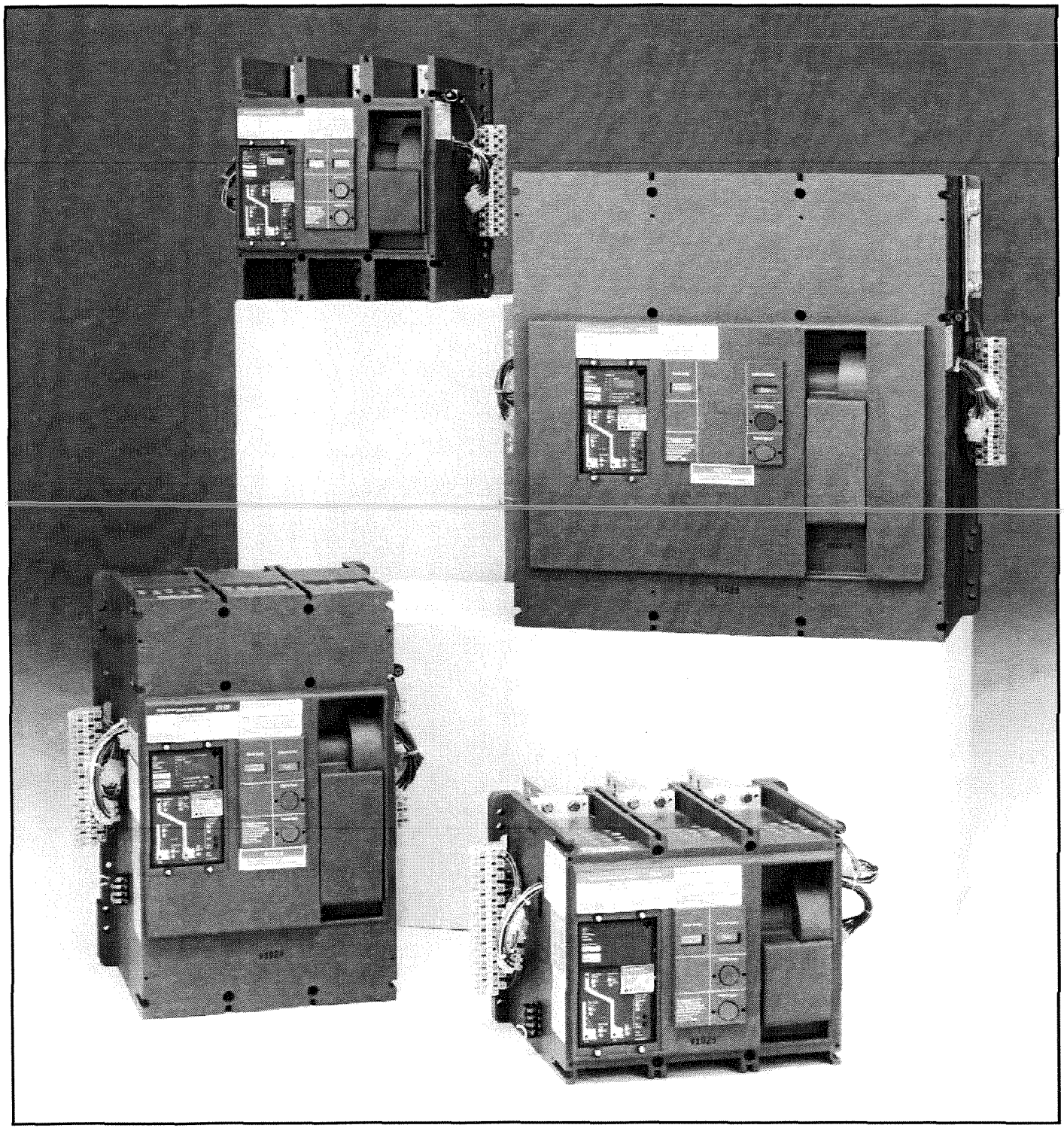
Instructions for the Systems Pow-R Breaker and Drawout Mechanism - 400, 800, 1200, 1600, 2000C, 2500, 3000, 4000, 5000 Amp Frames



PURPOSE

This instruction manual is expressly intended to cover the installation, operation and maintenance of Type Systems POW-R Circuit Breakers.

For application information, consult Cutler-Hammer Inc., and see Cutler-Hammer Descriptive Bulletins, Application Publications and/or the applicable industry standards.

SAFETY

All safety codes, safety standards and/or regulations must be strictly observed in the installation, operation and maintenance of this equipment.

WARNING

THE WARNINGS AND CAUTIONS INCLUDED AS PART OF THE PROCEDURAL STEPS IN THIS MANUAL ARE FOR PERSONNEL SAFETY AND PROTECTION OF EQUIPMENT FROM DAMAGE. AN EXAMPLE OF A TYPICAL WARNING LABEL HEADING IS SHOWN ABOVE TO FAMILIARIZE PERSONNEL WITH THE STYLE OF PRESENTATION. THIS WILL HELP TO INSURE THAT PERSONNEL ARE ALERT TO WARNINGS. IN ADDITION, CAUTIONS ARE ALL UPPER CASE AND BOLDFACE.

Cutler-Hammer

PITTSBURGH, PENNSYLVANIA, U.S.A.

All possible contingencies which may arise during installation, operation or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of particular equipment, contact a Cutler-Hammer representative.

TABLE OF CONTENTS

Page

SECTION 5: ACCESSORIES

SECTION 6: INSPECTION AND MAINTENANCE

FIGURES

TABLES

SECTION 1: INTRODUCTION

1-1 GENERAL INFORMATION

The Cutler-Hammer Systems POW-R Breaker is an encased power breaker designed to provide benefits of special interest to designers and users of power distribution systems. These instructions cover the description and operation of Systems Pow-R Breakers and their drawout mechanisms in the 400, 800, 1200, 1600, 2000C, 2500, 3000, 4000 and 5000 ampere frame sizes (Figure **1-1**).

Systems Pow-R Breakers must be applied within their published ratings in accordance with UL489 and NEMA AB-1 Standards as defined under "Usual Service Conditions." Systems Pow-R Breakers are available for standard interrupting capacities (100,000 amperes at 480 volts) and high interrupting capacities (150,000 amperes at 480 volts). Special lower interrupting capacity breakers are also available in 400, 800, 1200, 1600 and 2000C ampere frames (Table **1.1**). Systems Pow-R Breakers are assembly rated for application at 100% of their continuous current rating.

Molded case switches are also available in accordance with UL 1087 in the non-automatic version with short circuit withstand ratings shown in Table **1.2**.

Systems Pow-R Breakers are available in either drawout or fixed mounted configurations. In the case of fixed mounted breakers, the sections of this manual referring to the drawout mechanism, levering device, and drawout procedures will not apply.

There are two drawout design types available: one having the complete circuit breaker mounted **BEHIND THE DOOR** and a second having the integral trip unit and operating devices projecting **THROUGH THE DOOR**.

The electronic trip units used with the Systems Pow-R Breaker are generally addressed in this manual. For specific details concerning compatible Cutler-Hammer trip units, refer to separate reference and instruction material.

NOTICE

Please read and understand these instructions before attempting to unpack, operate or maintain this equipment. Study the breaker and its mechanism carefully before attempting to operate it on an energized circuit.

1-2 SAFETY FEATURES

Systems Pow-R Breakers and associated drawout equipment are manufactured with built-in interlocks and safety related features. They are provided to reduce hazards to operating personnel and provide proper operating sequences.

WARNING

SYSTEMS POW-R BREAKERS ARE STRONGLY BUILT AND PROVIDED WITH SAFETY FEATURES. NEVERTHELESS, THE VOLTAGES, CURRENTS AND POWER LEVELS AVAILABLE IN AND AROUND THIS EQUIPMENT WHEN IT IS IN OPERATION ARE EXTREMELY DANGEROUS AND COULD BE FATAL. ALL POWER SHOULD BE TURNED OFF. UNDER NO CIRCUMSTANCES SHOULD INTERLOCKS AND OTHER SAFETY FEATURES BE MADE INOPERATIVE, AS THIS MAY RESULT IN DEATH, BODILY INJURY OR PROPERTY DAMAGE.

1-3 SAFETY PRACTICES

To protect personnel associated with the installation, operation and maintenance of this equipment, the following practices must be followed:

1. Only qualified electrical personnel familiar with the equipment, its operation and the associated hazards should be permitted to work on the equipment. Additionally, only qualified personnel should be permitted to install or operate the equipment.

2. Always be certain that the primary and secondary circuits are de-energized or the circuit breaker is removed to a safe work location before attempting any maintenance.

3. For maximum safety, only insert a completely assembled breaker into an energized cell.

4. Always insure that drawout breakers are in one of their designed cell positions, such as Connected, Test, Disconnected or Withdrawn. A breaker permitted to remain in an intermediate position could result in control circuits being improperly connected resulting in electrical failures.

1-4 QUALIFIED PERSONNEL

For the purpose of operating and maintaining low voltage circuit breakers, a person should not be considered qualified if the individual is not thoroughly trained in the operation of the circuit breaker and how it interfaces with a switchboard. In addition, the individual should have knowledge of the connected loads.

For the purpose of installing and inspecting circuit breakers and their associated switchboard, a Qualified Person should also be trained with respect to the hazards inherent to working with electricity and the proper way to perform such work. The individual should be able to de-energize, clear and tag circuits in accordance with established safety practices.

1-5 OTHER PUBLICATIONS AND DOCUMENTATION

In addition to this instruction manual, other printed information and documentation is available and supplied as appropriate. This additional information will include, but not necessarily be limited to, an instruction manual for the specific electronic trip unit being used with the Systems Pow-R Breaker and necessary dimensional drawings.

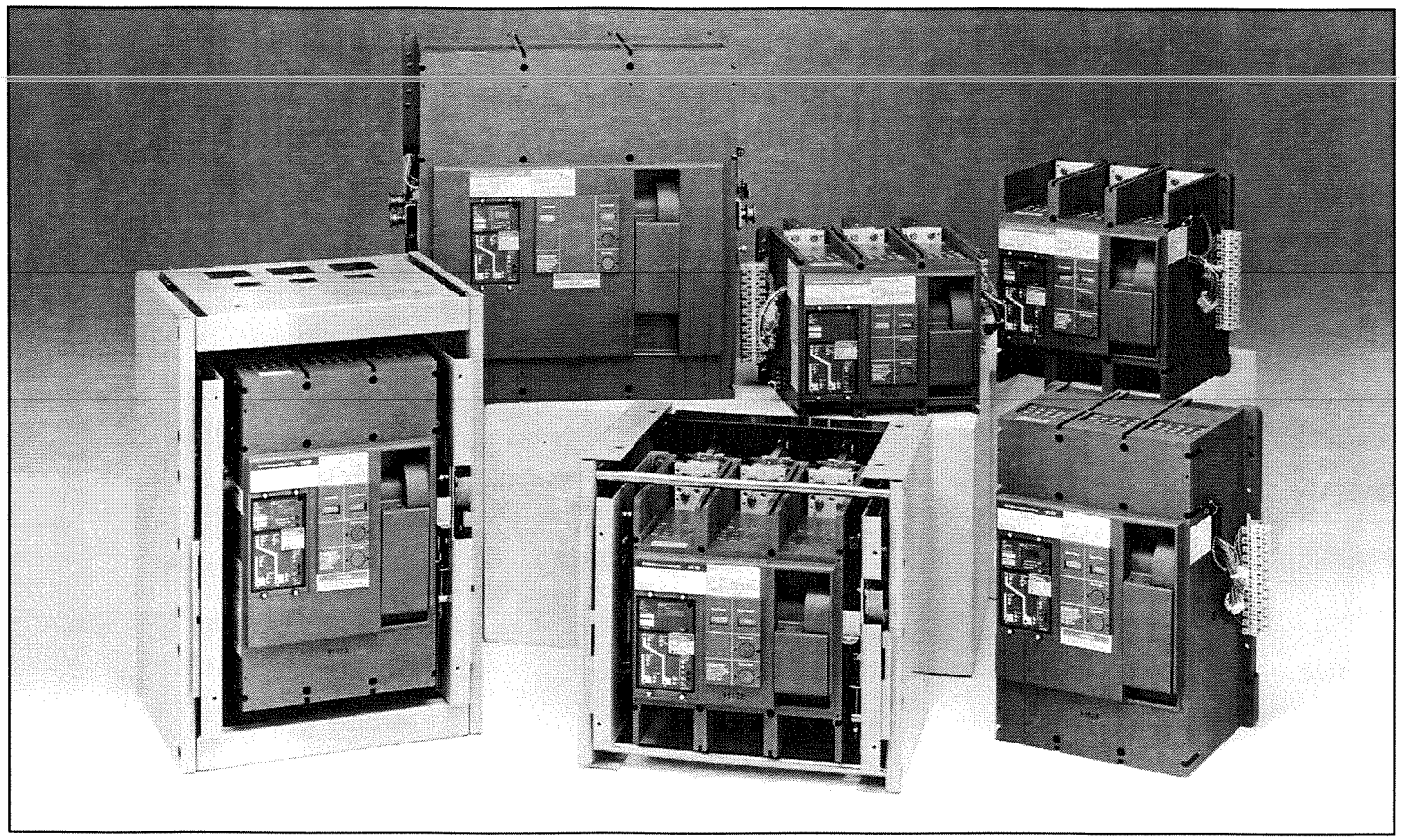


Figure 1-1 Systems Pow-R Breakers and Structures

Table 1.1 Interrupting Ratings for Systems Pow-R Breaker with Digitrip RMS Trip Unit

Type SPB-50 (400 and 800 Amp. Frames)

Interrupting②	65KA at 240 Volts 50 KA at 480 Volts 42KA at 600 Volts
Short Time③	25KA

Type SPB-65 (1200, 1600, 2000C Amp. Frames)

Interrupting②	1200 Amps.	1600 Amps.	2000C Amps.	Volts
	85KA	85KA	85KA	240
	65KA	65KA	65KA	480
	42KA	50KA	50KA	600
Short Time③	35KA			

Type SPB-100 (400 thru 5000① Amp. Frames)

Interrupting②	400-1200 Amps.	1600-5000 Amps	Volts
	100KA	100KA	240
	100KA	100KA	480
	50KA	85KA	600

Short Time③	250/800 Amps.	1200-3000 Amps.	4000-5000 Amps.
	25KA	35KA	65KA

Type SPB-100M (1600 thru 5000① Amp. Frames)

Interrupting②	1600-3000 Amps.	4000-5000 Amps.	Volts
	100KA	100KA	240
	100KA	100KA	480
	85KA	85KA	600
Short Time③	51KA	85KA	

Type SPB-150 (400 through 5000① Amp. Frames)

Interrupting②	200KA at 240 Volts 150KA at 480 Volts 100KA at 600 Volts

Short Time③	400/800 Amps.	1200 Amps.	1600/3000 Amps.	4000-5000 Amps.
	25KA	35KA	51KA	85KA

① 5000 Amp available only in fixed, rear connected.
② Interrupting in KA RMS Symmetrical.
③ Maximum Short Time Delay Setting of 0.5 seconds.

