

**Instructions for the  
Systems Pow-R Breaker  
and Draw-out Mechanism—  
250, 800, 1600, 2000, 2500,  
3000 Amp. Frames**



I.B. 15082,  
File 29-800

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## Introduction

The Westinghouse Systems Pow-R Breaker is an enclosed 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 draw-out mechanisms in the 250, 800, 1600, 2000, 2500, and 3000 amp frame sizes. See Figure 1.

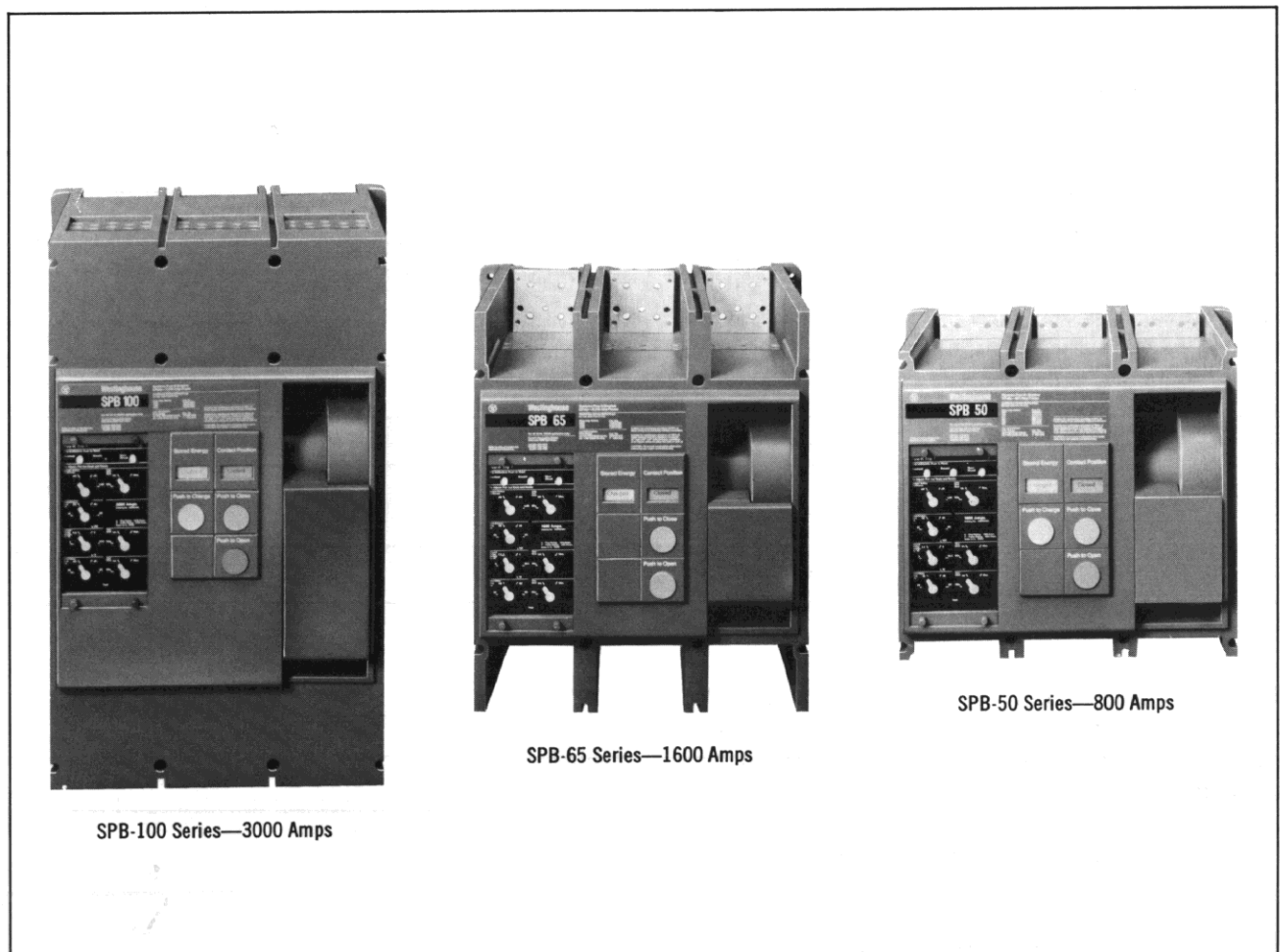
Systems Pow-R Breakers must be applied within their published ratings in accordance with UL and NEMA standards defined as "Usual Service Conditions." Systems Pow-R Breakers are available for standard interrupting capacities (100,000 amps at 480 volts), or high interrupting capacities (150,000 amps at 480 volts). See Table 1. High interrupting capacity breakers are distinguished from standard I.C. breakers by their light grey operating handle. Special lower I.C. breakers are available in 250, 800, and 1600 amp frames. Sys-

tems Pow-R Breakers are assembly rated for application at 100% of their continuous current rating.

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

If you follow these instructions carefully you will realize the full capabilities of this equipment. Therefore:

**PLEASE STUDY THESE INSTRUCTIONS AND UNDERSTAND THEM. STUDY THE BREAKER AND ITS MECHANISMS CAREFULLY BEFORE ATTEMPTING TO OPERATE IT ON AN ENERGIZED CIRCUIT.**



**Fig. 1** Systems Pow-R Breaker's Three Frame Sizes.

**Table 1 — Interrupting/Short Time Ratings**

Series	SPB-50		SPB-65	SPB-100						SPB-150					
Frame Continuous Ampere Rating	250A	800A	1600A	250A	800A	1600A	2000A	2500A	3000A	250A	800A	1600A	2000A	2500A	3000A
Short Time Rating*	25KA	25KA	35KA	25KA	25KA	35KA	35KA	35KA	35KA	25KA	25KA	35KA	51KA	51KA	51KA
Max. Short Time Delay (Cycles)	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Interrupting Capacity KA RMS Symmetrical Amps @ AC Rating Volts	240	65	65	85	100	100	100	100	100	100	200	200	200	200	200
	480	50	50	65	100	100	100	100	100	100	150	150	150	150	150
	600	42	42	50	65	65	65	85	85	85	100	100	100	100	100

\*Short Time Rating (RMS Symmetrical Amps) in 600 V., 50/60 Hz System with X/R Ratio of 6.6.

Note: All Systems Pow-R Breakers Equipped with Pow-R Trip 7 Trip Devices.

## Section 1—Handling the Breaker and Draw-out Mechanism

### 1.0 HANDLING

Before you begin uncrating your new Westinghouse Systems Pow-R Breaker and draw-out mechanism, read and understand these directions. If you follow them, you will be sure that you have caused no damage to this highly sophisticated equipment.

The Westinghouse Systems Pow-R Breaker and draw-out mechanism is delivered in two crates. The larger crate is the stationary portion of the draw-out mechanism; the smaller is the breaker itself. Heed the following instructions, and uncrate the draw-out mechanism first.

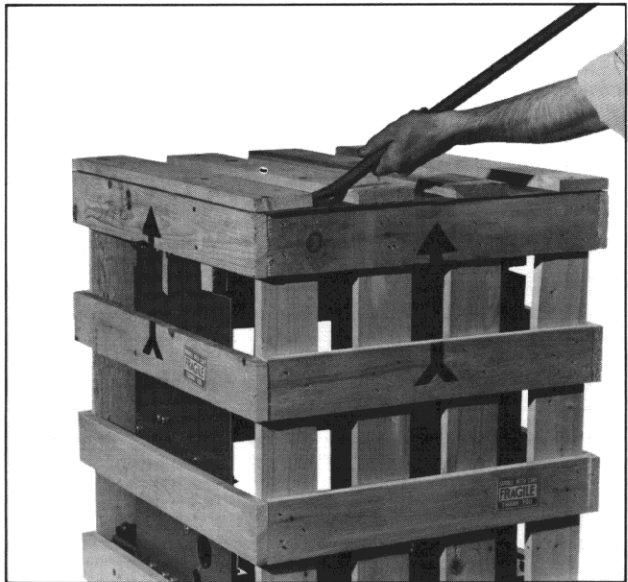
### 1.1 UNCRATING THE DRAW-OUT MECHANISM

Set the draw-out crate in position, with arrows pointing up, as shown in Figure 2.

Remove the top four boards and cardboard. If you use a crowbar, as shown here, be certain to clear all splinters and wood chips off the equipment before mounting. Don't remove any protective covering till the unit is completely uncrated.

Remove the sides and internal shipping braces.

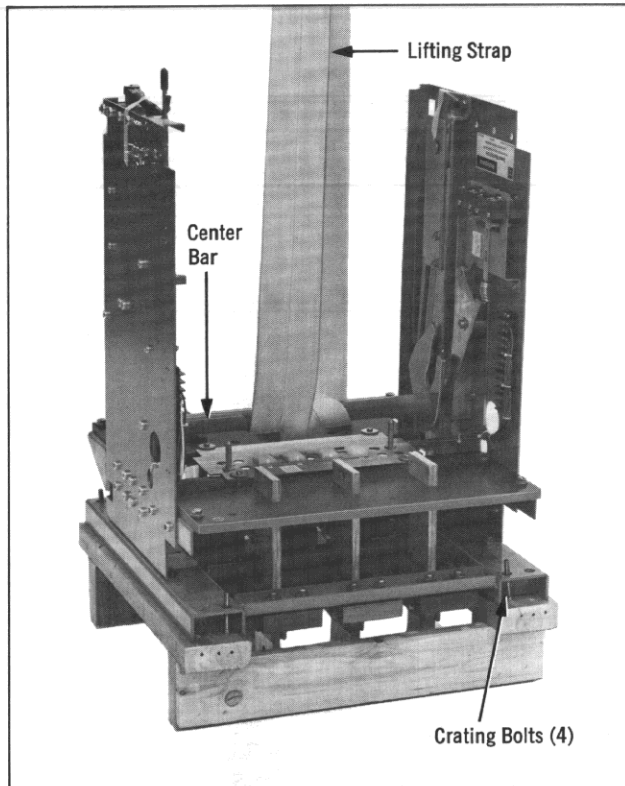
Loosen the four crating bolts at the bottom corners of the frame. Then remove protective covering. See Figure 3.



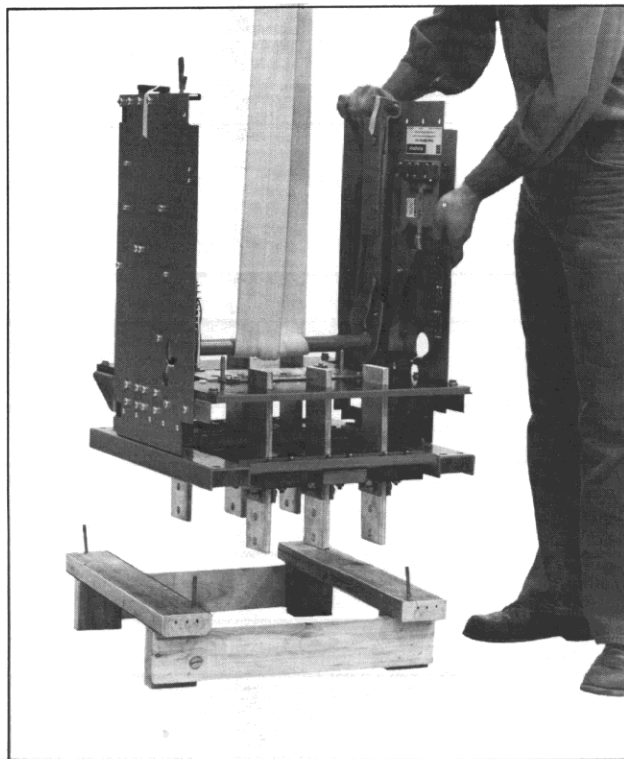
**Fig. 2** *Uncrating the Draw-out Mechanism.*

Attach overhead crane lift to center bar of draw-out, using a wide strap, wrapped several times around the center of the bar.

Raise the draw-out mechanism as shown in Figure 4.



**Fig. 3** Draw-out Mechanism Ready for Lifting.

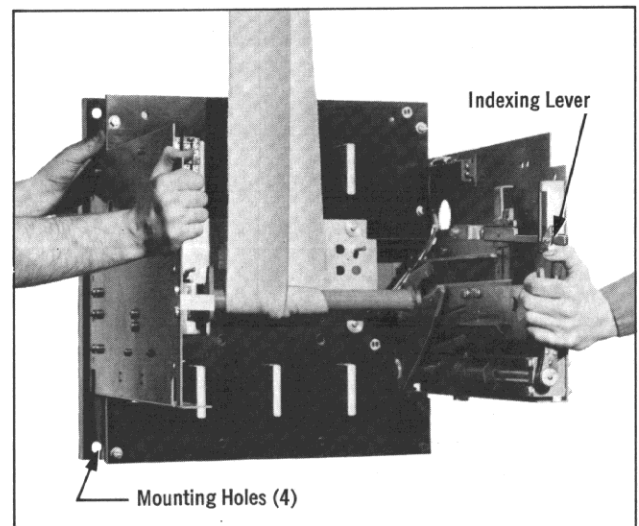


**Fig. 4** Balancing the Draw-out Mechanism.

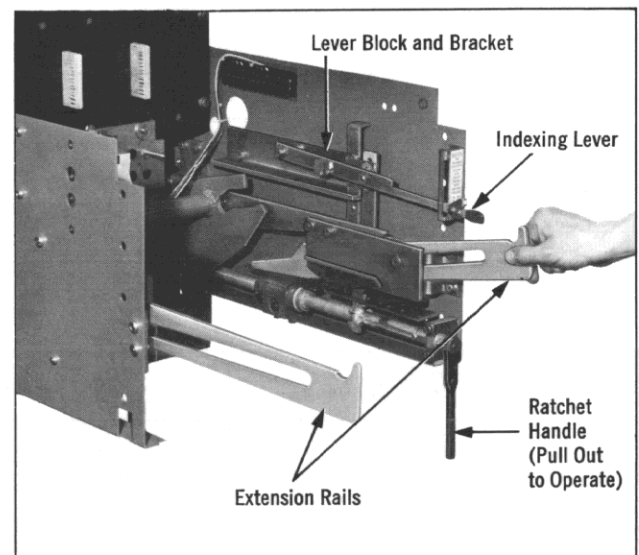
### 1.1.1 Mounting the Draw-out Mechanism

With the red indexing lever facing you on the right, as shown in Figure 5, mount the draw-out mechanism into the switchboard. See Figure 31, 32, and 33 for mounting dimensions. Use the strap for balance as you align the unit with the mounting holes.

