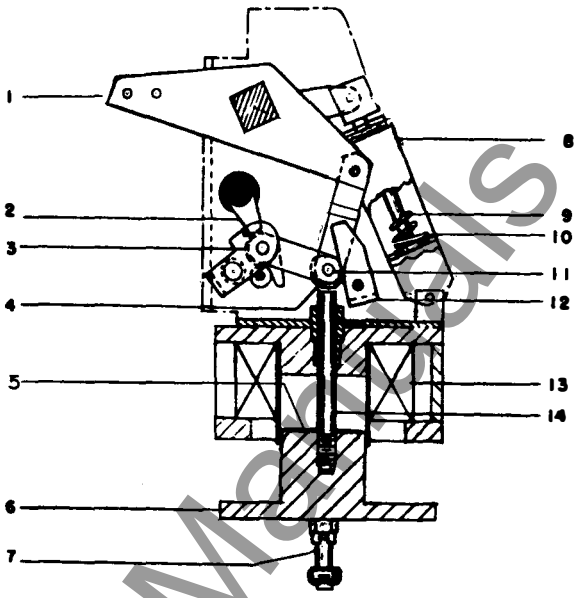
The operating sequence for those breakers designed for MI-6 metal-clad equipment is similar to that described above except that a relay mounted elsewhere in the metal-clad unit replaces the control device. Also, a cut-off switch (Fig. 6) is used to replace the mechanical trip arrangement of the control device. The cut-off switch energizes an auxiliary relay to de-energize the main relay.

OPENING OPERATION

An electrical opening operation is initiated by energizing the trip coil. This is accomplished either by actuating the opening control switch on the metal-clad unit or by a combination of relays and current devices used to detect a fault on the load side of the breaker. By energizing the trip coil, the trip plunger rotates the trip latch (2), Fig. 5, causing the operating mechanism linkage to collapse. The energy stored in the opening springs (9 and 10) is thus released, opening the breaker. During this operation, the trip coil circuit is de-energized, and upon completion of the opening operation, the operating mechanism is returned to its normal position, ready for closing.

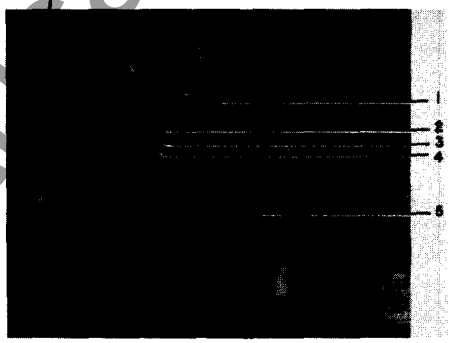
As the breaker opens, the main contacts part first, shunting the current through the arcing contacts. An arc forms as the arcing contacts part. See Fig. 19. As the movable arcing contact (24) is withdrawn through the slot or between the probes on the arc runner, the upper end of the arc is transferred to the upper arc runner (4). To assist the interruption at this point, a stream of air is emmitted from the booster tube (28) and forces the arc onto the lower arc runner (10). Establishment of the arc on the runners automatically inserts the blowout coils into the circuit, introducing a magnetic field between the pole pieces which tends to draw the arc away from the arcing contacts. The 250 MVA interrupter contains one upper magnetic blowout coil and one lower blowout coil each individually connected in series with its respective arc runner. The arc is forced outward along the diverging arc runners by the magnetic field.

At the same time, the arc is being forced into the arc chute (8) which is composed of a series of gradually interleaving insulating fins. These fins, which project alternately from the two opposite inner surfaces of the chute, elongate the arc into a gradually deepening serpentine path, so that the electrical resistance in the path of the arc is rapidly increased and the heat from the arc is absorbed. The increased resistance reduces both the magnitude and the phase angle of the current, and at an early current-zero the arc path is so long and the gases produced by the arc so cooled that the arc cannot re-establish itself, and interruption occurs.



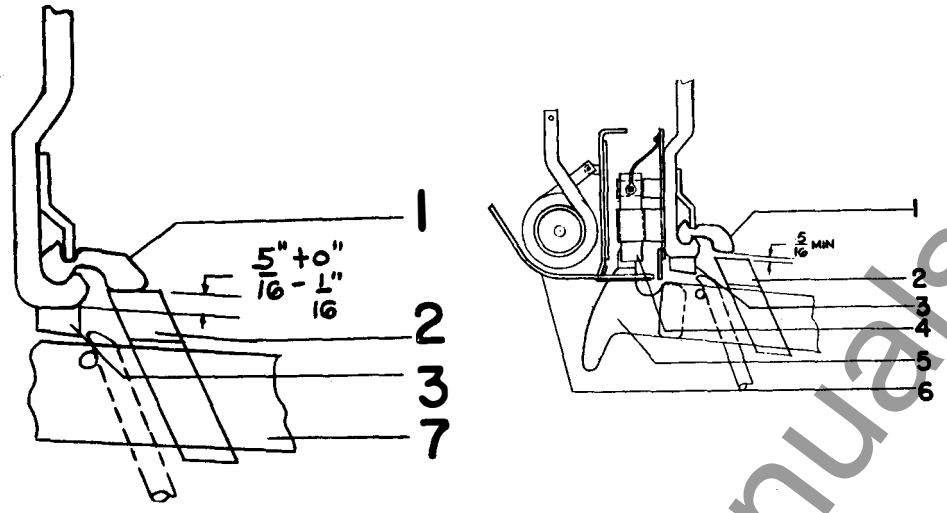
1. Main Crank
2. Trip Latch
3. Trip Roller
4. Closing Roller
5. Rubber Buffer
6. Closing Armature
7. Armature Guide Bolts
8. Spring Retainer
9. Opening Spring, Inner
10. Opening Spring, Outer
11. Closing Pin
12. Prop
13. Closing Coil
14. Closing Plunger Rod

Fig. 5 (137A7682) Cross Section of MS-13 Operating Mechanism in the Open Position



1. Cut-off Switch
2. Switch Roller
3. Striker
4. Washers
5. Lever Arm

Fig. 6 (8021970) Cut-off Switch Adjustments



Primary Contact Wipe

Arcing Contact Wipe

1. Stationary Primary Contacts
2. Movable Primary Contacts
3. Buffer Block
4. Stationary Arcing Contacts
5. Movable Arcing Contacts
6. Upper Arc Runner
7. Contact Arm

Fig. 7 Contact Adjustments

Fig.7 (258C688 & 836C143)

The 150 MVA interrupter is essentially the same as the 250 MVA interrupter except that on certain designs it utilizes the magnetic elements in the upper runner only.

Manual tripping follows the same procedure except that instead of energizing the trip circuit, the manual trip (6), Fig. 1, is used.

TRIP FREE OPERATION

If the trip coil circuit is energized while the breaker is closing, the trip plunger will force the trip latch (2), Fig. 5, away from the trip roller (3) causing the mechanism linkage to collapse and the breaker to re-open. The closing armature (6) completes its closing stroke, but the closing coil is de-energized at the end of the stroke, and the armature is returned to its original position by gravity.

ADJUSTMENTS

DO NOT WORK ON EITHER THE BREAKER OR THE MECHANISM WHILE IN THE CLOSED POSITION UNLESS THE PROP AND TRIP LATCH HAVE BEEN SECURELY WIRED OR BLOCKED TO PREVENT ACCIDENTAL TRIPPING.

A maintenance operating device is provided for operation of the breaker during adjustment checks. Mount the device as shown in Fig. 2, and turn the release valve (4) firmly to the right. To close the breaker, operate the handle (3) with a pumping motion. By turning the release valve (4) to the left, the closing armature will return to its normal position. Electrical operation must not be attempted until the breaker has been operated manually through its complete stroke several times and final installation inspection has been completed.

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. The following adjustments are listed in the order in which they are to be checked. First, however remove the breaker from the metal-clad unit and remove the box barriers.

PRIMARY CONTACT WIPE

When the breaker is closed, as shown in Fig. 7, the stationary primary contacts (1) should rise 5/16" + 0-1/16". To obtain this adjustment, open the breaker and, referring to Fig. 8, loosen the check nut (4) and turn the adjusting nut (3). Screwing up on the adjusting nut will decrease the primary contact wipe, down will increase it. Tighten the check nut, close the breaker and recheck the wipe. With the primary contact wipe correctly adjusted, the clearance between the contact arm (7) and the buffer block should be 1/16" or greater (as shown in Fig. 7) when the breaker is fully closed.

ARCING CONTACT WIPE

Refer to Fig. 7. Close the breaker until the arcing contacts just touch. This can be determined with the use of a circuit continuity tester such as a light indicator or bell set. In this position, the gap between the stationary primary contacts (1) and the movable primary contact (2) should be 5/16" or greater. This setting has been made in the factory and no adjustment is privided. A gap of less than 5/16" is usually an indication that the arcing contacts need to be replaced. When making this check, also see that the movable arcing contact (5) passes through the slot or between the probes on the upper arc runner (6) without touching whichever is applicable.

PRIMARY CONTACT GAP

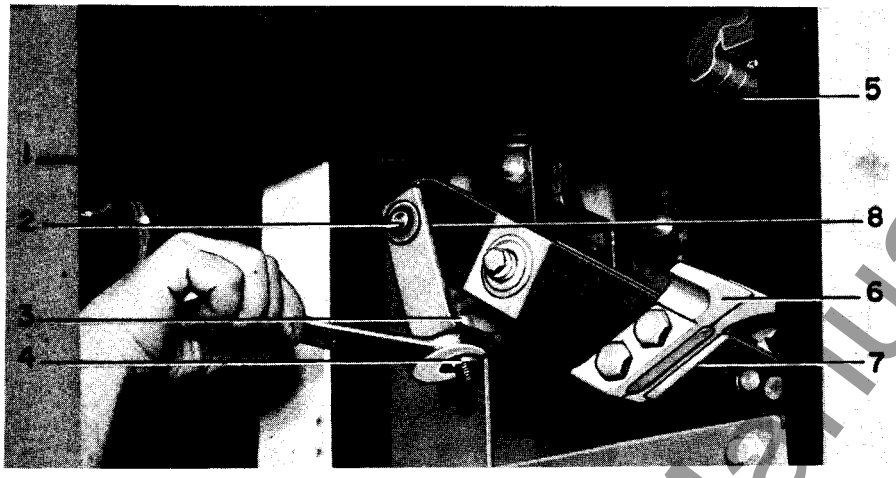
Refer to Fig. 8. With the breaker closed, press the manual trip button allowing the breaker to trip open normally. Do not force the contacts open wider by hand. The gap between the stationary primary contacts (5) and the movable primary contacts (6) should be 3-13/16" + 1/8" - 3/16". To change this gap, loosen the check nut (25), Fig. 9, and turn the adjusting nut (26) on stud (9). Screwing the adjusting nut down will decrease the primary contact gap. Tighten the check nut and remeasure the contact gap (close and trip the breaker before checking the measurement).

TRIP LATCH WIPE

Refer to Fig. 9. The wipe of the trip latch (4) on the trip roller (6) should be from 3/16" to 1/4". This can be measured by putting a film of grease on the latch (4), closing the breaker part way, and tripping. The mechanism has the proper trip latch wipe when the latch rests against the trip latch stop (5). No adjustment is provided and a visual inspection is usually all that is required. If this setting is not correct, look for insufficient travel of the trip shaft (3).

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

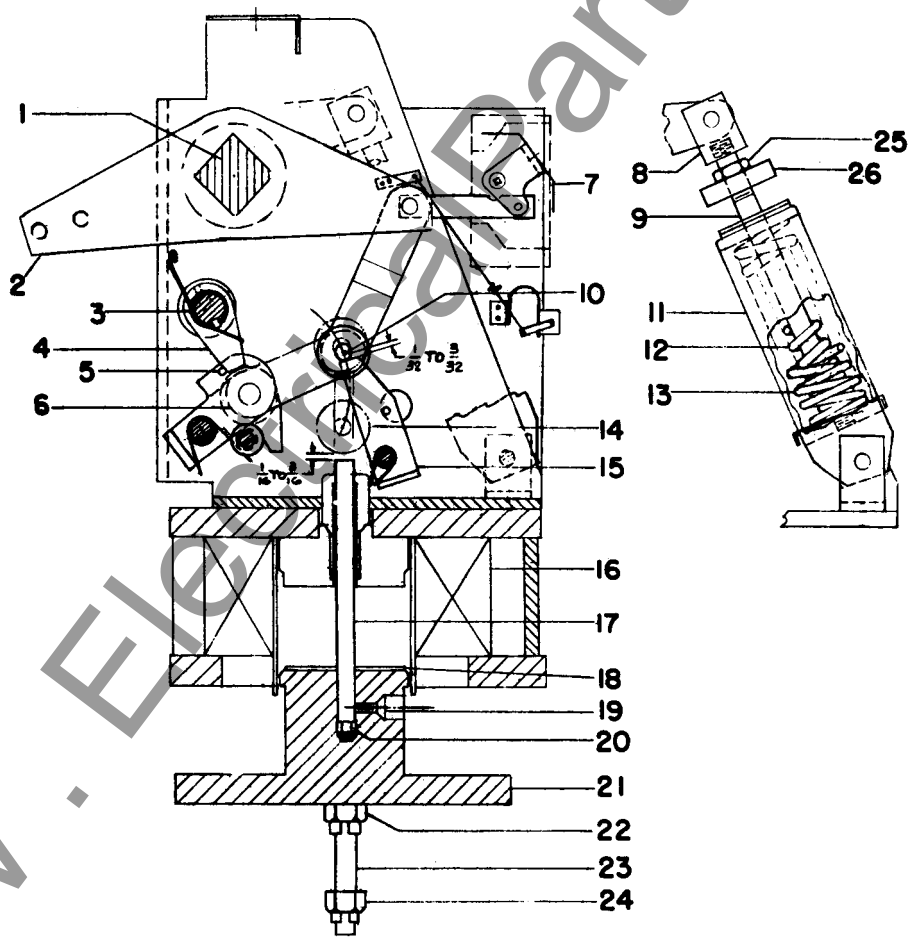
Fig. 8 (8018500)



1. Operating Rod
2. Operating Rod Pin
3. Adjusting Nut
4. Check Nut
5. Stationary Primary Contacts
6. Movable Primary Contacts
7. Contact Arm
8. Yoke

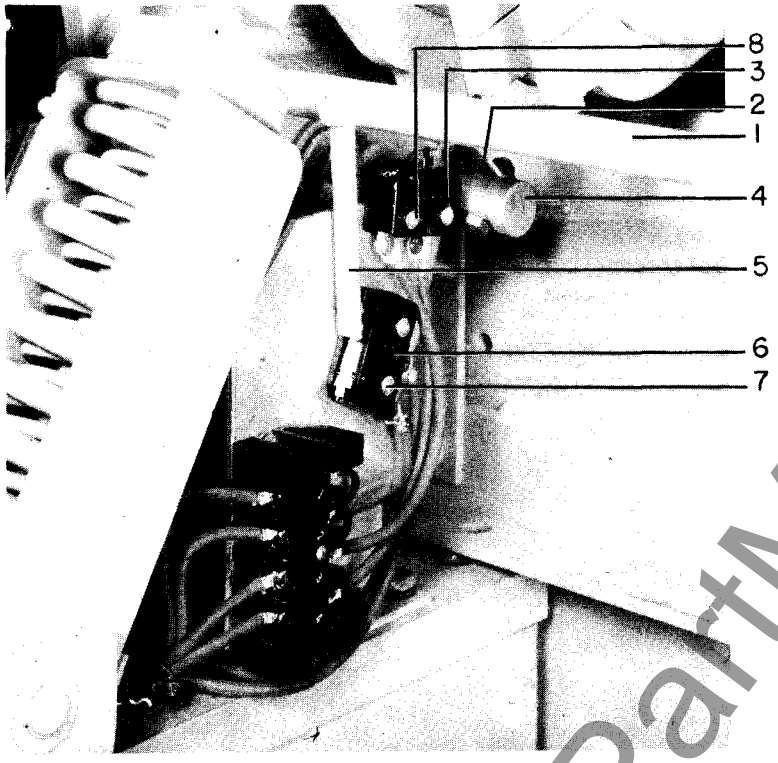
Fig. 8 Adjustable Coupling for Making Primary Contact Wipe Adjustment

Fig. 9 (962C772)



1. Main Operating Shaft
2. Main Crank
3. Trip Shaft
4. Trip Latch
5. Trip Latch Stop Pin
6. Trip Roller
7. Position Indicator
8. Clevis
9. Adjustable Stud
10. Closing Pin
11. Opening Spring Housing
12. Opening Spring, Inner
13. Opening Spring, Outer
14. Closing Roller
15. Prop
16. Closing Coil
17. Closing Plunger
18. Rubber Buffer
19. Set Screw
20. Shims
21. Closing Armature
22. Stop Nuts
23. Armature Guide Bolts
24. Stop Nuts
25. Check Nut
26. Adjusting Nut

Fig. 9 Cross Section of MS-13 Mechanism



1. Interlock Shaft
2. Latch Check Switch Arm
3. Latch Checking Switch
4. Trip Shaft
5. Interlock Switch Arm
6. Interlock Switch
7. Mounting Screw
8. Mounting Screw

Fig. 10 Interlock Switch and Latch Checking Switch

PROP CLEARANCE

Refer to Fig. 9. With the breaker closed as far as possible with the maintenance device, the clearance between the closing pin (10) and the prop (15) should be 1/32" to 3/32". Measure the prop clearance with a feeler gauge to determine whether or not an adjustment should be made, and if so, exactly how much adjustment will be required. To make the adjustment, it will first be necessary to open the breaker and remove the maintenance operating device. Remove the stop nuts (22 and 24) being careful not to drop the armature (21). Lower the armature from the mechanism and remove the two set screws (19). Remove the closing plunger (17) from the armature and add or subtract the necessary thickness of shims (20) to give the required adjustment, then replace the closing plunger, screwing it down against the shims. Using a small drill, spot the closing plunger through the set screw hole. Replace the set screws. Remount the armature on the breaker. After reassembly, remount the maintenance closing device and check the adjustment.

CLOSING PLUNGER CLEARANCE

Refer to Fig. 9. With the breaker in the open position, the clearance between the closing plunger (17) and the closing roller (14) should be 1/16" to 3/16". To obtain this clearance, the nuts (22) on the two armature guide bolts (23) may be raised or lowered. Both nuts should be moved the same amount. After making an adjustment, close and open the breaker and recheck the plunger clearance. Repeat the adjustment if necesssary.

INTERLOCK SWITCH ADJUSTMENT

Referring to Fig. 10, rotate the interlock shaft (1) manually clockwise to release the interlock switch arm (5). The point at which the contacts make can be determined with a circuit continuity tester such as a light indicator or bell set. To obtain adjustment on the interlock switch (6), bend the interlock switch arm (5). The roller and crank on the interlock switch (6) should have 1/32" to 1/16" overtravel after final adjustment.

CONTROL DEVICE ADJUSTMENT

Referring to Fig. 11, measure the overtravel of the two auxiliary switch plungers. Manually operate the control device by pressing the operating arm (5) with full extent of travel to the rear. With the device in this position further depress the plunger (4) on the top auxiliary switch (3). The gap between the plunger and operating arm should be 1/32" or greater. To increase the overtravel, loosen the screws (2) and move the switch toward the rear of the mounting plate. Tighten the screws and recheck the adjustment.

In a similar manner, check the overtravel on the back auxiliary switch (1).

Fig. 10 (8024689)

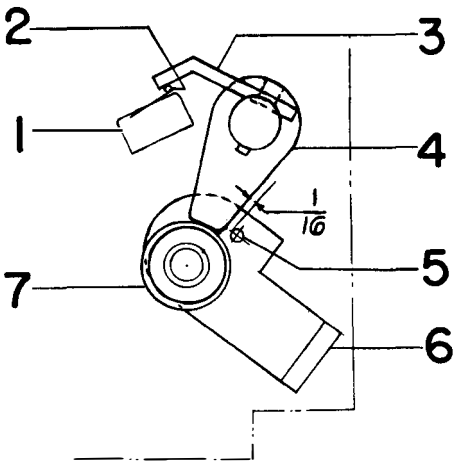


Fig. 10A (137A6038)

1. Latch Checking Switch
2. Latch Checking Switch Roller
3. Latch Checking Switch Operating Arm
4. Trip Latch
5. Trip Latch Stop Pin
6. Crank
7. Trip Roller

Fig. 10A Latch Checking Switch Adjustment

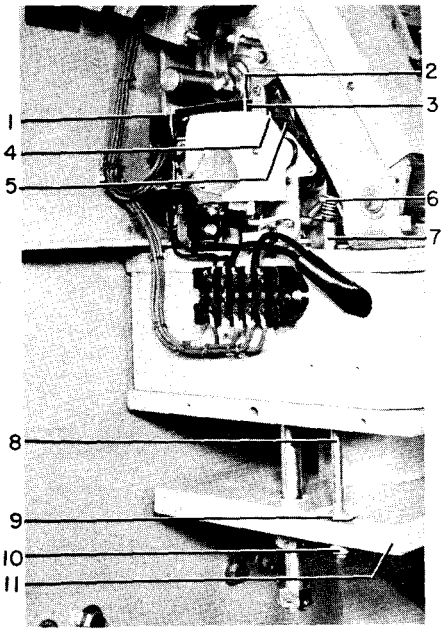


Fig. 11 (803923)

1. Back Auxiliary Switch
2. Mounting Screw
3. Top Auxiliary Switch
4. Plunger
5. Operating Arm
6. Trip Lever
7. Plunger Guide
8. Plunger
9. Adjusting Screw
10. Nut
11. Armature Plate

Fig. 11 Control Device

Operate the solenoid armature plate (11) with the maintenance closing device. The control device plunger (8) should not travel more than 3/32" from the operation of the device to the point where the prop (15), Fig. 8 falls in place. The plunger should travel a minimum of 1/32" after operating the device. The control device arm (6), Fig. 10 should have a minimum of 1/32" overtravel with the plunger fully raised by the armature plate.