Table 1.2 Application Guide for Molded Case Switch①

Switch Rating	Maximum Short Circuit RMS Sym. Amperes (KA) Withstanding Rating @ 600 Vac For 0.5 Sec.			Application Without Fuses② Maximum Short Circuit③ RMS Sym. Amperes for a Maximum of 1 Second
	Max. Fuse Rating	Fuse Class	Maximum Available Short Circuit RMS Sym. Amperes (KA) @ 600 Vac	
Standard Withstand (SPBN)				
400	400	R	200.000-480	35.000-480
800	800	L	200.000-480	35.000-480
1200	1200	L	100.000-480	35.000-480
1600	1600	L	35.000-480	35.000-480
2000C	2000	L	35.000-480	35.000-480
2500	2500	L	35.000-480	35.000-480
3000	3000	L	35.000-480	35.000-480
4000	4000	L	65.000-480	65.000-480
5000	5000	L	65.000-480	65.000-480
High Withstand (SPBNH)				
400	400	R	200.000-480	50.000-480
800	800	L	200.000-480	50.000-480
1200	1200	L	200.000-480	50.000-480
1600	1600	L	100.000-480	50.000-480
2000C	2000	L	100.000-480	50.000-480
2500	2500	L	50.000-480	50.000-480
3000	3000	L	50.000-480	50.000-480
4000	4000	L	85.000-480	85.000-480
5000	5000	L	85.000-480	85.000-480

① Molded Case Switch contains no overcurrent protection and must be protected by appropriate upstream overcurrent protective device.
② UL Listed and CSA Certified.
③ Must be protected within this time by some other device.

SECTION 2: RECEIVING, HANDLING AND INSTALLATION

2-1 GENERAL INFORMATION

Before beginning to unpack or uncrate new Cutler-Hammer Systems Pow-R Breakers and drawout mechanisms, read and understand these directions. Following these directions will insure that you have caused no damage.

The System Pow-R Breaker and stationary drawout mechanism are delivered in two crates and/or boxes. The larger container is the stationary portion of the drawout mechanism and the smaller the breaker itself. **UNCRATE THE DRAWOUT MECHANISM FIRST.**

NOTICE

400-4000A 3-pole fixed and behind the door drawout breakers are packed in heavy duty cardboard boxes. All other breakers through 5000A and the drawout mechanisms are crated.

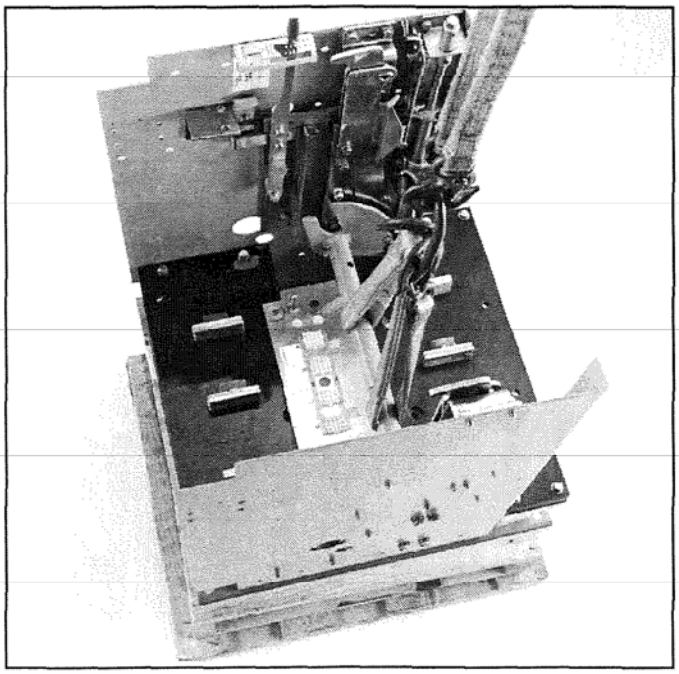


Figure 2-1 Drawout Mechanism Ready for Lifting

2-2 UNCRATING BEHIND THE DOOR DRAWOUT MECHANISM

Set the drawout crate in position with arrows pointing up. Remove the top boards and cardboard. If you use a crowbar, be certain to clear all splinters and wood chips off the equipment before mounting. Do not remove any protective covering until the unit is completely uncrated. Remove the sides and internal shipping braces. Loosen the four crating bolts at the bottom corners of the frame and remove any protective covering.

Attach an overhead crane lift to the center bar of the drawout using a wide strap wrapped several times around the center of the bar. Raise the drawout mechanism (Figure **2-1**).

2-2.1 MOUNTING DRAWOUT MECHANISM

With the red indexing lever on the right, mount the drawout mechanism into the switchboard. Use the strap for balance as you align the unit with the mounting holes. After mounting, remove the tapes which hold the extension rails in place. Lift slightly on both rails to slide them all the way out.

2-3 UNCRATING BREAKER

Place the breaker crate or box in position with arrows pointing up. Remove the top of the crate or box. If a crowbar is used on crates, place the bar only at the edges of the crate and use a small mallet to drive the bar. Do not push down with the crowbar - PRY UP ONLY. Remove the envelope containing the instruction book and QA Certificate from the crate or box and keep the instruction book handy for reference purposes.

Carefully remove the sides of the crate and internal shipping braces.

2-4 MOUNTING BREAKER IN DRAWOUT MECHANISM BEHIND THE DOOR

Insure that the drawout has its extension rails pulled out to their full extension.

Use a wide strap attached to an overhead crane for lifting. Tilt the breaker forward on the bottom of its crate. Slip the strap beneath it, placing the strap between the two drawout wheels on each side. This is its most balanced position (Figure **2-2**).

Raise the breaker with the crane. Hold breaker's side to assure firm balance. Lower all four wheels of the break-

er onto the top of the extension rails (Figure **2-5**). The front wheels on the breaker will fit into a depression at the front-most part of the rails, and the breaker will rest there securely.

Remove the strap. It will slide out between the breaker and the extension rails. For use in projecting the indexing lever through the breaker cell door, a molded escutcheon is provided for mounting to the breaker cell door (Figure **2-3**). With the cell door in place, attach the escutcheon to the outside of enclosure door.

Place breaker in the "Test" position (Section 4-2.2). Locate the position indication label provided and peel off the adhesive backing. Place the label on escutcheon so that the "Test" position indicator lines up correctly with indexing lever white dot.

The drawout mechanism includes an indexing lever with a red indicating handle that also serves as an emergency manual trip lever. An indexing bracket is mounted on the right-hand side of drawout mounted breakers. Positive indents are provided for each drawout position: "CONNECT," "TEST," "DISCONNECT." A commercially available 1/2 inch socket and ratchet are used to crank the breaker into each drawout position on the behind the door design.

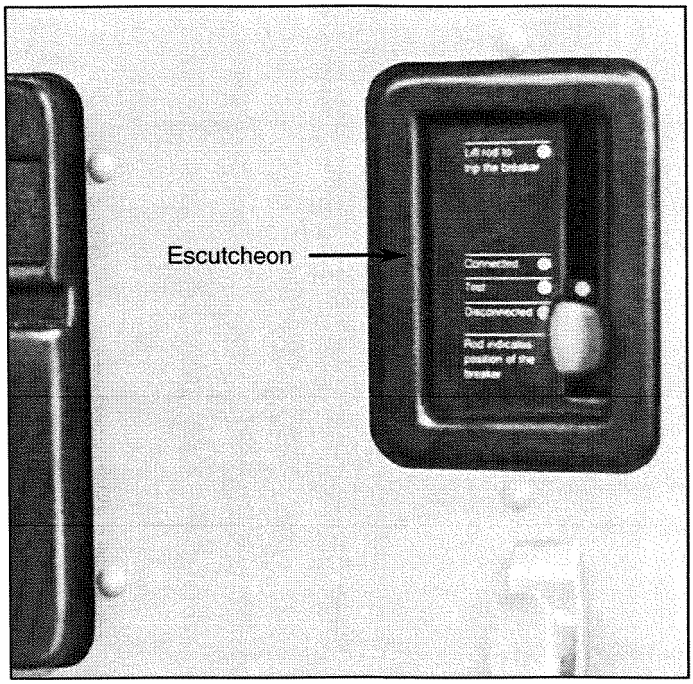


Figure 2-3 Cell Door Mounted Molded Escutcheon

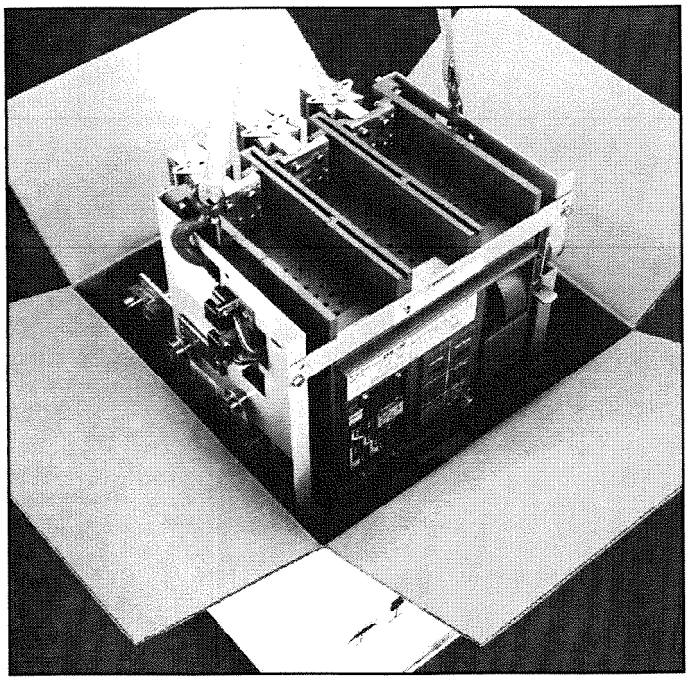


Figure 2-2 Breaker Being Lifted from Crate

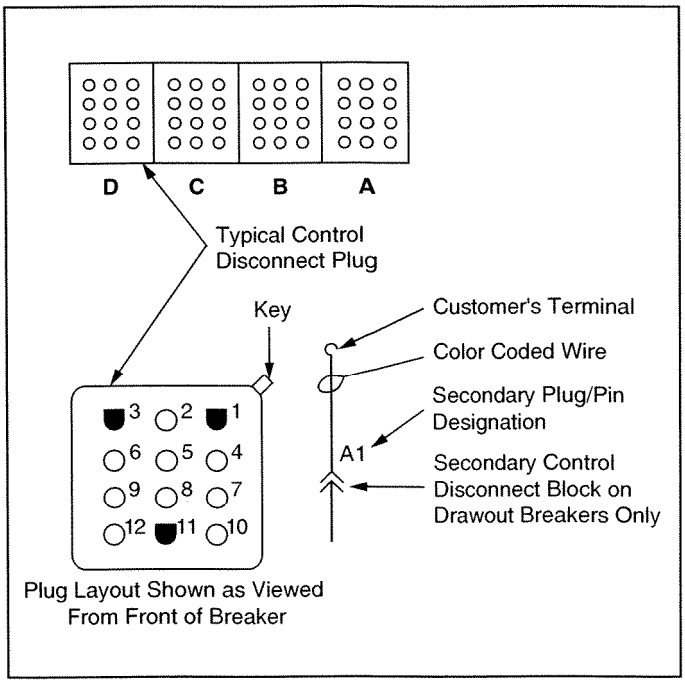


Figure 2-4 Secondary Contacts Layout (Viewed From Front of Breaker)

Self-contained extension rails are provided for moving the breaker into the "WITHDRAWN" position. The cell door can be closed in all but the "WITHDRAWN" position. The molded escutcheon is provided for mounting of the indexing lever label. This label indicates the drawout position of the breaker.