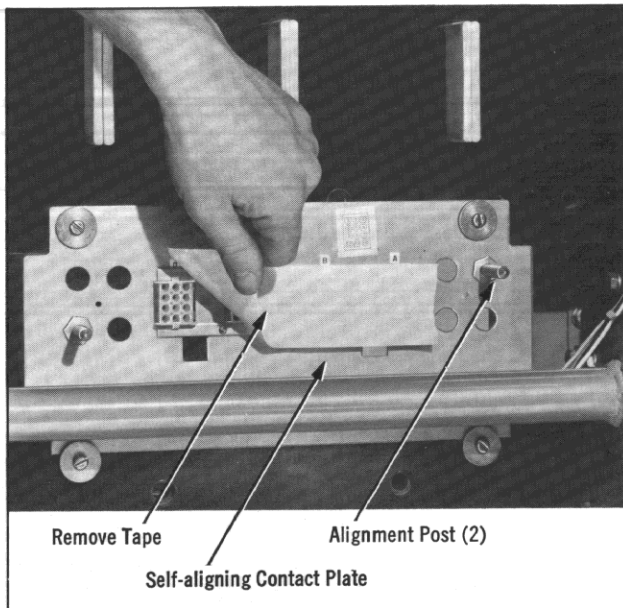
After mounting, refer to Figure 6, and remove the tapes which hold the extension rails in place. Lift slightly on both rails to slide them all the way out. Make sure the ratchet handle on the right is pointing straight down.



**Fig. 5** Mounting the Draw-out Mechanism.



**Fig. 6** Draw-out Mechanism Components.



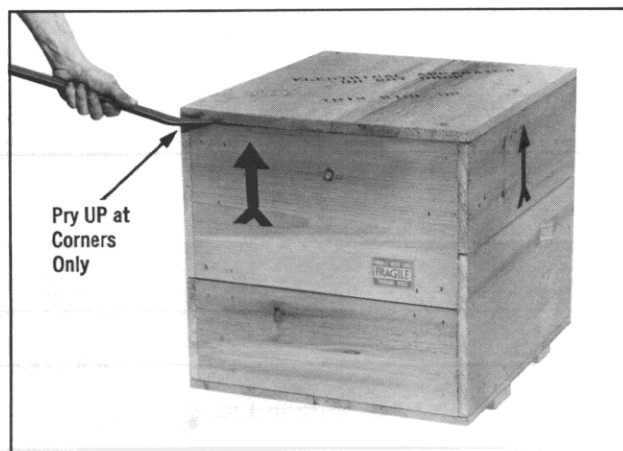
**Fig. 7** Removing Tape from Secondary Control Blocks.

For draw-out frames equipped with secondary control blocks, refer to Figure 7 and remove the tape from the contact openings. Note: Secondary control block mounting plate is self-aligning.

### 1.2 UNCRATING THE BREAKER

Place breaker crate in position with arrow pointing up. See Figure 8.

Remove the top of the crate. If a crowbar is used, do as shown in Figure 8: place the bar only at the edges of the crate, and use a mallet to drive the bar. Do not push down with the crowbar; pry up instead.



**Fig. 8** Proper Use of Crowbar for Uncrating Breaker.

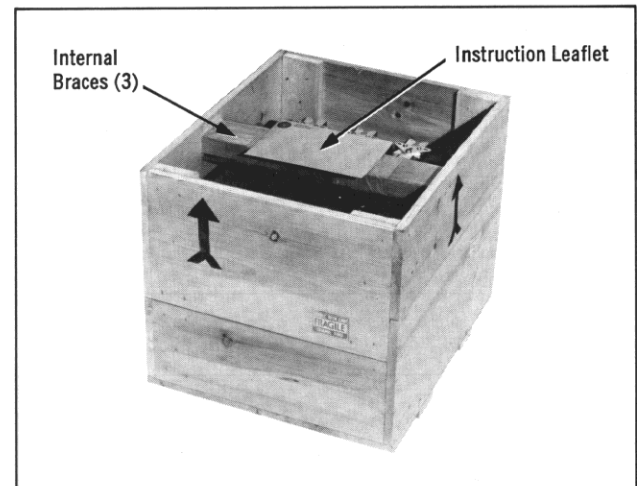
Remove envelope with instruction leaflet from crate, see Figure 9, and keep leaflet handy for reference. This envelope also contains labels for the enclosure door as well as the door escutcheon. (See Figures 16, 17, and 21.)

Carefully remove sides of the crate and internal shipping braces.

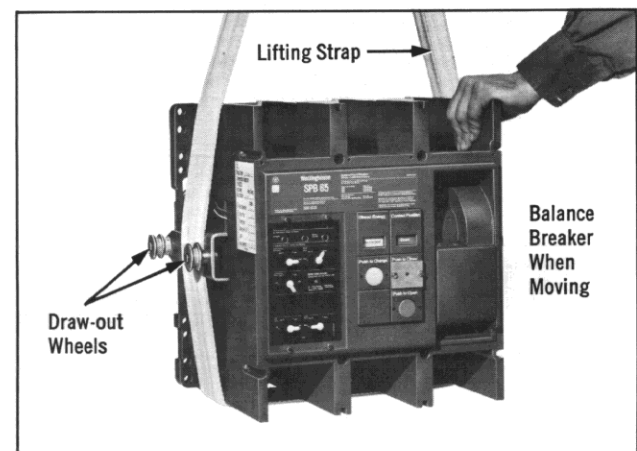
### 1.3 MOUNTING THE BREAKER IN THE DRAW-OUT MECHANISM

Be sure that the draw-out has:

- A. Extension rails pulled out to their full extension. See Figure 6.
- B. Tape removed from secondary control block contact openings. See Figure 7.



**Fig. 9** Breaker Crate with Lid Removed.



**Fig. 10** Breaker Lifted from Crate.

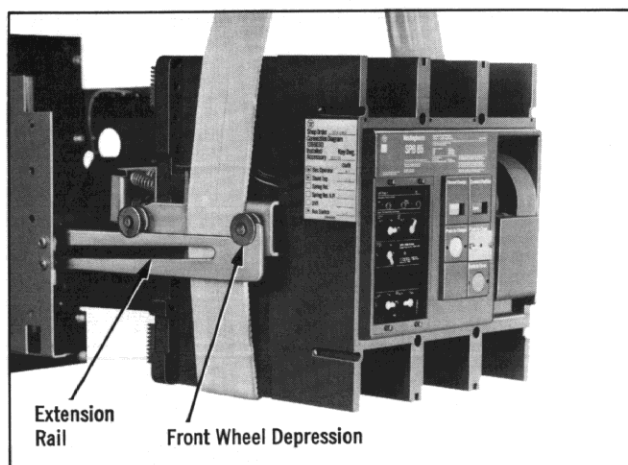
Use a wide strap attached to an overhead crane for lifting. Tilt the breaker forward on the bottom of its crate, slip the strap beneath it, placing the strap between the two draw-out wheels on each side, as shown in Figure 10, in its most balanced position.

Raise the breaker with the crane. Hold breaker's side to assure firm balance.

Lower all 4 wheels of the breaker onto the top of the extension rails, as shown in Figure 11. 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 (see Figure 16), is provided for mounting to the breaker cell door. Mounting dimensions are shown in Figures 31, 32, and 33. With the cell door in place, attach escutcheon to outside of enclosure door.

Place the breaker in "test" position. (See Section 3.2.2 and Figures 17 and 20.) With the position indication label provided (see Figure 17), peel off the adhesive backing on the label and place the label on escutcheon so that the "test" position indicator lines up correctly with indexing lever white dot.



**Fig. 11** *Placing the Breaker on the Extension Rails.*

#### 1.4 MOUNTING FIXED MOUNTED BREAKERS

For partial outline dimensions refer to Figure 12. Complete mounting dimensions for fixed mounted Systems Pow-R Breakers are found on the following outline drawings:

Outline drawing No. 2614D49—250 A and 800 A, front and rear connected

Outline drawing No. 2614D48—1600 A, front and rear connected

Outline drawing No. 2614D50—3000 A, front connected

Outline drawing No. 2614D47—3000 A, rear connected

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

**NOTE:** If the fixed mounted breaker is electrically operated, care must be taken during mounting not to damage the fuse holder. See Figure 13.

**ALSO NOTE:** If a key interlock is used, care must be taken during mounting not to damage the rotating tripper. See Figure 65.

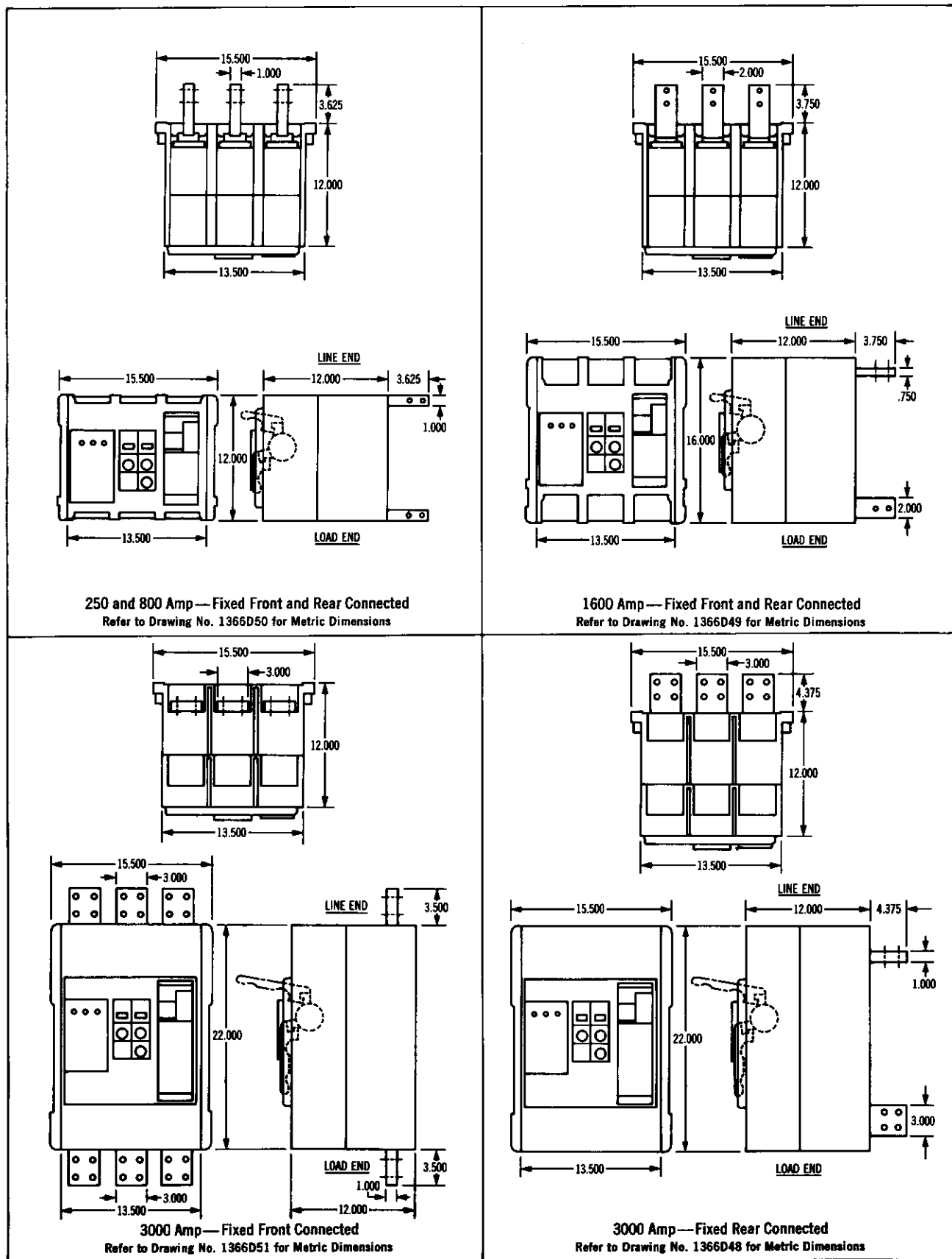


Fig. 12 Systems Pow-R Breaker Dimensions—Fixed Mounting.