If adjustments are necessary, loosen nut (10) and raise or lower adjusting screw (9) the correct amount. Tighten nut after adjusting and again measure the travel of the plunger.

BEFORE MANUALLY OPERATING THE CONTROL DEVICE" MAKE CERTAIN THAT ALL CONTROL POWER TO THE BREAKER HAS BEEN DISCONNECTED. MANUAL OPERATION OF THE CONTROL DEVICE WITH CONTROL POWER CONNECTED WILL ENERGIZE THE CLOSING COIL AND PRODUCE A CLOSING OPERATION.

CUT-OFF SWITCH ADJUSTMENTS (BREAKERS WITH "A" SUFFIX)

Refer to Fig. 6. The lever arm (5) is set at the factory and will require no adjustment. With the breaker in the open position, depress the arm of the cut-off switch (1). There should be 1/32" to 1/16" clearance between the depressed roller of the switch and the striker (3). Washers (4) should be added or removed if necessary to correct adjustment.

AUXILIARY DEVICES

Latch Checking Switch Adjustment

Referring to Fig. 10A, rotate the trip latch (4) clockwise by pressing the manual trip button to open the latch checking switch contacts and to release the latch checking switch operating arm (3). Allow the trip latch to reset slowly and determine the point at which the contacts make by using a circuit continuity tester, such as a light indicator or bell set. The contacts of the latch checking switch should just make when the gap between the trip latch (4) and the stop pin (5) located on the crank (6) is 1/16". The roller (2) on the latch checking switch should have a minimum of 1/32" overtravel after final adjustment.

To obtain adjustment of the latch checking switch (1), bend the latch checking switch operating arm (3).

Auxiliary Switch Linkage

(Furnished Special on Breakers with "A" Suffix)

Refer to Fig. 12. With the breaker in the open position, the distance from the center line of the front bushings (1) to the center of the slot in the fork lever (2) should be 12-9/32" as shown. To change this setting, loosen the locking bolts (3) and move the fork lever in the proper direction. Tighten the lock bolts.

Impact Trip, Current Trip and Undervoltage Trip Devices

Fig. 13 shows the necessary settings that are to be checked when these devices are furnished. The amount of wipe between the trip roller (16) and the trip latch (15) should be 3/32" to 5/32". This can be altered by changing the number of shims under the block against which the trip plate (14) stops.

In order to trip properly, the clearance between the trip bolt (11) and the trip plate (9) should be 1/32" to 1/16". This can be altered by releasing the check nut and screwing the trip bolt (11) in or out of the reset arm (8).

When an undervoltage device is furnished check the clearance between the trip hammer (19) and the trip plate (14), with the undervoltage coil energized. This clearance should be 1/32" to 1/16" and can be altered by removing the connecting pin at either end of the adjusting rod assembly (20), and turning the clevis at that end.

After checking all the mechanical adjustments as outlined above, operate the devices manually to make certain that they trip and reset properly.

Plunger Interlock

Refer to Fig. 13. With the breaker in the close position, the vertical distance "A" from the top of the interlock bolt (2) to the bottom of the elevating bar (13) should be 16-21/32" ± 1/16". To change this adjustment add or remove washers (3).

Auxiliary Switch

The auxiliary switch (2), Fig. 1 is mounted on the right side of the operating mechanism. The shaft of the position indicator operates the auxiliary switch shaft which opens and closes the "a" and "b" contacts. (The "a" contacts are open when the breaker is open and the "b" contacts are open when the breaker is closed). The "a" contacts should close when the breaker primary contact gap is a minimum of 1". The "b" contacts need only to be checked to see that they are open when the breaker is closed. No adjustment is provided and a visual inspection is usually all that is required.

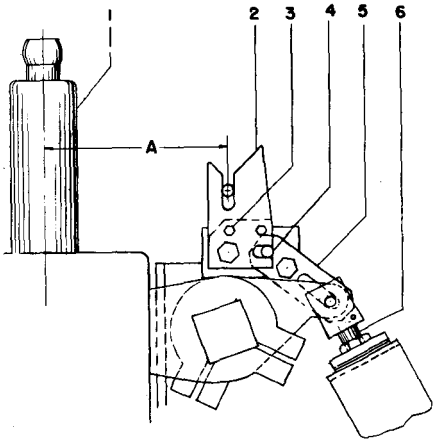


Fig. 12 (M-6291393)

1. Front Bushing
2. Fork Lever
3. Locking Bolts
4. Pin
5. Link
6. Rod

Fig. 12 Auxiliary Switch Linkage

1. Front Disconnect Stud
2. Plunger Interlock Bolt
3. Washers
4. Connecting Rod
5. Reset Plate
6. Reset Roller
7. Main Operating Shaft
8. Reset Arm
9. Trip Plate
10. Spring
11. Trip Bolt
12. Clevis
13. Elevating Bar
14. Impact Trip Plate
15. Trip Latch
16. Trip Roller
17. Trip Armature
18. Trip Lever
19. Undervoltage Trip Hammer
20. Adjusting Rod
21. Manual Trip Button
22. Trip Setting Plate
23. Undervoltage Devic

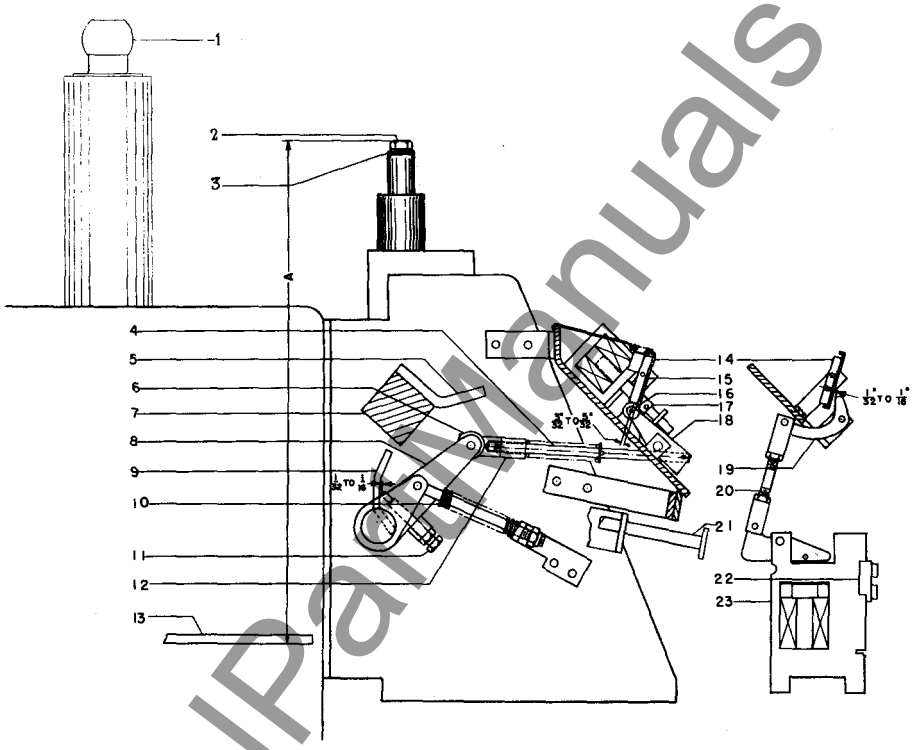


Fig. 13 (634D336)

Fig. 13 Adjustments On Current Trip Device and Undervoltage Trip Device, Shown With The Breaker In The Closed Position

INSPECTION AND TEST

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

   a. Primary contact wipe (Fig. 7): 5/16" + 0 - 1/16".

   b. Arcing contact wipe (Fig. 7): 5/16" or greater (gap at primary contacts).

   c. Primary contact gap (Fig. 8): 3-13/16" + 1/8" - 3/16".

   d. Trip latch wipe (Fig. 9): 3/16" to 1/4" with trip latch resting against stop pin.

   e. Prop clearance (Fig. 9): 1/16" ± 1/32".

   f. Closing plunger clearance (Fig. 9): 1/16" to 3/16".

   g. Interlock switch overtravel (Fig. 10): 1/32" to 1/16".

   h. Control device switch overtravel (Fig. 11): 1/32" min.

   i. Cut-off switch overtravel (Fig. 6): 1/32" to 1/16"

   j. Latch checking switch contacts make when the gap between trip latch and stop pin is 1/16" (Fig. 10A).

   k. Impact trip roller wipe (Fig. 12): 1/8" ± 1/32".

   l. Impact trip bolt clearance (Fig. 12): 3/64" ±1/64".

   m. Undervoltage trip hammer clearance (Fig. 12): 3/64" ± 1/64".

   n. Plunger interlock (Fig. 12): 16-21/32" ±1/16"

   o. Auxiliary switch linkage ("A" breakers only) (Fig. 13): 12-9/32".

   p. Auxiliary switch "a" contacts close when breaker primary contact gap is 1" or greater.

2. Check all nuts, washers, bolts, cotterpins, and terminal connections for tightness.

RECTIFIER REFERENCE CHART

Closing Coil		Rectifier Resistor Setting	
Dwg. No.	Amps.	Germanium	Silicon
6375521 G-6	58.0 to 62.0	1.50Ω	1.25Ω
6375521 G-2	95.0 to 115.0	1.0Ω (ea. bridge)	0.75Ω
Resistor Taps		¼Ω ¾Ω ¾Ω ¼Ω	

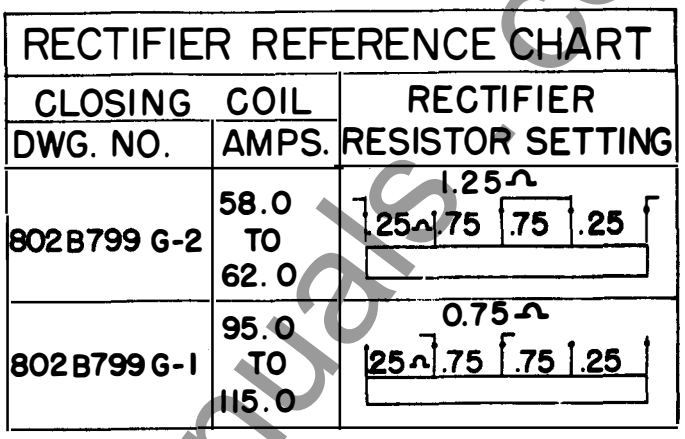


Fig. 14 (176V946)(137A7676)

Fig. 14 Rectifier Reference Chart

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 maintenance closing device 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.

AUXILIARY DEVICES

On breakers that are equipped with auxiliary devices such as a current trip, undervoltage trip, or capacitor trip, the device should be checked for proper electrical operation. The current trip device should trip the breaker at 3 amperes. The undervoltage trip device should trip the breaker when the control voltage drops below 30 to 60% of rated voltage, and it should pick up at 80% of the control voltage or less. An adjustment plate is provided on the front of the undervoltage trip device as an aid in obtaining the desired setting.

NOTE: When checking the pick-up value of the undervoltage device, apply a voltage equal to 80% of normal control voltage to the undervoltage device coil. The device should pick up at this value. Do not increase the voltage gradually on this coil as it will overheat the coil, producing a false reading, and may damage the coil if excessive overheating occurs.

The capacitor trip should be capable of tripping the breaker as late as 25 seconds after the control voltage is removed. The ST-230 trip device is capable of tripping the breaker for a limited period of time after the control voltage is removed. See instruction book GEI-77015 for necessary check. If the auxiliary devices do not perform in accordance with these specifications, a careful examination should be made for defective parts.
sary check.

OPENING AND CLOSING SPEED

The closing speed of the arcing contact should be 7 to 10 feet per second for the 150 MVA breakers and 7-1/2 to 10 feet per second for the 250 MVA breakers with rated closed circuit voltage at the closing coil terminals. These speeds represent the average speed of the movable arcing contact from a point 1" before the tip is tangent to the lower surface of the slot or probes on the upper arc runner to the tangent position.

The opening speed of the arcing contact should be 12 to 18 feet per second at rated control voltage. This speed represents the average speed over 3" from the point when the tip on the movable arcing contact is tangent to the lower surface of the slot or probes on the upper runner.

CONTROL POWER CHECK

After the breaker has been closed and opened slowly several times with the maintenance closing device, and the mechanism adjustments checked as described above, the operating voltages should be checked at the closing coil and trip coil terminals. For electrical operation of the breaker, the control power may be either an alternating or direct current source. The operating ranges for the closing and tripping voltages are given on the breaker nameplate. Ordinarily, standard ranges apply which are as follows:

NOMINAL VOLTAGE	CLOSING RANGE	TRIPPING RANGE
125v d-c	90-130v d-c	70-140v d-c
250v d-c	180-260v d-c	140-280v d-c
230v a-c	190-250v a-c	190-250v a-c

NOTE: When repetitive operating is required from a direct current source, the closed circuit voltage at the closing coil should not exceed 115v d-c and 230v d-c at the nominal voltages of 125 v d-c and 250v d-c, respectively.

To check the d-c voltage at the closing coil terminals, proceed as follows:

1. Mechanism with a control device, Fig. 4. Close the breaker by manually operating the control device. Hold the contacts in the closed position and read the d-c voltage at the closing coil terminals. To de-energize the circuit, release the control device.

2. Mechanism with cut-off switch, Fig. 6. Close the breaker by manually operating the control relay located in the metal-clad unit. Hold the relay closed and read the d-c voltage at the closing coil terminals. Release the closing relay to de-energize the circuit.

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

For A-c operation a germanium (color-black - flanged base) - or a silicon (color-blue, hex base) - rectifier bridge assembly is used, it is mounted in the metal-clad unit. These rectifiers are of the button-type and are hermetically sealed units. They have been tested and the associated resistor properly set at the factory. Unlike copper-oxide rectifiers the output of the germanium or silicon unit is affected very little by ambient temperature changes and it should not be necessary to disturb the factory setting. (See Rectifier Reference Chart, Fig. 14).

DO NOT MAINTAIN VOLTAGE ON THE CLOSING COIL ANY LONGER THAN THE TIME REQUIRED TO CLOSE THE BREAKER. (20 cycles max. at normal voltage.) Both the coils and the germanium and silicon rectifiers are designed for intermittent operation and may be damaged by prolonged current flow.

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 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 are provided for this purpose on the metal-clad unit. It is also possible to trip the breaker manually by pressing the manual trip button (6), Fig. 1.

Before the breaker is raised into position in the metal-clad unit, rub a small amount of G. E. Contact Lubricant D50H47 on the silvered portion of the breaker studs to form a thin coating for contacting purposes.

NOTE: This breaker mechanism combination is designed only for electrical closing when in use. NEVER ATTEMPT MANUAL CLOSING WITH THE BREAKER IN SERVICE, for under such conditions, sufficient closing force and speed cannot be applied.

MAINTENANCE

Dependable service and safer power equipment are contingent upon the unfailing performance of the power circuit breaker. To maintain such service, it is recommended that a definite inspection and maintenance schedule be set up and followed, as serious shutdowns can ofter be avoided by locating potential sources of trouble in an early stage. A periodic lubrication of parts subject to wear is also vitally important for the successful operation of the breaker.

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 PROP AND TRIP LATCH HAVE BEEN SECURELY WIRED OR BLOCKED TO PREVENT ACCIDENTAL TRIPPING.

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 is encountered, an inspection is recommended after any severe fault operation. The following instructions list the main points to be included in an inspection, and a number of general recommendations.

Arc Chutes

It is not necessary to inspect the arc chutes unless there is evidence of damage or if the arc chutes are removed for any reason. When inspecting an arc chute, the following points should be noted:

1. Scale formed over the surface of the arc chute MUST NOT BE REMOVED, but loose particles collected in the chute should be blown out.
2. Cracks which have formed in the fins of the arc chute are to be expected in ceramic materials of this type when subjected to the severe heat of an arc. These fine cracks do not interfere with the operation of the device in any way and should be disregarded. Small broken corners on the exhaust end of the chute will not interfere with its performance and should be disregarded.
3. If the arc chute has suffered mechanical injury due to dropping or accidental striking, resulting in the actual breaking off of fins, replacement of the chute will be necessary. Small broken corners on the exhaust end of the chute will not interfere with its performance and can also be disregarded.
4. The plastisol flexible covering for pole pieces (3 & 17), Fig. 17, and the upper mounting support (10) should be inspected for breaks in the insulation. If there are holes or breaks in the insulation, they should be repaired or the part replaced.

Breaker Contacts

By removing the box barrier the movable and stationary primary contacts and the movable arcing contacts can be inspected. The stationary arcing contacts can be inspected only after removing the arc chute assembly, as explained under REPAIR AND REPLACEMENT. If the contacts are burned or pitted, they should be made smooth with a fine file.

After completing inspection of the contacts, check the contact adjustments as specified under INSTALLATION, ADJUSTMENTS.

Mechanism

A careful inspection should be made to check for loose nuts or bolts and broken retaining rings. 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 maintenance operating device, open and close the breaker several times to make certain that the mechanism operates freely throughout its entire stroke. Check the mechanism adjustments as specified under INSTALLATION, ADJUSTMENTS. Check all terminal connections.

Bushings and Insulation

The surface of the bushings should be kept clean and unmarred. If the insulation surface should become damaged, it should be sanded and cleaned, and should be refinished with either clear varnish or clear resin. Allow to dry smooth and hard.

All other insulation parts on the breaker should be kept clean and dry. Smoke or dust collected between inspection periods should be wiped off, and if dampness is apparent, heaters should be installed to insure dryness.

Insulation Test

When insulation has been repaired or replaced or when the breaker has been stored under adverse conditions, it is recommended that the insulation be checked before the breaker is placed in service. A standard 60 cycle high potential test at 14,000 volts RMS will normally indicate whether the breaker is satisfactory for service. With the breaker contacts in the fully opened position apply the high potential to each terminal of the breaker individually for one minute with all other terminals and the breaker frame grounded. After high potential tests are made on organic insulating materials, these materials should be inspected for visible leakage current paths, and necessary action must be taken to replace insulation that may have been affected by moisture absorption.

LUBRICATION

In order to maintain reliable operation it is important that all circuit breakers be properly lubricated at all times. During assembly at the factory, all bearing surfaces, machined surfaces, and all other parts of the breaker and mechanism subject to wear have been properly lubricated using the finest grade 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. Alxo 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.

Part	Lubrication at Maintenance Period	Alternative Lubrication (Requires Disassembly)
Ground surfaces such as cams, rollers, latches, etc.	Wipe clean and apply D50H15.	Wipe clean and apply D50H15.
Sleeve Bearings (Mechanism and Breaker Linkage)	Very light application of light machine oil SAE-20 or -30.	Remove pins and links and clean as per cleaning instructions below. Apply D50H15 liberally.
Removable Seal and Open Type Ball, Roller and Needle Bearings	Light application of light machine oil SAE-20 or -30.	Clean as per cleaning instructions below and repack with D50H15.
Silver Plated Contacts and Primary Disconnect Studs	Wipe clean and apply D50H47. **	Wipe clean and apply D50H47. **
Arcing Contacts	Do not lubricate.	Do not lubricate.
CONTACT ARM HINGE ASSEMBLY		
1. Cup Bearing	No lubrication required.	Wipe clean and apply D50H47**
2. Loose rings between bushing and contact arm.	No lubrication required. Except on highly repetitive duty.	Wipe clean and apply D50H47.**
Booster Cylinders	No lubrication required.	No lubrication required.
Trip Shaft Dry Bearings	No lubrication required.	No lubrication required.

** D50H47 supersedes D50H28.

Fig. 15 Lubrication Chart

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 chart, Fig. 15. It is also recommended that all circiut breakers be operated at regular intervals to insure the user that the equipment is operating freely.

The lubrication chart (Fig. 15) 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 a general overhaul or disassembly for other reasons, or if the operation of the breaker becomes slower.

General Electric Lubricant D50H15 and D50H47 are available in 1/4# collapsible tubes. It is so packaged to insure cleanliness and to prevent oxidation.

METHOD OF CLEANING BEARINGS

Wherever cleaning is required, as indicated in the lubrication chart, the following procedures are recommended:

Sleeve Bearings

The pins should be removed and all old oxidized grease removed by immersion in clean petroleum solvent or similar cleaner. DO NOT USE CARBON-TETRACHLORIDE. Wipe the bearing clean. Apply a small amount of G.E. Lubricant D50H15 to the entire surface of the bearing and pin just before reassembling.

Removable Seal and Open Type Ball, Roller and Needle Bearings

The bearings should be first removed from the mechanism and disassembled by the removal of the seals or inner race in the case of needle bearings. 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 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 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. The removable seals should then be replaced.

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 anti-freeze should be used. Even then the bearings should be removed from the alcohol within twenty-four hours. Esso Anti-Freeze and Du Pont Zerone are satisfactory for this purpose. 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 bearing is light oil and draining should follow immediately then apply the lubricant.