CAUTION

CARE MUST BE TAKEN DURING HANDLING NOT TO DAMAGE ROTATING TRIPPER.

2-4.1 SECONDARY CONTACTS

Secondary contacts for the behind the door design are self-aligning plug-in type contacts. They provide an access for control leads to enter the movable drawout breaker from the stationary breaker cell. Secondary contacts are connected in the "Test" and "Connected" positions only, not the "Disconnected" position.

A maximum of 48 contact points may be mounted on a single breaker in the form of four 12 point blocks. All four blocks are always supplied on the breaker and in the stationary drawout, although only the blocks required for operation of the breaker and its accessories are wired. Additional secondary contact wiring can be done in the field.

The individual blocks are identified right to left (A, B, C and D) as viewed from the front of the breaker (Figure **2-4**). Secondary control terminals are normally terminated in a control terminal block located in the cable compartment.

2-5 *MOUNTING BREAKER IN DRAWOUT MECHANISM THROUGH THE DOOR*

2-5.1 BREAKER INSERTION

CAUTION

THE DRAWOUT CASSETTE MUST BE SECURELY ANCHORED.

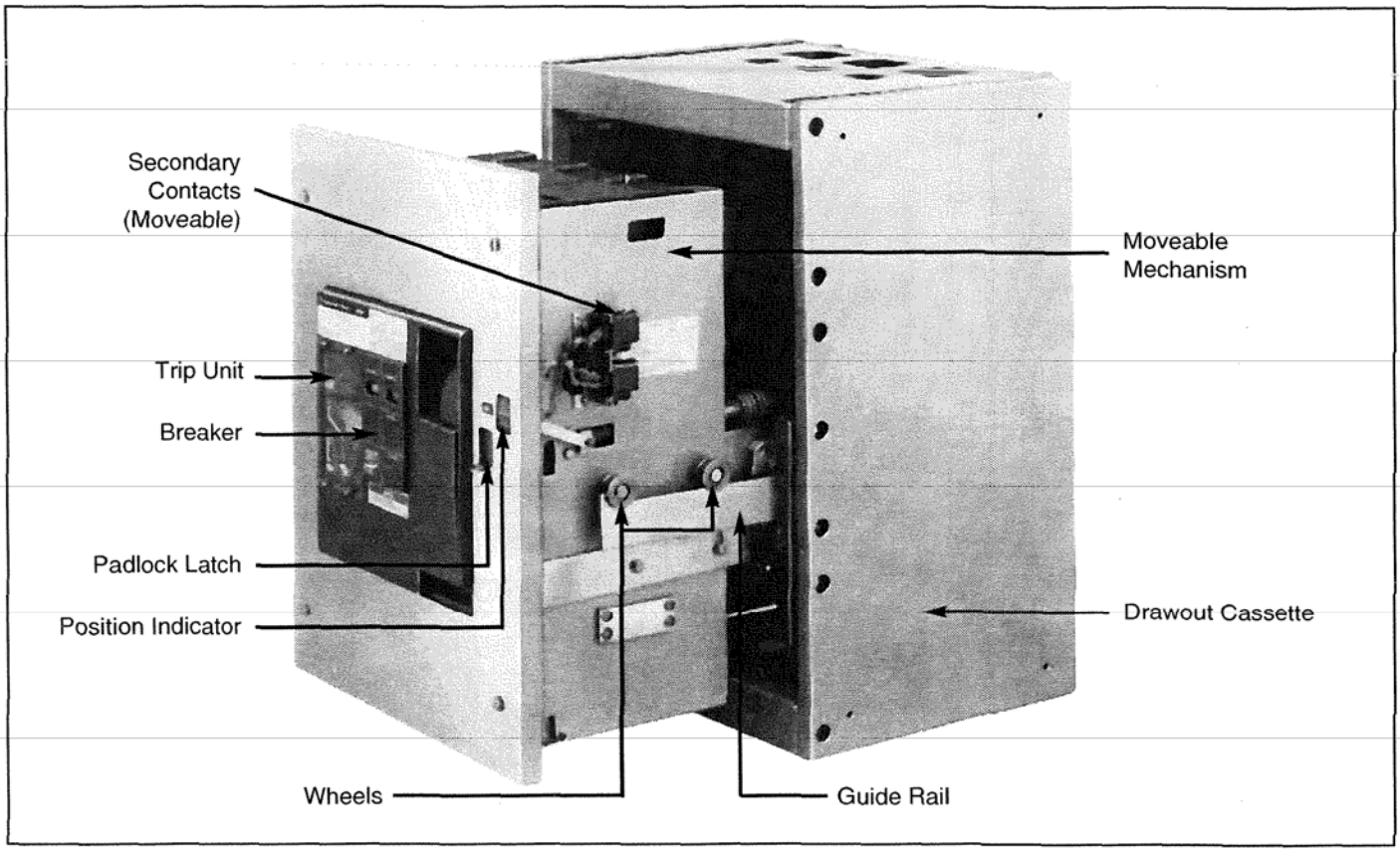


Figure 2-5 Through the Door Drawout Breaker on Cassette Extension Rails

WARNING

A CIRCUIT BREAKER SHOULD NOT BE INSERTED WITH THE SHIPPING STRAPS IN PLACE. A SUITABLY SIZED DEAD FRONT SHIELD MUST BE INSTALLED TO PREVENT ENTRY INTO THE BREAKER COMPARTMENT, WHICH, IF NOT INSTALLED, COULD RESULT IN DEATH OR SERIOUS INJURY (SECTION 2-5.6).

Proceed as follows:

- Insure position indicator on movable mechanism is in "WITHDRAW" location.
- Extend guide track rails of cassette.
- Raise breaker to height just above the guide track rails
- Lower breaker so that the wheels of the movable mechanism sit on the rails on both sides.
- Push breaker into cassette.

2-5.2 BREAKER POSITION

The drawout mechanism has four positions. They are achieved by lifting the padlock latch and inserting a commercially available 3/8 inch socket and ratchet. Clockwise motion moves the breaker towards the "CONNECTED" position. Counter clockwise motion moves the breaker towards the "WITHDRAW" position (Figure **2-5**).

2-5.3 DRAWOUT INTERLOCKS

The breaker is mechanically interlocked to the drawout mechanism to insure that the breaker is always open when connecting or disconnecting it from the line and load stabs. Lifting the padlock latch in an attempt to rack the breaker in or out while the breaker contacts are closed will result in the breaker tripping to the open position.

The breaker will only close in the "DISCONNECTED," "TEST," AND "CONNECTED" positions. It will NOT CLOSE in the "WITHDRAW" position.

To protect the worm gear of the movable mechanism, there is an interlock bar on the right hand side of the cassette that prevents racking in of the breaker unless fully inserted.

2-5.4 SECONDARY CONTACTS

Secondary contacts may be mounted on the left or right hand side of the breaker to a maximum of 48 contact points. There are four terminal blocks of twelve contacts each: "A," "B," "C," and "D" (Figure **2-5**). The secondary contacts consist of a moving assembly mounted on to the guide track of the cassette and a fixed assembly mounted onto the movable mechanism of the breaker. The fixed and moving secondary contacts are self-aligning.

Every cassette comes standard with "C" and "D" secondary contacts. Additional kits may be ordered for "A" and "B" secondary contacts.

12SPBRSEC - 12 point right hand contact kit for "A" or "B" secondary contacts.

24SPBRSEC - 24 point right hand contact kit for "A" and "B" secondary contacts.

2-5.5 OPERATION CHECK

Proceed as follows:

- Insure wiring is clear of all obstructions.
- Rack the breaker to "DISCONNECTED" position. Visually verify that the secondary contacts are apart. Insure tab falls into slot of indicator wheel on right hand side of movable mechanism (Figure **2-6**).
- Rack the breaker to "TEST" position. Insure tab falls into slot of indicator wheel.
- Visually verify that the secondary contacts are connected. Check electrical continuity by energizing the control circuit and operating the breaker.
- Rack the breaker to the "CONNECTED" position. Visually verify that secondary contacts remain connected.
- Rack the breaker to "DISCONNECTED" position. Visually verify that secondary contacts are apart.

2-5.6 DEADFRONT COVER FOR THROUGH THE DOOR DRAWOUTS

Shipping straps on through the door drawout must be replaced with a dead front cover. The dead front cover is to be sized so that when the breaker is installed, it is not possible to gain entry into the breaker compartment.

To cutout the front cover for through the door drawouts, refer to appropriate dimensional information provided.

2-5.7 BREAKER POSITION NAMEPLATE INSTALLATION INSTRUCTIONS

Lift the padlock latch and use a 3/8 inch socket and ratchet. Rotate ratchet clockwise until the indicator label is in the "TEST" position. Remove the ratchet and verify that the padlock latch drops, and that the tab on the right side sheet falls into the test position slot on the indicator wheel.

Place the Breaker Position Nameplate to the left of the indicator window so that the arrows line up.

Reinsert the ratchet and rotate counterclockwise until the indicator label lines to the "WITHDRAW" position prior to insertion into the station any portion of the cassette.

2-6 MOUNTING OF FIXED MOUNTED BREAKERS

For outline dimensions, refer to appropriate dimensional drawings provided. Complete mounting dimensions for fixed mounted Systems Pow-R Breakers are available from Cutler-Hammer.

When mounting 400 through 3000 ampere frames, use 4-.375 diameter bolts with wide washers against the breaker mounting flange and torque to 15 ft-lbs.

When mounting 4000 through 5000 ampere frames, use 8-.375 diameter bolts with wide washers against the breaker mounting flange and torque to 25 ft-lbs.

By following the correct outline drawing, mounting should present no difficulty. Mounting flanges should be supplied by the switchboard builder.

NOTICE

If a key interlock is used, care must be taken during mounting not to damage the rotating tripper.

2-6.1 SECONDARY CONTACTS

Like its through the door drawout type counterpart, the fixed design breaker offers a maximum of 48 secondary contact points in the form of terminal blocks mounted to the right and/or left side breaker mounting flange (Figure **2-7**). Two Terminal blocks are mounted and wired as *standard with additional terminal blocks available for* field installation.

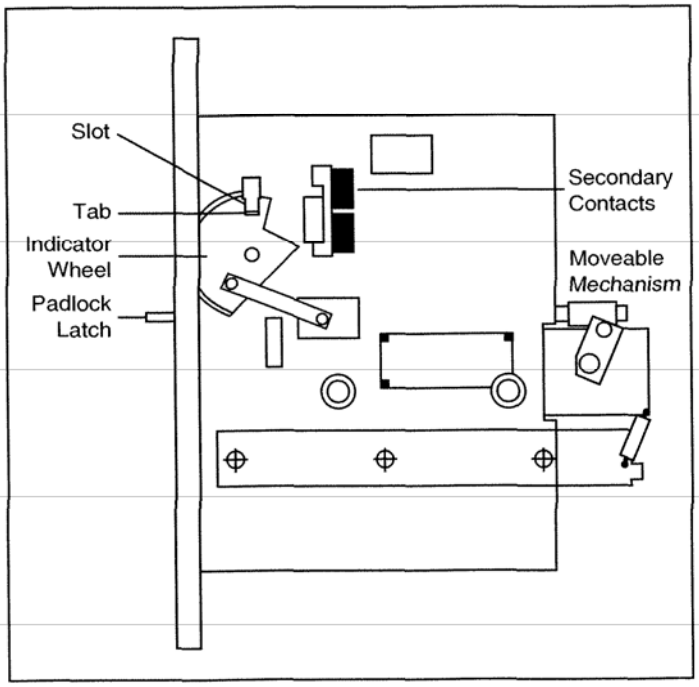


Figure 2-6 Indicator Wheel Shown in Test Position with Tab in Slot

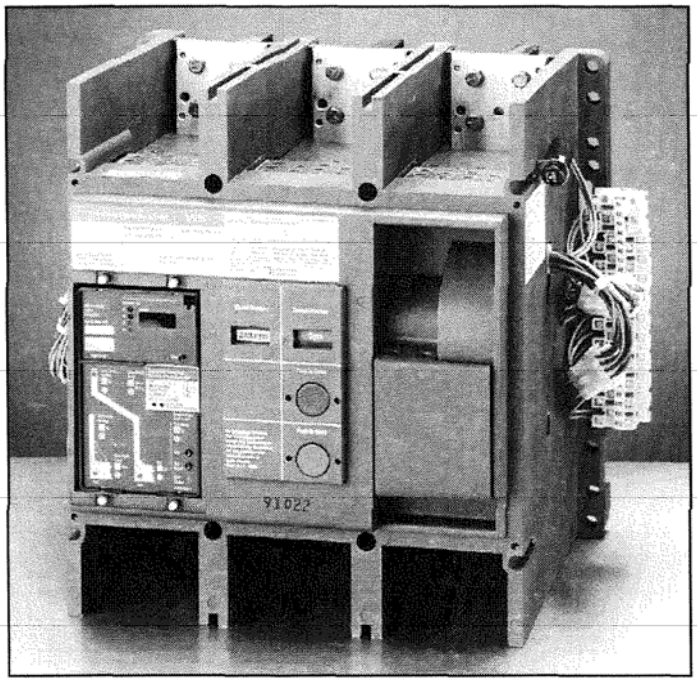


Figure 2-7 Secondary Contacts Shown Mounted on Fixed Breaker Right Flange

SECTION 3: EQUIPMENT DESCRIPTION

3-1 GENERAL DESCRIPTION

All Systems Pow-R Breaker ratings within the same configuration design have the same depth. All fixed mounted breakers have the same depth. All through the door drawout mounted breakers have the same depth, as do all behind the door drawout breakers. Breakers with 400 through 3000A frames have the same width and pole spacings for both manually and electrically operated units. The 4000 and 5000A ratings are larger, but both manually and electrically operated units have the same width and pole spacings. These designs permit simplified bus arrangements and assembly layouts (Figures **3-1**, **3-2**).

