

General

The McGraw-Edison PSD circuit breaker, Fig 1, is a magnetic-air, three-pole, electrically operated, horizontal-draw-out breaker with hydraulically charged, compressed-spring-stored-energy operating mechanism. The breaker is mechanically and electrically trip-free at any point in the operating stroke.

The PSD circuit breaker conforms to all applicable national standards and is manufactured to meet the standard class ratings shown in Table 1.

Table 1

Nominal Rating		Continuous Current at 60 Cycles
kv	mva	amp
5	150	1200
5	250	1200
5	250	2000
15	250	1200
15	500	1200
15	500	2000

Shipping

The McGraw-Edison PSD circuit breaker is shipped disassembled:

- 1-circuit breaker with operating mechanism installed;

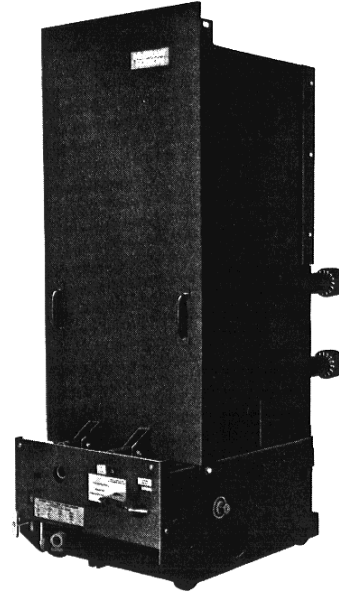


Fig 1--Typical PSD circuit breaker

- 2-arc chutes and dessicant;
- 3-interphase barrier assembly;
- 4-grounded steel front barrier.

Initial Inspection

Immediately upon receipt of the shipment--preferably before unloading--inspect crates and associated packages for damage. Should there be damage, evidence of rough handling in transit, and/or shortage, notify--and file a claim with--the carrier at once. Also notify McGraw-Edison Power Systems Division, Canonsburg, Pa 15317.

These instructions do not claim to cover all details or variations in the equipment, procedure, or process described, nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your McGraw-Edison Power Systems Division sales engineer.

Storage

If the PSD circuit breaker is not to be placed in service immediately upon its receipt, all parts--the circuit breaker, the arc chutes, the inter-phase barrier assembly, and the grounded steel front barrier--must be stored in a clean, dry place at moderate temperature. Particular care must be taken to prevent foreign material from entering the arc chutes. It is recommended that the arc chutes be kept in their unopened shipping crate until time to install them on the circuit breaker.

Uncrating

Follow the instructions stenciled on each crate for correct opening procedure.

Keep the arc chutes in their unopened crate in a dry place until time to install them on the circuit breaker.

Uncrate the Circuit Breaker

The PSD circuit breaker is protected by a plastic cover and banded to a skid that forms the base of the shipping crate. The top and four sides of the crate form the crate cover that is nailed to the base. To uncrate the breaker:

- 1-Remove all the nails securing the crate cover to the skid (base of the shipping crate).
- 2-Lift off the crate cover, but leave the breaker banded to the skid.
 - A-For 5-kv--1200-amp breakers, it is recommended that an overhead lifting device equipped with slings be used. Place a sling on the inside of the front wheels and a sling on the inside of the back wheels of the breaker to distribute the weight evenly.
 - B-For 5-kv--2000-amp breakers, it is recommended that a hoist--or similar overhead lifting device equipped with a spreader bar that will protect the current-carrying studs--be attached to the lifting holes in the sides of the breaker.

Uncrate the Arc Chutes

To uncrate the arc chutes:

- 1-Turn the unopened crate over gently so that the skid--bottom of the crate--is on top.
- 2-Remove the skid portion of the crate, exposing the three arc chutes in their normal, upright position.
- 3-Remove the dessicant from inside the arc chutes.

Note: Arc chutes must be lifted from the crate one at a time and placed in position on the breaker immediately.

Install the Arc Chutes--5-kv Breakers

Note: Install the middle arc chute first.