## Section 2—Description

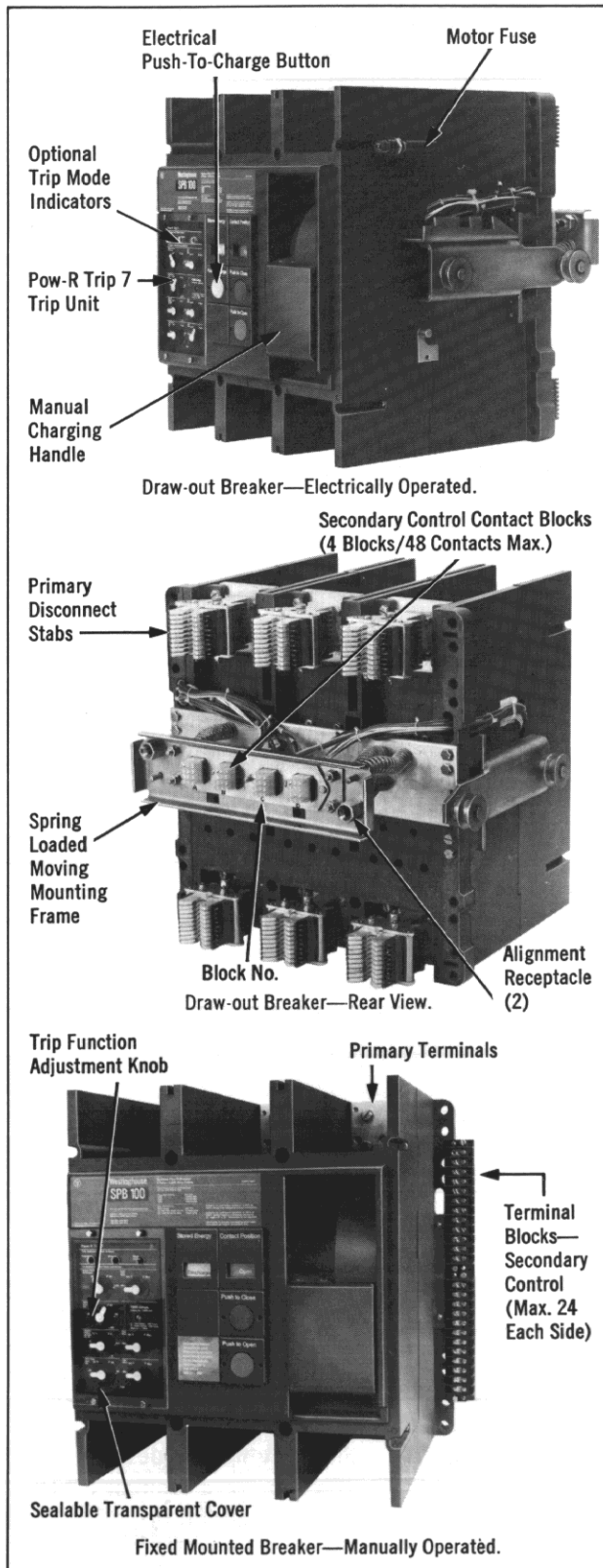


Fig. 13 Systems Pow-R Breaker Styles.

### 2.0 GENERAL

The three physical frame sizes of the Systems Pow-R Breaker accommodate all continuous current ratings from 160 through 3000 amps. All three frame sizes have the same depth, width, and pole spacing, with height the only variable dimension. See Figure 12.

### 2.1 BREAKER

Refer to Figure 13.

The breaker terminals are at the top and bottom of the breaker frame, in the rear. Fixed front connections for cable and bus bar are available in fixed mounted breakers in the 250, 800, and 1600 amp frame ratings. Extended front terminals are available in 2000, 2500, and 3000 amp frame ratings. Fixed rear connections are available in all fixed mounted breaker frames.

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. Electrically operated breakers also have a push-to-charge pushbutton.

The lever for manual charging of the breaker spring is on the right-hand side of the breaker front. A dark grey lever indicates standard or special lower interrupting capacities; a light grey lever indicates higher interrupting capacities.

On the left side of the breaker front is the Pow-R Trip 7 trip unit. It includes the standard adjustments of ampere setting, long-time delay, and instantaneous pick-up. Optional adjustments include short time pick-up, short time delay, ground fault pick-up, and ground fault time delay. Adjustments are made with the white knobs, clearly identified as to function.

The trip unit also includes the rating plug, and the optional indicators for breaker tripping on overload, ground fault, or short circuit.

On breakers with an electrical operator, a fuse for motor protection is located on the upper right edge of the frame.



## 2.2 CONTACTS

Refer to Figure 13.

Primary disconnect stabs are located on the back of the breaker. Secondary control contacts on draw-out breakers are plug-in terminal blocks, also located on the rear of the breaker. On fixed mounted breakers, terminal blocks are provided on each side of the breaker as an option and as required for secondary control wiring (max. 24 points each side).

## 2.3 DRAW-OUT MECHANISM

Refer to Figures 6 and 17.

The draw-out 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 draw-out mounted breakers. Positive indents are provided for each draw-out position: "Connect," "Test," "Disconnect." A ratchet handle below the right-hand extension rail provides the means for cranking the breaker into each of these draw-out positions. 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. A molded escutcheon is provided for attaching to the breaker cell door for mounting of the indexing lever label. This label indicates the draw-out position of the breaker.

# Section 3—Basic Operating Instructions

## 3.1 BREAKER

All basic breaker and draw-out operations can be performed from the front of the breaker, with the exception of the inspection of the primary and secondary disconnects in draw-out mounted breakers. For that operation, see Section 3.2.3—Rotation on the Draw-out Mechanism. Suitable electrical and mechanical interlocks are provided to prevent incorrect operation of the breaker.

### 3.1.1 How to Charge Manually

To charge either a manual or electrically operated breaker manually, push or pull up on the charging handle. See Figure 13. 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 normal position when released. Manually operated breakers have multiple charge-close provisions which allow the following possible operating sequence: charge-close-recharge-open-close-open.

### 3.1.2 How to Charge Electrically

Refer to Figure 13.

With the internally mounted electrical operator, all that is required to charge the breaker locally is to momentarily push the yellow "Push-to-Charge" pushbutton on the front of the breaker frame. 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 electrical operated version also has multiple charge-close provisions which allow the following sequence: charge-close-recharge-open-close-open. Terminations are provided for optional remote charging as well as automatic recharging following either an "opening" or "closing" operation. Refer to Section 5.3 and connection diagram 1366D30.

### 3.1.3 How to Close

Refer to Figure 13.

All that is required to close the breaker locally is to push the mechanical "Push-to-Close" pushbutton. Pre-charged breakers may be closed remotely via a spring release solenoid which is standard for electrically operated breakers (Section 5.3) and optional for manually operated breakers (Section 5.2). (Refer also to connection diagram 1366D30.) For special applications, local manual closing may not be desired. Provisions are available in the form of a manual closing blocking adaptor to prevent this action except by authorized personnel. (Refer to Section 5.13.)

Before attempting to close the breaker locally, the yellow stored energy window indicator 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.

### 3.1.4 How to Open

Refer to Figure 13.

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 5.1) or an under-voltage release (Section 5.5) depending upon the application requirements. For maintenance and/or safety requirements, a push-to-open padlockable adaptor is available to hold the breaker in the “open” position. Refer to Section 5.12.

### 3.1.5 How to Discharge Stored Energy without Closing Breaker

Refer to Figure 13.

As a safety feature, it is possible to discharge the breaker’s stored energy locally without closing the breaker. This is possible in both manually and electrically operated breakers. 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*. There are two ways to release this stored energy when the breaker is in the “Open” position:

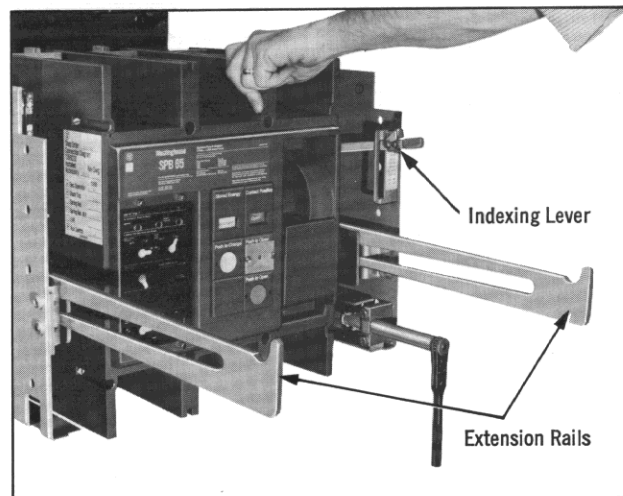
1. Fixed Mounted or Draw-out Breakers:  
First, depress and hold the Push-to-Open pushbutton and then depress the Push-to-Close pushbutton.
2. Draw-out Breakers:  
Raise the red indexing lever (Figures 15 and 17) to the uppermost position.

When the breaker is in the “Closed” and “Charged” position, either of the above actions will simultaneously open the breaker and discharge the stored energy.

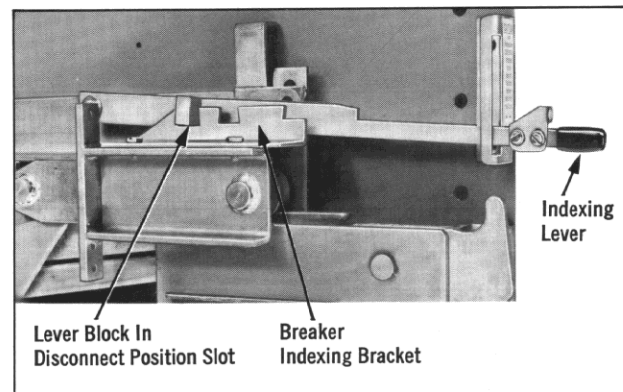
### CAUTION:

With the breaker in the “Closed” position and with the mechanism “Charged” and should the local “Push-to-Close” button be accidentally depressed, then 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.



**Fig. 14** Moving the Breaker from “Withdrawn” to “Disconnect” Position.



**Fig. 15** Indexing Bracket in “Disconnect” Position (Breaker Removed for Clarity).



**Fig. 16** Molded Escutcheon for Mounting to Breaker Cell Door.

### 3.2 DRAW-OUT MECHANISM

Refer to Figures 17 and 19.

Movement of the breaker on its draw-out is easily accomplished by using the draw-out indexing lever and ratchet crank. With one exception (see 3.2.1), the indexing lever must always be lifted before any draw-out 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 draw-out mechanism on NP235P001H01 attached to the rear of the cell door - see Figure 21.

#### 3.2.1 Moving the Breaker from Withdrawn to Disconnect Position

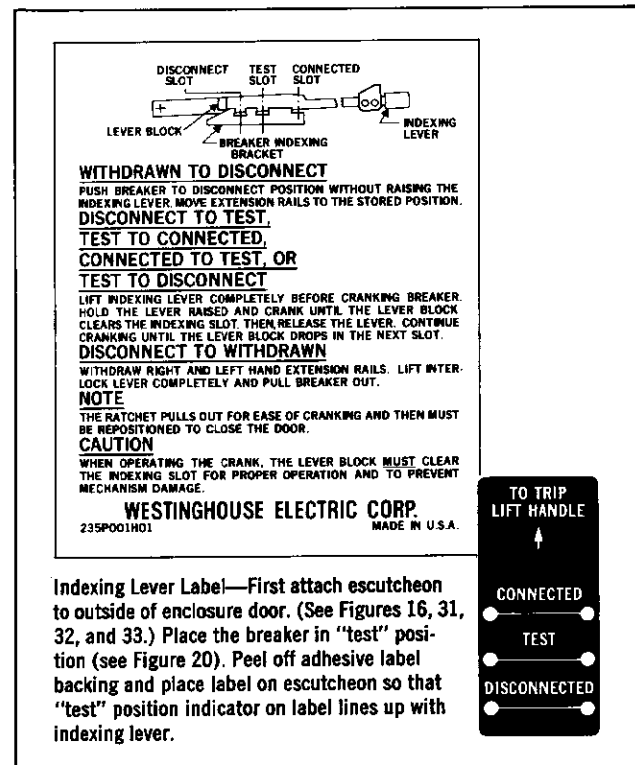
To move the breaker from the "withdrawn" position at the end of the extension rails to the "disconnect" position, push the breaker back on the rails as shown in Figure 14, until the lever block drops in the disconnect slot. This is the one and only time that the index lever need not be lifted prior to a breaker racking operation. In this case, the lever cams up and down automatically. See Figures 15 and 17. At this time the extension rails can be pushed to the stored position. Note: Prior to any movement into or out of the "withdrawn" position, the ratchet handle should be pulled out and rotated to avoid its blocking the breaker's movement.

#### 3.2.2 Moving the 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 as shown in Figure 18. It is very important to always lift the indexing lever to its uppermost position when moving from one position to another. Pull out the ratchet handle and crank it clockwise, as shown in Figure 19. After the lever block has cleared, you can release the indexing lever. When it drops into the next position, the breaker is in the "test" position. See Figures 16 and 20.