3-2 BREAKER

The breaker terminals are located in the rear at the top and bottom of the breaker frame. Fixed front connections for cable and bus bar are available with fixed mounted breakers in 400, 800, 1200 and 1600 ampere ratings. Extended front terminals are available in 2000C, 2500, 3000, and 4000 ampere frame ratings. Fixed rear connections are available in all fixed mounted breaker frames.

The contact position and stored energy status are clearly indicated by color coded indicators on the breaker front cover. Buttons for push-to-close and push-to-open are located below the status indicators. The handle for manually charging the breaker spring is on the right-hand side of the breaker front.

On the left side of the breaker front is the electronic trip unit. It includes the standard adjustments of ampere setting, long-time delay, and instantaneous pick-up. Optional adjustments include short-time pickup, short-time delay, ground fault pickup, and ground fault time delay. The trip unit also includes a rating plug, and LED indicators for breaker tripping on overload, ground fault, or short circuit.

For specific details, refer to the instruction material supplied with the trip unit or contact Cutler-Hammer.

3-3 CONTACTS

Primary disconnect stabs are located on the back of the breaker for the drawout design. Drawout breaker secondary control contacts are plug-in terminal blocks also located on the rear of the breaker for behind the door draw-out. The terminal blocks are located on the side of the through the door drawouts. Plug-in terminal blocks are provided as standard. A fixed terminal block kit (SPBFTBK) is an available option.

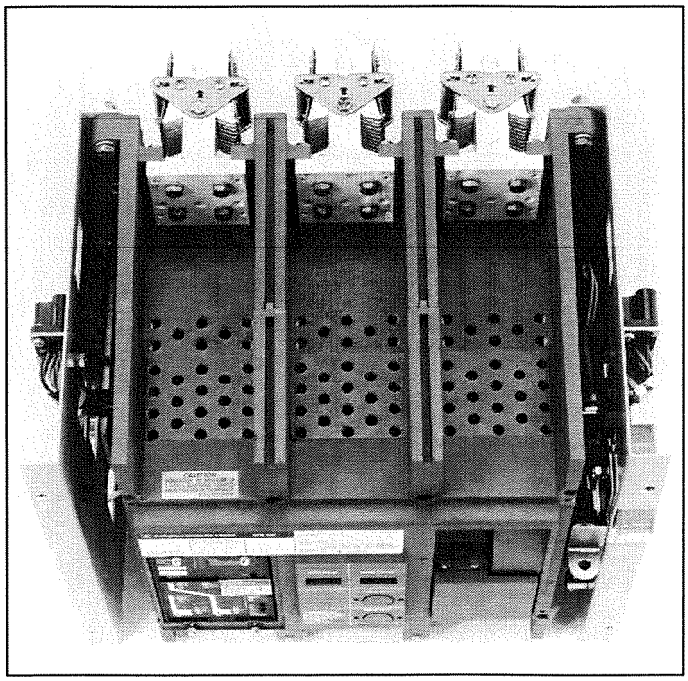


Figure 3-1 Drawout Breaker (top view) Showing Pole Spacing

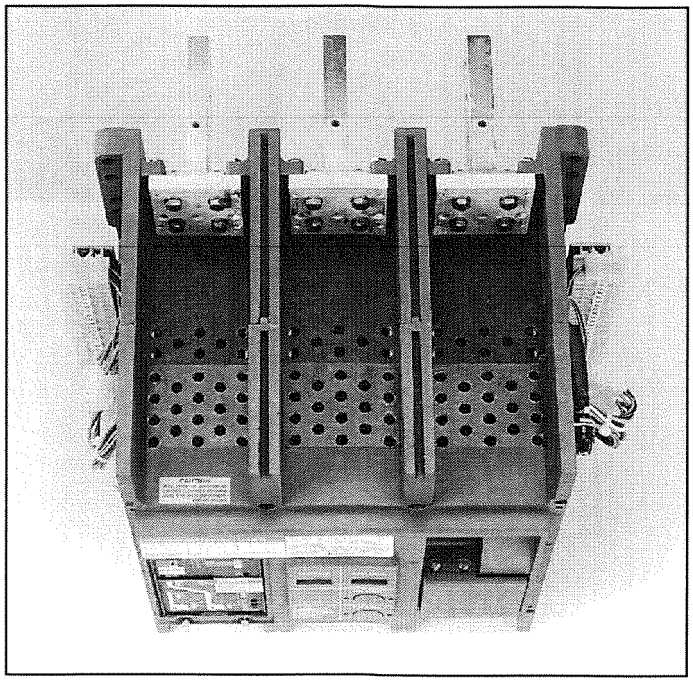


Figure 3-2 Fixed Breaker (top view) Showing Pole Spacing

SECTION 4: BASIC OPERATING INSTRUCTIONS

4-1 BREAKER

All basic breaker and drawout operations can be performed from the front of the breaker, except for the inspection of primary and secondary disconnects in drawout mounted breakers. For that operation, see Section 4-2.3 (Rotation on the Drawout Mechanism). Suitable electrical and mechanical interlocks are provided to prevent incorrect operation of the breaker. See Figure **4-1** for Section 4-1 references.

4-1.1 HOW TO CHARGE MANUALLY

To manually charge either a manual or electrically operated breaker, push or pull up on the charging handle. The handle is shaped to make manual charging easy when the breaker is located in either a low or high position within a switchboard enclosure. Four full strokes or several partial inching strokes can be used. When the spring is fully charged, the yellow "CHARGED" indicator will appear in the stored energy window on the breaker front cover. When the mechanism is fully charged the handle stops and will return to its normal position when released. Manually operated breakers have multiple charge-close provisions which allow the following possible operating sequence: Charge-Close-Recharge-Opening-Close-Open.

4-1.2 HOW TO CHARGE ELECTRICALLY

With the internally mounted electrical operator, charging is automatic when the breaker is discharged. Electrical charging requires approximately 3 seconds. When fully charged, the yellow "CHARGED" indicator will appear in the stored energy window on the breaker front. The electrically operated version also has multiple charge-close provisions which allow the following sequence: Charge-Close-Recharge-Open-Close-Open.

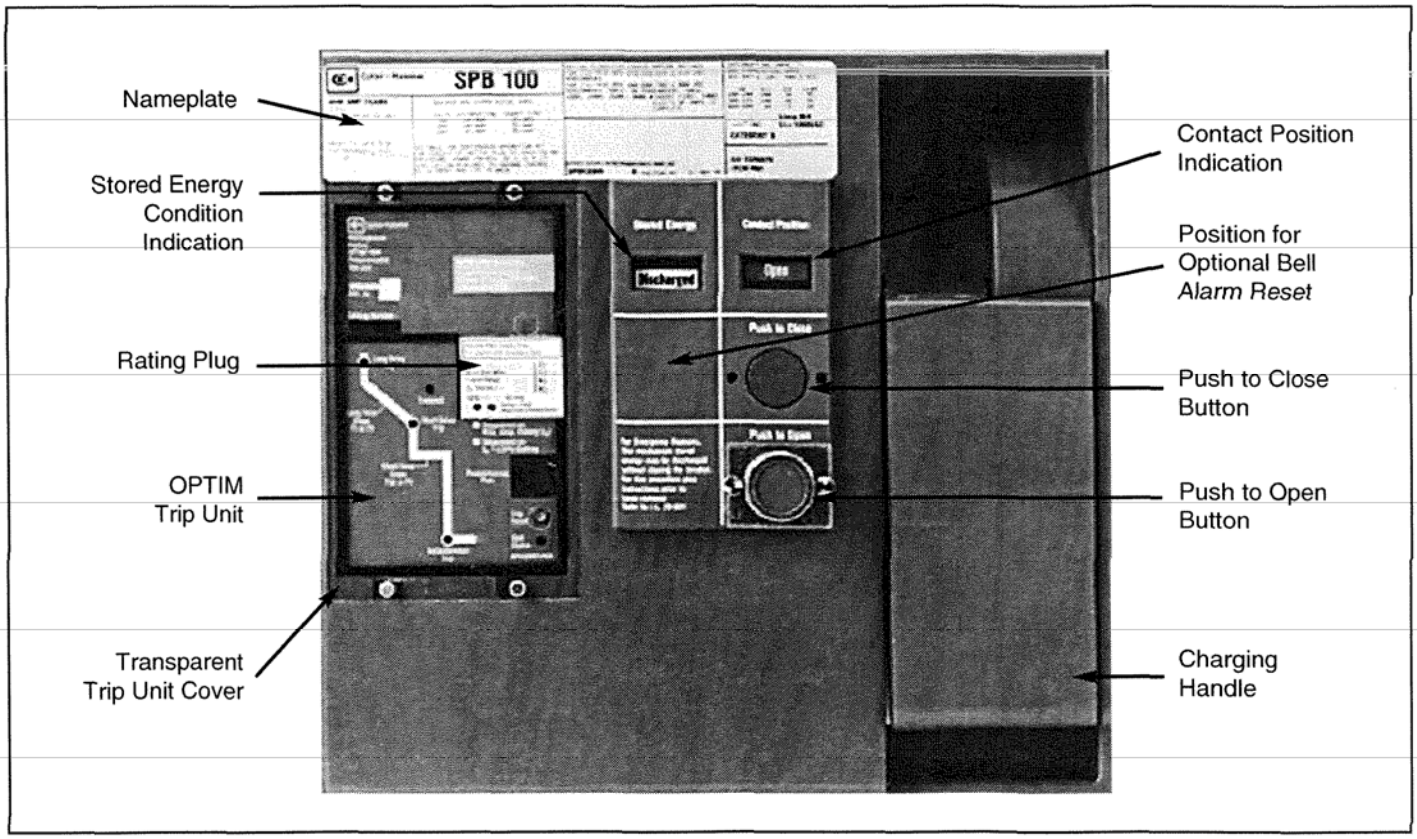


Figure 4-1 Systems Pow-R Breaker Faceplate

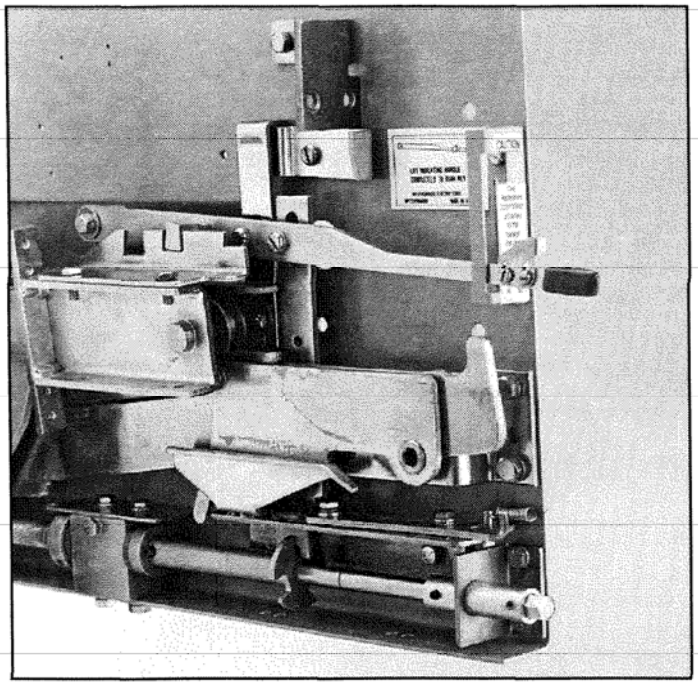


Figure 4-2 Indexing Bracket Shown in "TEST" Position (Breaker Removed for Clarity)

4-1.3 HOW TO CLOSE

All that is required to close the breaker locally is to push the mechanical "PUSH-TO-CLOSE" pushbutton. Precharged breakers may be closed remotely via a spring release solenoid which is standard for electrically operated breakers and optional for manually operated breakers (Section 5-3). For special applications, local manual closing may not be desired. Provisions are available in the form of a manual closing blocking adapter to prevent this action except by authorized personnel (Section 5-11).

Before attempting to close the breaker locally, the yellow stored energy window must read "CHARGED." Electrical interlocks are provided to prevent remote closing unless the closing energy is fully charged and the mechanism is ready to be closed.

4-1.4 HOW TO OPEN

Opening the breaker locally is accomplished with the mechanical "PUSH-TO-OPEN" pushbutton on the breaker control faceplate. Breakers may be opened remotely via either a shunt trip device (Section 5-2) or an undervoltage release (Section 5-6), depending upon the application requirements. For maintenance and/or safety requirements, a push-to-open padlockable adapter is available to hold the breaker in the "OPEN" position (Section 5-10).

4-1.5 HOW TO DISCHARGE STORED ENERGY WITHOUT CLOSING BREAKER

As a safety feature, it is possible to locally discharge the breaker's stored energy without closing the breaker. This is possible in both manually and electrically operated breakers. Control power to the electrical operator must be removed to prevent undesired recharging. The action involved in releasing the stored energy without closing the main contacts causes an abnormally high shock condition on the breaker and should be avoided except for emergency reasons. To release this stored energy when the breaker is in the "OPEN" position: First, depress and hold the PUSH-TO-OPEN pushbutton and then depress the PUSH-TO-CLOSE pushbutton.