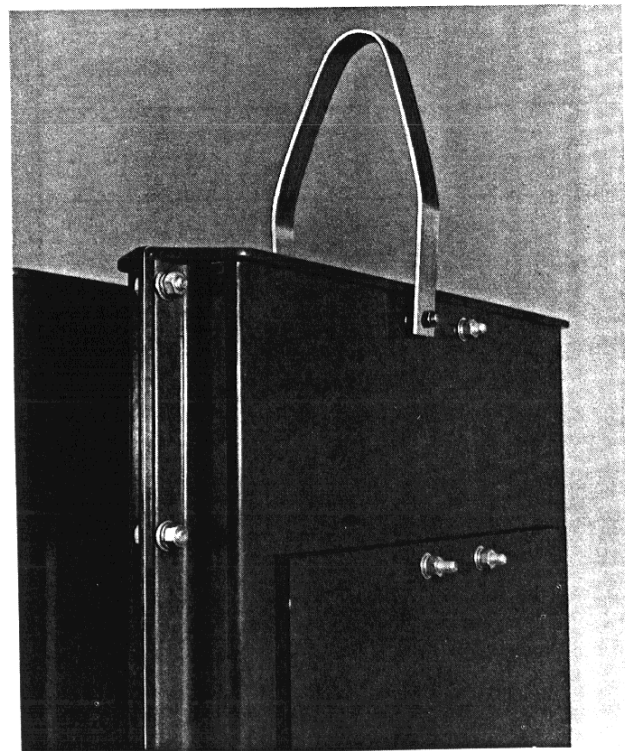


Fig 2--Lifting yoke attached to 5-kv arc chute

1-Slip the lifting yoke over the extended bolts at the top center of each side of the arc chute. (Fig 2)

2-Secure the lifting yoke to the bolts with nuts.

3-With a small hoist--or similar overhead lifting device--lift the arc chute from the crate.

Note: In place of a hoist, 5-kv arc chutes can be easily lifted and installed by two men.

4-Remove the 2 bolts and the 2 insulating inserts at the lower back of the chute.

5-Remove 1 bolt at the lower front of the chute.

6-Line up the arc chute with the breaker.

7-Place the arc chute in position on the breaker.

8-Secure the arc chute to the breaker by inserting the 2 insulating inserts and the 2 bolts at the lower back of the chute where it is seated on the breaker. Tighten the bolts.

9-Remove the lifting yoke from the chute.

10-Following the instructions for installing the middle arc chute, install the other two arc chutes.

11-Tilt back each chute--one at a time.

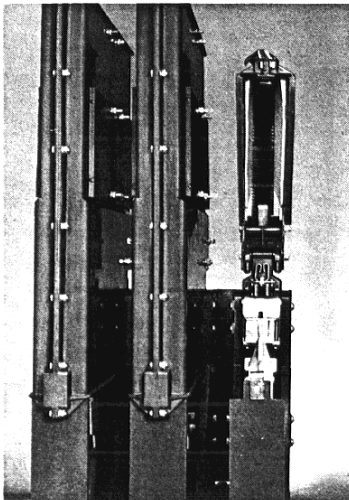


Fig 3--
5-kv arc
chute tilted
back for
inspection

12-Inspect each chute for damage and/or foreign material.

A-If foreign material is present, blow out the chute with dry, filtered, low-pressure compressed air.

13-After a chute has been inspected, tilt the chute forward into position on the breaker.

A-Insert the bolt at the lower front of the breaker where it is seated on the breaker. Tighten the bolt.

14-After all three chutes have been inspected and bolted into position, use the maintenance-positioning lever (Fig 4) to slowly operate the breaker contacts.

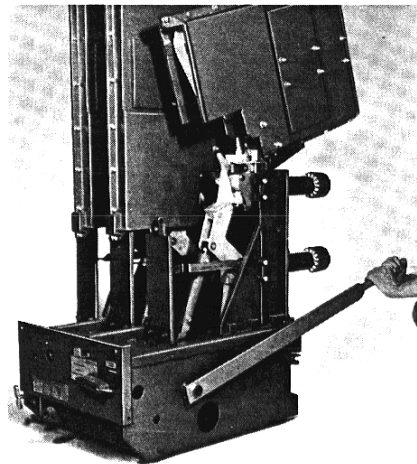


Fig 4--
Contacts
closed
using the
maintenance-
positioning
lever

Safety Precaution

The PSD circuit breaker must be de-energized and the closing spring discharged before inserting the maintenance-positioning lever in the breaker and while using it to operate the breaker contacts. Because use of this lever involves compressing the opening spring by pulling on the lever, there is nothing to prevent the lever from returning to its original position should the operator inadvertently let it slip from his grasp. Return in such a case would be at high speed. Extreme care, therefore, must be taken to be sure that personnel are not in a position to be hit by the lever should it slip from the operator's grasp.

A-If the contacts touch the arc chute runner, move the runner until the contacts move freely.

15-Following the procedure outlined for lifting, installing, and inspecting the middle arc chute, lift, install, and inspect the remaining two chutes.

Uncrate the Interphase Barrier Assembly

In uncrating the interphase barrier assembly (Fig 5), exercise care in removing the assembly from the crate.