The deadfront shield - see Figure 21 - is installed on the breaker with the matching pieces in the cell - see Figures 31, 32, and 33 - 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" posi-



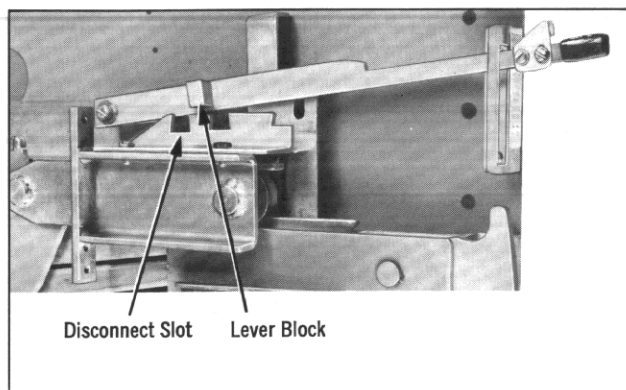
**Fig. 17** Schematic of Operation of Indexing Bracket and Lever.

tion 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.

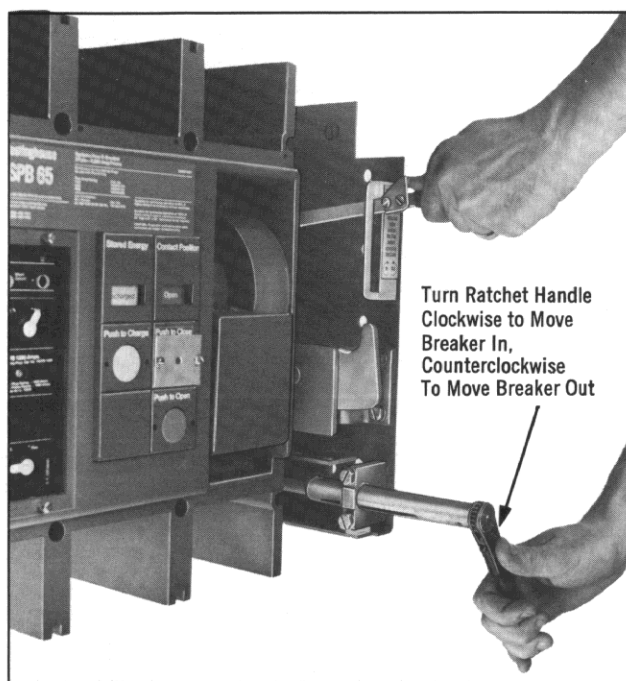
To move the breaker from "test into "connected," repeat the procedure of lifting the indexing lever to its uppermost position and cranking the ratchet clockwise. Be certain to hold the indexing lever up until the lever block has cleared the test slot as shown in Figure 22. When the slot has been cleared, you can release the lever. When it drops into the next position, the breaker is in the "connected" position. See Figure 23.

Self-aligning contact posts, see Figure 24, fit into cone-shaped receptacles in the rear of the breaker to self-align the secondary control contact blocks.

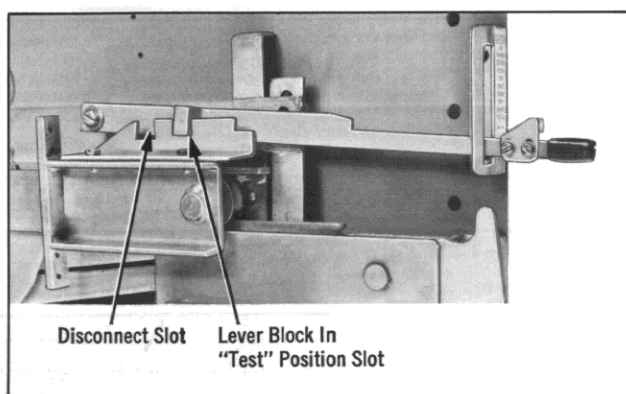
To remove the breaker from "connected" and place it in "test" or "disconnect" positions, first reverse the ratchet to counterclockwise position, then follow the procedure above. Always be sure to lift the indexing lever to its uppermost position as you crank the ratchet until the lever block has cleared that slot on the indexing bracket.



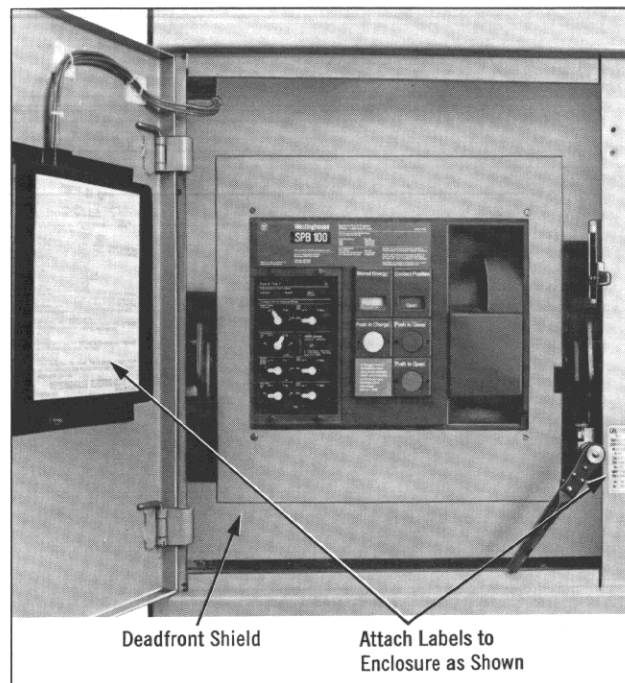
**Fig. 18** The Lever Block Clears the Slot as the Breaker Is Moved Out of the "Disconnect" Position.



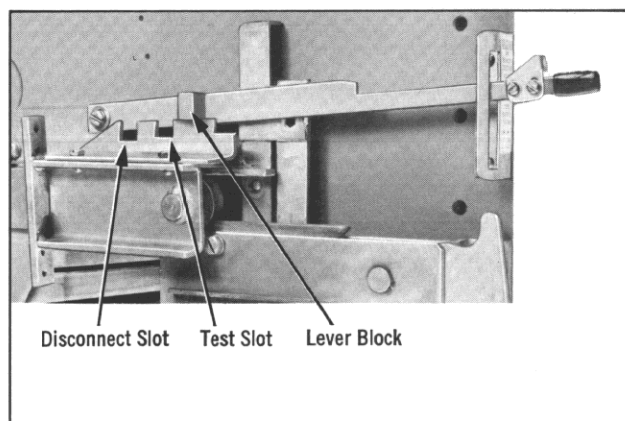
**Fig. 19** Operating the Ratchet Handle to Move the Breaker In.



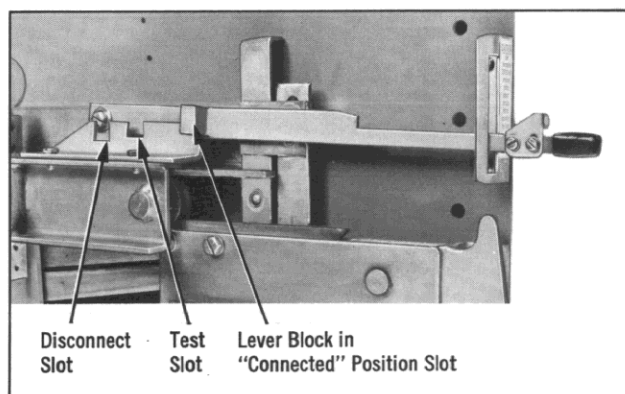
**Fig. 20** Lever Block Locked into the "Test" Position Slot.



**Fig. 21** Deadfront Shield Installed.



**Fig. 22** Lever Block Clearing the "Test" Slot.



**Fig. 23** Lever Block Locked into "Connected" Position.

To move the breaker from "disconnect" to "full withdrawn" position, pull out the extension rails to their full extension. Then lift the indexing lever to its uppermost position and pull the breaker out to the end of the extension rails. See Figure 14. Before moving the breaker, position the ratchet handle so that it does not block the movement of the breaker into the "withdrawn" position.

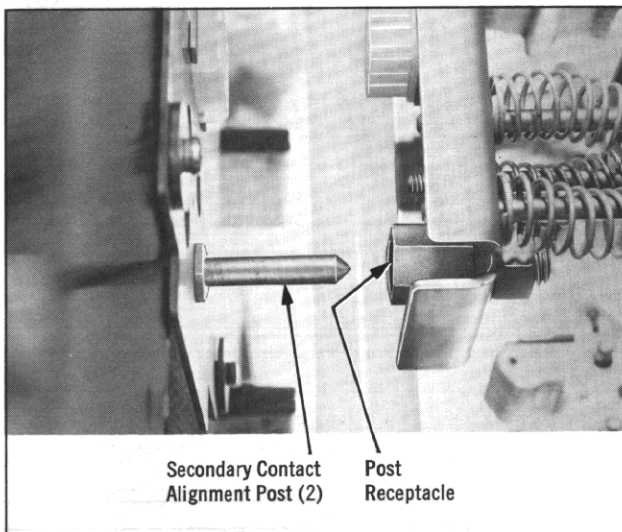
### 3.2.3 Rotation on the Draw-out

If rotation of the breaker on the draw-out is desired for inspection, the deadfront shield must first be re-

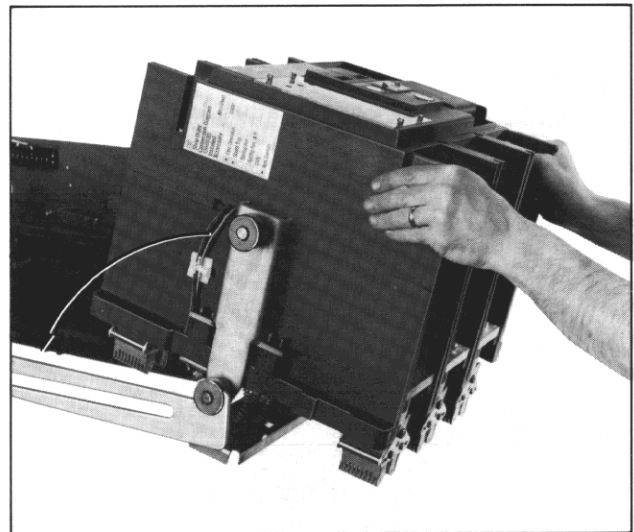
moved. Removal of the shield should be performed while the breaker is in the "Disconnect" position, *before* it is pulled into "Withdrawn" position. Then, before beginning the rotation, make sure that the breaker is fully withdrawn, with the front wheels in the depressions in the front of the extension rails.

Lift the front of the breaker so that the front wheels are off the extension rails, and pull forward as shown in Figure 25.

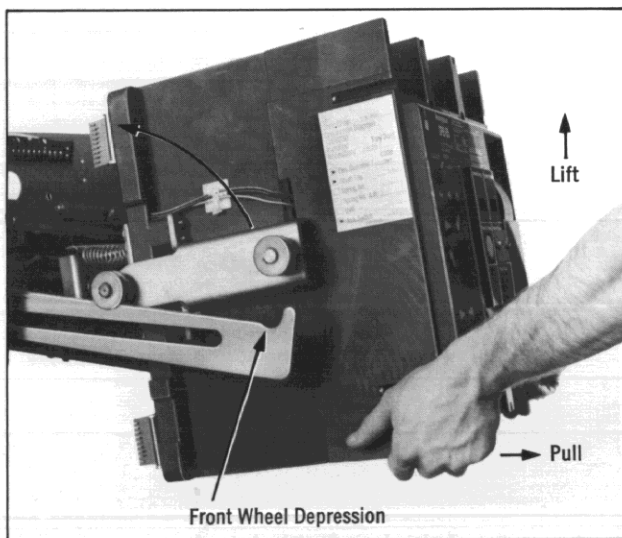
NOTE: For 250 and 800 Amp. frames in a minimum height cell size, breakers must be rotated on front



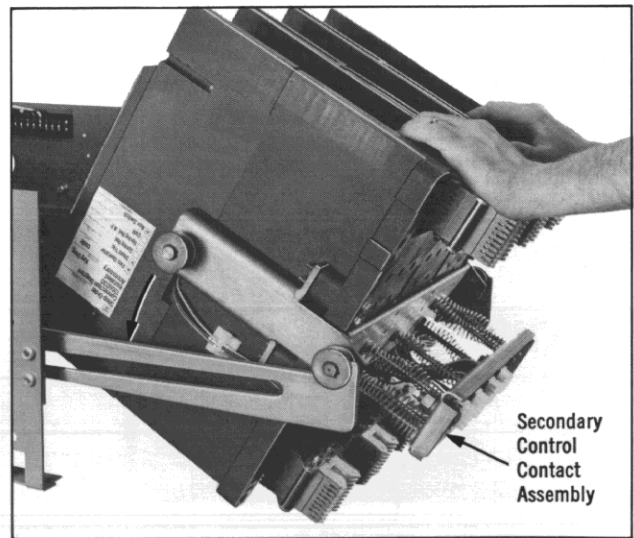
**Fig. 24** Secondary Control Contact Blocks are Self-aligning.



**Fig. 26** Moving the Breaker's Back Wheels into the Front-wheel Depression on the Rail.



**Fig. 25** Lifting the Front Wheels of the Breaker Off the Rail for Rotation. 250 and 800 Amp Breakers in a Minimum Height Cell Size Must Be Rotated on Front Wheels in Opposite Direction from That Shown.