When the breaker is in the "CLOSED" and "CHARGED" position, the above actions will simultaneously open the breaker and discharge the stored energy.

WARNING

SHOULD THE LOCAL "PUSH-TO-CLOSE" BUTTON BE ACCIDENTALLY DEPRESSED WITH THE BREAKER IN THE "CLOSED" POSITION AND WITH THE MECHANISM "CHARGED," THE ENERGY WILL BE RELEASED AND THE BREAKER COULD *"SHOCK" OPEN. THEREFORE, CARE SHOULD BE* EXERCISED TO AVOID THIS OPERATION.

THE STORED ENERGY CANNOT BE DISCHARGED WITHOUT CLOSING THE BREAKER FROM A REMOTE LOCATION.

4-2 DRAWOUT MECHANISM

Movement of the breaker on its drawout is easily accomplished by using the drawout indexing lever and ratchet crank, with one exception as described in Section 4-2.1. The indexing lever must always be lifted before any drawout movement is begun, and it must be held until the indexing lever block clears the slot for the position being vacated. Complete instructions are given for racking the breaker in and out of the cell using the drawout mechanism on NP235P001H01 attached to the rear of the cell door (Figures **4-2** and **4-3**).

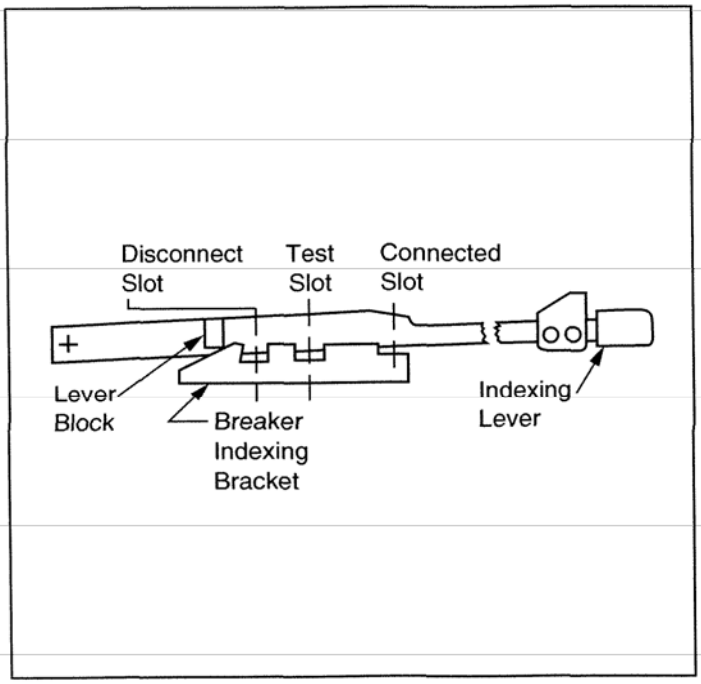


Figure 4-3 Operation Schematic of Indexing Bracket and Lever

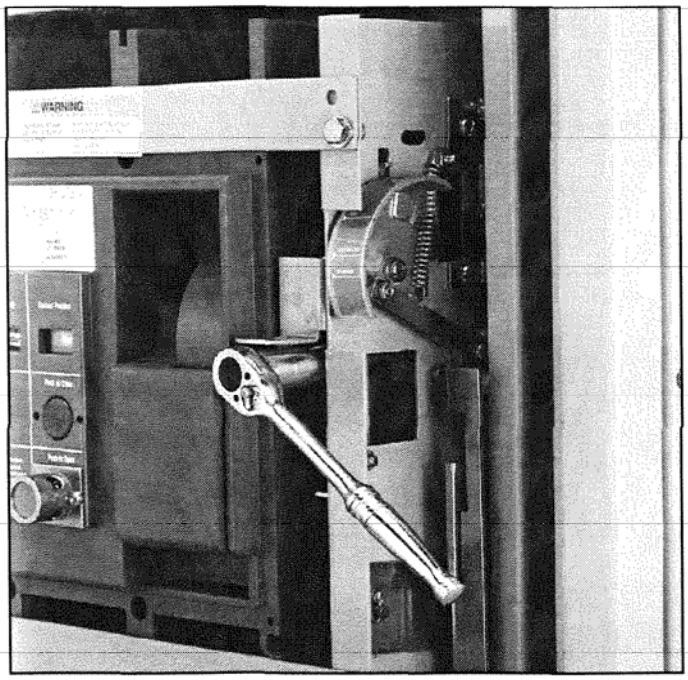


Figure 4-4 Ratchet and Socket Shown in Operation Position (Breaker Deadfront Removed for Clarity)

4-2.1 MOVING BREAKER FROM WITHDRAWN TO DISCONNECT POSITION

To move the breaker from the "WITHDRAWN" position at the end of the extension rails to the "DISCONNECT" position, push the breaker back on the rails until the lever block drops into the disconnect slot. This is the one and only time that the index lever need not be lifted prior to a breaker racking operation. In this case, the lever cams up and down automatically. At this time the extension rails can be pushed to the stored position.

4-2.2 MOVING BREAKER BETWEEN DISCONNECT, TEST, AND CONNECTED POSITIONS

To move the breaker from the "DISCONNECT" to the "TEST" position, lift the indexing lever to its uppermost position so that the lever block will clear the indexing bracket. It is very important to always lift the indexing lever to its uppermost position when moving from one position to another. Move the ratchet clockwise (Figure **4-4**). After the lever block has cleared, the indexing lever can be released. When it drops into the next position, the breaker is in the "TEST" position (Figure **4-2**).

A deadfront shield is installed on the breaker with the matching pieces in the cell to protect the operator, should the breaker be operated in the "CONNECTED" position with the cell door open.

The shield attached to the breaker should be installed when the breaker is placed in the "DISCONNECT" position prior to its being racked into the "TEST" position. If rotation of the breaker for inspection is desired, the shield should be removed in the "DISCONNECT" position prior to the breaker being pulled into the "WITHDRAWN" position.

To move the breaker from "TEST" to "CONNECTED," repeat the procedure of lifting the indexing lever to its uppermost position and move the ratchet clockwise. Be certain to hold the indexing lever up until the lever block has cleared the test slot.

When the slot has been cleared, you can release the lever. When it drops into the next position, the breaker is in the "CONNECTED" position.

Self-aligning contact posts (Figure **4-5**) fit into cone-shaped receptacles in the rear of the breaker to self-align the secondary control contact blocks.

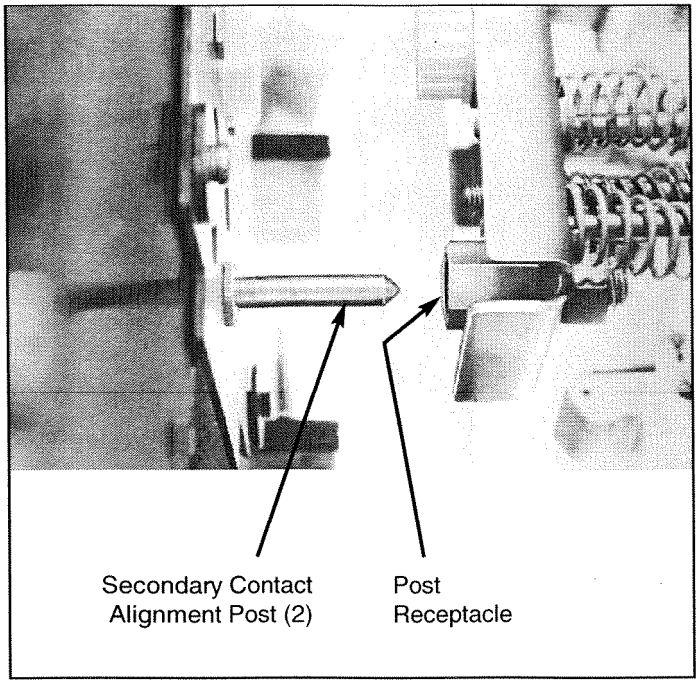


Figure 4-5 Self-Aligning Secondary Control Contact Blocks (Behind Door Design)

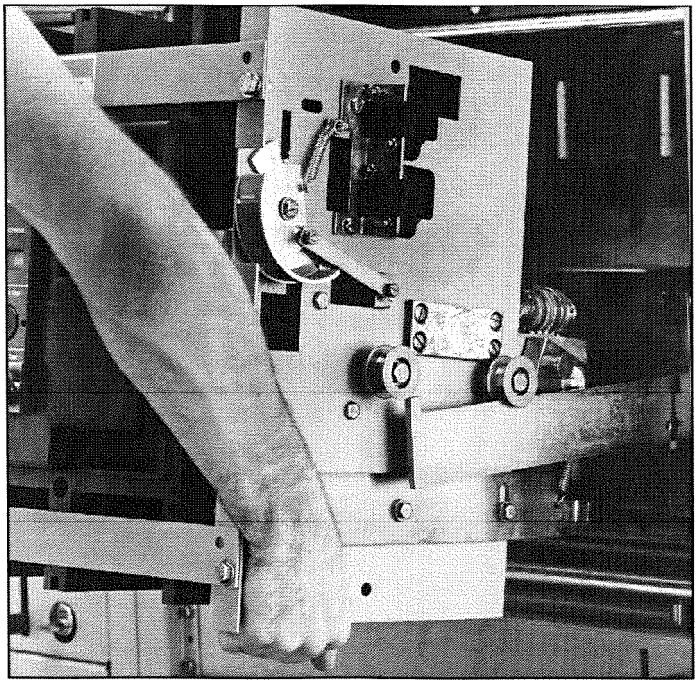


Figure 4-6 Lifting Front Wheels of Breaker Off Rail for Rotation

To remove the breaker from "CONNECTED" and place it in "TEST" or "DISCONNECT" positions, reverse the ratchet to the counterclockwise position, and follow the procedure previously described. Always be sure to lift the indexing lever to its uppermost position as you crank the ratchet until the lever block has cleared that slot on the indexing bracket.

To move the breaker from "DISCONNECT" to the "FULL WITHDRAWN" position, pull the extension rails out to their full extension. Lift the indexing lever to its uppermost position and pull the breaker out to the end of the extension rails (Figure **2-5**). Before moving the breaker, remove the ratchet so it does not block movement of the breaker into the "WITHDRAWN" position.

4-2.3 ROTATION ON THE DRAWOUT

If rotation of the breaker on the drawout is desired for inspection, the deadfront shield must first be removed. Removal of the shield should be performed while the breaker is in the "DISCONNECT" position, before it is pulled into "WITHDRAWN" position. Before beginning the rotation, make sure that the breaker is fully withdrawn with the front wheels in the depressions in the front of the extension rails.

Lift the front of the breaker so that the front wheels are off the extension rails, and pull forward as shown in Figure **4-6**.

NOTICE

For 250 to 1200 ampere frames in a minimum height cell size, breakers must be rotated on front wheels in the opposite direction. To return breaker to its "FRONT" position, reverse the procedure.

Keep pulling forward on the breaker until the back wheels move into the depression where the front wheels sat on the end of the extension rail.

As the breaker is turned, be careful of the compartment opening. Don't lift or put pressure on the secondary control contact block assembly on the back of the breaker. Turn it by holding the top or bottom of the breaker. Be certain all four wheels rest on the extension rails.

The breaker can be rotated through 360°. To return it to its regular position, lift on the bottom and return the front wheels to their original depressions in the extension rails. Again, do not put pressure on or lift with the sec-

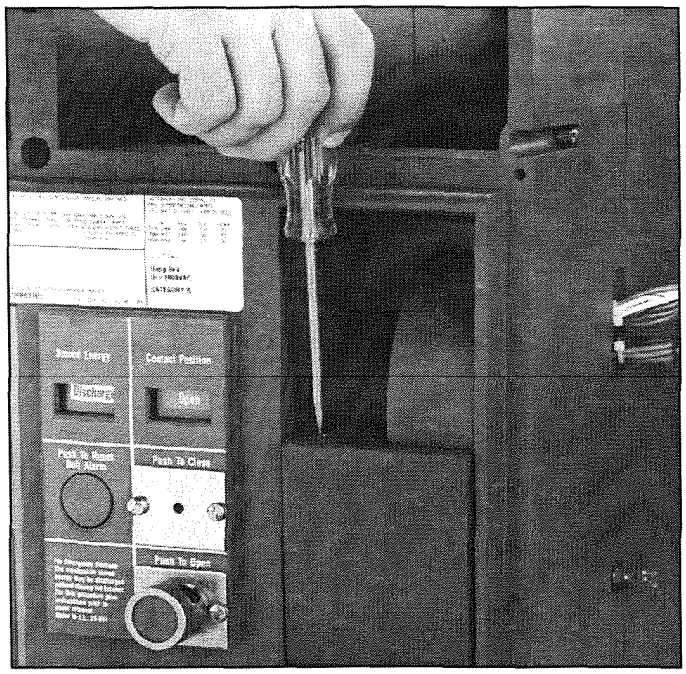


Figure 4-7 Removing Charging Handle Screws

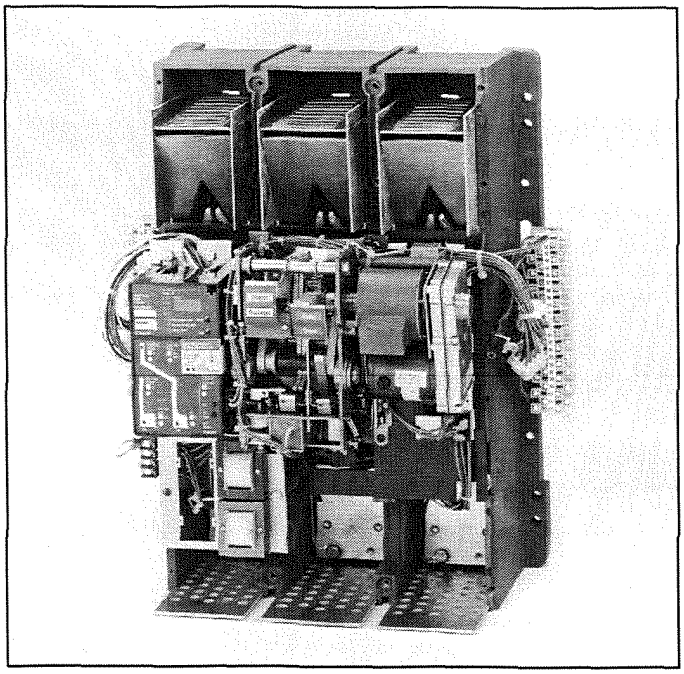


Figure 4-8 Breaker Cover and Charging Handle Removed

ondary control contact block assembly on the back of the breaker.