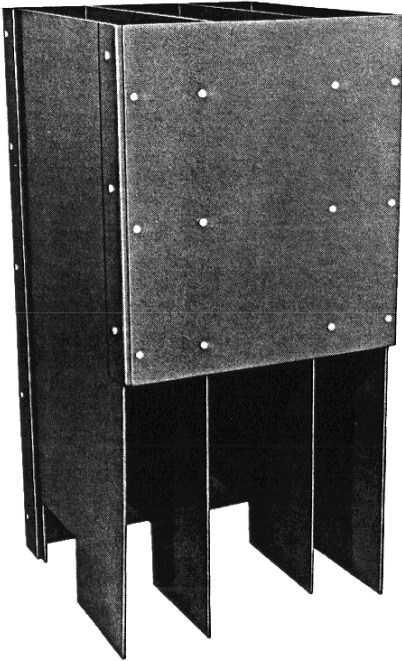


Fig 5--5-kv interphase barrier assembly

Install the Interphase Barrier Assembly

Both the 5-kv and the 15-kv interphase barrier assemblies are completely assembled and ready for installation as shipped.

Safety Precaution

The interphase barrier assembly protects operating personnel from contact with the live parts of the circuit breaker. It must be installed before placing the breaker in service.

1-Place the interphase barrier assembly on the breaker.

Uncrate the Grounded Steel Front Barrier

In uncrating the grounded steel front barrier, exercise care in removing the barrier from the crate.

Install the Grounded Steel Front Barrier

1-Place the steel front barrier on the breaker.

2-Bolt the barrier in position at the sides and front as shown in Fig 6.

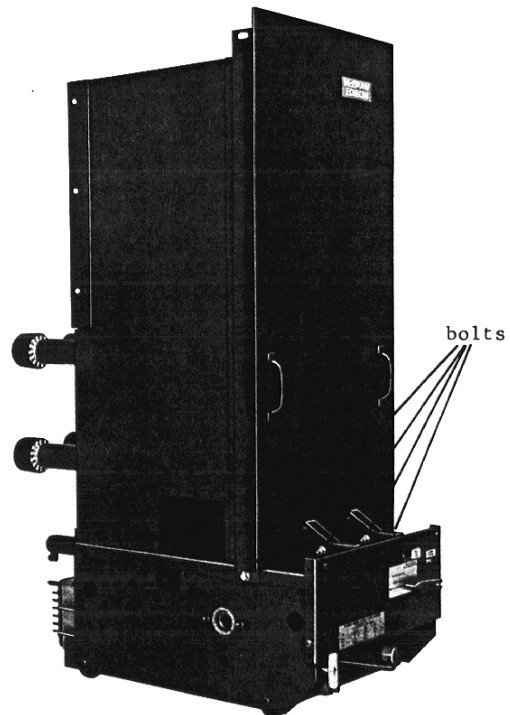


Fig 6--Grounded steel front barrier bolted in position on the breaker

Control Facilities

In addition to the major components, the standard McGraw-Edison Type PSD circuit breaker has the following auxiliary devices:

1-Secondary contact block

The male section of an 18-point bayonet-type separable contact (Fig 7) is mounted on a movable carriage that is locked in the retracted position and moves with the breaker.

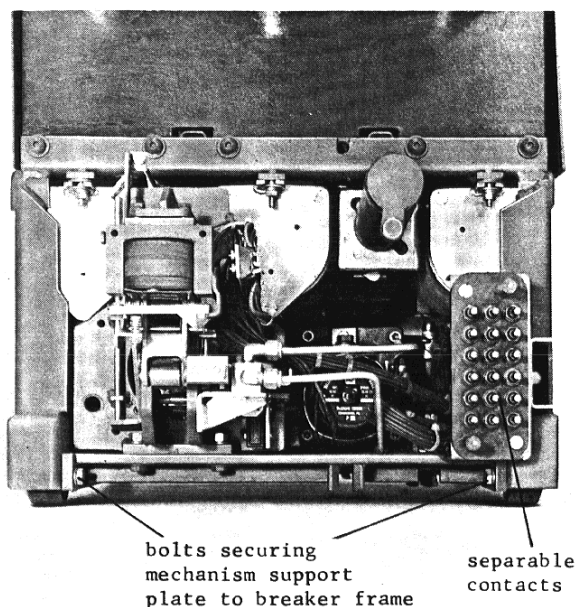


Fig 7--Male section of 18-point bayonet-type separable contact

When the breaker is in the breaker compartment of the metalclad switchgear assembly, the movable carriage on which the male secondary block is mounted may be unlatched and extended to complete the connection with the female portion of the secondary block which is located in the breaker compartment. (Fig 8)

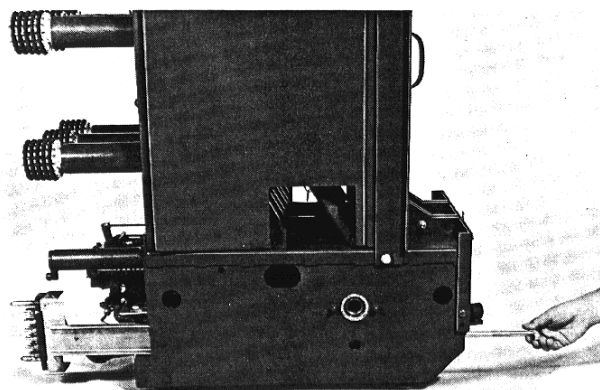


Fig 8--Movable carriage showing extension of male portion of secondary block

2-Auxiliary switch

A 10-stage auxiliary switch has each stage actuated by a rotating cam positioned on a common shaft. Four stages are normally used for the circuit breaker electrical control. This leaves six stages for supervisory schemes and similar controls.