**Fig. 27** Lowering the Breaker into Reversed Position.



wheels in opposite direction from that shown in Figure 25. To return breaker to its "front" position, proceed as shown in Figures 29 and 30.

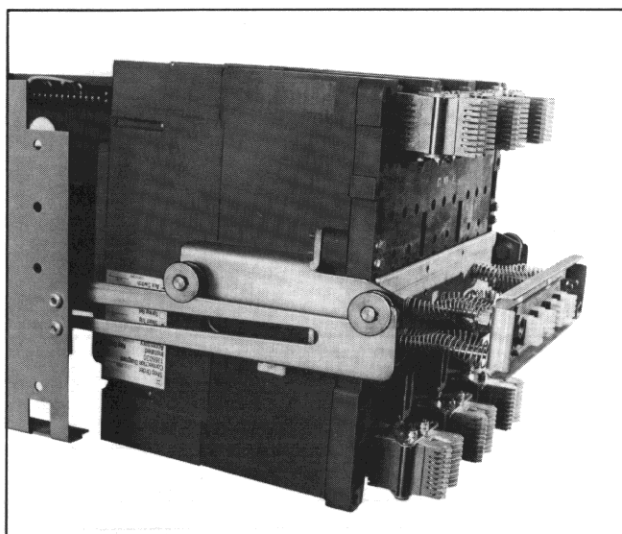
Keep pulling forward on the breaker, see Figure 26, until the back wheels move into the depression where the front wheels sat on the end of the extension rail.

As you turn the breaker, 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 as

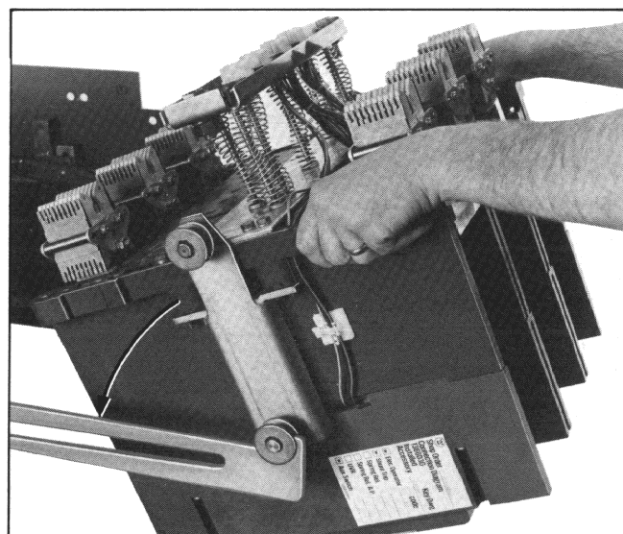
shown in Figure 27. Be certain all four wheels rest on the extension rails. See Figure 28.

The breaker can be rotated through 360°. So, to return it to its regular position, lift on the bottom as shown in Figures 29 and 30, and return the front wheels to their original depressions in the extension rails. Again, do not put pressure on, or lift with, the secondary control contact block assembly on the back of the breaker.

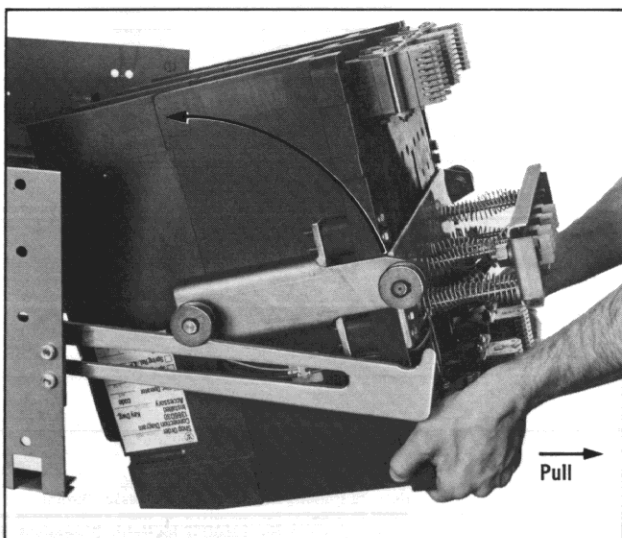
Return breaker to desired position. Replace deadfront shield when breaker is in "Disconnect" position.



**Fig. 28** Breaker in Reversed Position for Primary and Secondary Disconnect Inspection.



**Fig. 30** Lowering the Breaker into Upright Position.



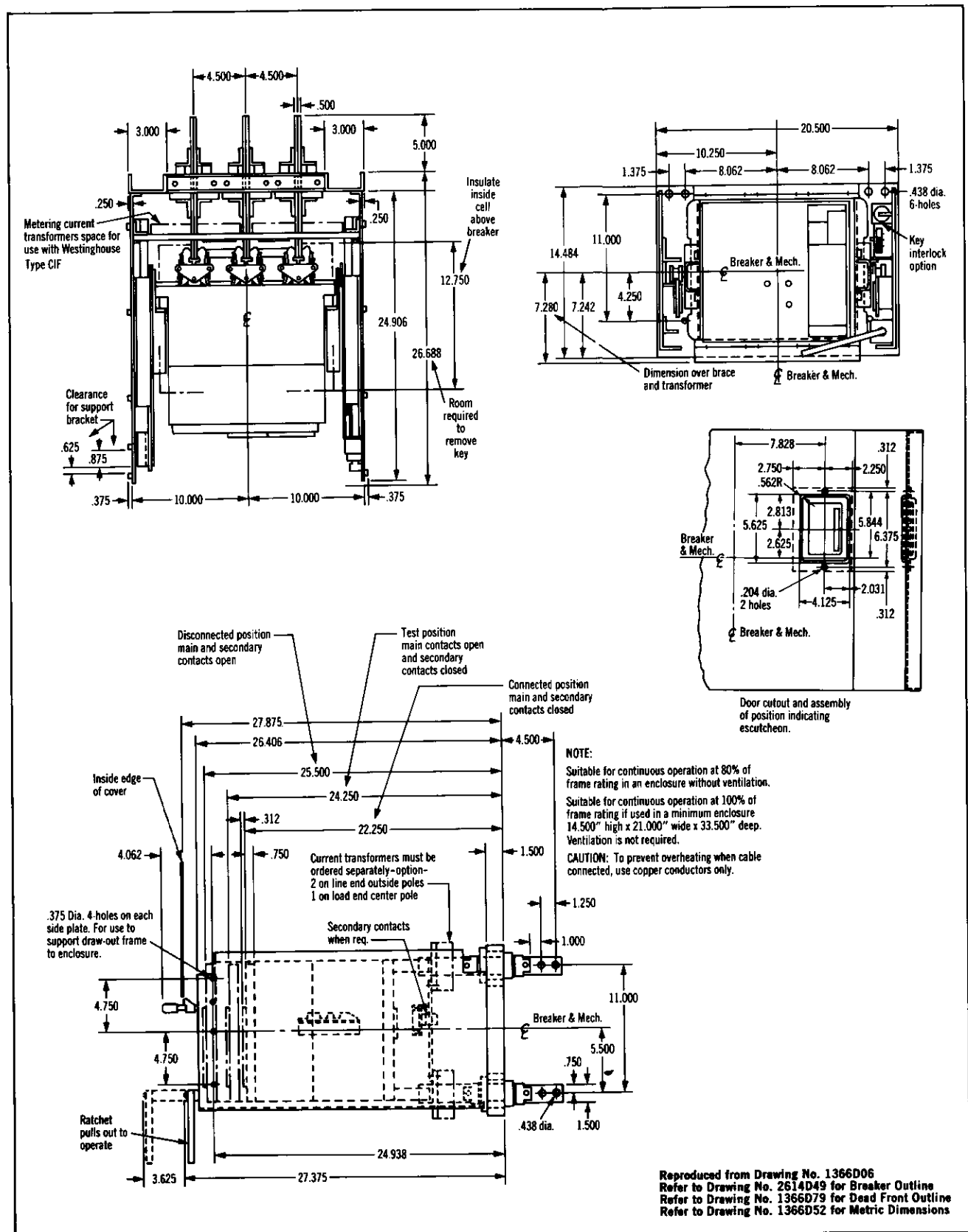
**Fig. 29** Lifting the Breaker to Return it to Upright Position.

### 3.2.4 Removing Breaker Molded Cover

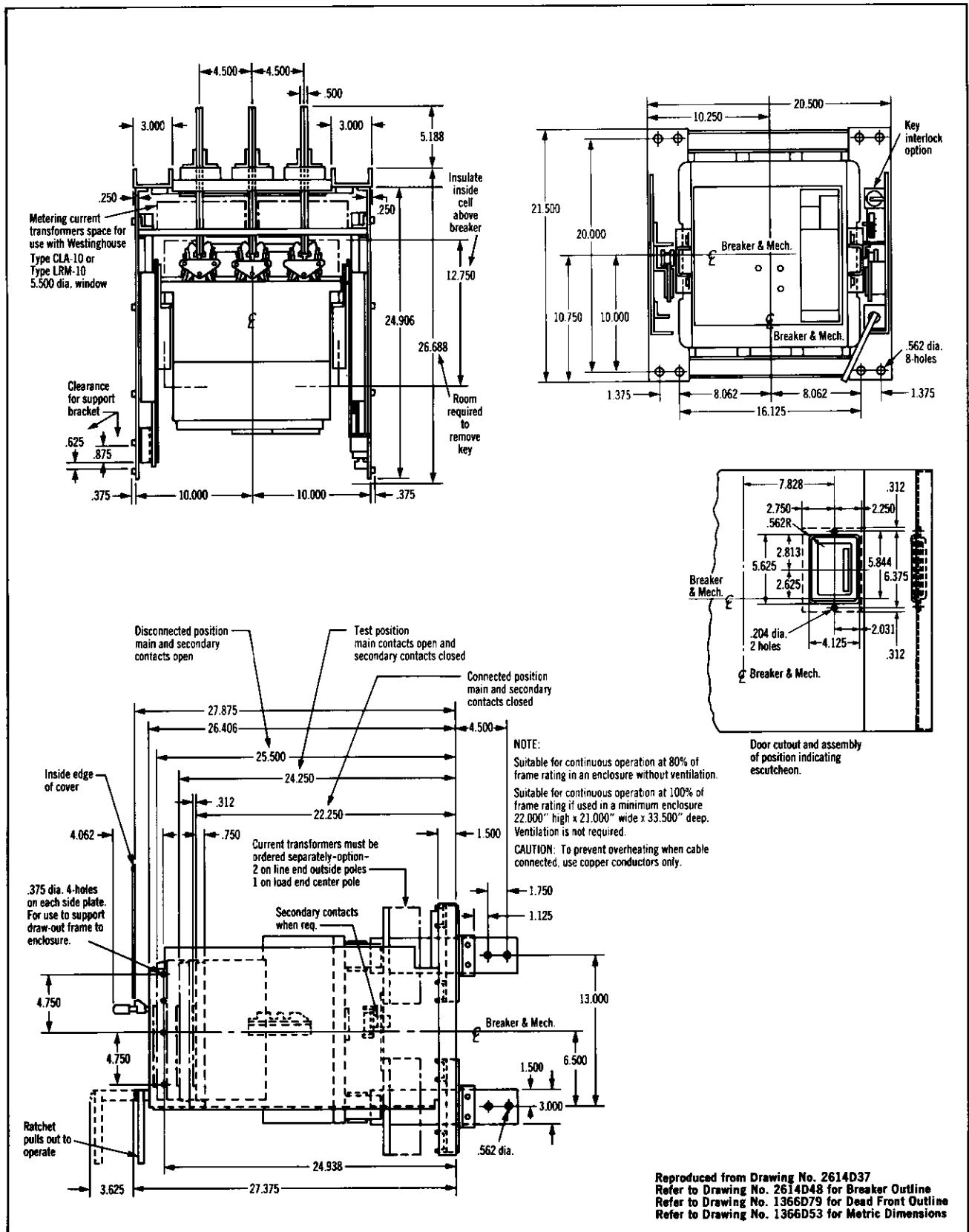
Refer to Figures 37 and 38.

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. If the breaker is electrically operated, remove the motor fuse holder as well. After removal of the cover screws, the cover can be taken off with no difficulty.