Return the breaker to desired position. Replace dead-front shield when breaker is in "DISCONNECT" position.

4-2.4 REMOVING BREAKER MOLDED COVER

Remove the breaker cover by first taking out the two screws on top of the charging handle. Slide the charging handle down after removing the screws. It will pull off. Then remove the cover screws. After removal of the cover screws, the cover can be taken off with no difficulty (Figures **4-7** and **4-8**).

NOTICE

It is recommended that the breaker be in the fully withdrawn position or on a work bench before removing the cover. Also, the breaker contacts should be open and the stored spring energy discharged. The mechanism is electrically isolated from the primary conductors; however, for fixed mounted breakers all control power to the accessories should be disconnected to avoid accidental contact with energized leads or breaker operation with the cover removed.

SECTION 5: ACCESSORIES

5-1 GENERAL

The descriptions in this section apply to factory installed accessories. Unless indicated, all of these accessories are available in kits for field installation. Details on installation are found in the instruction leaflet with each kit.

5.2 SHUNT TRIP

The breaker shunt trip is a conventional shunt trip accessory used in conjunction with an "a" auxiliary switch to provide for breaker opening from a remote control source. In addition to the cut-off function, the S.P.D.T. auxiliary switch provides control contacts that can be used for remote indication of the breaker "open" or "closed" position. All shunt trip components are mounted internally in the center pole (Figures **5-1** and **5-2**).

5-3 SPRING RELEASE FOR MANUAL BREAKERS

The spring release accessory is used in conjunction with a cut-off switch, a spring charged contact and a latch check contact to provide remote closing of the breaker following either a manual or electrical spring charging operation. The spring release is optional on manual breakers but is supplied as standard on all electrically operated breakers.

For close circuits employing a "momentary" closed initiating contact, an anti-pump relay is not required. For those circuits employing a "maintained" closed initiating contact, an anti-pump relay is available to prevent: either **a)** a non-desired automatic reclosing operation following either a manual or automatic opening operation; or **b)** a closing operation following a manual charging operation (Figures **5-3** and **5-4**).

For remote signal purposes, a normally open spring charged contact in series with the latch check contacts is provided as standard. This allows an optional remote "spring charged" indicator circuit that signifies the "ready to close" condition of the breaker.

All components are mounted internally in the center pole except the anti-pump relay which is mounted in the right-hand pole.

5-4 ELECTRICAL OPERATOR

An electrical operator may be used to provide the energy required to electrically pre-charge the closing springs in the stored energy mechanism. The opening energy is automatically stored in a separate set of springs during

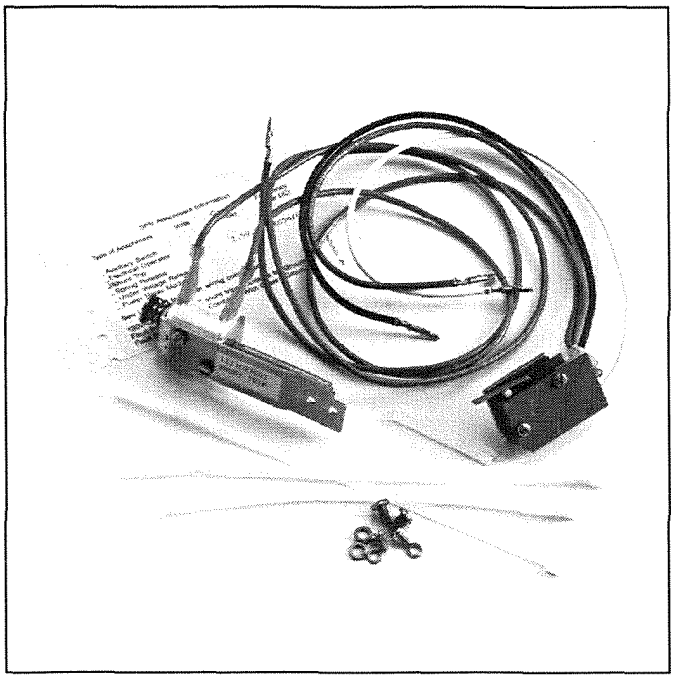


Figure 5-1 Shunt Trip Kit

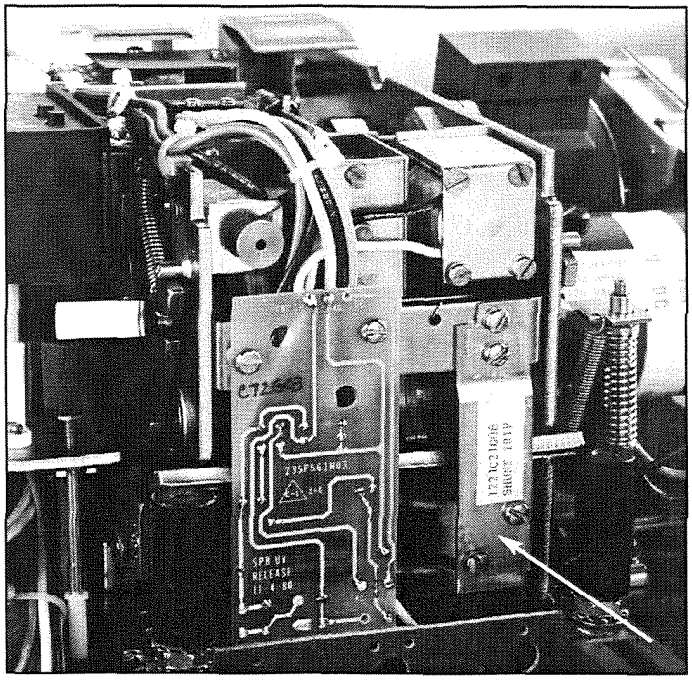


Figure 5-2 Shunt Trip Installed

any closing operation. The electrical operator is designed to charge the springs automatically when they are discharged.

When the springs are completely charged, the motor circuit is disconnected by a spring charged contact. A yellow mechanical target indicator shows the "spring charged" position of the mechanism. Remote charging can be accomplished by using a maintained contact in the electrical operator control circuit. If for any reason the charging control power should be interrupted during an electrical charging operation, the charging sequence may be completed with the manual charging handle.

The electrical operator is internally bracket mounted in the right-hand pole. The spring charged contact is installed in the center pole (Figures **5-5** and **5-6**).

5-5 AUXILIARY SWITCH

Auxiliary switches are used in remote control circuits for interlocks, indicating lights, and signal contacts to indicate the open or closed position of the breaker main contacts. The position of the main contacts is indicated by closed or open switches as follows:

"a" contacts - Open when breaker is open and closed when breaker is closed.

"b" contacts - Closed when breaker is open and open when breaker is closed.

A maximum of four S.P.D.T. spare auxiliary switches may be installed in a single breaker. All components are internally mounted in the right-hand pole (Figures **5-7** and **5-8**).

5-6 UNDERVOLTAGE RELEASE

An undervoltage release operates to open the breaker when the monitored voltage is equal to or less than the release setting. Normally the UVR coil is connected to the line side of the circuit breaker without an auxiliary switch in the circuit. The UVR will automatically reset when the breaker main contacts open. Should an attempt be made to close the breaker during an undervoltage condition, the breaker main contacts may make contact.

The undervoltage release will operate instantaneously if the monitored voltage should dip into the dropout voltage range. A time delay of up to 0.5 seconds may be obtained with the addition of a remote mounted time delay device (Section 5-7).

The undervoltage release and any required supplemental resistors and/or bridge are internally mounted in the center pole (Figures **5-9** and **5-10**).