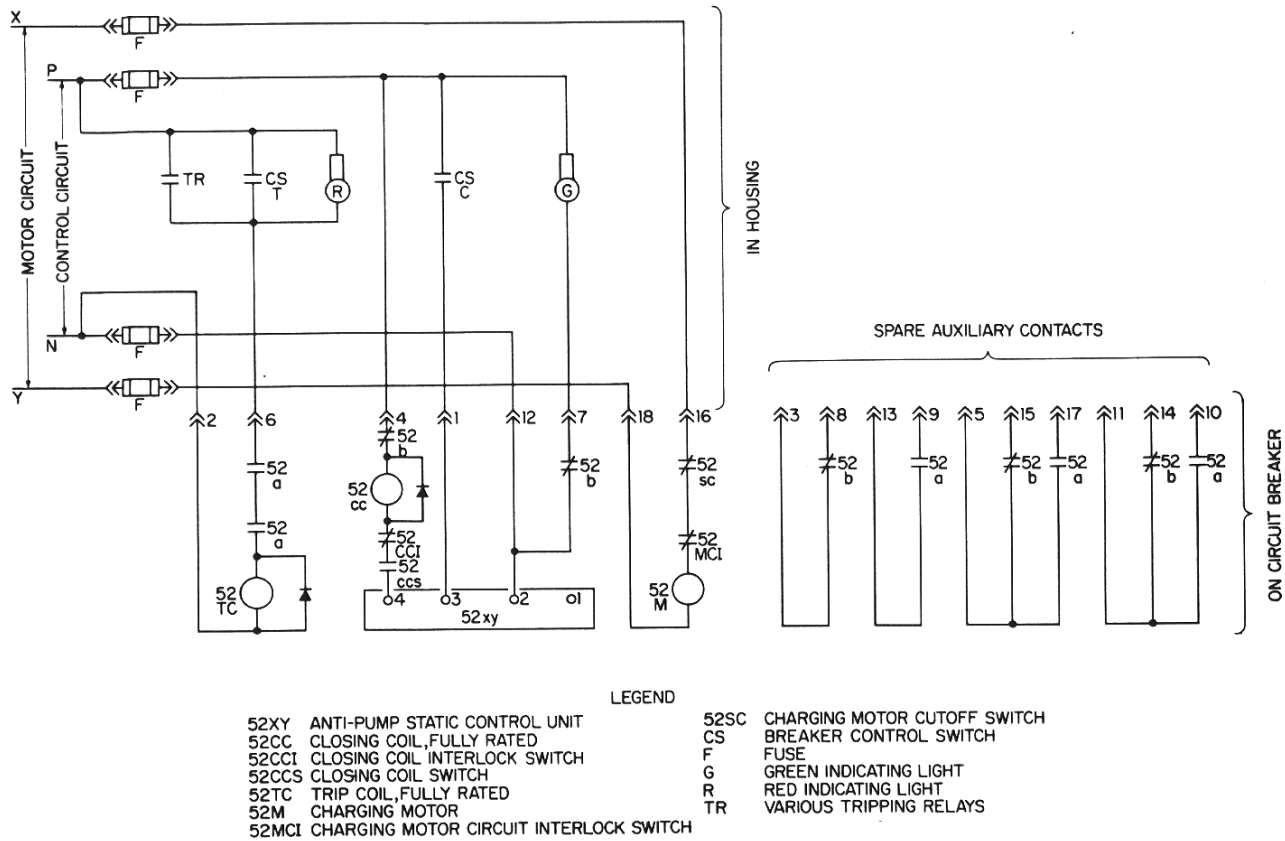


Fig 9--Schematic diagram, typical Type PSD breaker d-c electrical control system

Type PSD Operating Mechanism

The Type PSD operating mechanism, Fig 10, is filled with hydraulic fluid, adjusted, tested, and installed in the circuit breaker at the factory. No field adjustments are required.