RECOMMENDED MAINTENANCE FOR MAGNE-BLAST BREAKERS APPLIED TO REPETITIVE SWITCHING DUTY

Magne-blast breakers applied to repetitive operation such as switching arc furnaces, capacitors and motors should be serviced and maintained according to the following schedule:

A. Every 2000 Operations, or Every Six Months - Whichever Comes First (500 Operations For Capacitor Switching Breakers)

1. Remove the box barriers.
2. Wipe all insulating parts clean of smoke deposit and dust, with a clean dry cloth, including the bushings, and the inside of the box barriers.
3. Primary Contacts - Inspect the condition of the stationary contact fingers and movable contact blocks Badly pitted or burned contacts should be replaced. (Note: Burned primary contacts indicate the probable need for arcing contact replacement). If the contact surfaces are only roughened or galled, they should be smoothed with crocus cloth or draw filed. After contact dressing the primary contacts should be greased lightly with D50H47.
4. Arcing Contacts - When the arcing contact wipe is less than the minimum specified under ADJUSTMENTS, the contacts should

should be replaced. The contacts should be inspected for uneven wear and/or damage using a mirror to inspect the stationary contacts. Normally it will not be necessary to remove the arc chutes for this 2000 operation servicing unless inadequate wipe or contact condition indicate a need for replacement. When the arc chutes are removed, the contact braids, coil protectors, and other parts subject to arcing should be checked for possible cleaning or replacement. DO NOT GREASE THE ARCING CONTACTS UNDER ANY CIRCUMSTANCES.

5. Check the breaker and mechanism adjustments as summarized under INSPECTION AND TEST. The necessary readjustments should be made as described under ADJUSTMENTS.

6. The breaker and operating mechanism should be carefully inspected for loose nuts, bolts, retaining rings, etc., all cam, latch and roller surfaces should be inspected for damage or excessive wear. The buffer blocks and their retainers on the bottom of the stationary contact support should be inspected for possible need of replacement.

7. The main contacts of the control device should be inspected for wear and possible replacement.

8. Lubricate the breaker operating mechanism in accordance with the table under LUBRICATION.

9. Inspect all wiring for tightness of connections and possible damage to insulation.

10. The throat area of the chute which collects the arc products from the arcing contacts should be cleaned with sandpaper. This may be done without the removal of the arc chute. Inspection can be made with a small mirror.

11. After the breaker has been serviced, it should be slowly closed and opened with the maintenance closing device to be sure there is no binding or friction and that the breaker contacts can move to the fully opened and fully closed positions. Its electrical operation should then be checked using either the test cabinet or the test couplers.

B. After Every 10,000 Operations

1. In addition to the servicing done each 2,000 operations, the arc chutes should be removed from the breaker and disassembled to permit a detailed inspection of insulation, blowout coils, arc runners and assemblies which can become contaminated by arc products.

2. All areas in the throat area of the arc chute should be thoroughly cleaned by using sandpaper. This cleaning should be performed any time the arc chute is removed. The arc chute fins should not be cleaned. Whenever the arc chute is removed, loose dust and dirt should be blown out before replacing arc chutes.

3. The blow-out coils should be carefully examined and if the insulation has been cracked, shrunk or eroded from arc action and heat so that the turns of the coils are not fully insulated from each other, the coils should be replaced. All connections should be checked for tightness.

4. The arc runners should be inspected and replaced when any part of their area has been reduced to 25% of the original metal thickness as a result of arc erosion.

5. Check the stationary arcing contacts to assure that the arcing contacts are in good condition and that their connections are tight.

6. Insulating material that is carbonized and cannot be satisfactorily cleaned should be replaced.

7. Any parts damaged or severely burned and/or eroded from arc action should be replaced.

NOTE: Fine cracks may develop in the fins of the arc chute sides. This is to be expected with ceramic materials when subjected to the high heat of an arc and may be disregarded unless they are long and present a possibility of fin sections breaking completely off. Small broken corners on the exhaust end of the arc chute will not interfere with its performance and can also be disregarded.

8. The cup bearing and the loose rings at the hinge point of the contact blade should be disassembled, inspected, cleaned and re-lubricated with G.E. Contact Lubricant D50H47. The contact rings should be inspected for wear and replaced when reduced in thickness to less than 1/32".

C. Every 20,000 Operations or Approximately Every Five Years - Whichever Comes First

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. The trip roller and trip shaft bearings in the operating mechanism should be disassembled, cleaned and repacked with G. E. Lubricant D50H15 as described under "Lubrication".

3. The stationary primary contact fingers should be disassembled and the silver-plated pivot area of the contact and contact support cleaned and lubricated with G. E. Lubricant D50H47.

4. The breaker and operating mechanism should be serviced as described for every 2000 operations and properly adjusted before being put back into service.

TROUBLE SHOOTING

Failure of a breaker to operate properly will generally fall within three general classes: Failure to trip, failure to close or latch closed, and overheating. The following is a brief outline showing particular types of distress that might be encountered, together with suggestions for remedying the trouble:

Failure to Trip

1. Mechanism binding or sticking caused by lack of lubrication.
REMEDY: Lubricate complete mechanism.

2. Mechanism binding or sticking caused by being out of adjustment.
REMEDY: Check all mechanism adjustments, latches, stops, auxiliary devices, etc., in accordance with section on ADJUSTMENTS. Examine latch and roller surfaces for corrosion.

3. Damaged trip coil.
REMEDY: Replace damaged coil.

4. Blown fuse in trip circuit.
REMEDY: Replace blown fuse after determining cause of failure.

5. Faulty connections in trip circuit.
REMEDY: Repair broken or loose wires and see that all binding screws are tight.

6. Damaged or dirty contacts in trip circuit.
REMEDY: Recondition or replace contacts.

Failure to Close or Latch Closed

1. Mechanism binding or sticking caused by lack of lubrication.
REMEDY: Lubricate complete mechanism.

2. Mechanism binding or sticking caused by being out of adjustment.
REMEDY: Check all mechanism adjustments, latches, stops, auxiliary devices, etc., in accordance with section on ADJUSTMENTS. Examine latch and roller surfaces for corrosion.

3. Control device sticking or not operating properly.
REMEDY: Check and adjust control device, or replace.

4. Damaged or dirty contacts in control circuit, including control device.
REMEDY: Recondition or replace contacts.

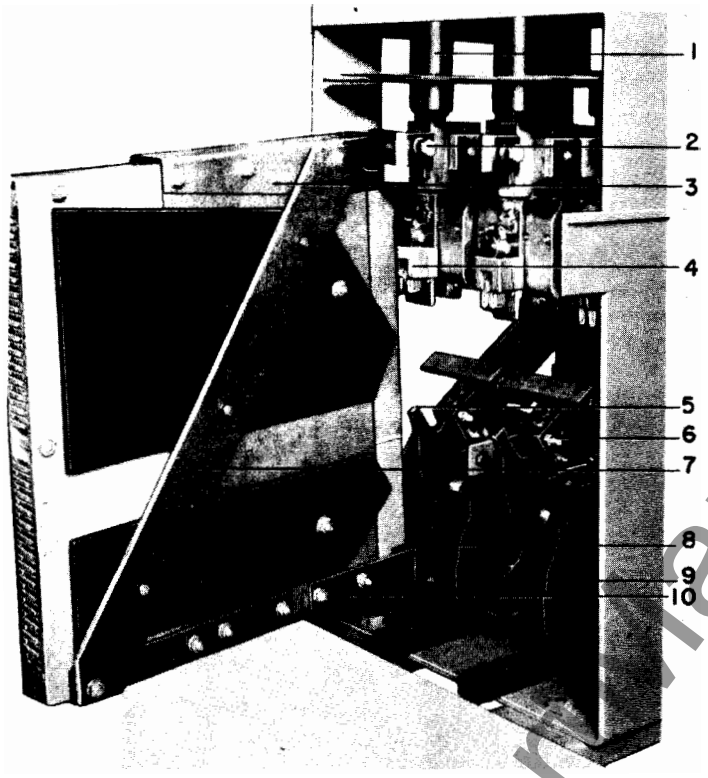
5. Damaged control device coil.
REMEDY: Replace damaged coil.

6. Damaged closing coil.
REMEDY: Replace damaged coil.

7. Defective cut-off switch, latch-checking switch, or interlock switch.
REMEDY: Replace defective switch.

8. Blown fuse in closing circuit.
REMEDY: Replace blown fuse after determining cause of failure.

9. Faulty connections in closing circuit.
REMEDY: Repair broken or loose wires and see that all binding screws are tight.



1. Rear Bushing
2. Supporting Bolt
3. Upper Mounting Support
4. Stationary Arcing Contact Assembly
5. Movable Arcing Contact
6. Assembly Bolts
7. Brace for Arc Chute
8. Arc Chute Mounting Bracket
9. Lower Supporting Bolt
10. Lower Mounting Support

Fig. 16 (801997I)

Fig. 16 Arc Chute Partially Removed Showing Accessibility of Arcing Contacts

10. Insufficient control voltage caused by excessive drop in leads.
REMEDY: Install larger wires and improve electrical contact at connections.
11. Insufficient control voltage caused by poor regulation (a-c control).
REMEDY: Install larger control transformer. Check rectifier to be sure it is delivering adequate d-c supply.

Overheating

1. Poor condition of contacts due to lack of attention after severe duty or too frequent operation.
REMEDY: Recondition or replace burned and pitted contacts. (Contacts should be reconditioned very carefully and only when absolutely necessary).
2. Contacts not properly aligned or adjusted.
REMEDY: Check all adjustments in accordance with section on ADJUSTMENTS.
3. Breaker kept closed or open for too long a period.
REMEDY: Operate breaker more often to wipe contacts clean. Replace contacts if necessary.
4. Overloading.
REMEDY: Replace breaker with one of adequate rating for present or future load, or re-arrange circuits so as to remove excess load.
5. Primary connections of inadequate capacity.
REMEDY: Increase size or number of conductors or remove excess current.
6. Loose connections or terminal connections.
REMEDY: Tighten.
7. Ambient temperature too high.
REMEDY: Relocate in a cooler place, or arrange some means of cooling.

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 and FINAL INSPECTION.

Arc Chute (To inspect or replace blow - out coils)

To remove an arc chute, first open the breaker and remove the box barrier (7), Fig. 19. Loosen the two upper supporting bolts (2), Fig. 16, and the one lower support bolt (9) using a 3/4" wrench. By raising the complete arc chute assembly about 3/8" and sliding it toward the rear of the breaker it can be removed as shown in Fig. 16.

To disassemble the arc chute after it has been removed from the breaker, proceed as follows:

1. Remove the caps and assembly bolts (7, 9, 11 and 13), Fig. 17.
2. Remove the side brace (5) and pole pieces (3 and 17), Fig. 17.
3. To remove the upper mounting support (10), Fig. 17, remove the assembly bolt (1), Fig. 16 and connection bolt (2), Fig. 18.
4. Remove the assembly bolts (16), Fig. 17 to remove the lower brace (8).
5. Remove the lower mounting support (14), Fig. 17, by removing the assembly bolts (15) and the connection nut (9), Fig. 18.
6. At this point the fiber side shields (6), Fig. 18, the upper arc runner assembly (4) and lower arc runner assembly (7) can be removed.
7. Further disassembly of both the upper and lower arc runner assemblies can be done by removing the various screws and 1/4" assembly bolts (not illustrated) as shown in Fig. 22.
8. The arc chute sides, Fig. 22, can be separated by removal of assembly bolts (2 and 4), Fig. 17.

Reassemble the arc chute in the reverse order. The following items should be noted during reassembly:

1. Equally space the fins of the arc chute sides before bolting together.
2. Check to insure that electrical connections to the blowout coils are tight.

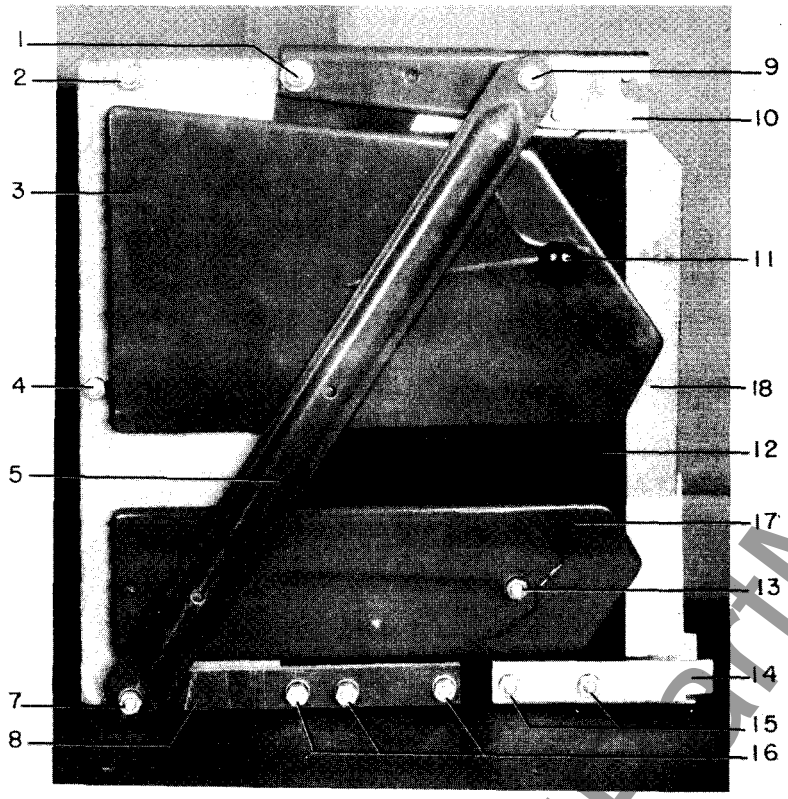


Fig. 17 (8025741)

1. Assembly Bolts and Bushing
2. Assembly Bolts
3. Upper Pole Piece
4. Assembly Bolt
5. Side Brace
7. Assembly Bolt
8. Lower Brace
9. Assembly Bolt
10. Upper Mounting Support
11. Insulating Cap
12. Side Shield
13. Assembly Bolt
14. Lower Mounting Support
15. Assembly Bolts
16. Assembly Bolts
17. Lower Pole Piece
18. Upper Insulation

Fig. 17 Arc Chute Assembly Complete

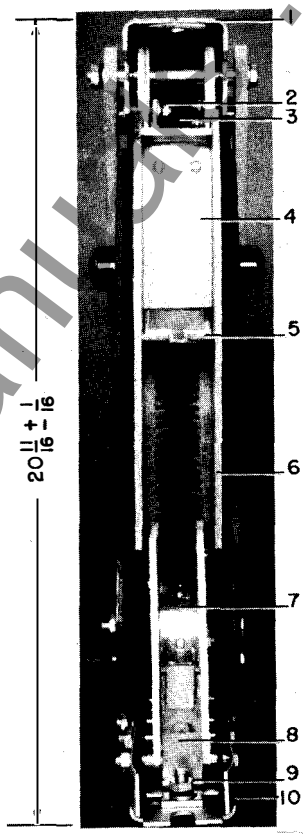


Fig. 18 (8024605)

1. Upper Mounting Support
2. Connection Bolt
3. Upper Blowout Coil
4. Upper Arc Runner Assembly
5. Upper Arc Runner
6. Side Shield
7. Lower Arc Runner Assembly
8. Lower Coil Connection
9. Connection Nut
10. Lower Mounting Support

Fig. 18 Front View Arc Chute Assembly

3. When reassembling the arc runner assemblies, check that the spacers (1 and 14), Fig. 22, are correctly installed.

4. Before bolting the upper mounting support in place, make certain that the upper arc runner assembly is tight against the arc chute side so that the gap between the upper insulation (8), Fig. 22, and the arc chute side (7) is a minimum.

5. Make certain that the electrical connections (2 and 9), Fig. 18 are tight.

To reassemble the arc chute to the breaker proceed as follows:

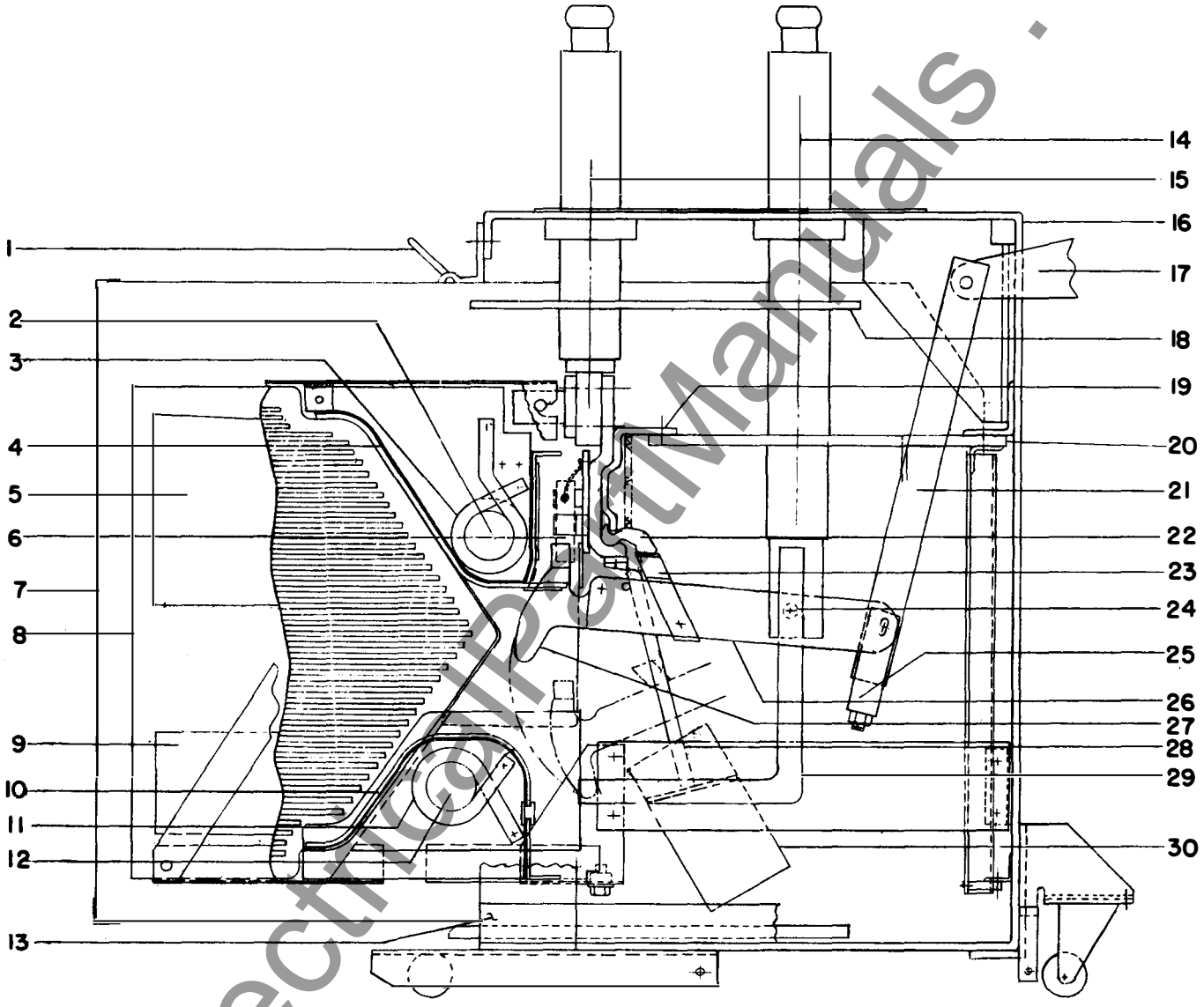
1. Rest the lower mounting support (10) on the arc chute mounting bracket (8) as shown in Fig. 16.

2. Slide the arc chute forward and lift it slightly to engage the supporting bolts (2), Fig. 16, in the slots of the upper mounting support (3).

3. Check the spring baffle (11) Fig. 23, to assure that it closes the gap between the upper insulation (18), Fig. 17, and the back of the contact support (4), Fig. 23. (-4 and -4S designs only)

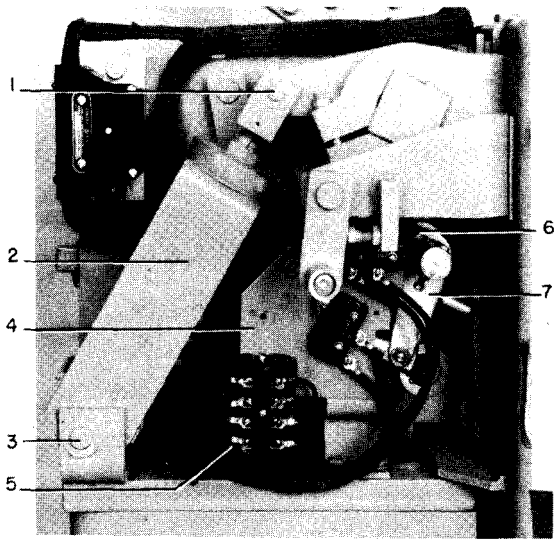
4. Tighten the supporting bolts (2 and 9), Fig. 16. These bolts serve as both the electrical and mechanical connections between the bushing and the arc runners.