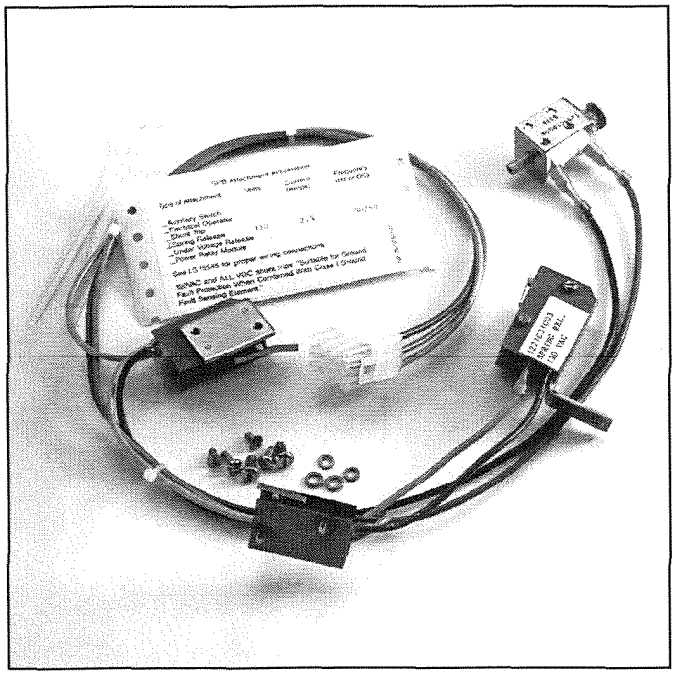


Figure 5-3 Spring Release Kit without Anti-Pump Relay

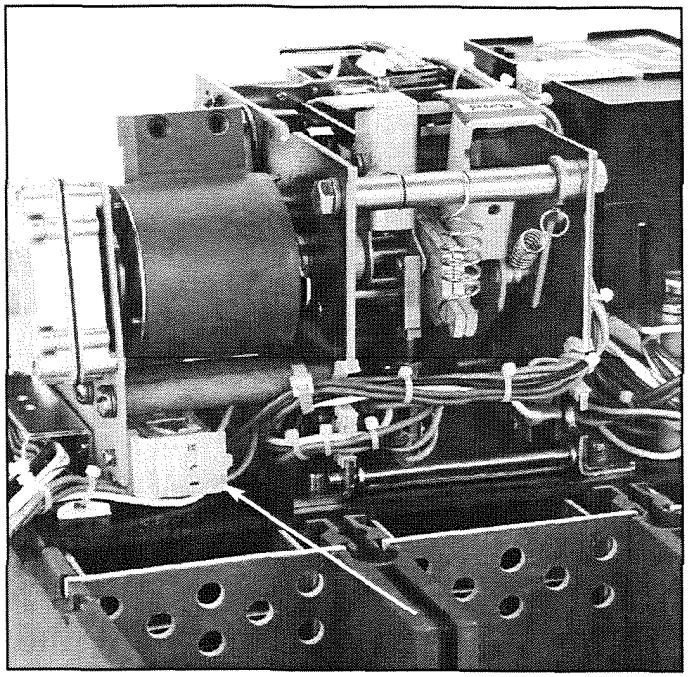


Figure 5-4 Anti-Pump Relay Shown Installed Under Handle Hub

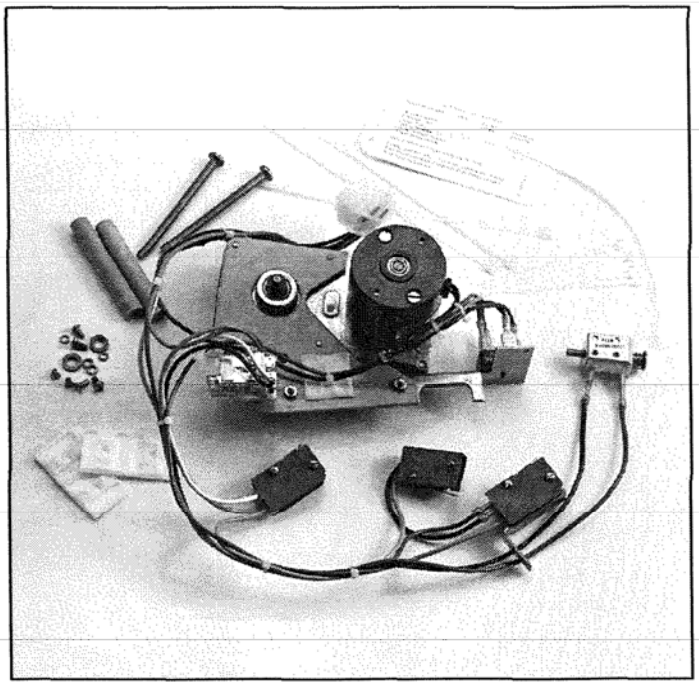


Figure 5-5 Electrical Operator Kit

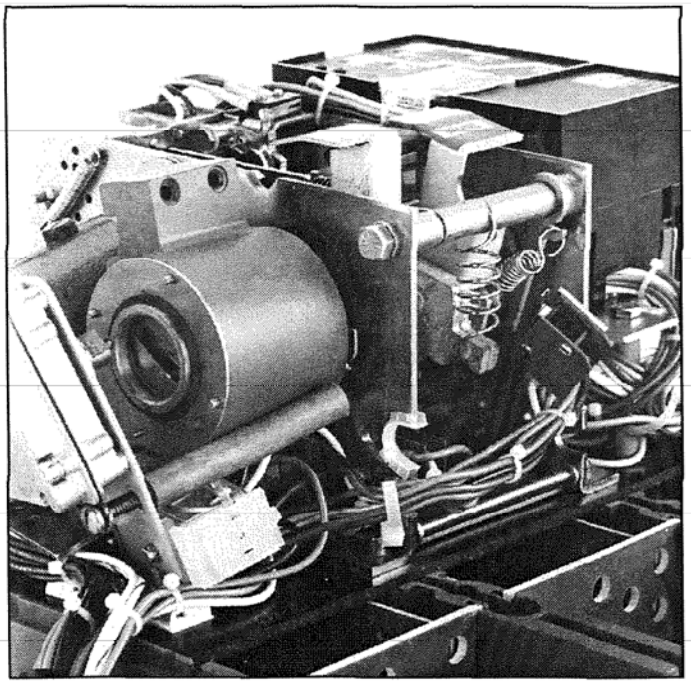


Figure 5-6 Electrical Operator Kit Being Installed

Figure 5-7 Auxiliary Switch Kit

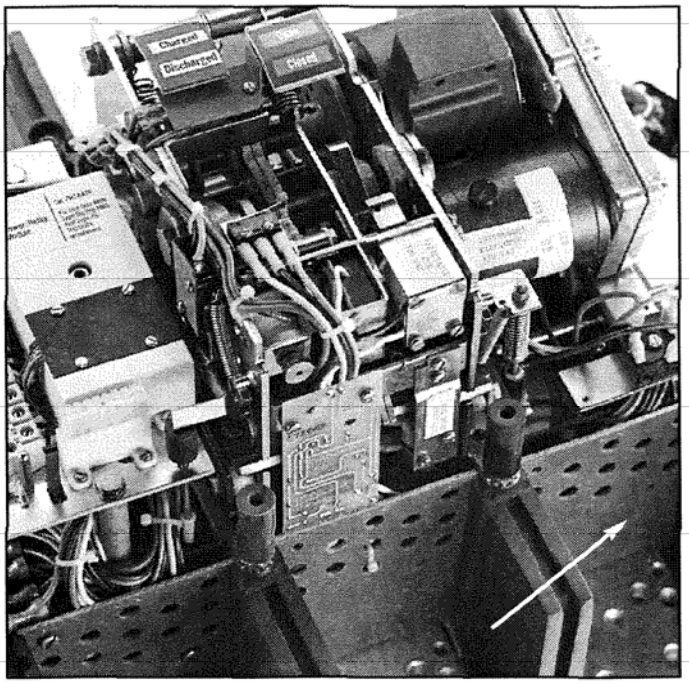


Figure 5-8 Auxiliary Switch Installed Behind Right End Barrier

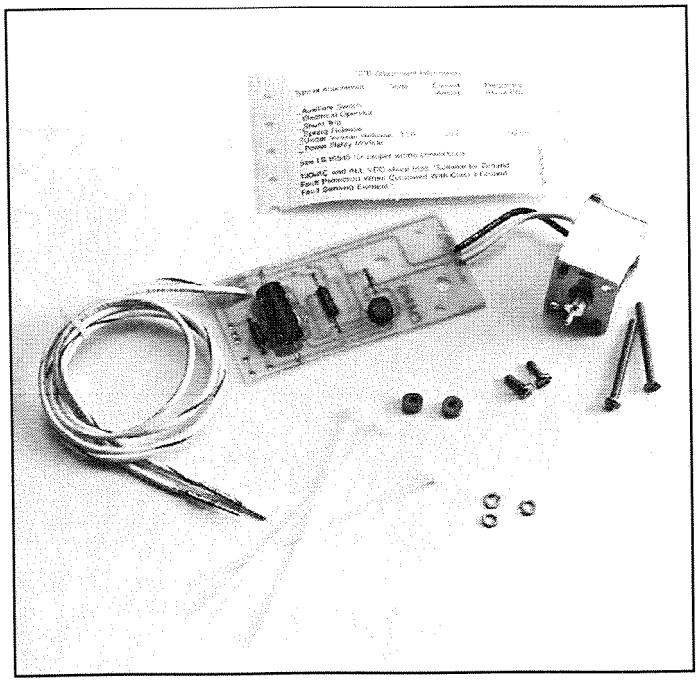


Figure 5-9 Undervoltage Release Kit

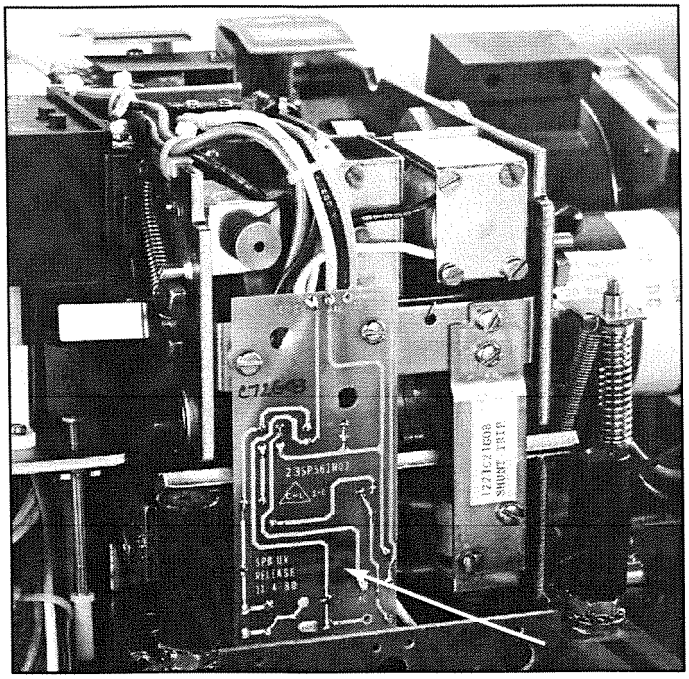


Figure 5-10 Undervoltage Release Installed

5-7 UNDERVOLTAGE RELEASE TIME DELAY DEVICE

An undervoltage release time delay device used in conjunction with the instantaneous undervoltage release accessory will provide the necessary time delay operation to avoid nuisance breaker openings, resulting from momentary dips in the monitored AC voltage source.

The device has AC voltage taps at 120 and 240 volts with time delay settings of .1, .3 and .5 seconds at 120 volts and .5, .7 and 1.0 at 240 volts. It must be applied only with a 60V DC instantaneous undervoltage release.

The device is available in a surface mounted enclosure for remote mounting. If required, the surface unit may be adapted for flush mounting with the addition of a special mounting adapter.

5-8 KEY INTERLOCKS

Key interlock mechanisms provide a means for the mechanical sequencing of circuit breakers, as may be required when multiple power sources are available for a common load. Key interlock assemblies are available for both fixed mounted and drawout breakers (Figures **5-11** and **5-12**). For fixed breakers the assembly is bolted to the right-hand side of the breaker. For drawout breakers behind the door, the assembly is mounted to the right-hand side of the drawout stationary racking mechanism. With either arrangement, the charging and closing of the breaker is blocked. With the lock in the "BOLT EXTENDED" position, the breaker may be racked to the "WITHDRAWN" position. For through the door drawout breakers the assembly is mounted below the cassette in the switchgear.

Linkage kits are available for field mounting on the drawout stationary racking mechanism. Provisions for key interlocks must be factory installed on fixed mounted breakers.

Ordinarily, the actual key interlocks are ordered separately and installed by the customer. However, complete lock provisions including the locks may be installed in the factory to satisfy customer requirements.

Locks supplied by the customer should be Kirk- or physical equivalent- Type "F," standard 3/8 inch bolt projection for through the door design and "Zero" bolt projection for behind the door and fixed designs.

"ZERO" bolt projection, with the key removable with the bolt extended. Mounting bolts are normally supplied with the locks by the supplier. For factory installed locks on fixed mounted breakers only, sealing provisions are installed with the mounting bolts to prevent tampering.

A maximum of six lock cylinders may be used with any one fixed mounted breaker. A maximum of four may be used with all drawout stationary mechanisms.

The fixed breaker lock mounting bracket will also permit the addition of up to two 12-point terminal blocks on the right-hand side for secondary control wiring.

5-9 DRAWOUT CELL POSITION PADLOCK ADAPTER (BEHIND THE DOOR ONLY)

A padlockable adapter kit is available for factory installation to padlock the breaker in either the "CONNECTED," "TEST," or "DISCONNECTED" position. For safety and maintenance purposes, this adapter, when installed and used, will prevent the breaker from being moved to any other cell position.

Four locks may be installed with the breaker in the "CONNECTED" position; two in the "TEST" position one in the "DISCONNECT" position. Where additional locks are required in either the "TEST" or "DISCONNECT" positions, a commercially available auxiliary padlock adapter may be used (Figures **5-13**).

5-10 PUSH-TO-OPEN PADLOCKABLE ADAPTER KIT

A padlockable adapter kit is available for factory or field installation over the PUSH-TO-OPEN button, allowing the breaker to be padlocked in the "OPEN" position. The adapter will accommodate up to four padlocks. The adapter is installed with one way screws to prevent its removal (Figures **5-14** and **5-15**). For field installation, the two blind holes provided in the cover must be tapped with a 0.190-32 tap for the one way screws.

5-11 MANUAL CLOSING BLOCKING ADAPTER KIT

A manual closing blocking adapter is available for factory or field installation over the PUSH-TO-CLOSE button, preventing the breaker from being manually closed under normal conditions. Provisions are available for emergency manual closing under "TEST" or bench maintenance conditions, by using a small screwdriver in the center opening (Figure **5-16**).

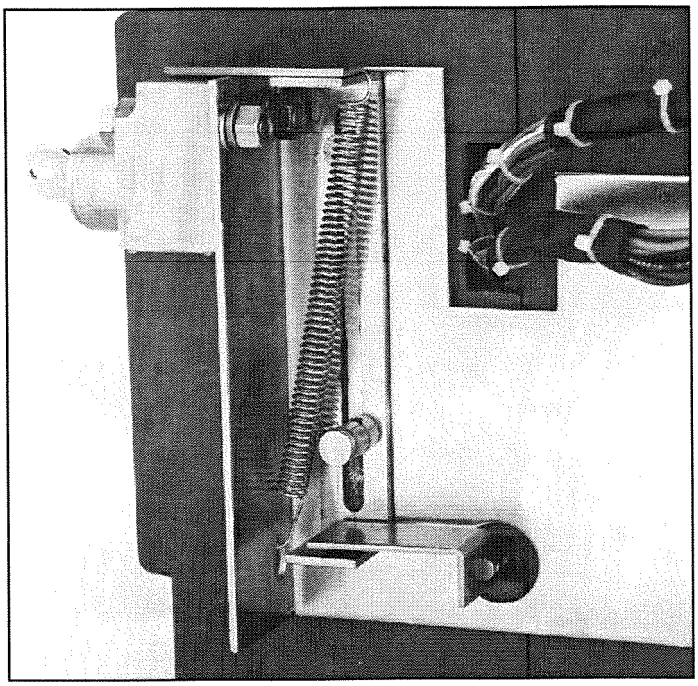


Figure 5-11 Rear View of Installed Key Interlock and Linkage Kit on Fixed Mounted Breaker

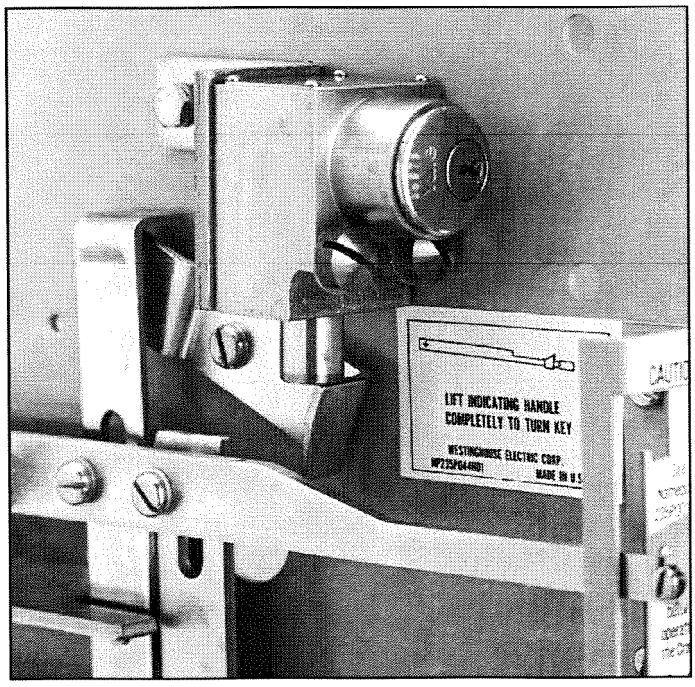


Figure 5-12 Key Interlock Installed on Behind Door Drawout Mechanism

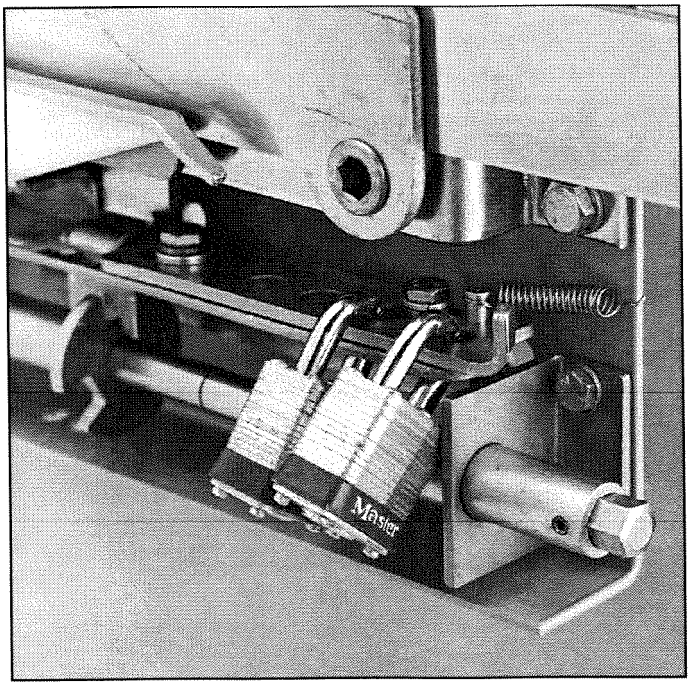


Figure 5-13 Padlocks Installed on Behind Door Drawout Mechanism

The blocking of manual closing may often be required in automatic transfer schemes where automatic sequencing of breaker operations is controlled.