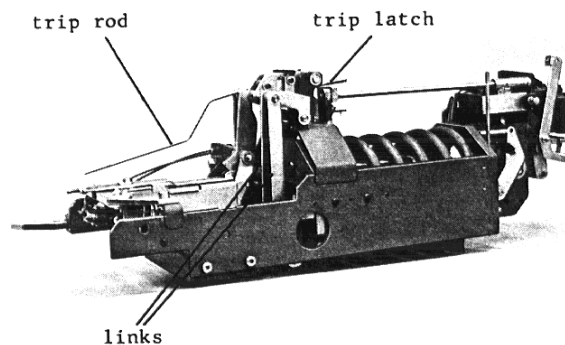


Fig 10--Type PSD operating mechanism

How the PSD Operating Mechanism Works

(Part numbers refer to Fig 11, page 8)

Motor-driven hydraulic pump 7 forces hydraulic fluid into charging cylinder 9 which, in turn, compresses closing spring 21.

The charging action continues until closing latch 3 catches closing pin 8 and roller lever 2 is reset; at which time, the supply voltage to motor 6 is interrupted and the charging sequence is halted.

Simultaneously, pressure-release valve 4 is opened to sump 7, releasing the hydraulic pressure in charging cylinder 9 and permitting the closing pin to load the closing latch.

When the circuit breaker is in the open position and the closing spring is discharged, linkage 11 is in the collapsed position. Hold-on catch 12 is held down by the linkage and, as charging cylinder 9 moves back, it is followed by drive block 10. This drive block movement resets the linkage and sets trip lever 18 on trip latch 20.

After pressure-release valve 4 is opened and the pressure is reduced in charging cylinder 9 and dump valve 13, a bias spring in the dump valve opens the dump valve to sump 7 so that the charging hydraulic fluid is now at sump pressure. When the dump valve opens, a check switch to closing coil 1 is made, permitting the closing coil to be energized. The breaker is now in condition to operate.

To close the breaker:

1-Using proper dc supply, energize closing coil 1.

2-Roller lever 2 is mechanically moved from under closing latch 3 and the closing latch is driven free of closing pin 8 by the force of closing spring 21.

3-Charging cylinder 9 moves forward, forcing drive block 10 along with it.

4-The interconnecting linkages rotate drive shaft 15, moving the main contacts into the closed position.

5-The puffer pistons are reset and a fresh charge of air is taken into the puffers.

6-The hydraulic fluid is returned to sump 7.

7-Opening spring 14 is compressed.

8-Cam 16 mechanically closes dump valve 13.

9-Motor-control switch 5 is made up, energizing motor 6 so that closing spring 21 is immediately returned to the charged position.

10-Pressure-release valve 4 is closed so that there is positive pressure in charging cylinder 9.

11-Charging cylinder 9 moves back.

12-Drive block 10 is held in the set position by hold-on catch 12.

13-Linkage 11 is set.

To trip or open the breaker:

1-Using proper dc supply, energize trip coil 19 which, in turn, mechanically moves trip roller 17, allowing linkage 11 to collapse.

2-As linkage 11 collapses, hold-on catch 12 is knocked loose and drive block 10 moves back against charging cylinder 9 and linkage 11 resets.