Fig. 19 (258C689)



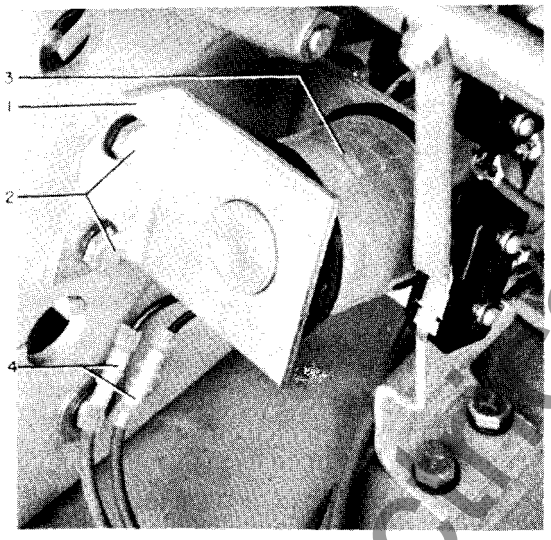
1. Box Barrier Handle
2. Blow-out Core
3. Blow-out Coil
4. Arc Runner
5. Pole Piece
6. Stationary Arcing Contact
7. Box Barrier
8. Arc Chute
9. Pole Piece
10. Arc Runner
11. Blow-out Coil
12. Blow-out Core
14. Front Bushings
15. Rear Bushings
16. Frame
17. Operating Crank
18. Upper Horizontal Barrier
19. Spring Retainer
20. Lower Horizontal Barrier
21. Operating Rod
22. Stationary Primary Contacts
23. Movable Primary Contacts
24. Cup Bearing
25. Yoke
26. Movable Contact Arm Assembly
27. Movable Arcing Contact
28. Booster Tube
29. Connection Bar
30. Booster Cylinder and Piston

Fig. 19 Cross Section of Breaker Pole Unit



1. Pivot Pin
2. Opening Spring Unit
3. Pivot Pin
4. Trip Coil Mounting Plate
5. Terminal Board
6. Switch Bar
7. Trip Coil Plunger Bracket

Fig. 20 Opening Spring Assembly



1. Trip Coil Support
2. Mounting Bolts
3. Trip Coil
4. Trip Coil Leads

Fig. 21 Potential Trip Coil

5. Check that the movable arcing contact (5), Fig. 7, passes through the slot or between the probes on the upper arc runner (6) without touching.

Trip Shaft and Self Lubricating Bearings

1. Remove mounting bolts for control device (7), Fig. 1, letting control device hang free. Do not remove wiring.
2. Remove the trip coil frame mounting bolts (2), Fig. 21, letting frame hang free. Also, disconnect trip coil leads (4), Fig. 21.
3. Remove switch bar (6) Fig. 20, from latch shaft.
4. Remove the trip coil and plunger bracket (7), Fig. 20, from trip shaft using snap ring pliers on ring holding trip coil plunger assembly.
5. Remove snap ring and washers near bearing.
6. Remove stop bar (13), Fig. 27, for manual trip rod. Also remove snap rings and washers next to bearing on left side.
7. Using a brass rod approximately 15" long and 3/8" diameter, drive each bearing and bearing housing out, taking the right one out first using the opening in the left side of the mechanism frame and the left one out from the opening made from the removal of the right hand bearing.

NOTE:
#1 When removing the left hand bearing, brass rod as mentioned above may have to be bent in order to clear latch.

#2 The bearings are self-lubricating and do not need lubrication.

8. To reassemble, reverse the above procedure except to drive bearings back in the mechanism frame, a pipe should be used so as not to damage bearing surface.

NOTE: If latch is to be replaced, the first six steps as listed above should be followed. Also remove the set screw holding the latch on shaft then place block between latch and frame to stop movement, and drive shaft out of latch. When replacing, make sure spring is in proper place and one half turn has been made to wind spring. Also, make sure latch is in place on stop bar roller before bearings and shaft are reassembled.

Trip Latch Roller Bearing

1. Remove mounting bolts on control device (7), Fig. 1, leaving control device hang free. Do not remove wiring.
2. Place block between manual trip rod (6), Fig. 1, and stop bar on trip shaft. This holds trip shaft in trip position and allows trip linkage to be free.
3. Working through hole on left hand side of mechanism, remove snap ring and washer from trip roller pin (289), Fig. 35, View C, using snap ring pliers.
4. Slide trip roller pin just enough to the right to allow room to hook snap ring pliers on ring on other end of pin. Compress pliers to free snap ring and pry the pin to the left with screwdriver to complete the removal of snap ring.
5. Trip roller bearing can now be removed for lubrication (see section on LUBRICATION). Particular attention should be paid to the location of washers and spacers.
6. To reassemble, reverse the above procedures.

Fig. 20 (8020728)

Fig. 21 (8029371)

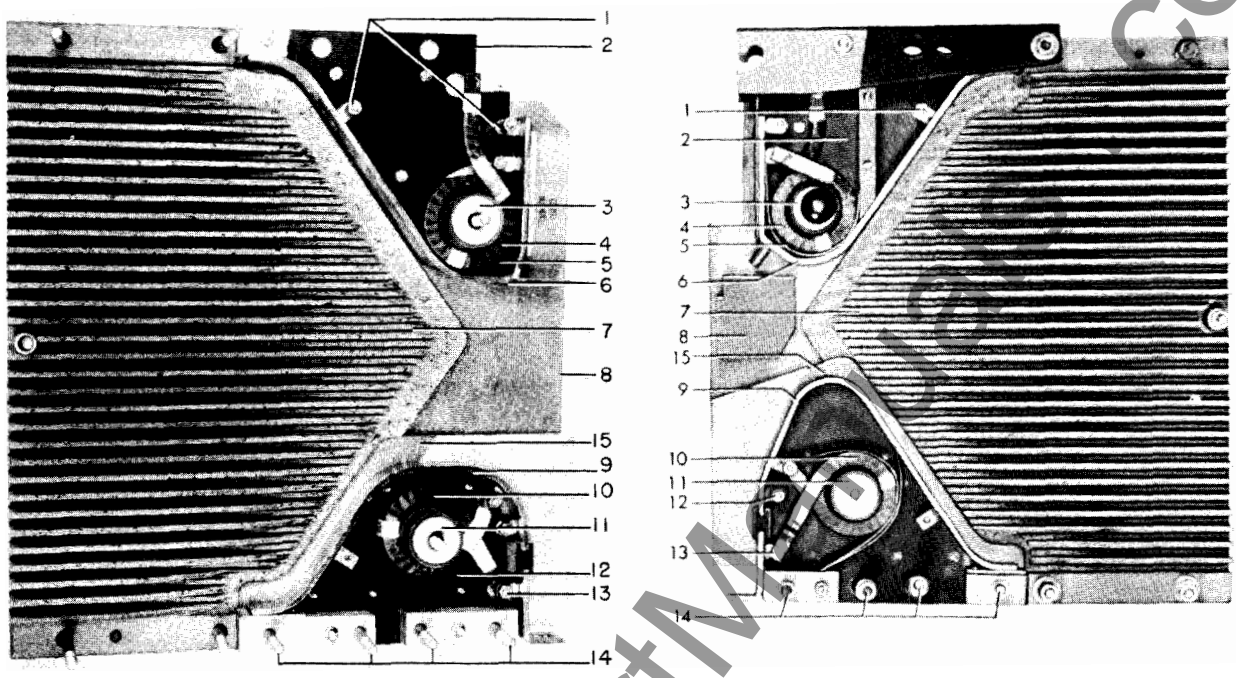
Contacts

Open the breaker and remove the box barrier and arc chutes as previously described. To remove the contacts, proceed as follows:

A. Stationary Arcing Contact (10) Fig. 23

1. Disconnect the contact braids from contact fingers by removing two bolts (8), Fig. 23.
2. Grasp the lower end of the contact fingers with pliers and pull contact assembly downward to remove from stud assembly.
3. To disassemble braids from stud assembly, remove one bolt (5).
4. To disassemble stud assembly from contact support, remove two bolts (6).
5. Reassemble in the reverse order.

Fig. 22 (8024600 & 8036734)



-4 & -4S Design

-7S Design

1. Upper Arc Runner Spacers
2. Upper Arc Runner Assembly
3. Blowout Core
4. Blowout Coil
5. Insulation
6. Upper Arc Runner
7. Arc Chute Side
8. Upper Insulation
9. Lower Arc Runner
10. Blowout Coil
11. Blowout Core
12. Lower Arc Runner Assembly
13. Lower Coil Connection
14. Lower Arc Runner Spacers
15. Lower Shield

Fig. 22 Arc Chute Assembly with Side Removed

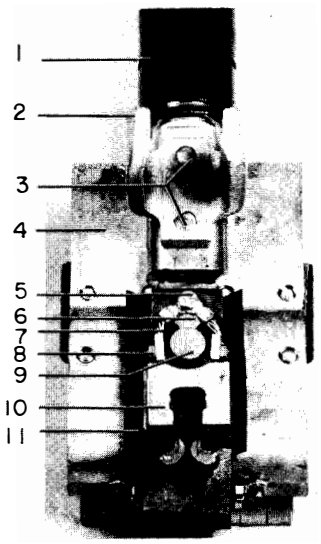
Fig. 23 (8025170)

B. Stationary Primary Contacts (9), Fig.24

1. Compress the contact spring (6).
2. Remove spring and spring guide (1).
3. Raise the contact finger to clear the primary contacts stop plate (8) and lift the finger out of contact support (7).

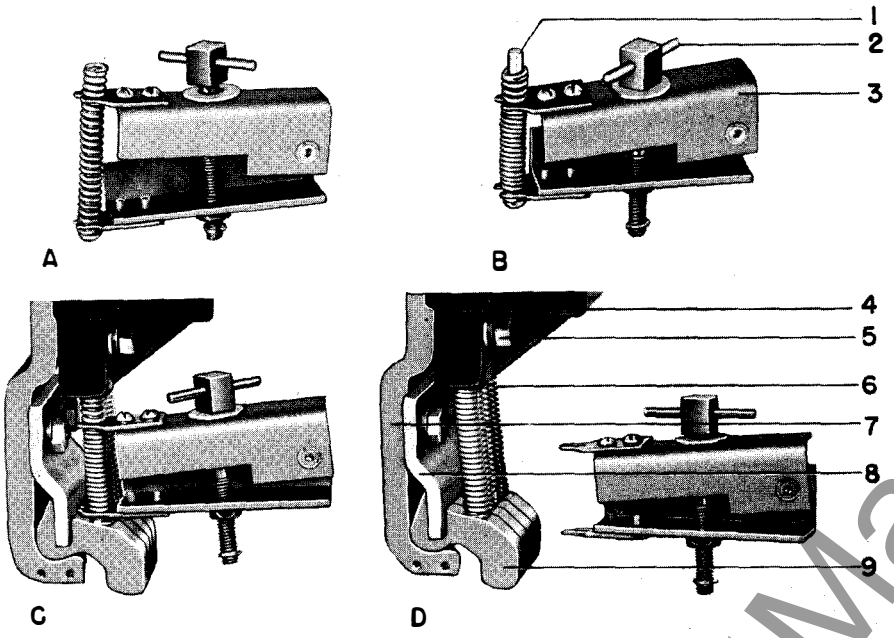
To replace the Stationary Primary Contacts:

1. Apply a thin coating of D50H47 grease on the hinged end of the finger (9) then place it on contact support (7) so that it is retained by stop plate (8).
2. Open spring compressor (3) and assemble spring guide, spring and spring compressor (Fig. 24A).
3. Turn handle (2) in clockwise direction to compress contact spring (Fig. 24B). Hold spring firmly in yoke on spring compressor to prevent the spring from slipping out of the compressor.
4. Place washer (not shown) on guide on top of spring, place top of guide into hole in spring retainer (4) and the round end of spring guide in cut out in primary finger (Fig. 24C).



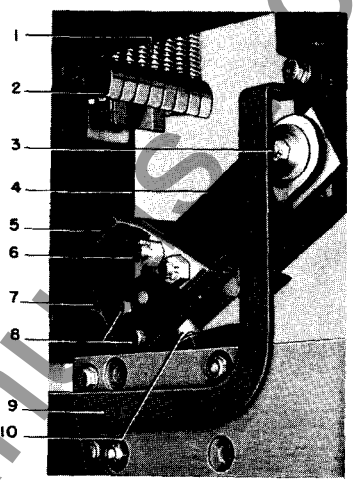
1. Rear Bushing
2. Guide and Support For Arc Chute
3. Bolts for Contact Support
4. Contact Support
5. Bolt for Flexible Braid
6. Mounting Bolt
7. Flexible Braid
8. Connection Bolt
9. Stud for Mounting Arcing Fingers
10. Stationary Arcing Contact Assembly
11. Spring Baffle

Fig. 23 Rear Bushing Assembly



1. Spring Guide
2. Handle for Spring Compressor
3. Spring Compressor
4. Spring Retainer
5. Assembly Bolt for Spring Retainer
6. Spring
7. Contact Support
8. Stop Plate
9. Stationary Primary Contact Fingers

Fig. 24 Method of Installing Primary Contact Springs Using a Spring Compressor



1. Contact Springs
2. Stationary Primary Contacts
3. Cup Bearing
4. Contact Arm
5. Movable Primary Contacts
6. Assembly Bolts
7. Movable Arcing Contact
8. Assembly Bolts
9. Connection Bar
10. Piston Assembly

Fig. 25 Removal of Contacts

Fig. 24 (8017149)

Fig. 25 (8012188)

5. Hold spring assembly firmly in place and remove spring compressor.

C. Movable Arcing Contact (7), Fig. 25

1. Remove the assembly bolts (8).
2. Reassemble in reverse order.

D. Movable Primary Contacts (5), Fig. 25

(1200 Amp Breaker)

1. Remove the nuts from assembly bolts (6).
2. Remove the primary contacts (5) and spacers (not illustrated).
3. Reassemble in reverse order.

(2000 Amp Breaker)

1. Remove the nuts from assembly bolts (6).
2. Remove the connection bar (9).
3. Remove the cup bearing (3).
4. Spread the contact arms (4) and remove the primary contacts (5).
5. Reassemble in the reverse order.

E. Contact Blade Assembly (4, 5, 7), Fig. 25

1. Remove the connection bar (9).
2. Remove the cup bearing (3), Fig. 25, and the pin (2) Fig. 8.
3. When reassembling, first insert the piston assembly (10), Fig. 25, into the booster cylinder and reassemble the cup bearing (3).
4. Replace pin (2), Fig. 8, and connection bar (9), Fig. 25.

F. After disassembly and reassembly of any contacts, check all contact adjustments as described under ADJUSTMENTS.

Bushings

IMPORTANT: DO NOT REMOVE ALL SIX BUSHINGS AT ONCE. The bushings have been carefully aligned with the breaker frame, during assembly at the factory, and it is important that this alignment be maintained to facilitate installation of the breaker in the metal-clad unit. It is therefore recommended that the bushings be removed and reassembled one at a time. Also, before removing any one bushing, measure the distance from that particular bushing to adjacent bushings in both directions, so that it may be re-installed in the same location.

It is also possible to remove and reassemble three bushings at one time. If this is preferred, alignment of the bushings may be accomplished by placing the breaker in a de-energized spare metal-clad unit before tightening the bushing mounting bolts. This must be done before the arc chutes are re-installed.

To replace the bushing, proceed as follows:

Rear Bushing

1. Open the breaker and remove the box barrier and arc chutes as already described.
2. Remove the upper and lower horizontal barriers (4 and 5), Fig. 26.
3. Remove the four bolts (3) at the mounting flange of the rear bushing being removed and lower the bushing assembly.
4. Referring to Fig. 24, disassemble the primary contact springs (6) as previously described.
5. Disassemble the spring retainer (4) by removing mounting bolts (5).
6. Referring to Fig. 23, disassemble the contact support (4) and guide and support for arc chute (2) by removing two bolts (3).
7. Reassemble in the reverse order. The guide and support for arc chute (2) is not symmetrical and must be assembled correctly to orient the arc chute properly on the breaker. The longest projection of the bracket should be toward the lower end of the bushing.

Front Bushing

1. Open the breaker and remove the box barrier and arc chutes as already described.

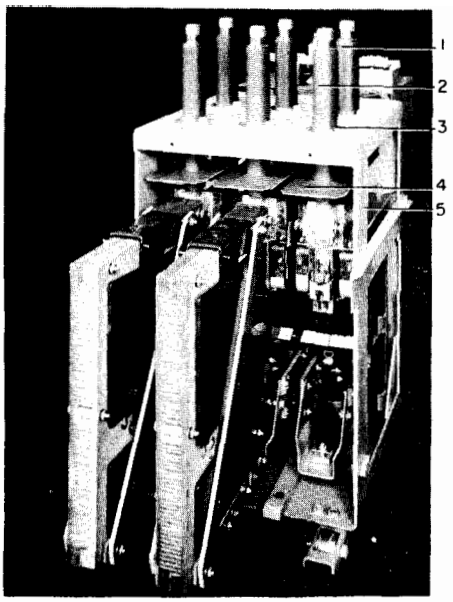


Fig. 26 (8022047)

1. Front Bushing
2. Rear Bushing
3. Mounting Bolts
4. Upper Horizontal Barrier
5. Lower Horizontal Barrier

Fig. 26 Rear View of Breaker with One Arc Chute Removed

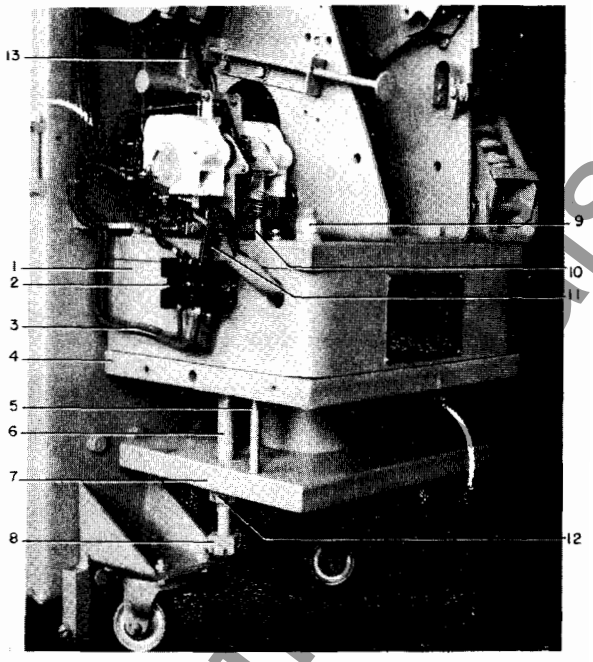


Fig. 27 (8022045)

1. Soleniod Pot
2. Terminal Board
3. Wire Strap
4. Bottom Plate
5. Control Device Trip Plunger Rod
6. Guide Studs
7. Armature
8. Stop Nuts
9. Front Stud Nuts
10. Plunger Guide
11. Closing Coil Leads
12. Stop Nuts
13. Stop Bar

Fig. 27 Closing Solenoid Assembly

2. Remove the upper and lower horizontal barriers (4 and 5), Fig. 26.
3. Remove the connection bar (9), Fig. 25, and cup bearing (3).
4. Remove operating rod pin (2), Fig. 8.
5. Remove the four bolts at the mounting flange of the front bushing being removed, and lower the bushing.
6. When reassembling, first mount the bushing and assemble operating rod pin (2), Fig. 8, the cup bearing (3) and contact arm (4), Fig. 25. The contact surface at the hinge point of the contact blade and cup bearing should have a thin coating of D50H47 grease.
7. Check all contact adjustments as outlined under ADJUSTMENTS.

Closing Coil

The closing coil is contained within the solenoid pot (1), Fig. 27. To remove the closing coil, proceed as follows:

1. Open the breaker.
2. Remove the two closing coil leads (11). Remove the terminal board (2) from the solenoid pot and let it hang by the wires. Also, remove the wire from strap (3).
3. Remove the stop nuts (8 and 12) on guide studs (6), lower the armature (7) and control device trip plunger (5).

NOTE: Armature rests on stop nuts (12) only. Armature should be supported during the removal of these stop nuts and then lowered.

4. Loosen the four nuts under the bottom plate (4) approximately 1/2". Support the bottom plate with a rope sling or hoist and remove the two rear nuts.
5. Remove the nuts (9) at the top of the front studs. This permits the bottom plate, closing coil, solenoid pot (1) and control device plunger guide (10) to be removed.
6. To reassemble, first place the closing coil and spacers on the bottom plate (4). Raise into position, inserting the control device plunger guide (10) and compressing the piston ring on the upper pole piece.
7. Tilt the bottom plate downward and replace the solenoid pot (1) and two front studs and nuts (9).
8. Tighten the four nuts under the bottom plate taking special precaution to center the closing coil around the pole piece. If the closing coil is not firmly held in place, add spacers above the closing coil.
9. Replace the control device trip plunger rod (5) and armature (7).
10. Recheck the mechanism adjustments as explained under ADJUSTMENTS.

Trip Coil

To replace the potential trip coil (3), Fig. 4, proceed as follows:

1. Open the breaker and remove the opening spring unit (2), Fig. 20, by removing the pivot pins (1 and 3).
2. Disconnect the two trip coil lead wires (4), Fig. 21.
3. Remove the two mounting bolts (2) and the trip coil support (1).
4. Remove the trip coil (3).
5. After reassembling (in the reverse order) check the primary contact gap adjustment as explained under ADJUSTMENTS.

Interlock Switch

To remove the interlock switch (6), Fig. 10, remove the two mounting screws and disconnect the lead wires. Reassemble in the reverse order and check the switch adjustments as explained under ADJUSTMENTS.

Latch Checking Switch

To remove the latch checking switch (3), Fig. 10, (when furnished), remove the two mounting screws and disconnect the lead wires. Reassemble in the reverse order and check the switch adjustments as explained under ADJUSTMENTS.