The adapter is installed with one way screws to prevent its removal. For field installation, the two blind holes provided in the cover must be tapped with a 0.190-32 tap for the one way screws.

5-12 BELL ALARM

The bell alarm is factory installed and functions only when the breaker trips automatically, not when the breaker is operated manually. A normally open contact closes when the breaker trips due to an overload or short-circuit. The normally open contact can be placed in a circuit with a warning device (bell). Remote signaling and interlocking capabilities can also be provided.

5-13 CONTROL TERMINAL BLOCKS FOR FIXED MOUNTED BREAKERS

Two 24-point terminal blocks used to terminate control leads leaving the breaker can be assembled to the sides

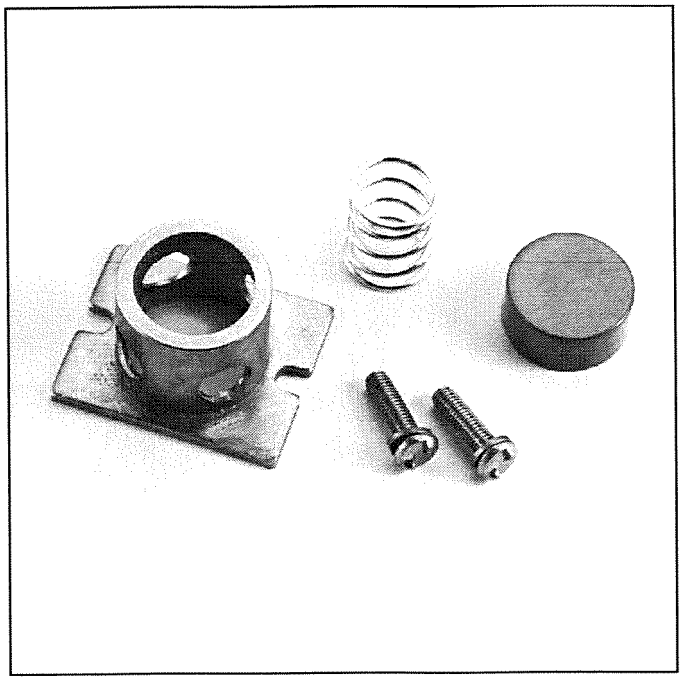


Figure 5-14 PUSH-TO-OPEN Padlockable Adapter Kit

Figure 5-15 PUSH-TO-OPEN Padlockable Kit Installed

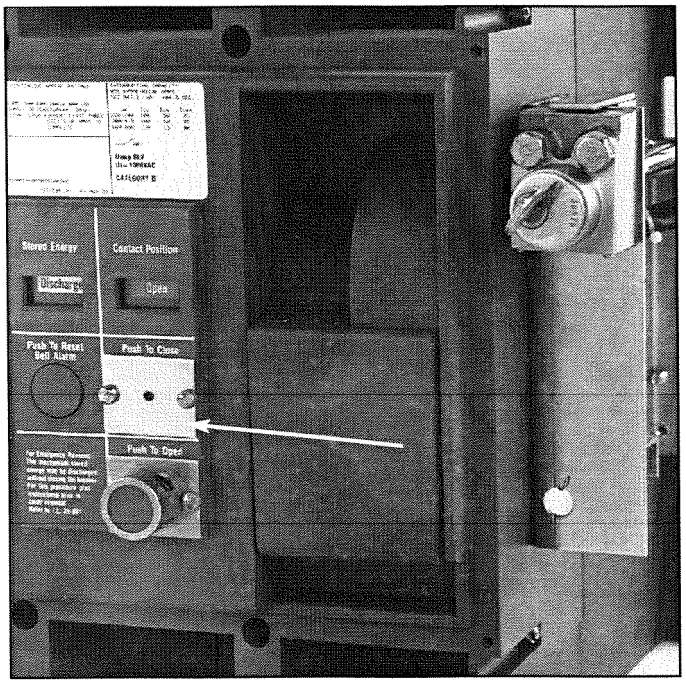


Figure 5-16 Manual Closing Blocking Adapter Kit Installed

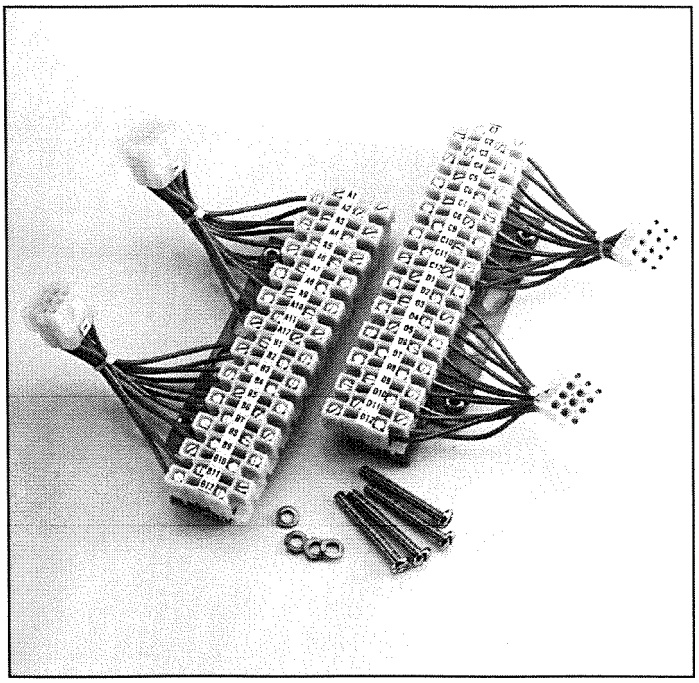


Figure 5-17 Fixed Mounted Breaker Control Terminal Block Kits

of a fixed mounted breaker. The terminal blocks, one on a side, are bracket mounted for convenience (Figure **5-17**).

The terminal block mounting bracket may be mounted simultaneously with the Kirk key interlock mounting bracket.

The terminal blocks are rated 6 A. 600 volts.

5-14 CABLE INTERLOCK

The mechanical cable interlock is a cable operated device which mutually interlocks a pair of breakers. When properly installed, the cable interlock puts one breaker in a trip free mode when a second interlocked breaker is in the closed position. The use of cables gives the interlock great flexibility and permits the breakers to be located varying distances from one another.

The cable interlock is supplied in kit form for field installation and consists of two cable assemblies and mounting hardware. Cable interlock kits are available for both fixed and drawout breaker configurations.

5-15 "T" CONNECTORS

Removable "T" Connectors are mounted and supplied as standard on all fixed mounted circuit breakers. The "T" Connectors provide horizontal pads for primary rear connections. If the "T" Connectors are removed, the remaining vertically mounted pads may permit a front connected configuration under some circumstances.

SECTION 6: INSPECTION AND MAINTENANCE

6-0 GENERAL

Encased Systems Pow-R Breakers are "Top of the Line" equipment. This means they are manufactured under a high degree of quality control, with the best available materials and with a high degree of tooling for accuracy and interchangeability of parts. Systems Pow-R Breakers are designed, built, tested and listed in accordance with the requirements outlined in the Underwriter' Laboratories, Inc. "Standard For Safety For Molded Case Circuit Breakers and Circuit Breaker Enclosures." UL 489, Systems Pow-R Breakers exceed many of these requirements, particularly in the areas of short time capability and endurance. Design tests show Systems Pow-R Breakers have durability considerably beyond minimum standard requirements.

Standard molded case circuit breakers have an excellent record of reliability, due to a great extent to their enclosed design, which minimizes tampering and exposure to dirt, dust, and other contaminants. This reliability also depends on proper installation and careful application, particularly with reference to the maximum available short-circuit current of the circuit to which the circuit breaker is applied.

Reliability after installation also depends upon environment and maintenance. All devices with moving parts require periodic check-ups. A circuit breaker is no exception. It is not unusual for a circuit breaker to be in service for extended periods and never be called upon to carry out its overload or short-circuit functions. Therefore, the breaker should be exercised periodically to assure that it is functioning.

Encased Systems Pow-R Breakers are designed to be relatively maintenance free. However, because of the variability of application conditions and the great dependence on these breakers for protection and the assurance of service continuity, inspection and maintenance checks should be made regularly.

Since maintenance of these breakers will consist mainly of keeping them clean, the frequency of maintenance will depend to some extent on the cleanliness of the surroundings. If there is a significant amount of dust, lint or other foreign matter present, more frequent maintenance will be required.

With the trip mode indicators within the trip unit, the number of trial and error procedures to determine the cause of an automatic breaker tripping operation will be limited. Trip operations initiated by "short circuit" and/or "ground fault" conditions will generally require more breaker inspections than those initiated by "overload" operations.

6-1 WHEN TO INSPECT

Since breakers that are designed, built and tested under UL 489 are designed to be maintenance free, there are no time periods established by the industry for the performance of routine maintenance inspections. In the absence of established standards, it is recommended that a routine inspection be conducted at the end of the first six months of service for breakers used under normal operating conditions. After the first inspection, inspect at least once a year. If these recommended inspections show no maintenance requirements, the period may be extended to a more economical point. Conversely, if the recommended inspection shows, for instance, heavy accumulations of dirt or other foreign matter that might cause mechanical, insulation or other electrical damage, the inspection and maintenance interval should be decreased.

When a breaker opens a fault at or near its rating, give it a visual inspection in the withdrawn position with the front cover and arc chutes removed. For breakers equipped with trip mode indicators, the need for this type of inspection can be quickly seen.

6-2 WHAT TO INSPECT

What to inspect and to what extent is dictated by the nature of the maintenance function. Routine, periodical inspections require one type of observation. Inspections following a known high level fault require more detailed inspections.

6-2.1 PERIODIC ROUTINE INSPECTIONS

Periodic routine type inspections should normally be limited to external housecleaning activities to remove any dust and dirt that might have accumulated externally on the breaker surface and terminations that could lead to future dielectric problems. There is adequate experience to indicate that where electrical testing is not practical or cannot be justified, the manual mechanical exercising of a circuit breaker is usually effective in assuring its proper electrical operation. A few mechanical operations of the charging and closing mechanism, performed periodically, together with a careful visual inspection of terminal connections for tightness, physical damage or evidence of overheating are considered good practice. This will keep mechanical linkages free, and the wiping action by

contacts will tend to avoid resistance buildup and thereby minimize heating. Circuit breakers used for frequent switching need no further exercising.

For working convenience and safety, bus systems supplying fixed mounted breakers should be de-energized. Drawout mounted breakers should be racked to the "TEST" or removed positions for inspection and for conducting mechanical tests. Electrically operated drawout breakers may be routinely operated electrically while in the "TEST" position.

For functional testing of the trip unit, refer to separate detailed trip unit instruction publications.

This instruction booklet is published solely for information purposes and should not be considered all inclusive. If further information is required, you should consult Cutler-Hammer.

Sale of product shown in this literature is subject to terms and conditions outlined in appropriate Cutler-Hammer selling policies or other contractual agreement between the parties. This literature is not intended to and does not enlarge or add to any such contract. The sole source governing the rights and remedies of any purchaser of this equipment is the contract between the purchaser and Cutler-Hammer.

NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, OR WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE, ARE MADE REGARDING THE INFORMATION, RECOMMENDATIONS AND DESCRIPTIONS CONTAINED HEREIN. In no event will Cutler-Hammer be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information, recommendations and description contained herein.

Cutler-Hammer
Pittsburgh, Pennsylvania, U.S.A.

Effective 7/00 (ISI)
Style 6647C23H04
Printed in U.S.A.