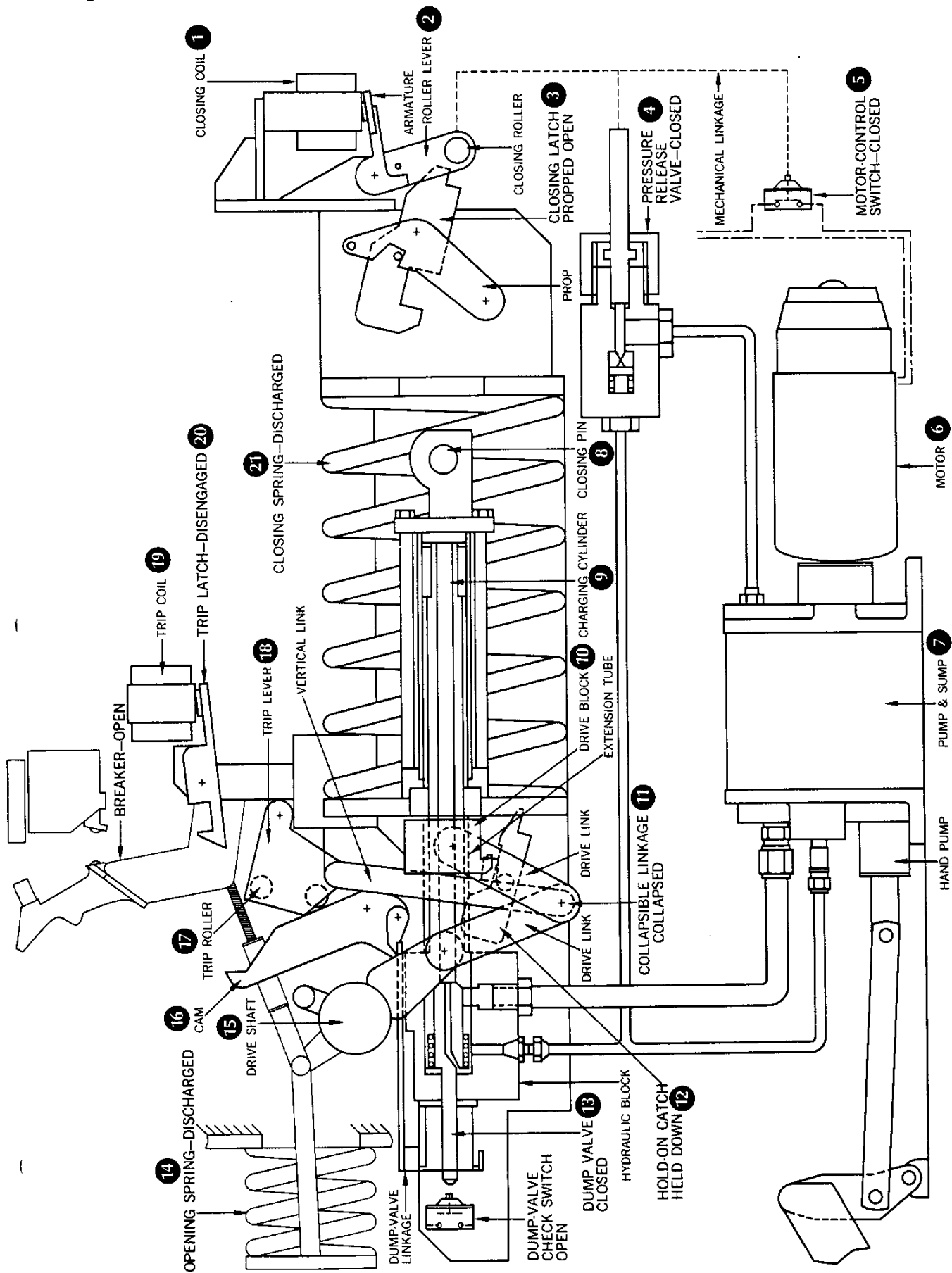


Fig 11--Type PSD operating mechanism: breaker open; closing spring discharged

Install the Breaker in the Breaker Compartment

After the Type PSD circuit breaker has been completely assembled--with arc chutes, interphase barrier assembly, and steel front barrier in place--it is ready to be installed in the metalclad switchgear breaker compartment.

Safety Precaution

Never connect the PSD circuit breaker to a high-voltage circuit if the arc chutes and the interphase barrier assembly are not in place.

Maintenance

The frequency of circuit breaker maintenance depends upon the degree of exposure to contaminating atmospheres and the severity of operating duty.

It is good practice to inspect the breaker after a severe fault interruption near its maximum rating.

Safety Precaution

De-energize the PSD circuit breaker before performing any inspection or maintenance work.

Keep clear of all moving parts of the circuit breaker unless the closing spring is discharged and the main contacts are open. Unlike a solenoid device, a stored-energy circuit breaker may be operated at full speed even though the breaker is not connected to a control circuit.

Circuit Breaker

Inspection and maintenance of the PSD circuit breaker are convenient because of the ease with which the breaker can be removed from its compartment, the steel front barrier and the interphase barrier assembly removed, and the arc chutes tilted back.

1-Remove breaker from compartment.

2-Remove steel front barrier.

3-Remove interphase barrier assembly.

4-Inspect primary disconnect contacts.

A-Make sure they are clean, show no evidence of erosion, and are free to self-align.

B-If the contacts are eroded, replace them.

5-Tilt back the arc chutes.

6-Inspect the main contacts.

A-Make sure they are clean and show no evidence of erosion.

B-If contacts are eroded, replace them.

7-Inspect the arcing contact surfaces.

A-Dress the arcing contact surfaces only in case of extreme burning.

8-Inspect the arc chutes.

A-Wipe the interiors of insulating sheets with a cloth moistened in a cleaning solution (preferred: heptane, Stoddard's solvent, cleaner's naphtha) obtainable from most oil companies.

B-Wipe the interiors of ceramic plates with a lint-free cloth. If necessary, sand lightly.

C-Check for--and replace--damaged ceramic parts.

9-Inspect bushings and other insulating parts.

A-Wipe ceramic parts with a lint-free cloth. If necessary, sand lightly.

B-Check for--and replace--damaged ceramic parts.

C-Wipe non-ceramic parts with a cloth moistened in a cleaning solution (preferred: heptane, Stoddard's solvent, cleaner's naphtha) obtainable from most oil companies.

Safety Precaution

Since the preferred cleaning solutions are flammable, avoid sparks and flames and be sure there is good ventilation in the areas where they are used.

10-Inspect the contact surfaces of the secondary block.