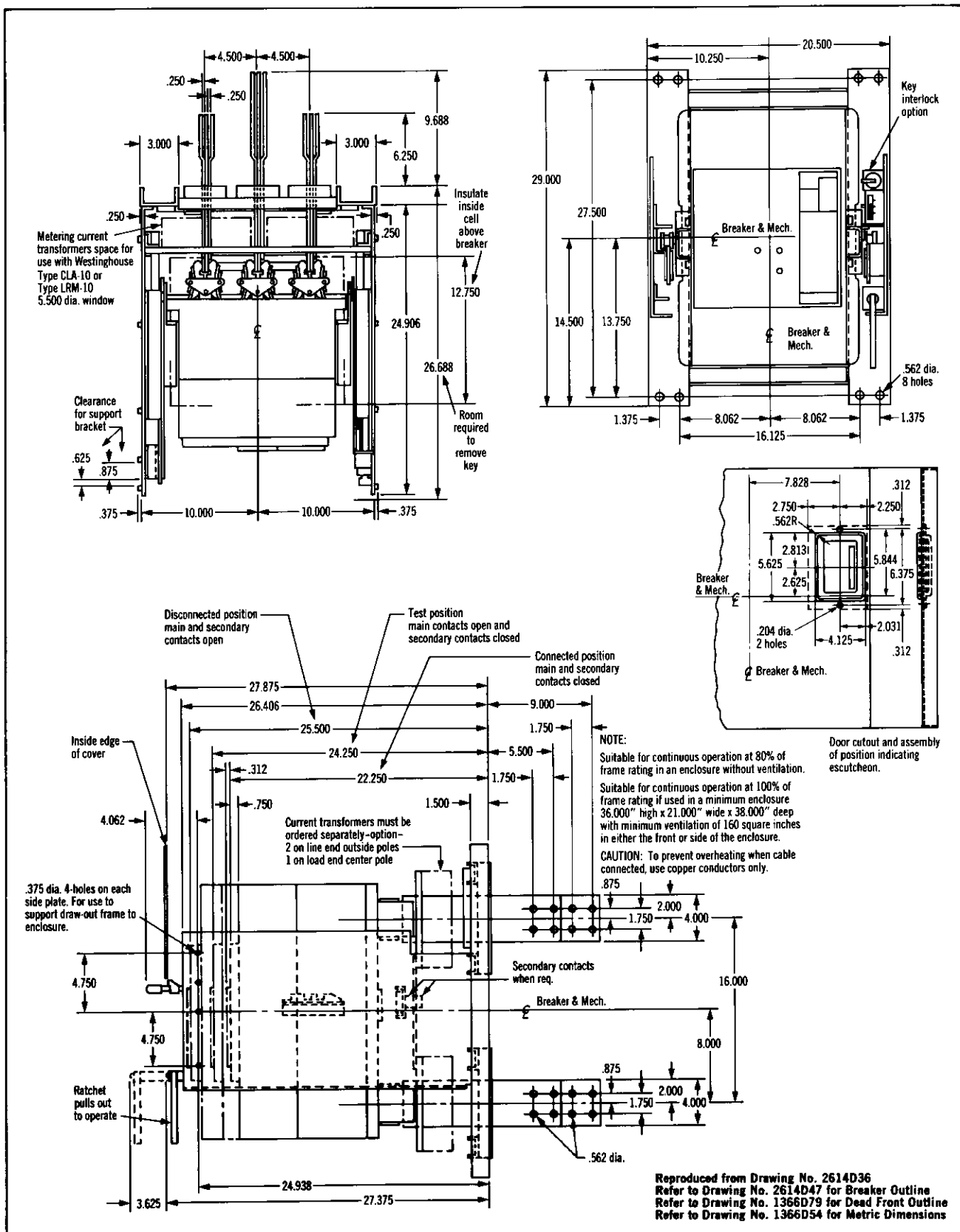
**NOTE:** It is recommended that the breaker be in the fully withdrawn position or on a work bench before removing the cover. Also, the breaker contacts should be open and the stored spring energy discharged. The mechanism is electrically isolated from the primary conductors; however, for fixed mounted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



**Fig. 31 Systems Pow-R Breaker Draw-out Mounting Frame—800 Amp.**







**Fig. 33 Systems Pow-R Breaker Draw-out Mounting Frame—3000 Amp.**

## Section 4—The Pow-R Trip 7 Trip Unit

### 4.0 GENERAL

Refer to Figures 34, 41, 42, 43, and 44.

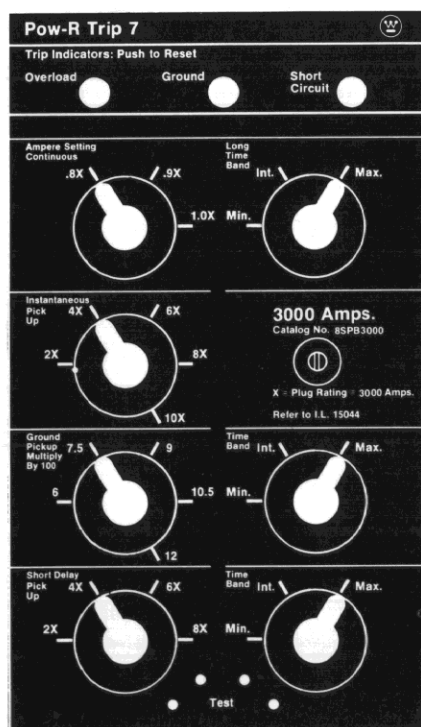
Systems Pow-R Breakers are equipped with the Pow-R Trip 7 trip unit, which has a complete range of adjustable trip functions and characteristics. The trip unit module itself is common to all frame sizes and is

#### Ratings

Adjustments: .8-9-1.0 Times  
Plug Value (Ampere Settings)

Frame Ratings	Plug Ratings*	Max.	Min.	Frame Ratings	Plug Ratings*	Max.	Min.
3000	3000	3000	2400	800	800	800	640
2500	2500	2500	2000		700	700	560
2000	2000	2000	1600		600	600	480
1600	1600	1600	1280		500	500	400
	1200	1200	960		400	400	320
	1000	1000	800	250	300	300	240
					250	250	200
					225	225	180
					200	200	160

\*Load side cable or bus bar to be sized to the plug rating.



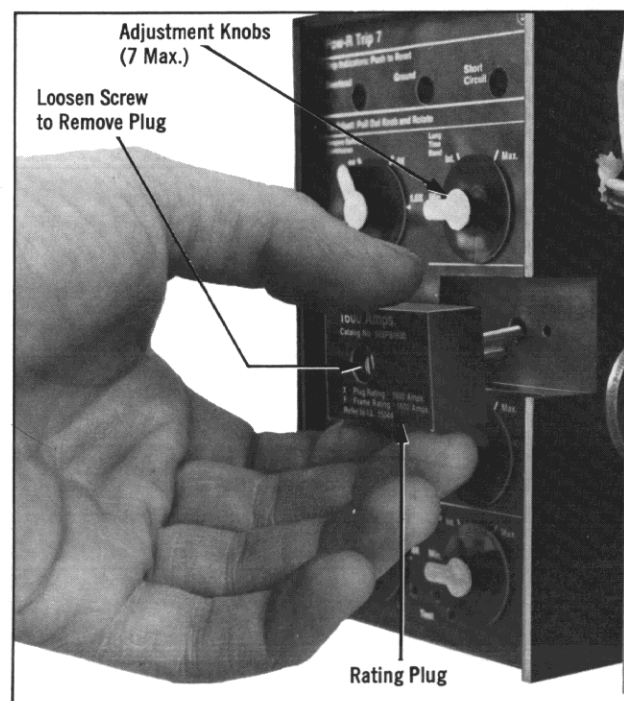
**Fig. 34** Pow-R Trip 7 Trip Unit with All Available Adjustments and Optional Trip Mode Indicators (Maximum Number of Adjustments Shown).

designed to plug into compatible breaker frames. Interlocks prevent incorrect application between non-compatible breaker frames. In Pow-R Trip 7, all required control power is derived from the fault initiating the tripping operation. No external control power is required. Optional trip mode indicators when supplied are located at the top front of the trip unit. Following a tripping action, the indicator relating to the tripping cause will "pop out" approximately one quarter inch. The trip mode indicator must be reset before it can operate again. However, failure to reset will not affect the trip unit's tripping operations. To reset the indicator, depress it with a small screwdriver or pencil through the hole provided in the transparent cover.

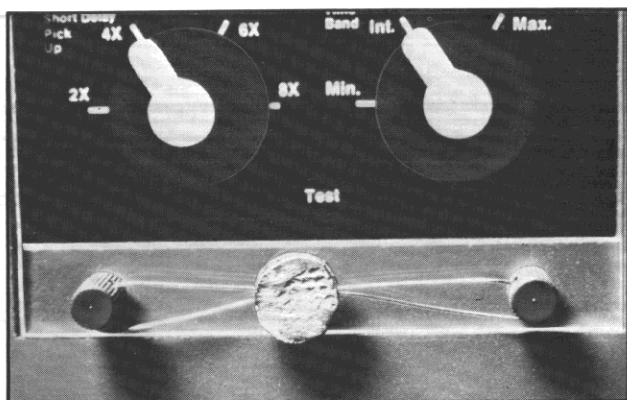
### 4.1 RATING PLUGS

Refer to Figure 34 and Figure 35.

Interchangeable rating plugs make available several different ampere ratings within a given frame size. Rating plugs are mechanically arranged to prevent insertion into non-compatible trip units. The rating plug is interlocked with the tripping mechanism to automatically open the breaker upon plug removal. The breaker remains "trip free" with the plug removed.



**Fig. 35** Interchangeable Rating Plug Being Removed. (Breaker Covered Removed for Clarity)



**Fig. 36** Seal on Pow-R Trip 7 Trip Unit Transparent Cover.

#### 4.1.1 Removal of Rating Plug

Refer to Figure 35.

In order to remove the rating plug, loosen the screw in the plug's center with a screwdriver. It requires many turns, since the plug engages a mechanical interlock inside the breaker. The breaker should be open before the rating plug is removed. However, if it is not, then as the screw is turned the breaker will open. Should the breaker be "Open" and the closing energy stored, this action will not discharge the stored energy.

### 4.2 ADJUSTMENTS

Refer to Figures 34 and 35.

All adjustments in the trip unit are made by switching plugs, operated by rotary knobs which move the plugs in discrete steps. To set an adjustment, pull out the knob, turn to the desired setting, and re-insert the switching plug until the plug surface is flush with the face of the trip unit. After all desired settings have been made, the transparent cover over the trip unit face (Figure 13) should be installed and can be sealed, see Figure 36, to prevent tampering by unauthorized personnel. All adjustments should be made with the breaker in the "Open" position, since the function setting reverts to the minimum position automatically anytime the switching plug is pulled out during a setting change. The results of adjusting the switching plugs are illustrated in the time current curves shown in Figures 41, 42, 43 and 44.

#### 4.2.1 Continuous Setting

Refer to Figure 34, and 41, 42 or 43.

The continuous ampere setting is a standard adjustment. With it, the ampere rating of the breaker can be set at either 80%, 90%, or 100% of the plug rating, by using the knob adjustment.

#### 4.2.2 Long Time Band Setting

Refer to Figure 34, and 41, 42, or 43.

The long time band setting is also a standard adjustment. It can be set at Minimum, Intermediate, or Maximum. These settings represent total clearing time calibration points for the breaker at 6 X the ampere rating of the installed rating plug. Refer to the time-current curve indicated above for the specific time setting.

#### 4.2.3 Instantaneous Pick-up Setting

Refer to Figure 34, and 41, 42, or 43.

The instantaneous pick-up setting is an optional adjustment. By using the knob, instantaneous pick-up can be set at 2, 4, 6, 8, or 10 times the ampere rating printed on the rating plug. The adjustable instantaneous setting may be omitted when the short time setting (4.2.4) option is selected.

#### 4.2.4 Short Time Delay Pick-up Setting

Refer to Figure 34, and 41, 42, or 43.

The short time delay pick-up setting is an optional adjustment which can be set at 2, 4, 6, or 8 times the rating plug ampere rating.

#### 4.2.5 Short Time Delay Band Setting

Refer to Figure 34, and 41, 42, or 43.

The short time delay band adjustment, which is supplied with the optional short time pick-up adjustment can be set at either Minimum, Intermediate, or Maximum setting. These settings - as shown on the above time-current curves - represent total breaker clearing time settings of 0.1, 0.2, or 0.3 seconds.

#### 4.2.6 Ground Fault Pick-up Setting

Refer to Figures 34 and 44.

Ground fault pick-up, another optional adjustment, can be set at these ampere settings: 600, 750, 900, 1050, and 1200, for breakers 2000 amps and above. The 1200 ampere setting is the maximum allowed for ground fault by the National Electrical Code. Breakers with ratings of 1600 amps and below have ground fault pick-up settings of 0.2, 0.3, 0.4, 0.5, 0.6, and 0.75 times frame rating.

NOTE: Proper ground fault breaker tripping operations are dependent upon proper choice of sensing means and proper connections. Systems Pow-R Breakers are equipped with terminations that permit their application in a variety of ground fault detection schemes including: residual, source ground and zero sequence. Different external current sensors and/or connections are required for each scheme selected. For required connections and details, refer to connection diagrams 1366D30 and 1273C40 or 1273C41.

#### 4.2.7 Ground Fault Time Delay Setting

Refer to Figures 34 and 44.

The ground fault time delay setting, which is supplied with the optional ground fault pick-up adjustment, can be set at either Minimum, Intermediate, or Maximum settings. These settings - as shown on the above time-current curves - represent total breaker clearing time settings of 0.1, 0.3 or 0.5 seconds.

NOTE: Zone selective interlocking is supplied as standard with every ground fault function option. For supplementary connection details, refer to connection diagram 1366D30. Should zone interlocking performance characteristics not be desired, then the jumper indicated by the asterisk (\*) note on connection diagram 1366D30 must be installed.

When the zone selective interlocking scheme is utilized, then minimum tripping times as indicated on the following time-current curves can be expected for all ground faults (exceeding the pick-up settings) occurring within the applied breakers protective zone regardless of pre-set time delay settings.