Cut-off Switch

To remove the cut-off switch (1), Fig. 6, remove the two mounting bolts and disconnect the lead wires. When reassembling check the cut-off switch adjustment as explained under ADJUSTMENTS.

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 save 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.

Note: The listed terms "right" and "left" apply when facing the solenoid mechanism 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, REFER TO THE NEAREST OFFICE OF THE GENERAL ELECTRIC COMPANY.

PARTS RECOMMENDED FOR NORMAL MAINTENANCE

FIG. NO.	REF. NO.	MVA RATING	AMPERE RATING	CATALOG NO. FOR TYPE AM-4.16-(MVA)- -4	-4S	-7S	NO. REQ'D	DESCRIPTION
28	9	All	All	0281B0708 G-002	0281B0708 G-002	0281B0708 G-002	3	Operating Rod
30	118	All	All	0414A0116 P-002	0414A0116 P-002	0114C5381 P-004	3	Insulating Plate
30	119	All	All	0414A0117 P-001	0414A0117 P-001		6	Throat Insulation
30	119	All	All			0108B1965 G-001	3	Throat Insulation (Right)
30	119	All	All			0108B1965 G-002	3	Throat Insulation (Left)
30	130	All	All	0383A0932 P-001	0383A0932 P-001	0161A5906 P-001	6	Lower Shield
30	135	All	All	0258C0616 P-009	0258C0616 P-009	0836C0197 P-014	6	Upper Insulation
30	137	All	All	000421711 P-001	000421711 P-001	000421711 P-001	6	Insulating Cap
30	137A	All	All	000407193 P-001	000407193 P-001	000407193 P-001	6	Washer (For Ref. 137)
30	138	250/250A	All	0258C0616 P-006	0258C0616 P-006		6	Lower Barrier
30	138	150/150A	All	0258C0616 P-013	0258C0616 P-013		6	Lower Barrier
30	138	All	All			0114C5381 P-001	6	Lower Barrier
31	155	All	All	0236C0791 G-001	0236C0791 G-001	0236C0791 G-001	3	Flexible Connection (Right)
31	155A	All	All	0236C0791 G-004	0236C0791 G-004	0236C0791 G-004	3	Flexible Connection (Left)
31	156	All	All	0236C0790 G-009	0236C0790 G-009	0236C0790 G-009	3	Arcing Contact Assembly
31	158	All	All	0414A0116 P-004	0414A0116 P-004	0414A0116 P-004	3	Insulating Plate
31	160	150/150A	600/1200	0414A0180 P-001	0414A0180 P-001		12	Primary Contact Finger Spring
31	160	150/150A	600/1200			0414A0180 P-001	18	Primary Contact Finger Spring
31	160	250/250A	1200	0121A5964 P-001	0121A5964 P-001		12	Primary Contact Finger Spring
31	160	250/250A	1200			0121A5964 P-001	18	Primary Contact Finger Spring
31	160	All	2000			0121A5964 P-001	18	Primary Contact Finger Spring
31	160	All	2000	006509787 P-001	006509787 P-001		24	Primary Contact Finger Spring
31	165	All	600/1200	0236C0791 P-008	0236C0791 P-008		12	Primary Contact Finger
31	165	All	2000	0236C0791 P-008	0236C0791 P-008		24	Primary Contact Finger
31	165	All	All			0114C5382 P-002	18	Primary Contact Finger
32	211	All	All	0802B0742 G-001	0802B0742 G-001	0802B0742 G-001	3	Movable Arcing Contact
32	212	All	600/1200	0137A9164 P-003	0137A9164 P-003		3	Movable Primary Contact
32	212	All	2000	0137A9164 P-003	0137A9164 P-003		6	Movable Primary Contact
32	213	All	600/1200	0137A9164 P-004	0137A9164 P-004		3	Movable Primary Contact
32	213	All	2000	0137A9164 P-004	0137A9164 P-004		6	Movable Primary Contact
32	213	All	All			0114C5382 P-004	6	Movable Primary Contact
32	216	All	600/1200	0213X0343 G-043	0213X0343 G-043	0213X0343 G-043	3	Tube and Piston Assembly
32	216	All	2000	0213X0343 G-044	0213X0343 G-044	0213X0343 G-044	3	Tube and Piston Assembly
35	261	250/250A	All	006375521 G-002	0802B0799 G-001	0802B0799 G-001	1	Closing Coil - (125V-dc)-#
35	261	150/150A	All	006375521 G-006	0802B0799 G-002	0802B0799 G-002	1	Closing Coil (125V-dc)
35	261	250/250A	All	006375521 G-001	0802B0799 G-003	0802B0799 G-003	1	Closing Coil (250 V-dc)#
35	261	150/150A	All	006375521 G-005	0802B0799 G-004	0802B0799 G-004	1	Closing Coil (250 V-dc)
34	355	All	All	0456A0864 P-026	0456A0864 P-026	0456A0864 P-134	1	Capacitor (230 V-ac only)
34	370	All	All	006174582 G-001	006174582 G-001	006174582 G-001	1	Potential Trip Coil (125 V-dc)
34	370	All	All	006174582 G-002	006174582 G-002	006174582 G-002	1	Potential Trip Coil (250 V-dc)
34	370	All	All	006174582 G-014	006174582 G-014	006174582 G-014	1	Potential Trip Coil (230 V-ac)
34	370	All	All	006275070 G-001	006275070 G-001	006275070 G-001	1	Potential Trip Coil (24 V-dc)
34	370	All	All	006275070 G-002	006275070 G-002	006275070 G-002	1	Potential Trip Coil (48 V-dc)
39	663	All	All	006275017 G-019	006275017 G-019	006275017 G-019	1	UVD Coil (125 V-dc)
39	663	All	All	006275017 G-020	006275017 G-020	006275017 G-020	1	UVD Coil (250 V-dc)
39	663	All	All	006275017 G-033	006275017 G-033	006275017 G-033	1	UVD Coil (230 V-ac)
40	738	All	All	006174599 G-002	006174599 G-002	006174599 G-002	3	Current Trip coil (3 amps, ac)
40	738	All	All	006174599 G-006	006174599 G-006	006174599 G-006	1	Capacitor Trip Coil (230 V-ac)
41	753	All	All	006275017 G-019	006275017 G-019	006275017 G-019	1	Control Device Coil (125 V-dc)
41	753	All	All	006275017 G-020	006275017 G-020	006275017 G-020	1	Control Device Coil (250 V-dc)
41	753	All	All	006275017 G-033	006275017 G-033	006275017 G-033	1	Control Device Coil (230 V-ac) (Continuous)
41	753	All	All	006275017 G-034	006275017 G-034	006275017 G-034	1	Control Device Coil (230 V-ac) (Intermittent)

Used also on certain 150 MVA breakers with High current closing coil. Refer to breaker nameplate.

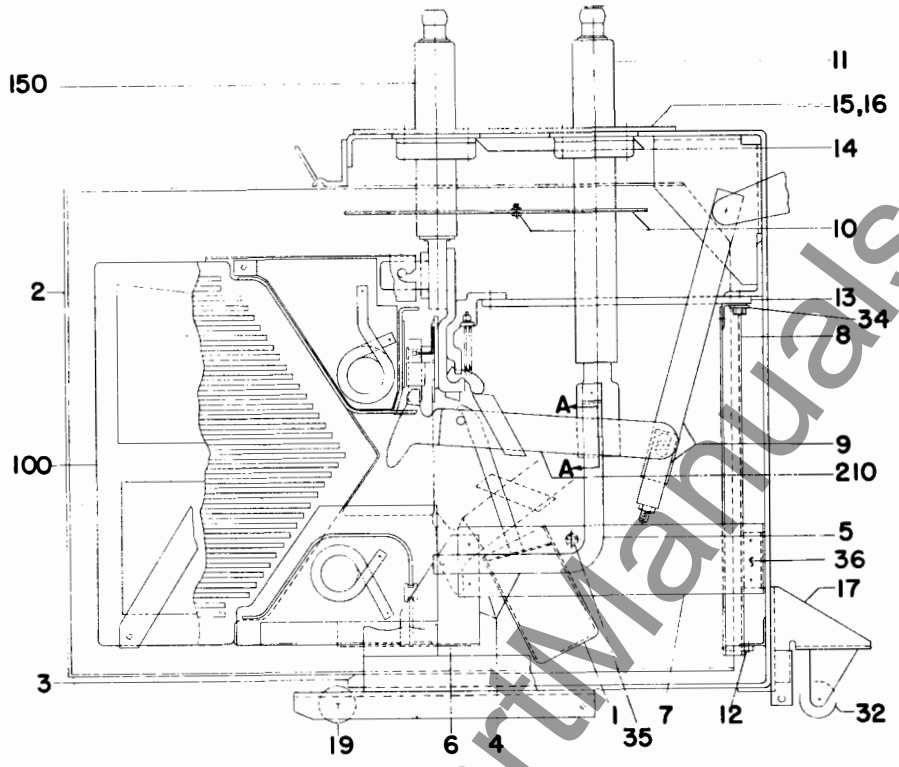


Fig. 28A

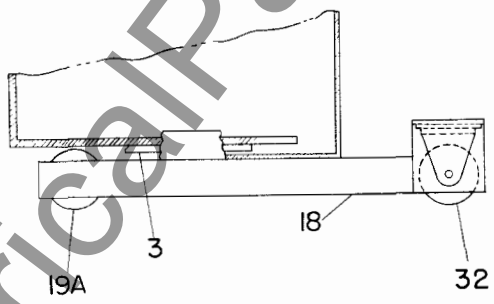


Fig. 28B

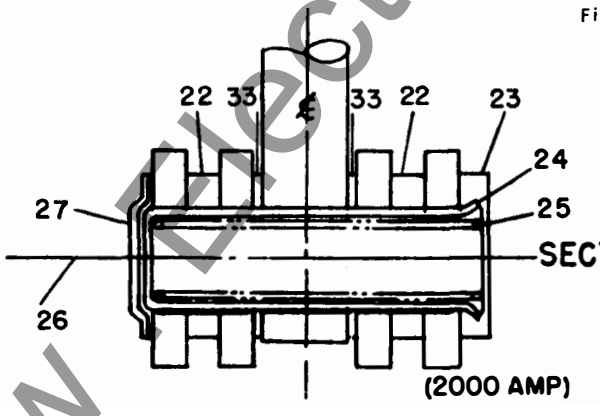


Fig. 28C (Ref. 21)

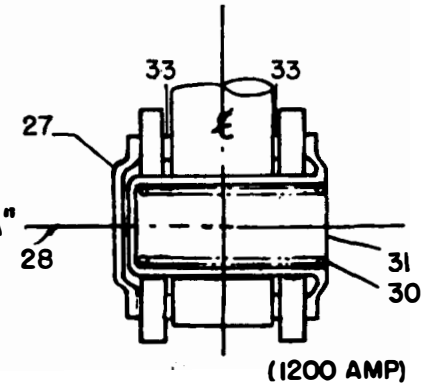


Fig. 28D (Ref. 20)

SECTIONS "AA"

Fig. 28 Cross-section Type AM-4.16-4

Fig. 28A (9580660)

Fig. 28B (281B771)

Fig. 28C (236C792)

Fig. 28D (236C792)

REF.	MVA	AMPS	CATALOG NUMBER -4 & -4S	CATALOG NUMBER -7S	NO. REQ'D	DESCRIPTION
1	All	All	0619C0444 G-005	0619C0444 G-005	3	Booster Cylinder
2	150A/250A	All	0108B1979 G-002	0108B1979 G-002	1	Box Barrier Assembly
2	150/250	All	0108B1979 G-001	0108B1979 G-001	1	Box Barrier Assembly
3	All	All	*	*	*	Box Barrier Guide
4	All	All	0137A6025 G-001		3	Arc Chute Support Assembly
5	All	All	0258C0619 P-008		3	Connection Bar
6	All	All	0619C0414 G-003		3	Arc Chute Clamp
7	All	All	0137A6001 P-001		3	Arc Chute Support (Left)
7	All	All	0137A6001 P-002		3	Arc Chute Support (Right)
8	All	All	0619C0461 G-005	0619C0461 G-012	1	Vertical Barrier (Left)
8	All	All	0619C0461 G-002	0619C0461 G-011	1	Vertical Barrier (Center)
8	All	All	0619C0461 G-001	0619C0461 G-010	1	Vertical Barrier (Right)
9	All	All	0281B0708 G-002	0281B0708 G-002	3	Operating Rod
10	All	600/1200	0137A6047 G-001	0137A6047 G-001	3	Horizontal Barrier (Upper)
10	All	2000	0137A6047 G-002	0137A6047 G-002	3	Horizontal Barrier (Upper)
11	150A	600	0688C0515 G-003	0688C0515 G-003	3	Bushing (Long)
11	All	1200	0688C0582 G-001	0688C0582 G-001	3	Bushing (Long)
11	All	2000	0688C0515 G-001	0688C0515 G-001	3	Bushing (Long)
12	All	All	0619C0461 P-026	0619C0461 P-026	3	Block
13	All	600/1200	0688C0575 P-011	0114C5380 P-011	6	Horizontal Barrier (Lower)
13	All	2000	0688C0575 P-012	0114C5380 P-012	6	Horizontal Barrier (Lower)
14	All	600/1200	0688C0575 P-009		6	Spacer
15	All	600/1200	0258C0614 P-020	0258C0614 P-020	4	Cover Plate
16	All	2000	0619C0444 P-024	0619C0444 P-024	1	Top Plate
17	All	All	0258C0683 G-001	0258C0683 G-001	1	Wheel Assembly Complete
18	ø	ø	0236C0767 G-007	0236C0767 G-007	1	Wheel Assembly Complete
19	All	All	006597296 P-008	006597296 P-008	2	Wheel & Spreader Bushing
19A	ø	ø	006597296 P-006	006597296 P-006	2	Wheel & Spreader Bushing
20	All	600/1200	0898B0282 G-001	0898B0282 G-001	3	Hinge Assembly Complete
21	All	2000	0898B0282 G-002	0898B0282 G-002	3	Hinge Assembly Complete
22	All	2000	006442246 P-001	006442246 P-001	6	Spacer
23	All	2000	006441630 P-001	006441630 P-001	3	Washer
24	All	2000	006442257 P-001	006442257 P-001	3	Bearing
25	All	2000	0369A0407 P-001	0269A0407 P-001	3	Spring
26	All	2000	0414A0106 P-007	0414A0106 P-007	3	Bolt
27	All	All	006441617 P-001	006441617 P-001	3	Washer
28	All	600/1200	0414A0106 P-004	0414A0106 P-004	3	Screw
30	All	600/1200	0421A0239 P-001	0421A0239 P-001	3	Spring
31	All	600/1200	0137A9186 P-001	0137A9186 P-001	3	Bearing
32	All	All	006597296 P-005	006597296 P-005	2	Front Wheel & Caster
--	150/250	All	0966C0321 G-001	0966C0321 G-001	1	Mechanism Cover (Standard)
--	150A/250A	All	0966C0321 G-002	0966C0321 G-002	1	Mechanism Cover (Interchangeable)
33	All	All	0104A2495 P-001	0104A2495 P-001	6	Loose Rings
34	All	All	0619C0461 P-025	0619C0461 P-025	3	Plate
35	All	All	006176110 P-441		6	Spacer
36	All	All	0619C0444 P-006	0619C0444 P-006	3	Support
37	All	All	0137A9103 P-001		3	Booster Cyl. Jumper (Not Shown)
40 △	All	All	0688C0575 P-001	0114C5380 P-003	6	Support
41 △	All	All	0688C0575 P-002	0114C5380 P-001	3	Support (Left)
42 △	All	All	0688C0575 P-003	0114C5380 P-002	3	Support (Right)
43 △	All	All	0688C0575 P-004	0114C5380 P-004	3	Connection Bar
44 △	All	All	0619C0444 G-004	0619C0444 G-003	3	Arc Chute Clamp
45 △	All	All	0421A0209 P-429	0421A0209 P-429	3	Spacer
46 △	All	All	0421A0209 P-447	0421A0409 P-447	3	Spacer

△ For "-4" & "-4S" only. Order parts No. 40-44 when individual parts are required. When several of these parts are required, order Ref. No. 4 which gives a complete assembly of replacement parts for parts 40-46.

ø For breaker model list numbers with "W" suffix.

* For Box Barrier with fabricated top - order quan. (2) 0258C0614 P-037
For Box Barrier with molded top - order quan. (2) 0114C5381 P-006

Fig. 29 (898B299)

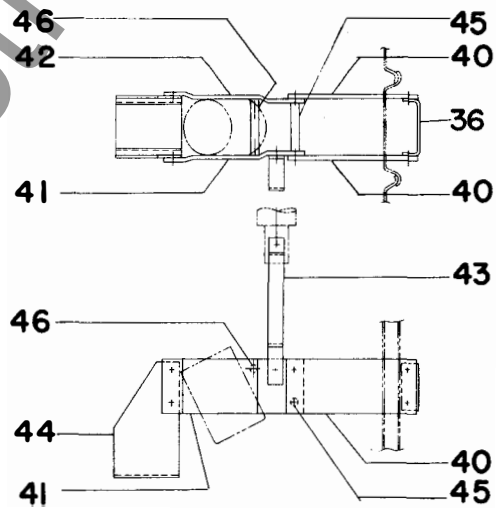


Fig. 29 Cylinder Support

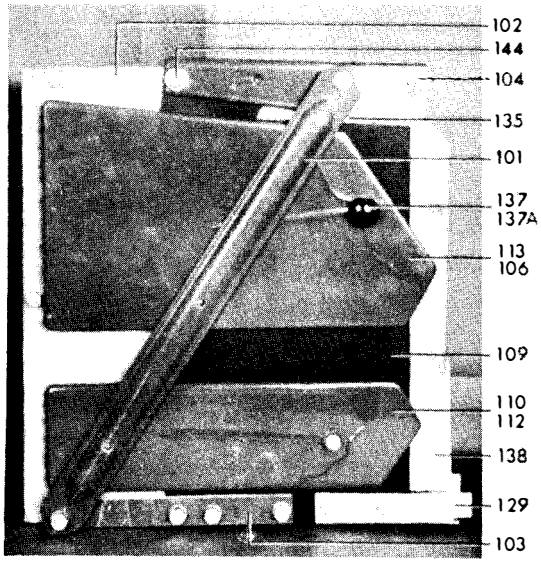


Fig. 30A Complete Assembly (250 mva)
".4" & "-4S" Design

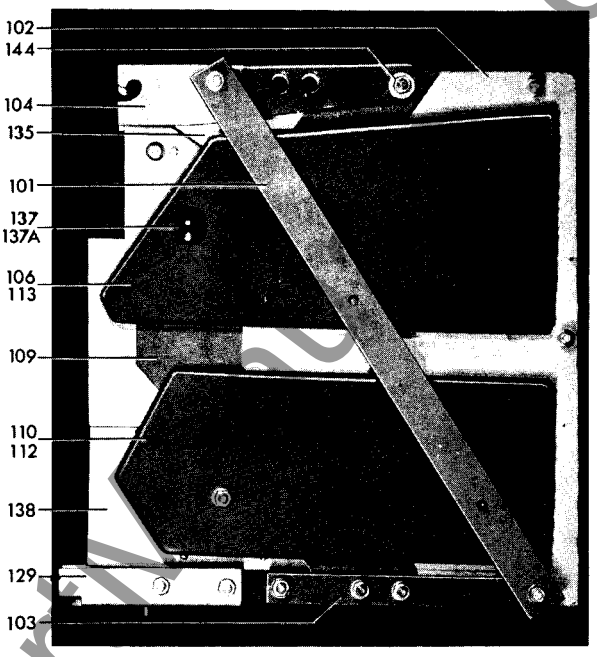


Fig. 30C Complete Assembly
"-7S" Design

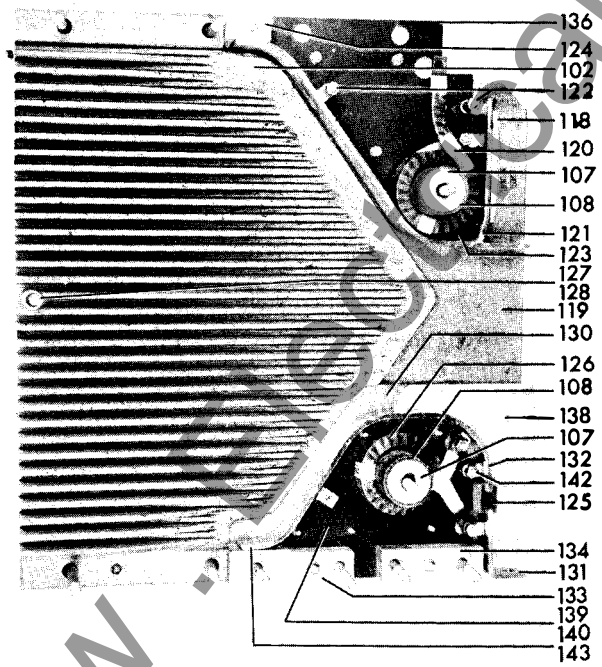


Fig. 30B Side Cover Removed (250 mva)
"-4" & "-4S" Design

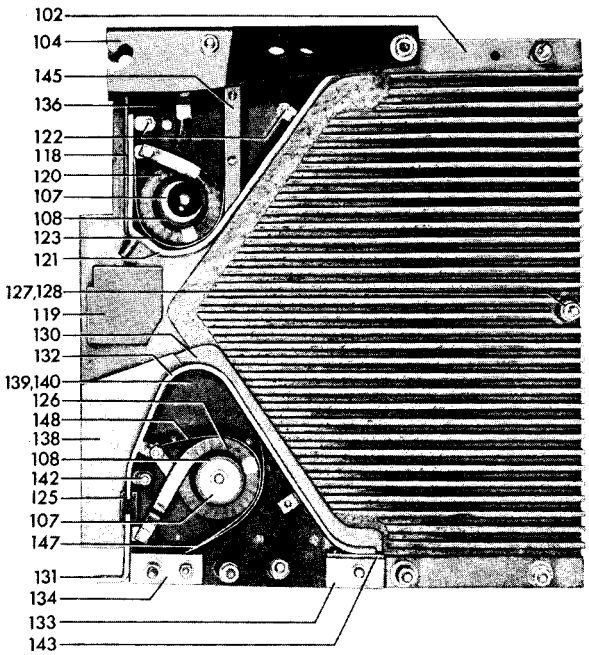


Fig. 30D Side Cover Removed
"-7S" Design

Fig. 30A (8025741)