A-Make sure they are clean and show no evidence of erosion.

B-If the contact surfaces are eroded, replace the contacts.

11-With the arc chutes removed, inspect auxiliary switches for proper operation and erosion on contacts.

A-If the contacts are eroded, replace the stage.

Note: Frequently, it is more practicable to replace the entire 10 stages rather than just one stage.

12-Inspect latching and linkage for wear.

A-Replace any latching or linkage that shows evidence of wear.

Operating Mechanism

The operating mechanism must be removed from the circuit breaker for inspection and maintenance.

Safety Precaution

The primary contacts of the PSD circuit breaker must be open and the closing spring discharged before removing the operating mechanism from the breaker.

At the back of the breaker:

1-Remove the terminal strip and the leads from the bottom of the terminal strip. (Fig 12)

2-Swing the wiring harness away from the operating mechanism. (If necessary, remove one or two tie wraps.)

3-Remove the two 10-32 nuts securing the rod to the closing lever at the closing coil. (Fig 12)

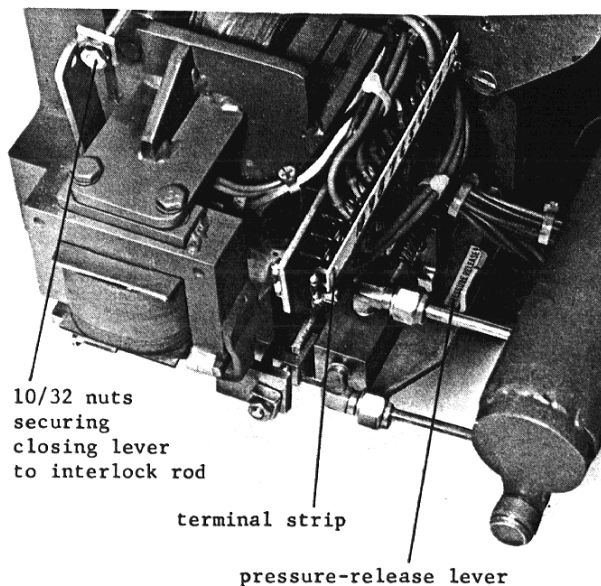


Fig 12--Closing lever; terminal strip

At the front of the breaker:

- 4-Remove the screw holding the positioning handle onto its shaft. (Fig 13)
- 5-Remove the handle by pulling it straight out and off both the shaft and the locating roll pin.
- 6-Remove the two 1/4-20UNC bolts on the front of the control panel and the two 1/4-20UNC bolts at the bottom sides of the control panel.
- 7-Remove the front control panel. Be careful not to pull off the charged indicator flag.
- 8-Stroke the hand pump 3 or 4 times to compress the closing spring approximately 2 in.
- 9-Remove the two bolts securing the hand pump extension and remove the hand pump extension.
- 10-Remove the three arc chutes.

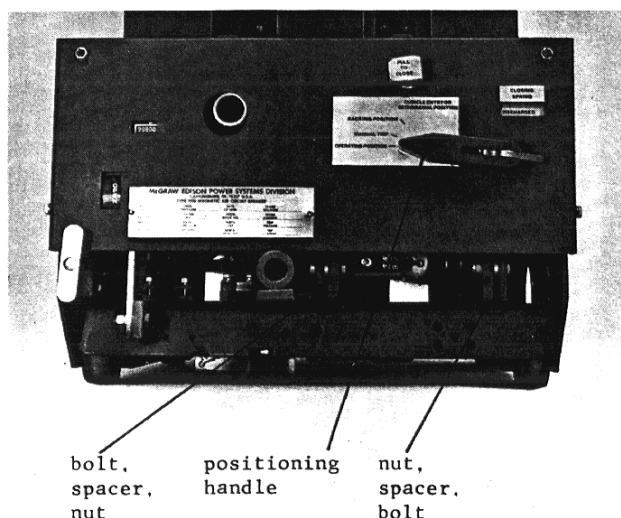


Fig 13--Front control panel

- 11-Place the breaker on its side with the secondary block uppermost.

A-Brace the contact support plate with a block. (Fig 14)

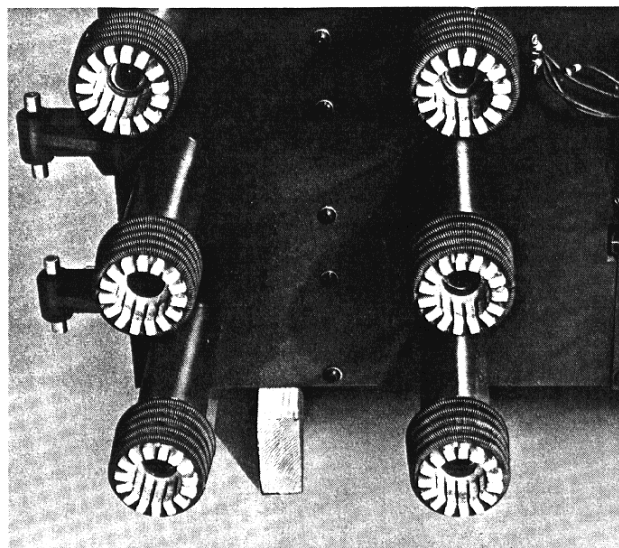


Fig 14--5-kv--1200-amp PSD circuit breaker on its side with blocking in place under contact support plate