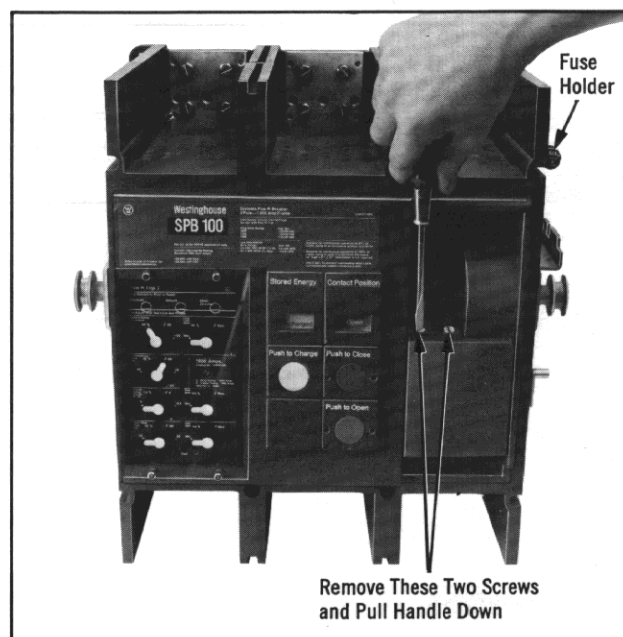


Fig. 37 Removing the Charging Handle.

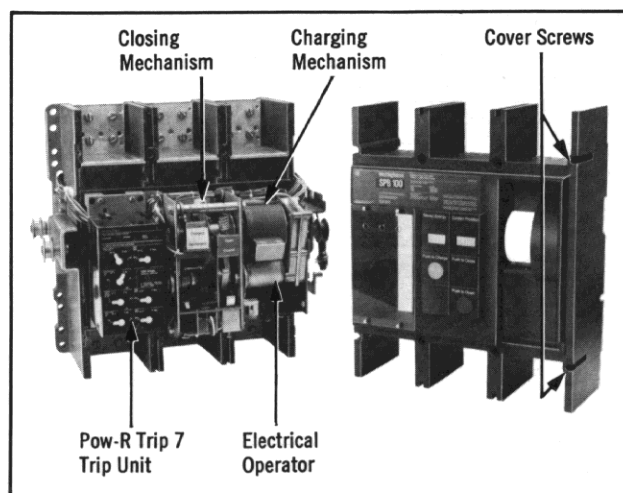
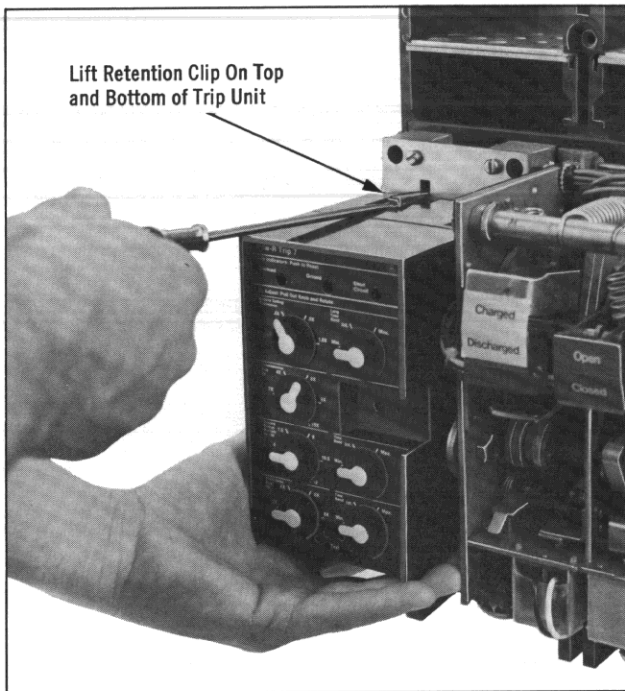


Fig. 38 Breaker Cover and Charging Handle Removed.

#### 4.3 REMOVAL OF POW-R TRIP 7 TRIP UNIT

To remove the trip unit, the breaker charging handle and front cover must first be removed. Refer to 3.2.4 and see Figures 37 and 38. It is not necessary to remove the transparent trip unit cover separately since it moves with the breaker front cover. After removing the front cover, the rating plug should be removed. See 4.1.1 above and Figure 35. After the rating plug has been removed, lift the spring retention clips on the *top* and *bottom* of the trip unit as shown in Fig-

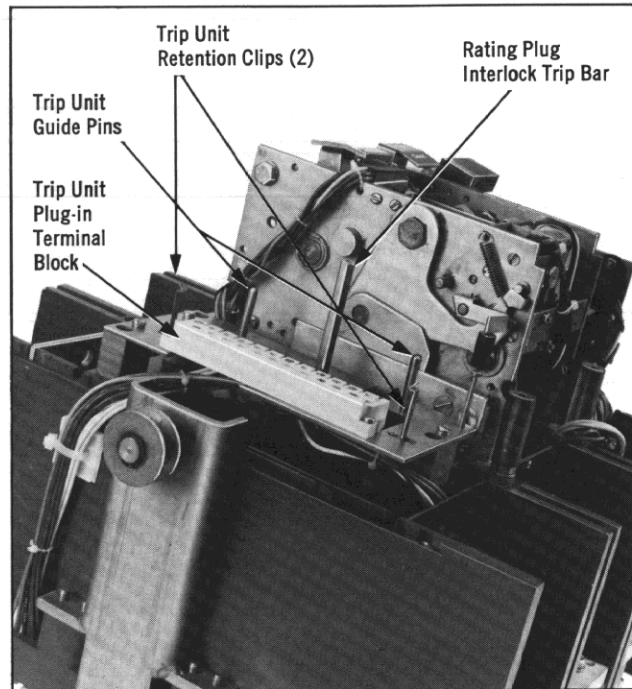


**Fig. 39** Removing Trip Unit from Breaker.

ure 39. After the top clip has been freed, pull out on the trip unit slightly and pry down on the bottom clip. The trip unit will not fall off the mounting plate since it is now held in place by the plug-in control terminal block. The trip unit must be pulled from the frame. See Figure 40.

To install a Pow-R Trip 7 trip unit in a breaker with the front cover and charging handle in place, the following steps should be followed:

1. Remove transparent trip unit adjustment cover (see Figure 13).
2. Before attempting to install a trip unit examine the conical rejection pins (see Notes A and B) and confirm that the pattern presented on the base of trip unit agrees with receptacle pattern in the mounting plate. The number of conical pins and placement on the base of trip unit must be exactly the same as the matching receptacles in the mounting plate. Any dissimilarity will prevent the trip unit from being properly installed and undue pressure can only cause physical damage.
3. Insert the trip unit - held in upright position - into opening and push into position. The guide pins pre-align the unit so that the plug-in control terminals and retention clips are properly engaged (see Figure 40).

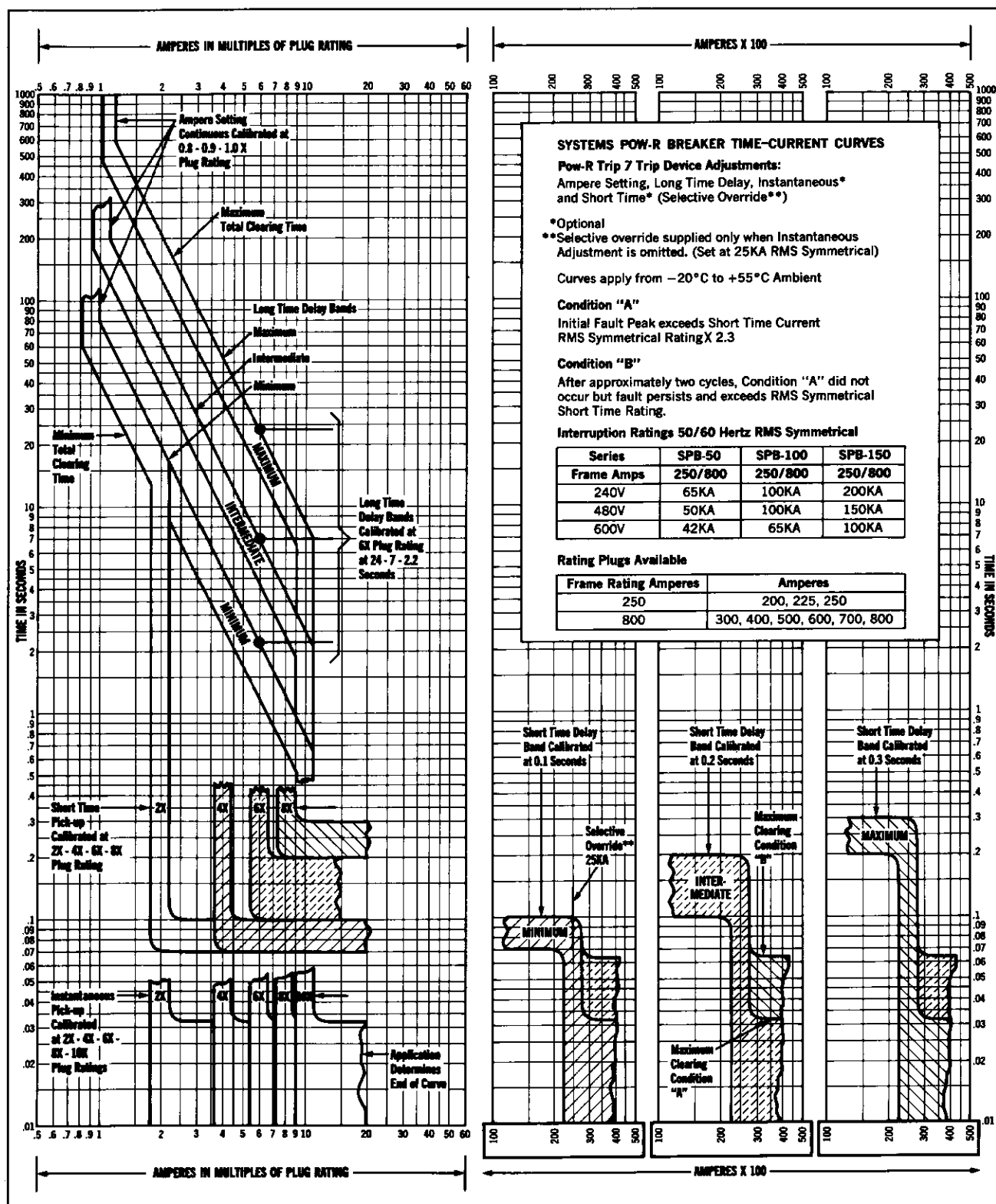


**Fig. 40** Trip Unit Removed from Breaker.

4. Install the rating plug (refer to Section 4.1.1 and Figure 35 for guidance). Note: The plug screw engages the interlock trip bar shown in Figure 40.
5. Re-install the transparent cover after proper setting are made. Note: The cover must be installed in correct position to reset the trip mode indicators since the reset holes are drilled off center.

**NOTE:** Mechanical interlocks (conical pins not shown) are provided to prevent insertion of trip unit into non-compatible frames, i.e.:

- A. Trip units with built-in ground fault function can be inserted only into breaker frames with similar provisions and
- B. Trip unit and breaker frame short time ratings must be compatible.



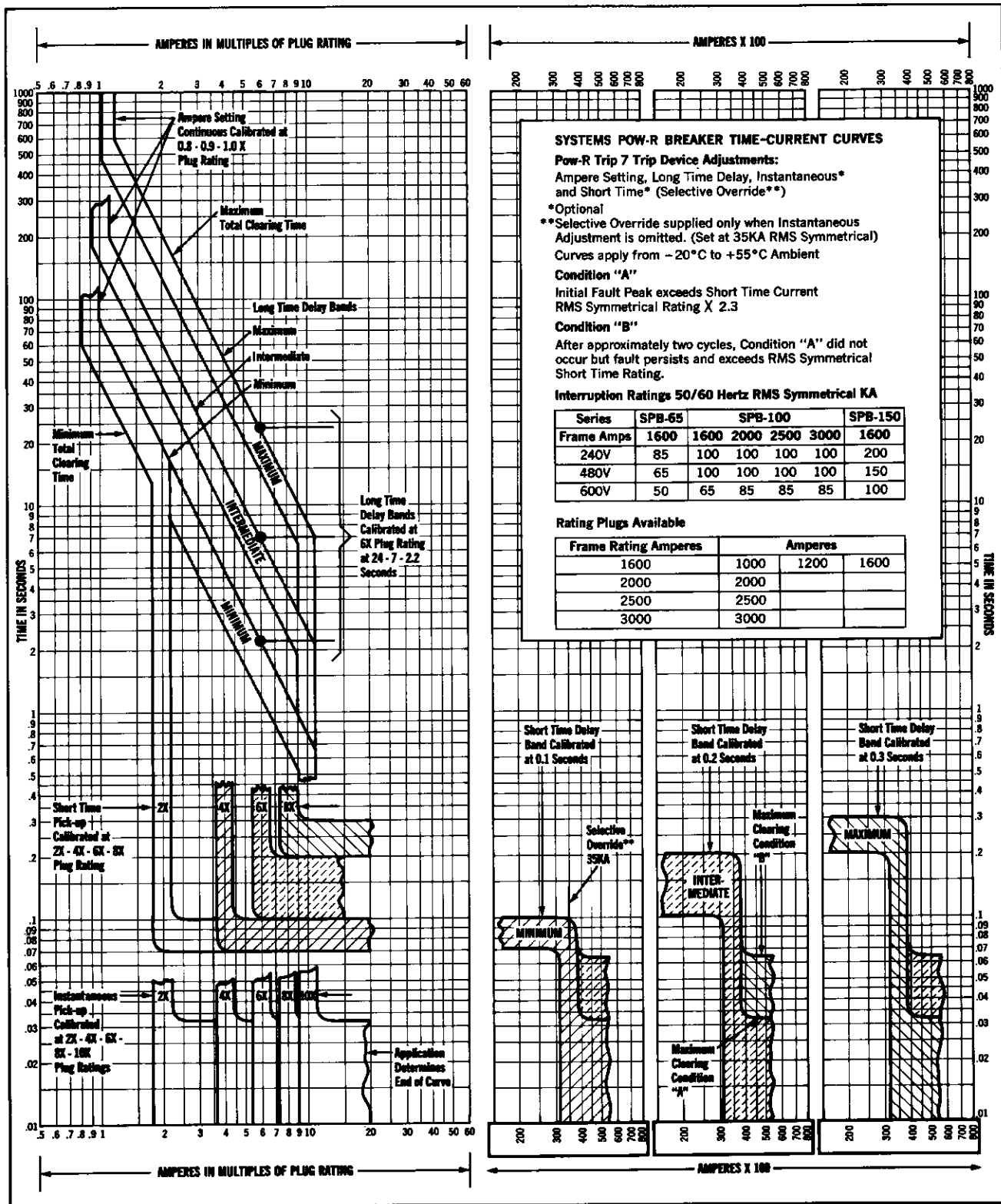


Fig. 42 SPB-65/100 Time-Current Curves: Ampere Setting, Long Time Delay, Instantaneous, and Short Time.  
(Taken from Curve Number 697148)