Fig. 30B (8024600)

Fig. 30C (8036736)

Fig. 30D (8036734)

Fig. 30E (8036733)

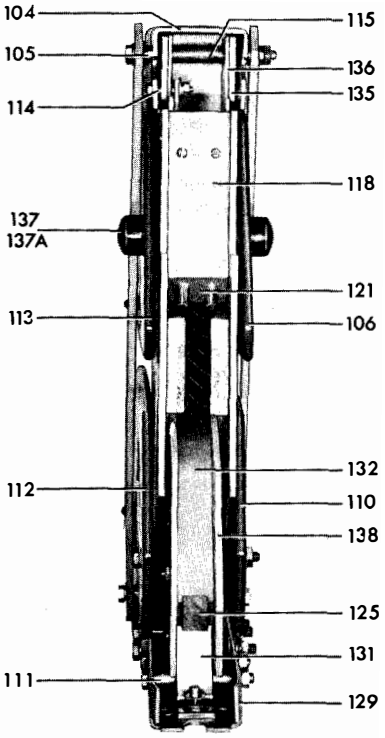


Fig. 30E Front View

Fig. 30F (8036737)

Fig. 30G (8028523)

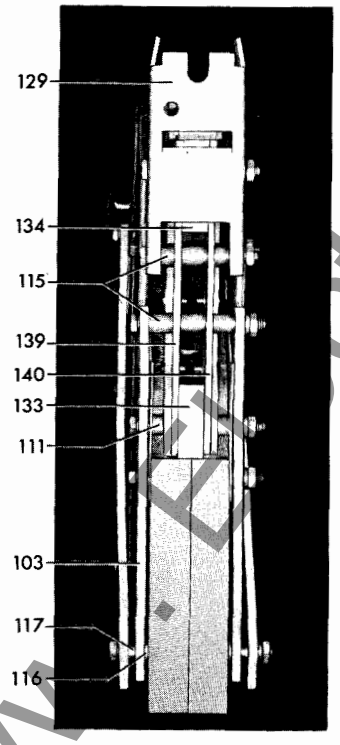


Fig. 30F Bottom View

REF.	MVA	CATALOG NUMBER -4 & -4S	CATALOG NUMBER -7S	NO. REQ'D	DESCRIPTION
100	150/150A	0215D0469 G-001	0213X0416 G-001	3	Arc Chute Assembly
100	250/250A	0215D0469 G-002	0213X0416 G-001	3	Arc Chute Assembly
101	All	0456A0381 P-002	0456A0381 P-003	6	Brace
102	All	0264B0100 G-003	0264B0100 G-003	3	Arc Chute Sides
103	All	0258C0616 P-004	0258C0616 P-004	6	Lower Support
104	All	0215D0469 G-050	0213X0416 G-004	3	Upper Support
105	All	0421A0208 P-078	006176109 P-072	6	Spacer
106	All	0258C0615 G-002	0836C0197 G-004	3	Upper Pole Piece (Right)
107	All	0258C0615 P-029	0258C0615 P-019	3	Core (Upper)
107	250/250A	0258C0615 P-019		3	Core (Lower)
107	All		0258C0615 P-030	3	Core (Lower)
108	All	0258C0616 P-018	0258C0616 P-023	3	Core Insulation (Upper)
108	250/250A	0258C0616 P-023		3	Core Insulation (Lower)
108	All		0258C0616 P-024	3	Core Insulation (Lower)
109	All	0107B9365 P-001	0114C5381 P-002	6	Shield
110	250/250A	0258C0615 G-006		3	Lower Pole Piece (Right)
110	All		0836C0197 G-002	3	Lower Pole Piece (Right)
111	All	0421A0208 P-093		24	Spacer
111	All		0421A0208 P-093	12	Spacer
112	250/250A	0258C0615 G-003		3	Lower Pole Piece (Left)
112	All		0836C0197 G-001	3	Lower Pole Piece (Left)
113	All	0258C0615 G-001	0836C0197 G-003	3	Upper Pole Piece (Left)
114	All	0258C0615 P-011	0258C0615 P-011	3	Connection
115	All	0421A0209 P-082		3	Spacer
115	All		0456A0888 P-005	9	Spacer
116	All	000432249 P-001	000432249 P-001	6	Spacer
117	All	006176109 P-072	006176109 P-072	6	Spacer
118	All	0414A0116 P-002	0114C5381 P-004	3	Insulation Plate
119	All	0414A0117 P-001		6	Throat Insulation
119	All		0108B1965 G-001	3	Throat Insulation (Right)
119	All		0108B1965 G-002	3	Throat Insulation (Left)
120	All	0366A0743 G-001	0366A0743 G-001	3	Coil (Upper)
121	All	0258C0632 G-001	0962C0745 G-001	3	Runner Assembly (Upper)
122	All	0421A0208 P-024	0421A0208 P-024	12	Spacer
123	All	0456A0891 P-210	0456A0891 P-210	3	Insulation Strip
124	All	0258C0616 P-005	0258C0616 P-005	3	Spacer
125	All	0258C0616 P-011	0258C0616 P-011	3	Spacer
126	250/250A	0366A0744 G-001		3	Coil (Lower)
126	All		0366A0744 G-001	3	Coil (Lower)
127	All	0414A0131 P-004	0958C0604 P-012	6	Shim (As Required)
128	All	006445050 P-010	006445050 P-010	3	Spacer
129	All	0258C0615 P-015	0836C0199 P-010	3	Support
130	All	0383A0932 P-001	0161A5906 P-001	6	Lower Shield
131	All	0258C0615 G-005	0258C0615 G-005	3	Connection Assembly
132	All	0258C0615 G-004	0836C0198 G-002	3	Runner Assembly (Lower)
133	All	0258C0616 P-022	0958C0604 P-004	3	Spacer
134	All	0258C0616 P-021	0958C0604 P-005	3	Spacer
135	All	0258C0616 P-009	0836C0197 P-014	6	Upper Insulation
136	All	0258C0632 P-010	0836C0197 P-013	6	Barrier
137	All	000421711 P-001	000421711 P-001	6	Insulating Cap
137A	All	000407193 P-001	000407193 P-001	6	Washer (For Ref. 137)
138	250/250A	0258C0616 P-006		6	Lower Barrier
138	150/150A	0258C0616 P-013		6	Lower Barrier
138	All		0114C5381 P-001	6	Lower Barrier
139	All	0258C0616 P-007	0836C0197 P-012	3	Barrier (Left)
140	All	0258C0616 P-008	0836C0197 P-011	3	Barrier (Right)
141	150/150A	0258C0615 P-027		3	Connection Bar
142	All	0421A0208 P-010	0421A0208 P-010	6	Spacer
143	All	0414A0198 P-001	0114C5381 P-005	3	Insulation
144	All	0137A9163 P-002	0137A9163 P-002	6	Insulation Bushing
145	All		0958C0604 P-002	3	Barrier
146	All		0836C0197 P-015	6	Cup Washer
147	All		0958C0604 P-006	3	Barrier
148	All		0456A0891 P-219	3	Insulation Strip

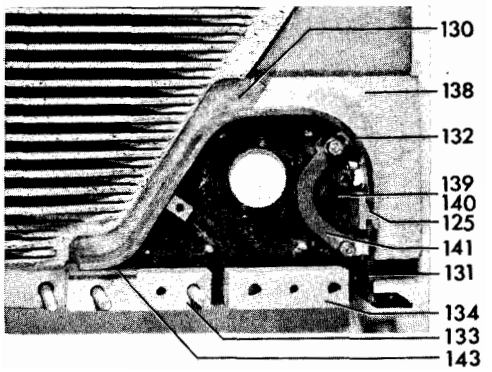


Fig. 30G Lower Runner Assembly (150 mva) "-4" & "-4S" Design

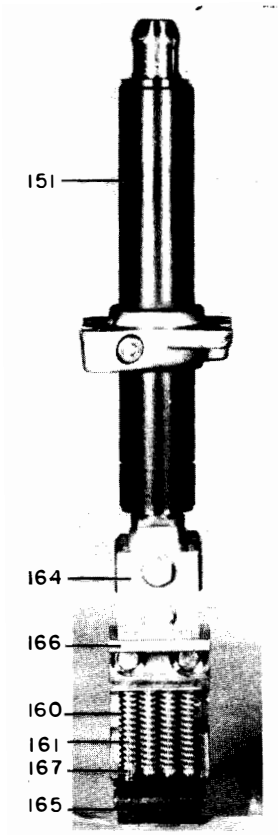


Fig. 31A Front View (for 1200 amp Breaker)

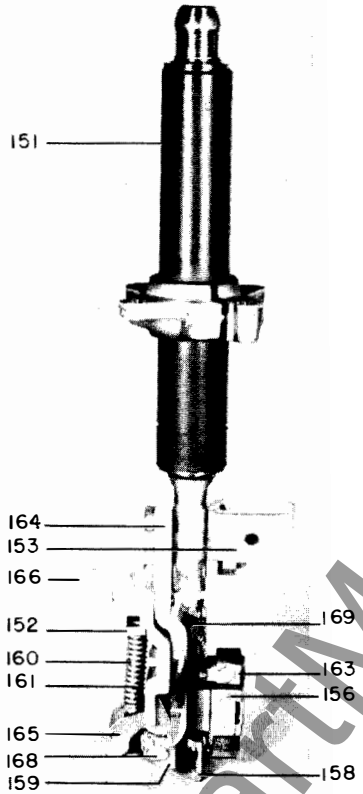


Fig. 31B Side View (for 1200 amp Breaker)

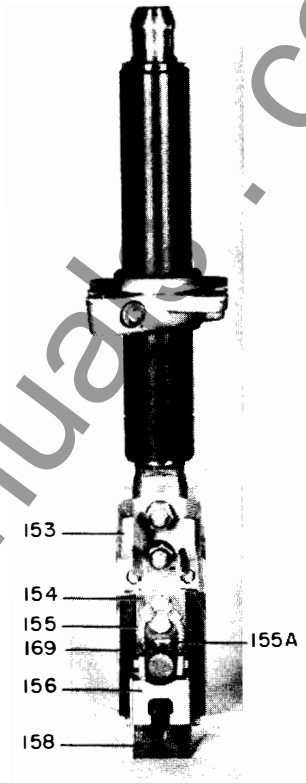


Fig. 31C Rear View (for 1200 amp Breaker)

Fig. 31B (8028321)
Fig. 31A (8028324)

Fig. 31D (8028324)
Fig. 31C (8028325)

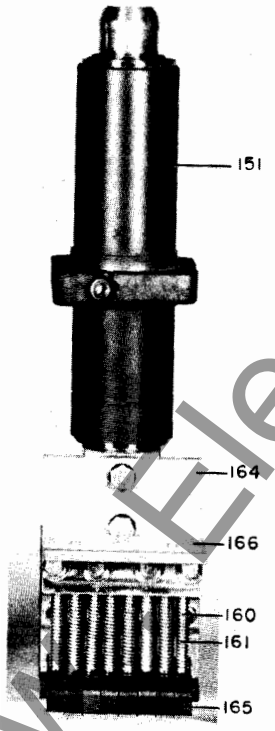


Fig. 31D Front View (for 2000 amp Breaker)

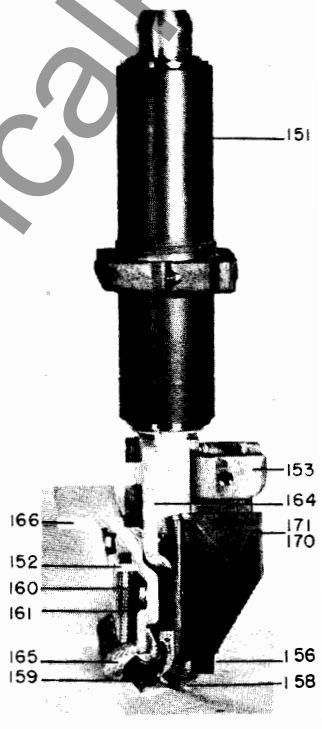


Fig. 31E Side View (for 2000 amp Breaker)

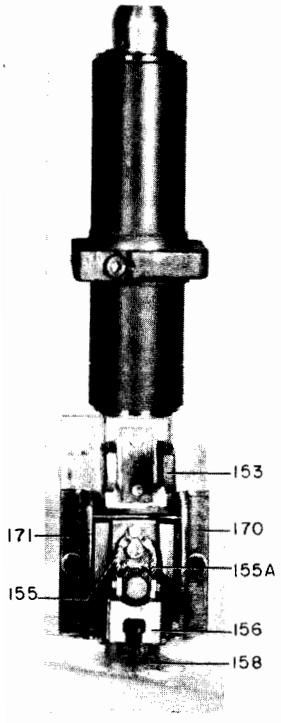


Fig. 31F Rear View (for 2000 amp Breaker)

Fig. 31E (8028321)

Fig. 31F (8028325)

Fig. 31 Rear Bushing Assembly (Ref. No. 150)

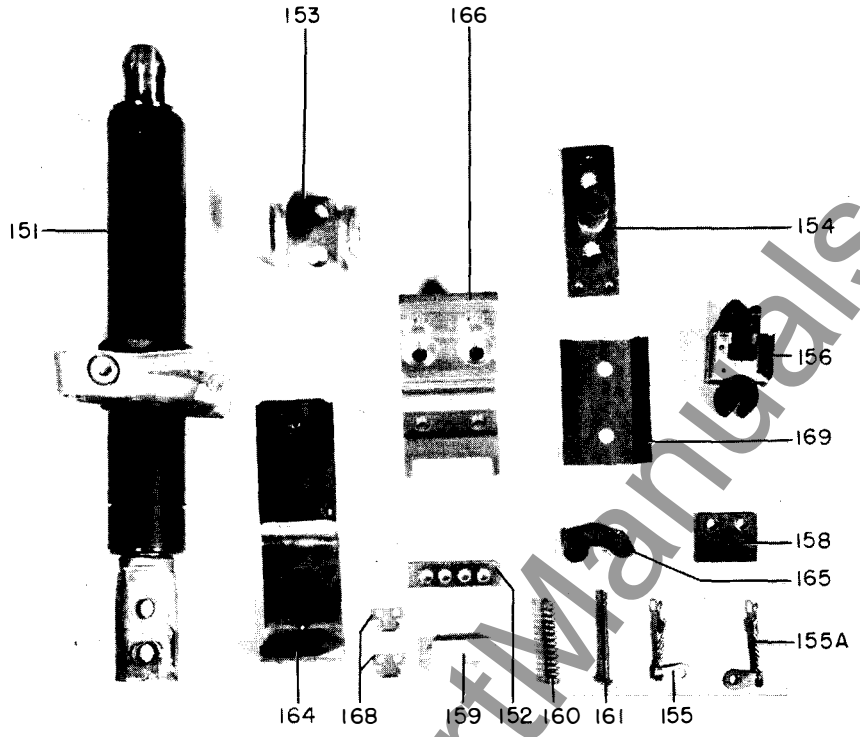


Fig. 31G (8028322)

Fig. 31G Component Parts - 1200 Amp. Rear Bushing

REF.	MVA	AMPS	CATALOG NUMBER -4 & -4S	CATALOG NUMBER -7	NO. REQ'D	DESCRIPTION
150	150A	600	0254D0754 G-016	0236C0790 G-109	3	Rear Bushing Assembly
150	150A	1200	0254D0754 G-013	0236C0790 G-106	3	Rear Bushing Assembly
150	150	1200	0254D0754 G-019	0236C0790 G-106	3	Rear Bushing Assembly
150	250A	1200	0254D0754 G-014	0236C0790 G-107	3	Rear Bushing Assembly
150	250	1200	0254D0754 G-020	0236C0790 G-107	3	Rear Bushing Assembly
150	All	2000	0254D0754 G-015	0236C0790 G-108	3	Rear Bushing Assembly
151	150A	600	0688C0516 G-003	0688C0516 G-005	3	Rear Bushing (Short)
151	150A/250A	1200	0688C0581 G-001	0688C0581 G-003	3	Rear Bushing (Short)
151	150/250	1200	0688C0581 G-003	0688C0581 G-003	3	Rear Bushing (Short)
151	All	2000	0688C0516 G-001	0688C0516 G-008	3	Rear Bushing (Short)
152	All	600/1200	0828C0782 P-004	0962C0778 P-007	3	Spring Retainer Strip
152	All	2000	0828C0782 P-005	0962C0778 P-007	3	Spring Retainer Strip
153	150A/250A	600/1200	0236C0791 P-009	0619C0443 P-017	3	Arc Chute Support
153	150/250	1200	0619C0443 P-017	0619C0443 P-017	3	Arc Chute Support
153	All	2000	0236C0791 P-019	0619C0443 P-008	3	Arc Chute Support
154	All	All	0236C0791 G-003	0236C0791 G-003	3	Arcing Contact Support
155	All	All	0236C0791 G-001	0236C0791 G-001	3	Flexible Connection (Right)
155A	All	All	0236C0791 G-004	0236C0791 G-004	3	Flexible Connection (Left)
156	All	All	0236C0790 G-009	0236C0790 G-009	3	Arcing Contact Assembly
158	All	All	0414A0116 P-004	0414A0116 P-004	3	Insulating Plate
159	All	All	006445087 P-004	006445087 P-004	3	Buffer
160	150/150A	600/1200	0414A0180 P-001		12	Spring
160	150/150A	600/1200		0414A0180 P-001	18	Spring
160	250/250A	1200	0121A5964 P-001		12	Spring
160	250/250A	1200		0121A5964 P-001	18	Spring
160	All	2000		0121A5964 P-001	18	Spring
160	All	2000	006509787 P-001		24	Spring
161	All	600/1200	N312P2542B		12	Spring Guide
161	All	2000	N312P2542B		24	Spring Guide
161	All	All		N312P2542B	18	Spring Guide
163	All	All	0175V0557 P-001	0175V0557 P-001	6	Locking Plate
164	150A/250A	600/1200	0258C0666 P-001		3	Contact Support
164	150/250	1200	0258C0666 P-009		3	Contact Support
164	All	2000	0258C0666 P-003		3	Contact Support
164	All	All		0962C0778 P-011	3	Contact Support
165	All	600/1200	0236C0791 P-008		12	Contact Finger
165	All	2000	0236C0791 P-008		24	Contact Finger
165	All	All		0114C5382 P-002	18	Contact Finger
166	All	600/1200	0828C0782 P-013	0962C0778 P-002	3	Primary Contact Finger Retainer
166	All	2000	0828C0782 P-008	0962C0778 P-002	3	Primary Contact Finger Retainer
167	250/250A	1200	006176109 P-006		12	Spacer
167	250/250A	1200		006176109 P-006	18	Spacer
167	All	2000		006176109 P-006	18	Spacer
168	All	600/1200	006557243 P-001	006176109 P-002	6	Buffer Clamp
168	All	2000	006557243 P-002	006176109 P-002	6	Buffer Clamp
169	All	All	0265C0151 P-025		3	Spring Baffle
170	All	2000	0258C0632 P-008		3	Copper Plate (Left Hand)
171	All	2000	0258C0632 P-009		3	Copper Plate (Right Hand)