- 12-Make sure the drive block is not being held by the hold-on catch.
- 13-Free the interlock trip rod by removing the two 10-32 nuts securing the trip rod to the interlock assembly.
- 14-Remove the two pins, each of which captures 5 links. (Fig 16)
- 15-Remove the spacers from between the links, noting the number of spacers between the various links so they can be replaced properly later.
- 16-Remove the two bolts securing the operating mechanism to the breaker frame at the front. (Fig 13)
- 17-Remove the two spacers aligning the operating mechanism and the breaker frame at the front, marking the spacer locations carefully so they can be replaced properly later.

- 18-Supporting the operating mechanism, remove the two bolts on each side of the support plate at the back of the operating mechanism. (Fig 15)

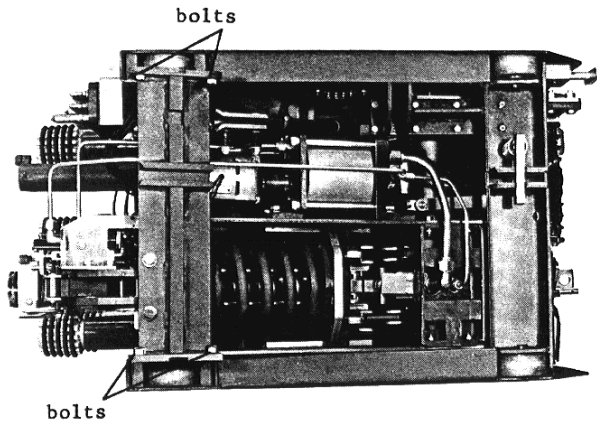


Fig 15--5-kv--1200-amp PSD circuit breaker on its side showing operating mechanism

- 19-Continuing to support the operating mechanism, gently swing the back portion down away from the breaker about 4 or 5 in. to clear the latching mechanism from the puffers.

- 20-Slowly move the mechanism out of the breaker until it is free of the two supporting lugs welded to the cross channel at the front of the breaker. Be careful not to catch any mechanism rods on the breaker frame.

- 21-Place the operating mechanism on a work bench for inspection and maintenance.

- 22-After all inspection and maintenance work on the operating mechanism has been completed, insert the hand pump and charge the mechanism by stroking the pump 3 or 4 times to compress the closing spring approximately 2 in.

- 23-Lower the trip lever from the trip latch and hold it in the down position.

- 24-Replace the operating mechanism in the circuit breaker by reversing the steps taken to remove it.

A-Make sure the two pairs of links from the jackshaft clear the hydraulic block support. (Fig 16)

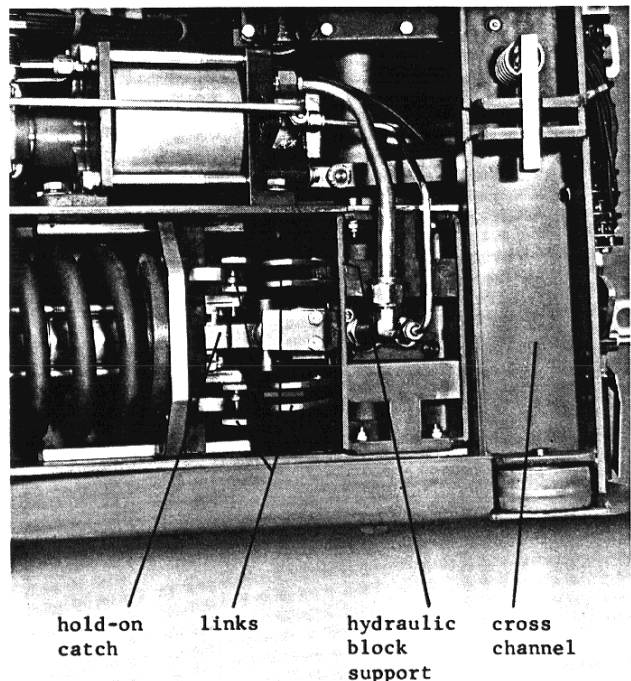


Fig 16--5-kv--1200-amp PSD operating mechanism showing links clearing the hydraulic block support when removing mechanism from--or replacing mechanism in--the PSD breaker