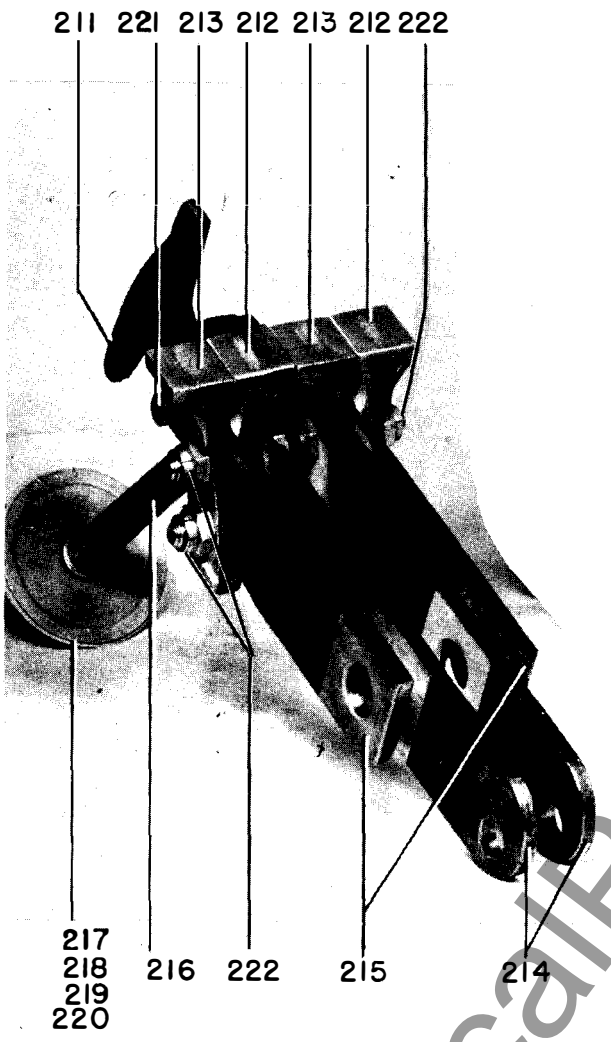


Fig. 32A For 2000 Amp Breakers, All Ratings

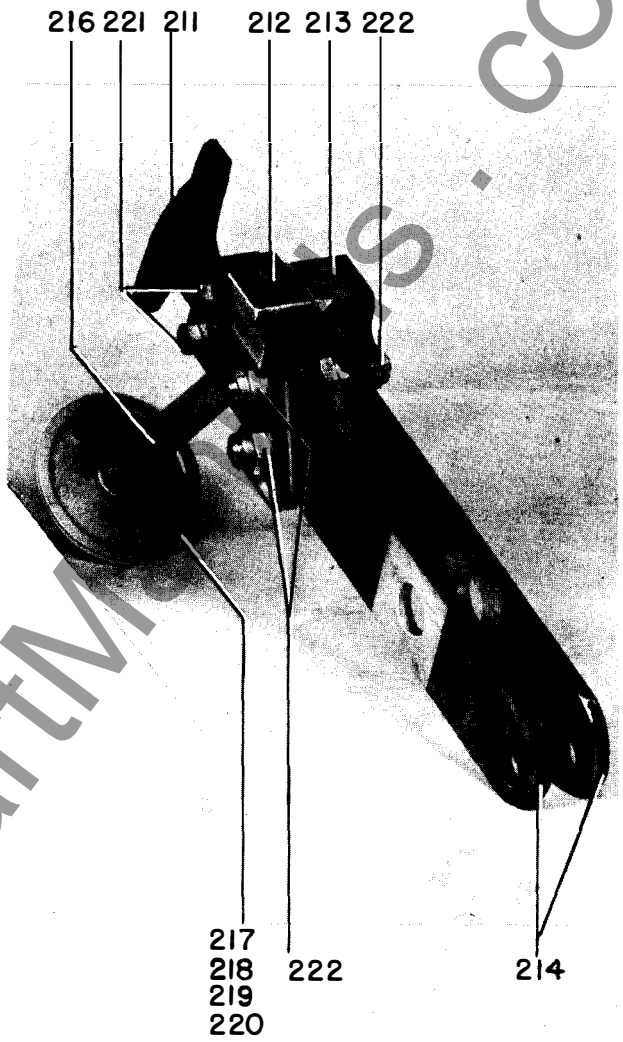


Fig. 32B For 600 and 1200 Amp., All Ratings

Fig. 32 Movable Contact Arm Assembly (Ref. No. 210)

REF.	MVA	AMPS	CATALOG NUMBER -4 & -4S	CATALOG NUMBER -7	NO. REQ'D	DESCRIPTION
210	All	600/1200	0254D0753 G-022	0213X0343 G-041	3	Movable Contact Arm Assembly
210	All	2000	0688C0522 G-002	0213X0343 G-042	3	Movable Contact Arm Assembly
211	All	All	0802B0742 G-001	0802B0742 G-001	3	Movable Arcing Tip
212	All	600/1200	0137A9164 P-003		3	Movable Primary Contact
212	All	2000	0137A9164 P-003		6	Movable Primary Contact
213	All	600/1200	0137A9164 P-004		3	Movable Primary Contact
213	All	2000	0137A9164 P-004		6	Movable Primary Contact
213	All	All		0114C5382 P-004	6	Movable Primary Contact
214	All	All	0258C0666 P-007	0258C0666 P-007	6	Contact Arm
215	All	2000	0258C0666 P-006	0258C0666 P-006	6	Contact Arm
216	All	600/1200	0213X0343 G-043	0213X0343 G-043	3	Tube & Piston Assembly
216	All	2000	0213X0343 G-044	0213X0343 G-044	3	Tube & Piston Assembly
217	All	All	0421A0248 P-001	0421A0248 P-001	3	Piston Ring
218	All	All	0456A0874 P-003	0456A0874 P-003	3	Piston Ring Expander (Corr.)
219	All	600/1200	0456A0874 P-002	0456A0874 P-002	3	Piston Ring Equalizer (Smooth)
219	All	2000	0456A0874 P-002	0456A0874 P-002	6	Piston Ring Equalizer (Smooth)
220	All	All	0258C0619 P-006	0258C0619 P-006	3	Orifice
221	All	All	0414A0146 P-053	0414A0146 P-053	6	Nut
222	All	All	0414A0146 P-054	0414A0146 P-054	12	Nut
223*	All	All	0121A5956 P-001	0121A5956 P-001	12	Spacer

*Not Shown.

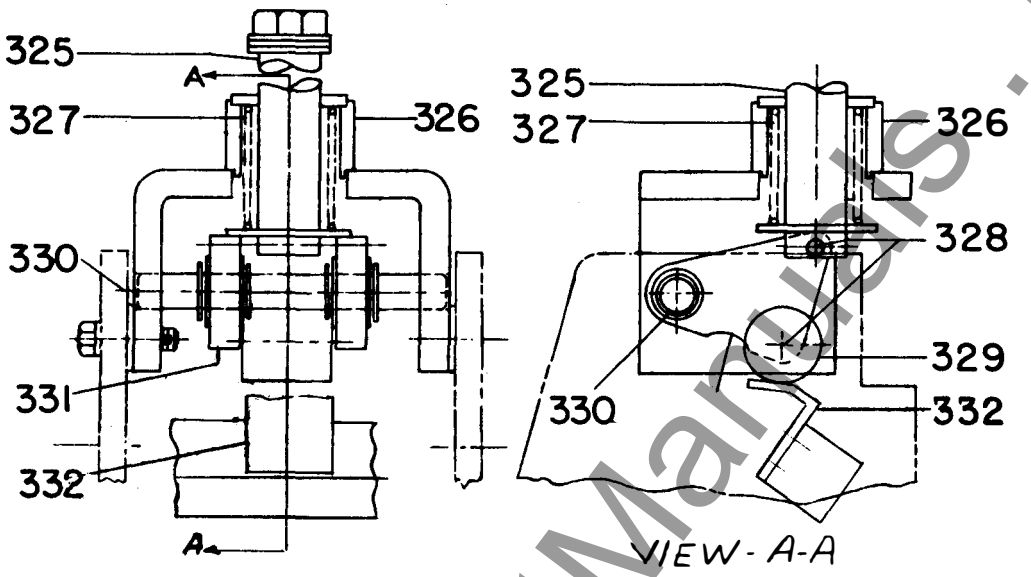


Fig. 33 (137A9177)

Fig. 33 Interlock Plunger

REF.	CATALOG NUMBER	NO. REQ'D	DESCRIPTION
324	0236C0787 G-001	1	Plunger Interlock Complete
325	0236C0787 P-012	1	Plunger For Interlock
326	0236C0787 G-002	1	Bracket For Interlock
327	006509728 P-001	1	Spring For Interlock
328	0137A6085 P-022	2	Pin
329	0236C0787 P-014	1	Roller
330	0236C0787 P-005	1	Pin
331	0236C0787 P-016	2	Crank
332	0958C0697 P-003	1	Crank (-4S & -7S Mech. Only)

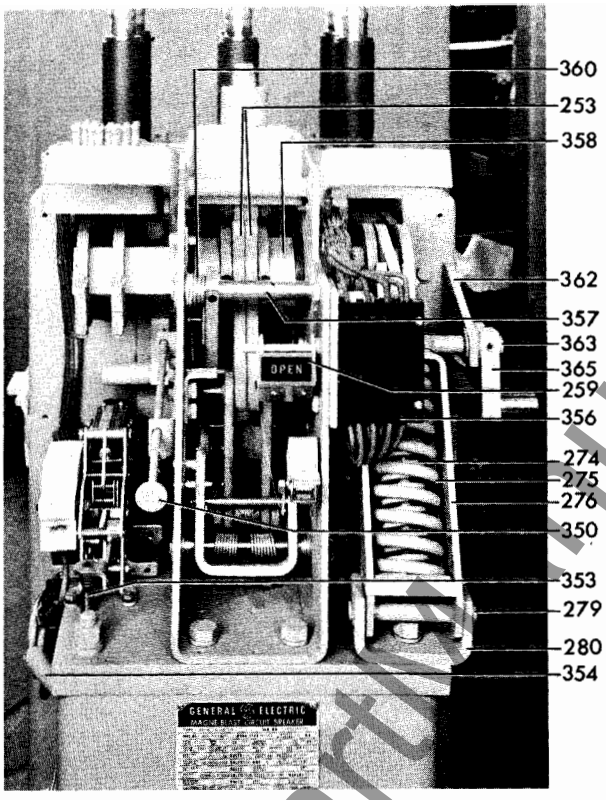


Fig. 34A (8024599)

Fig. 34A MS-13 Mechanism - Front View (-4 Breaker)

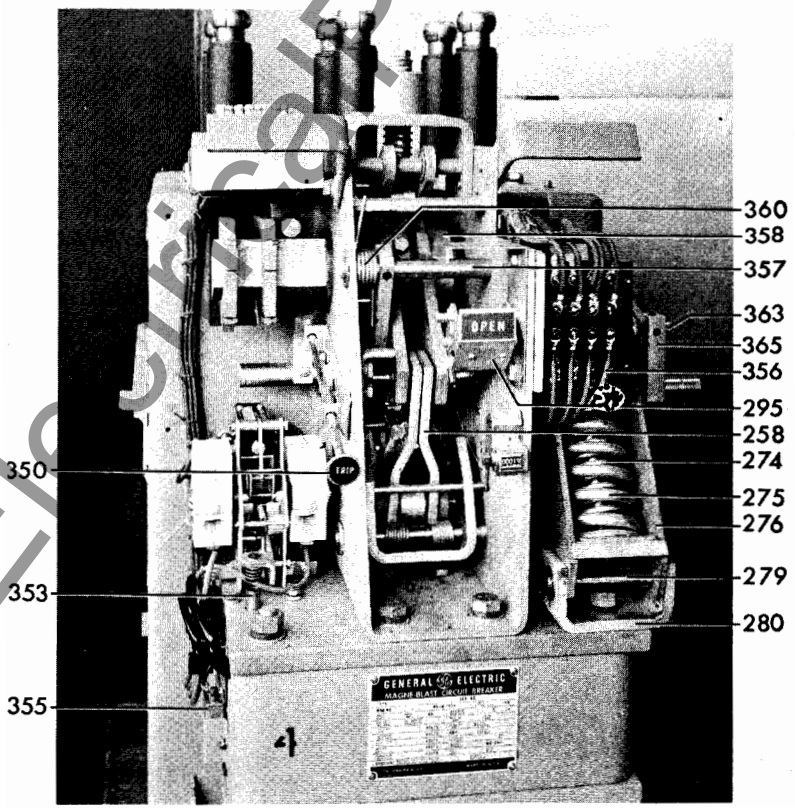


Fig. 34B (8029370)

Fig. 34B MS-13 Mechanism - Front View (-4S Breaker)

Fig. 34C (8025739)

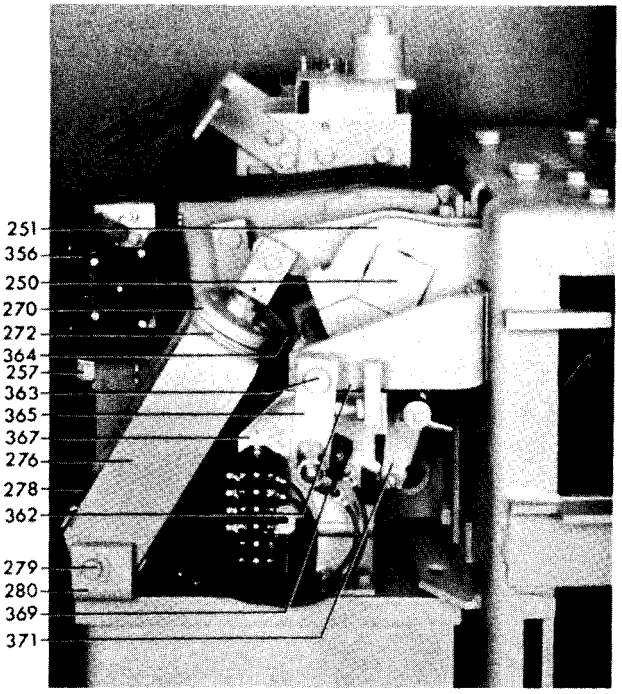


Fig. 34C Right Side View

Fig. 34D (8025740)

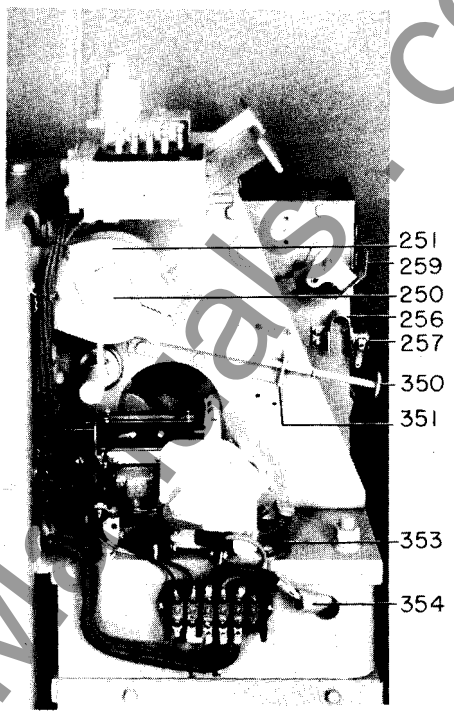


Fig. 34D Left Side View

Fig. 34 MS-13 Mechanism for Type AM-4.16 Breaker

REF.	CATALOG NUMBER	NO. REQ'D	DESCRIPTION
350	0258C0604 G-003	1	Manual Trip Rod
351	0258C0604 P-002	1	Manual Trip Rod Support
*352	0236C0795 P-052	1	Rod for Control Device
353	0174V0394 P-001	1	Tube (-4 Mech. Only)
353	0174V0394 P-003	1	Tube (-4S & -7S Mech. Only)
354	0064459 P-001	1	Insulating Tube
355	0456A0864 P-026	1	Capacitor (-4 & -4S Mech. Only)
355	0456A0804 P-134	1	Capacitor (-7S Mech. Only)
356	0137A9192 G-001	1	Auxiliary Switch
357	0236C0788 G-050	1	Interlock Prop Assembly
358	0456A0870 P-004	2	Spacer
360	0137A9128 P-001	1	Spring
362	0258C0601 G-003	1	Bearing Bracket
363	0236C0788 G-051	1	Roller & Link Assembly
364	0236C0788 P-008	2	Link
365	0236C0788 G-054	1	Roller Assembly
*366	0456A0866 P-002	1	Cut-off switch (150A/250A Only)
367	0161A4286 G-001	1	Bracket (150/250 only)
367	0236C0788 P-034	1	Bracket (150A/250A only)
*368	0456A0866 P-001	1	Latch Checking Switch (When Used)
369	0456A0866 P-001	1	Interlock Switch (150/250 Only)
*370	0064174582 G-001	1	Potential Trip Coil (125 V-dc)
*370	0064174582 G-002	1	Potential Trip Coil (250 V-dc)
*370	0064174582 G-014	1	Potential Trip Coil (230 V-ac)
*370	0064275070 G-001	1	Potential Trip Coil (24 V-dc)
*370	0064275070 G-002	1	Potential Trip Coil (48 V-dc)
371	0215D0470 G-005	1	Potential Trip Linkage

* Not Shown

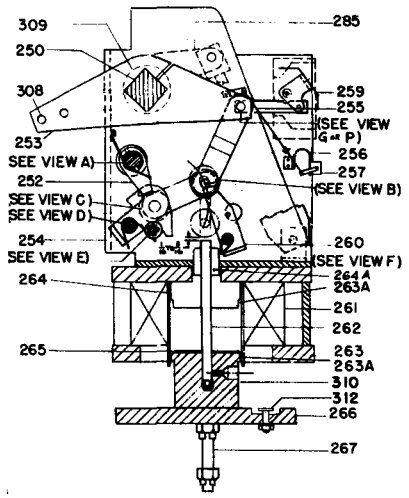


Fig. 35A Cross-section

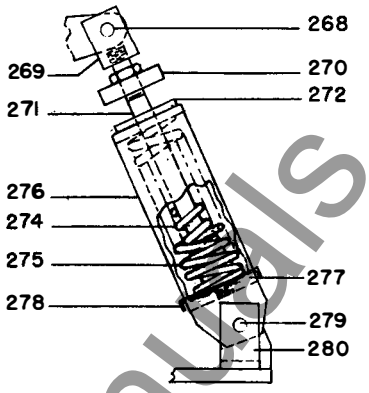
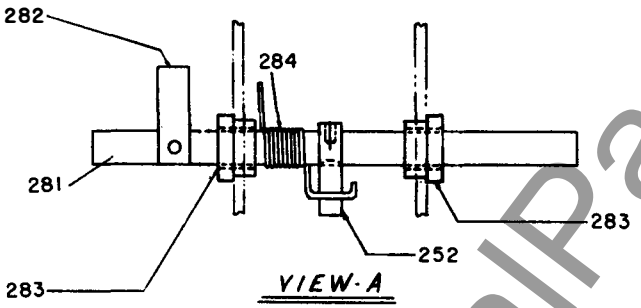
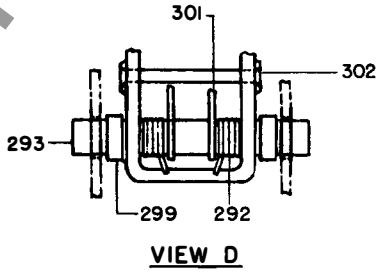
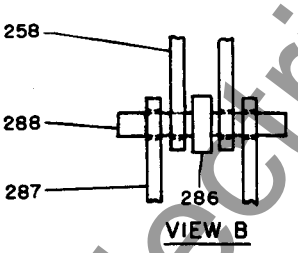
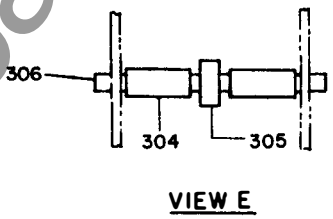


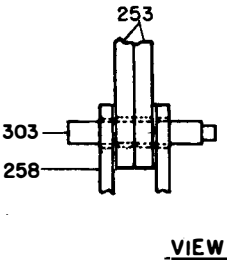
Fig. 35B Complete Spring Assembly (Ref. No. 273)

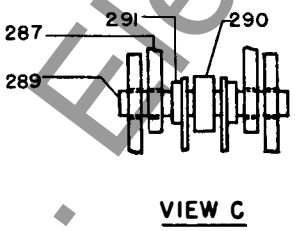


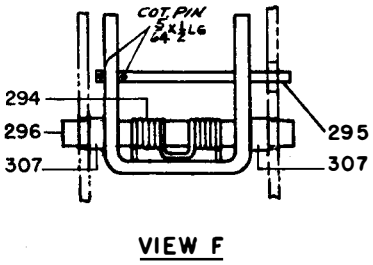












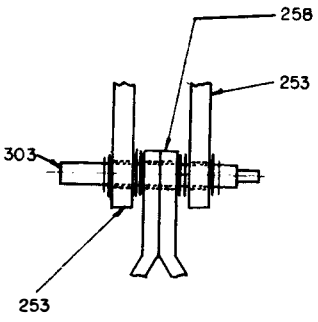


Fig. 35C Detailed Views

Fig. 35 MS-13 Mechanism for AM-4.16-4, -4S, & -7S

REF.	CATALOG NUMBER -4	CATALOG NUMBER -4S & -7S	NO. REQ'D	DESCRIPTION
250	006443518 P-002	006443518 P-002	1	Shaft
251	0836C0190 P-001		6	Crank (Standard)
251	0836C0190 P-002		6	Crank (Interchangeable)
251		0836C0190 P-008	4	Crank (Standard)
251		0826C0190 P-010	4	Crank (Interchangeable)
252	0258C0608 P-007	0258C0608 P-007	1	Latch
253	0215D0470 G-054	0215D0470 G-059	2	Crank
254	0215D0470 G-055	0215D0470 G-055	1	Link
255	006551742 P-001	006551742 P-001	1	Spring
256	0258C0604 P-008	0258C0604 P-008	1	Spring Clip
257	0137A9088 P-001	0137A9088 P-001	1	Veeder Counter
258	0215D0470 G-051	0215D0470 G-057	1	Link
259	0281B0711 G-001	0281B0711 G-001	1	Indicator Assembly
260	0258C0609 P-001	0258C0609 P-001	1	Prop
261	006375521 G-002	0802B0799 G-001	1	Closing Coil (125 V-dc) 250 MVA#
261	006375521 G-006	0802B0799 G-002	1	Closing Coil (125 V-dc) 150 MVA
261	006375521 G-001	0802B0799 G-003	1	Closing Coil (250 V-dc) 250 MVA#
261	006375521 G-005	0802B0799 G-004	1	Closing Coil (250 V-dc) 150 MVA
262	0236C0796 P-006	0236C0796 P-006	1	Plunger
263	006591632 P-001		1	Piston Ring
263A	006591632 P-001		1	Piston Ring (250 MVA)
263A	006591632 P-002		1	Piston Ring (150 MVA)
264	0236C0795 P-004	0962C0700 G-002	1	Pole Piece (250 MVA)
264	0236C0795 P-045	0962C0700 G-001	1	Pole Piece (150 MVA)
264A	0236C0796 P-014		1	Pole Piece Guide (150 MVA)
264A	0236C0796 P-012		1	Pole Piece Guide (250 MVA)
265	0414A0109 P-004	*	1	Buffer
266	0236C0796 G-002	0236C0795 G-002	1	Armature Plate
267	0236C0796 P-008	0236C0796 P-028	2	Stud
268	0137A6086 P-022	0137A6086 P-022	1 Δ	Pin
269	0258C0630 P-007	0258C0630 P-007	1 Δ	Clevis
270	0258C0630 P-031	0258C0630 P-031	1 Δ	Plate
271	0258C0630 P-008	0258C0630 P-008	1 Δ	Rod
272	0414A0109 P-008	0414A0109 P-008	1 Δ	Buffer
273	0258C0630 G-001		1	Complete Spring Asm.
273		0258C0630 G-001	1	Complete Spring Asm. (1200 Amp)
273		0258C0630 G-007	2	Complete Spring Asm. (2000 Amp)
274	0456A0808 P-001		1	Inner Spring
274		0456A0808 P-001	1	Inner Spring (1200 Amp Only)
275	0456A0807 P-001	0456A0807 P-001	1 Δ	Outer Spring
276	0258C0630 P-003	0258C0630 P-003	1 Δ	Spring Retainer
277	0258C0630 P-005	0258C0630 P-005	1 Δ	Retainer Plate
278	0258C0630 P-004		1	Spring Base
278		0258C0630 P-004	1	Spring Base (1200 Amp)
278		0258C0630 G-008	2	Spring Base (2000 Amp)
279	0137A6087 P-020	0137A6087 P-020	1 Δ	Pin
280	0258C0630 P-009	0258C0630 P-009	1 Δ	Bracket
281	0258C0611 P-001	0258C0611 P-001	1	Latch Shaft
282	0258C0611 P-011	0258C0611 P-011	1	Stop Bar
283	0121A7436 G-001	0121A7436 G-001	2	Trip Shaft Bearing
284	0421A0256 P-001	0421A0456 P-001	1	Spring
285	0258C0609 P-004	0258C0609 P-004	1 Δ	Crank
286	0215D0470 G-053	0215D0470 G-056	1	Roller
287	0215D0470 G-052	0215D0470 G-052	2	Link
288	0258C0611 P-003	0258C0611 P-003	1	Prop Pin
289	0414A0110 P-001	0414A0110 P-001	1	Trip Roller Pin
290	0414A0112 P-001	0414A0112 P-001	1	Trip Roller Bearing
291	0215D0470 P-018	0215D0470 P-018	2	Spacer
292	006509799 P-001	006509799 P-001	2	Spring
293	0414A0110 P-003	0414A0110 P-003	1	Pin
294	006477097 P-001	006477097 P-001	1	Prop Spring
295	0258C0609 P-008	0258C0609 P-008	1	Pin
296	0104A2474 P-001	0104A2474 P-001	1	Pin
299	0421A0210 P-001	0421A0210 P-001	2	Spacer
301	0258C0608 P-003	0258C0608 P-003	1	Latch Guide
302	0258C0611 P-005	0258C0611 P-005	1	Pin
303	0258C0609 P-009	0958C0697 P-004	1	Pin
304	0421A0209 P-101	0421A0209 P-101	2	Spacer
305	0258C0609 P-006	0258C0609 P-006	1	Roller
306	0137A6086 P-039	0137A6086 P-039	1	Pin
307	0421A0208 P-143	0421A0208 P-143	2	Spacer
308	0688C0568 P-008		1	Pin For Center Pole
308	0619C0478 P-019		2	Pin For End Poles
308		0619C0478 P-019	3	Pin
309	006442239 P-004	006442239 P-004	2	Bearings
310	0236C0796 P-002	0236C0796 P-026	1	Armature (250 MVA)
310	0236C0796 P-013	0236C0796 P-027	1	Armature (150 MVA)
312		0236C0795 P-075	1	Adjusting Screw

Δ Quantity - Two (2) required for AM 4.16-(MVA)-4S and -7S, 2000 Amp Breakers

Used also on certain 150 MVA Breakers with high current closing coil. Refer to Breaker nameplate.

* Order 0414A0109 P-010 for 2 1/2" O.D. Buffer.
Order 0414A0109 P-012 for 3 3/4" O.D. Buffer.

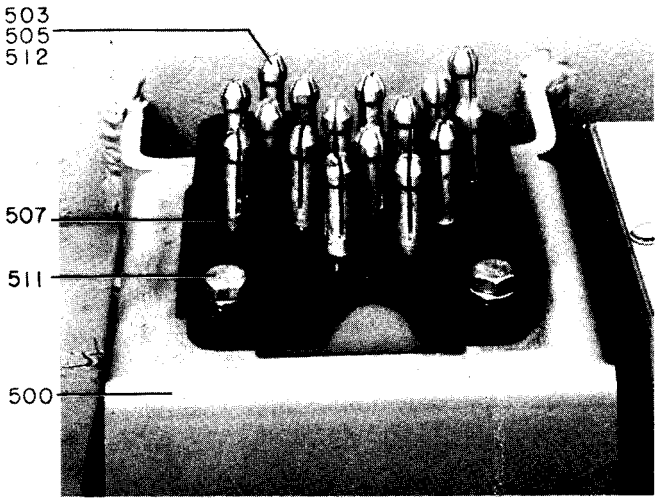


Fig. 36 (8026035)

Fig. 36 Secondary Disconnecting Device (Ref. 500)

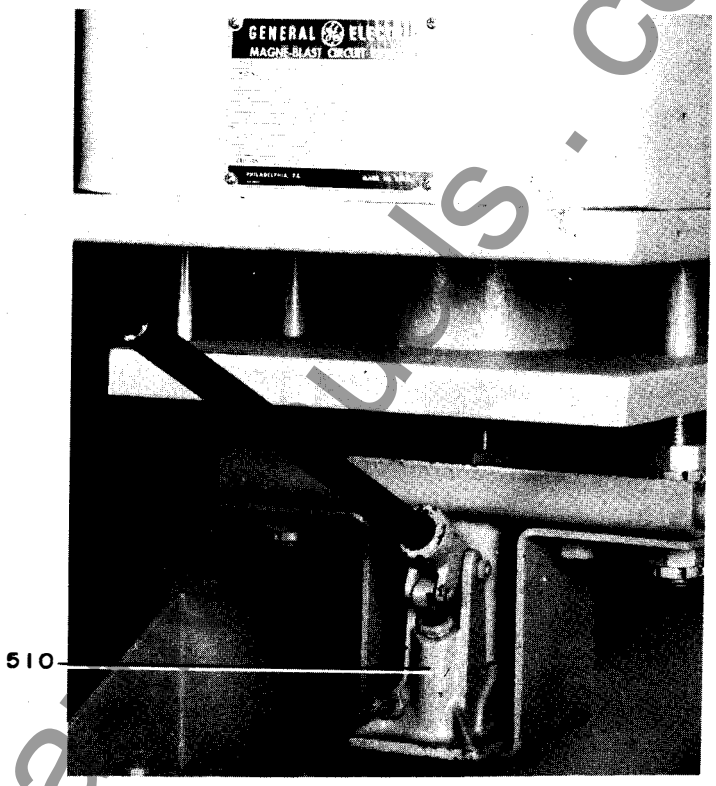


Fig. 37 (8022396)

Fig. 37 Maintenance Closing Device (Ref. 510)

REF.	CATALOG NUMBER	NO. REQUIRED 150/250	NO. REQUIRED 150A/250A	DESCRIPTION
500	0802B0795 G-005	1		Secondary Disconnect Device Complete, 16 Points
500*	0264B0173 G-006		2	Secondary Disconnect Device Complete, 7 Points
503	006319964 P-002	16	14	Contact Plug
505	000848768 P-001	16	14	Lockwasher for Contact Plug
507	006505244 P-001	1		Contact Socket, 16 Point
507*	006048758 P-001		2	Contact Socket, 7 Point
510	0258C0669 G-001	1	1	Maintenance Closing Device
512	0366A0234 P-001	△	△	Contact Nut for #8 Wire
512	0366A0234 P-002	△	△	Contact Nut for #14 Wire
512	0366A0234 P-003	△	△	Contact Nut for #12 Wire

* Not Shown

△ A total of 16 contact nuts is used on the 150 and 250 breakers and a total of 14 contact nuts is used on the 150A and 250A breakers. Order size and quantity of contact nuts to correspond with the size and quantity of wires entering the secondary disconnect device.

Fig. 38 (802016)

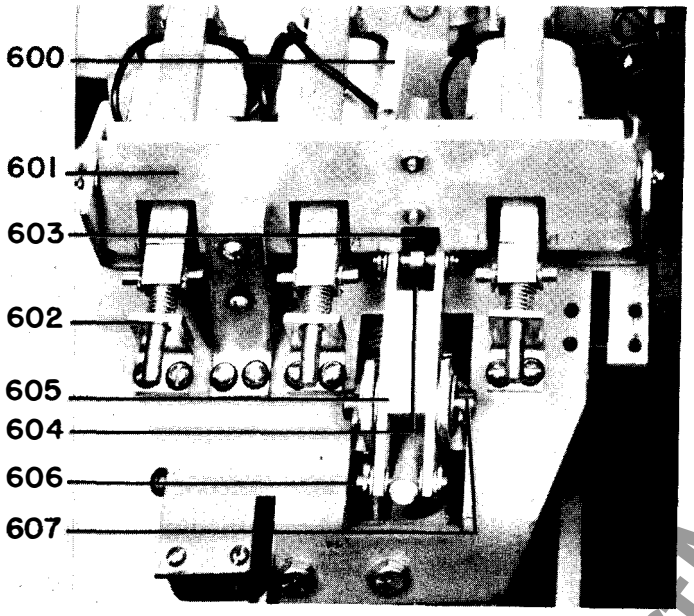


Fig. 38 Partial View of MS-13 Mechanism with Current Trip

Fig. 39 (801605)

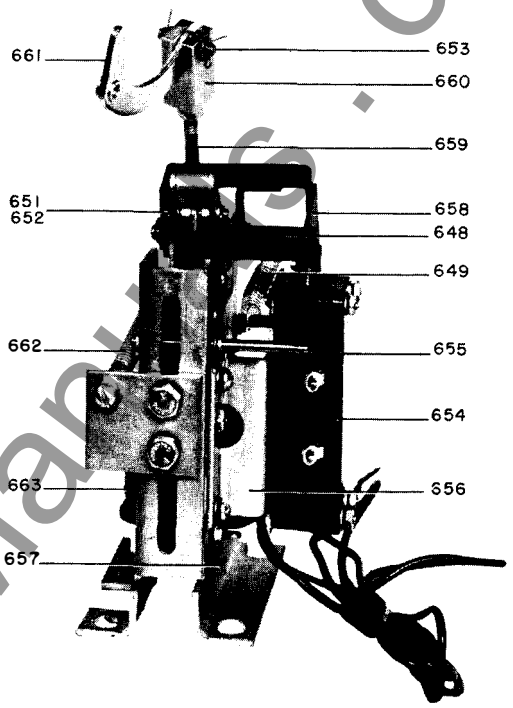


Fig. 39 Undervoltage Device (Ref. 647)

REF.	CATALOG NUMBER	NO. REQ'D	DESCRIPTION
600	006551725 P-001	1	Spring
601	0366A0611 G-001	1	Trip Pan
602	006558748 P-001	1	Bracket
603	006558756 P-001	1	Trip Latch
604	0414A0112 P-040	1	Ball Bearing
605	0366A0600 P-001	1	Trip Arm
606	006076401 P-307	1	Pin
607	006076404 P-313	1	Pin
647	0213X0185 G-001	1	AC Undervoltage Device (Less Coil)
647	0213X0217 G-001	1	DC Undervoltage Device (Less Coil)
648	0175V0574 P-001	1	Stop For d-c Device Only
649	0369A0443 P-001	1	Spring For d-c Device Only
650	006551726 P-001	1	Spring for a-c Device Only
651	0175V0578 P-001	1	Pin for d-c Device Only
652	006076401 P-309	1	Pin for a-c Device Only
653	006076401 P-305	2	Pin
654	0295B0227 G-002	1	Switch
655	0175V0576 P-001	1	Pin
656	0374A0246 P-001	1	Bracket
657	0175V0562 P-001	1	Shim for d-c Device Only
658	0384A0330 G-001	1	Link Arm Asm. For d-c Device Only
659	0137A6059 P-020	1	Stud
660	006558711 P-001	2	Coupling
661	006558723 G-001	1	Trip Arm
662	006509798 P-001	2	Spring
663	006275017 G-019	1	Coil (125V d-c)
663	006275017 G-033	1	Coil (230V a-c)
663	006275017 G-020	1	Coil (250V d-c)
*664	0684C0642 G-001	1	Terminal Board (6 Point)

* Not Shown.

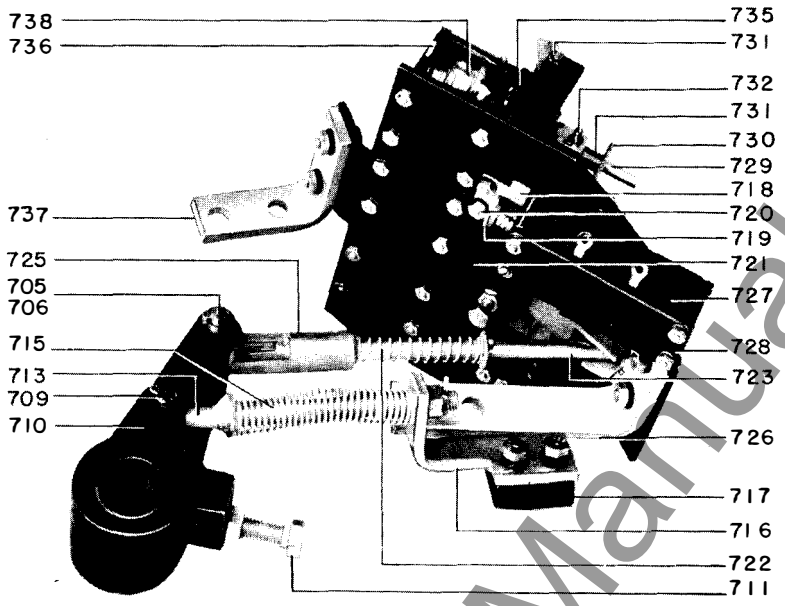


Fig. 40 (8016104)

Fig. 40 Impact Trip Device (Ref. No. 702)

REF.	CATALOG NUMBER	NO. REQ'D	DESCRIPTION
702	0213X0100 G-001	1	Impact Trip Device Complete
703	006591817 P-001	1	Lever
704	006591388 P-019	1	Locking Plate
705	006076403 P-315	1	Pin
706	0137A6064 P-003	1	Roller
709	006076403 P-311	1	Pin
710	006592554 G-001	1	Crank
711	006557106 P-001	1	Adjusting Screw
713	006558791 G-001	1	Eyebolt Assembly
715	0161A5831 P-001	1	Spring
716	006443516 P-001	1	Bracket
717	006557105 P-001	1	Spacer
718	006558746 P-001	1	Bracket
719	006558747 P-001	1	Trip Arm
720	006076401 P-315	1	Pin
721	0137A6048 P-003	2	Spacer
722	006509794 P-001	1	Spring
723	0174V0378 P-001	1	Rod
725	0174V0373 P-001	1	Coupling
726	006443666 P-001	1	Bracket
727	0295B0227 G-003	1	Switch
728	0107B9305 P-001	1	Frame Assembly
729	006558752 G-001	1	Core Assembly
730	006558751 P-001	1	Angle
731	006049320 P-001	3	Felt Washer
732	006557068 P-009	1	Pin
734	006076401 P-385	1	Pin
735	002236575 P-001	2	Guide
736	004905058 G-004	1	Coil Frame
737	006443667 P-001	1	Bracket
738	006174599 G-002	3	Current Trip Coil, 3 Amp a-c
738	006174599 G-006	1	Capacitor Trip Coil, 230V a-c
739	0456A0334 P-001	1	Rubber Guard (not shown)

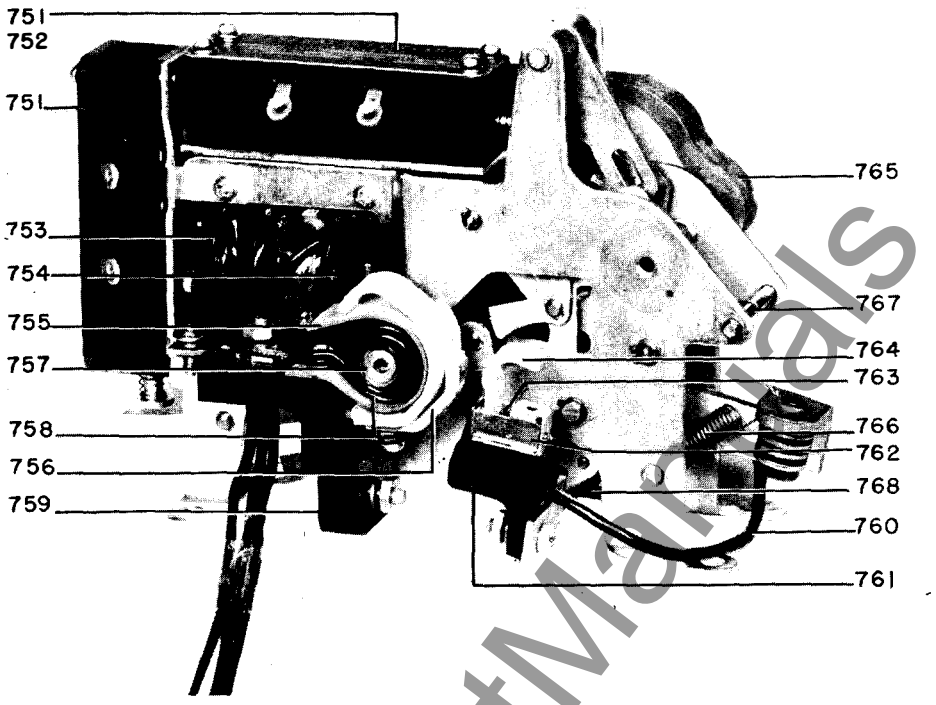


Fig. 41 (8011083)

Fig. 41 Control Device for all Mechanisms (Ref. 750)

PARTS REFERENCED IN FIG. 41 FOR ALL RATINGS **

REF.	CATALOG NUMBER	NO. REQ'D	DESCRIPTION
750	0403A0225 G-001	1	Control Device, 125V d-c
750	006375988 G-006	1	Control Device, 250V d-c
750	0403A0225 G-002	1	Control Device, 230V a-c (Intermittent) Δ
750	0403A0224 G-003	1	Control Device, 230V a-c (Intermittent) #
750	0403A0223 G-001	1	Control Device, 230V a-c (Continuous) Δ
750	0403A0224 G-004	1	Control Device, 230V a-c (Continuous) #
751	0295B0227 G-002	2	Auxiliary Switch, Top & Back (d-c Device)
751	0295B0227 G-002	1	Auxiliary Switch, Back (230V a-c Only)
752	0295B0227 G-001	1	Auxiliary Switch, Top (230V a-c Only)
753	006275017 G-019	1	Coil, 125V d-c
753	006275017 G-020	1	Coil, 250V d-c
753	006275017 G-033	1	Coil, 230V a-c (Continuous)
753	006275017 G-034	1	Coil, 230V a-c (Intermittent)
754	006591455 P-001	*	Support For Contact Tip
755	006442392 P-001	*	Insulation
756	006591411 G-001	*	Support For Stationary Contact
757	006591450 P-001	*	Core
758	006412255 P-001	*	Blowout Coil
759	006412251 P-001	*	Support For Coil
760	006591440 G-001	1	Connector 250V d-c
760	006591440 G-003	1	Connector 125V d-c, 230V a-c (Int. or Cont.) Δ
760	006591440 G-004	1	Connector 230V a-c (Int. or Cont.) #
761	006592161 P-001	*	Support for Movable Contact
762	006592162 P-001	*	Shield
763	006477041 P-001	*	Spring
764	006591412 G-001	*	Movable Contact
765	006591404 G-001	*	Arc Chute Assembly
766	006272844 P-001	1	Spring
767	0365A0458 P-001	1	Spring (a-c Int. & d-c)
767	006370699 P-001	1	Spring (a-c Cont.)
768	006477063 P-001	1	Spring
769	0456A0812 G-001	1	Hardware For Mounting Control Device

Δ This control device has a single arc chute.
\# This control device has double arc chutes.
* Quan. is (1) for control device with a single arc chute.
Quan. is (2) for control device with double arc chutes.
** Always specify complete information from nameplate of control device when ordering replacement parts.

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