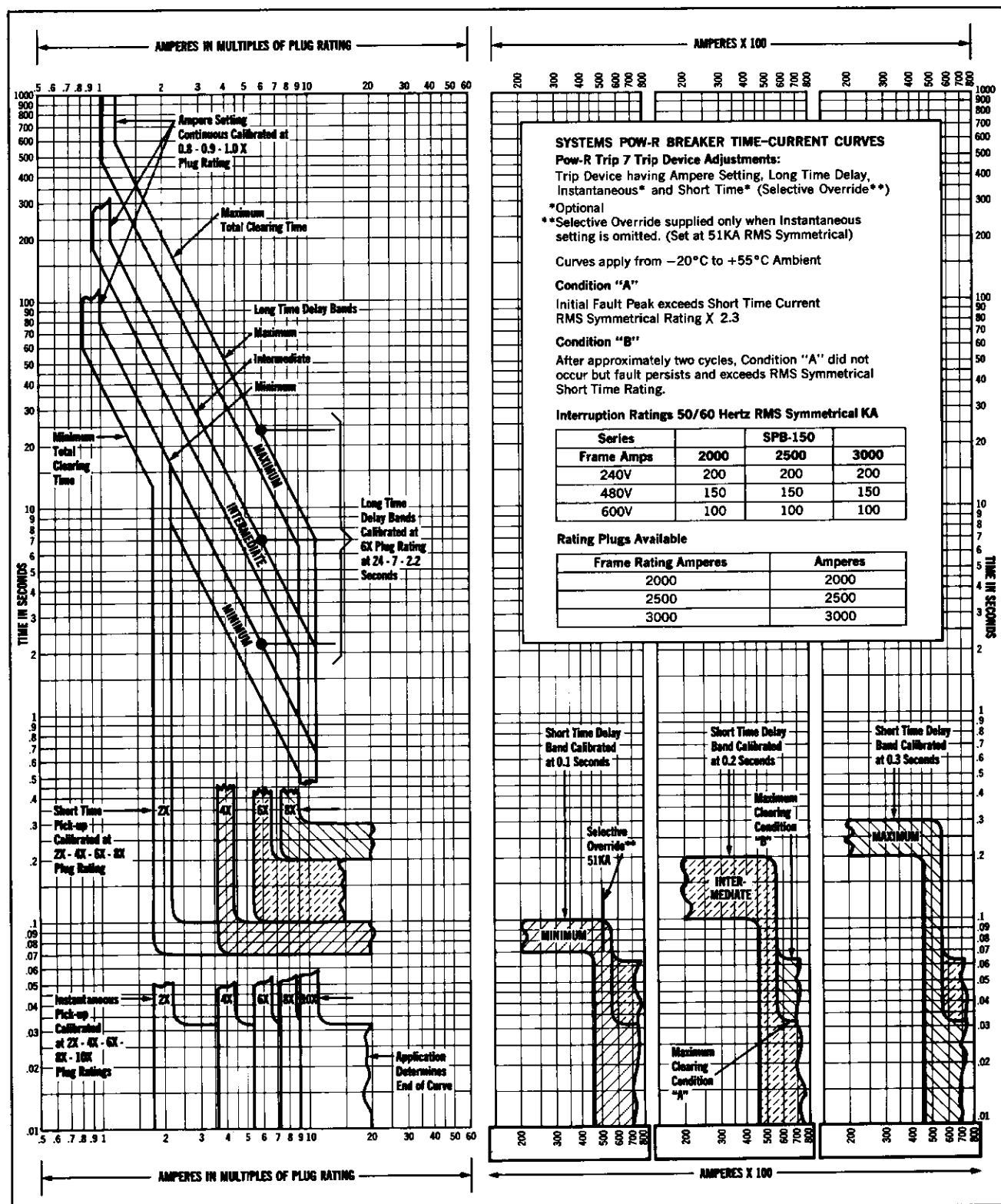
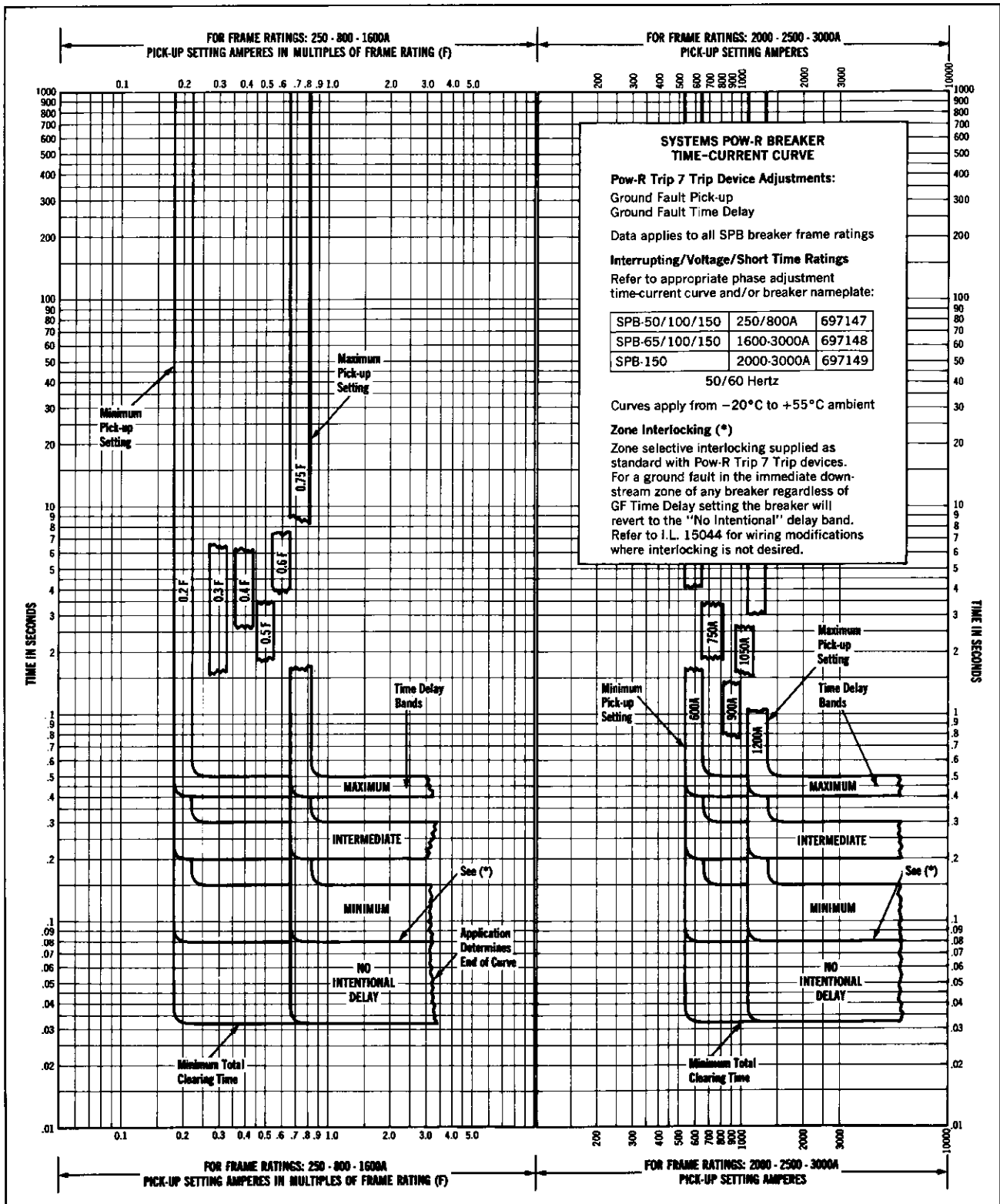


Fig. 43 SPB-150 Time Current Curves: Ampere Setting, Long Time Delay, Instantaneous, and Short Time.  
(Taken from Curve Number 697149)





**Fig. 44** Time Current Curves: Ground Fault Pick-Up/Time Delay.  
(Taken from Curve Number 697150)

## Section 5—Accessories

### 5.0 GENERAL

The descriptions below apply to accessories for the breaker which have been factory-installed. Many of these accessories are available in kits for field installation. Full details on installation are to be found in the instruction leaflet with each kit.

### 5.1 SHUNT TRIP

Refer to Figures 45, 46, and 47.

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.

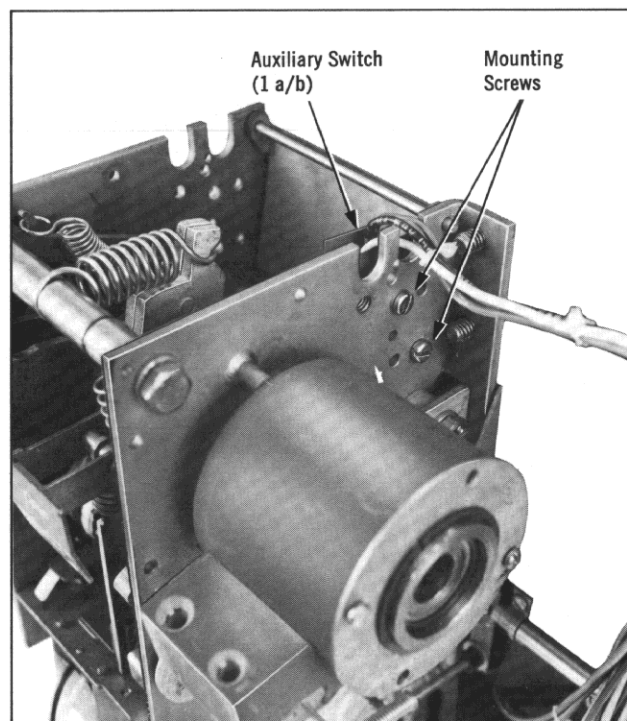


Fig. 46 Shunt Trip Auxiliary Switch Installed.

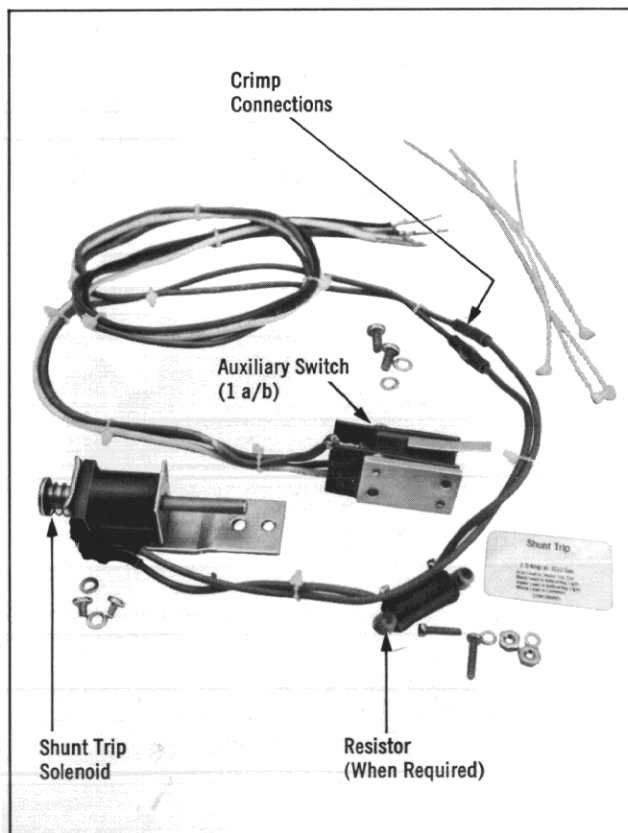


Fig. 45 Shunt Trip Kit.

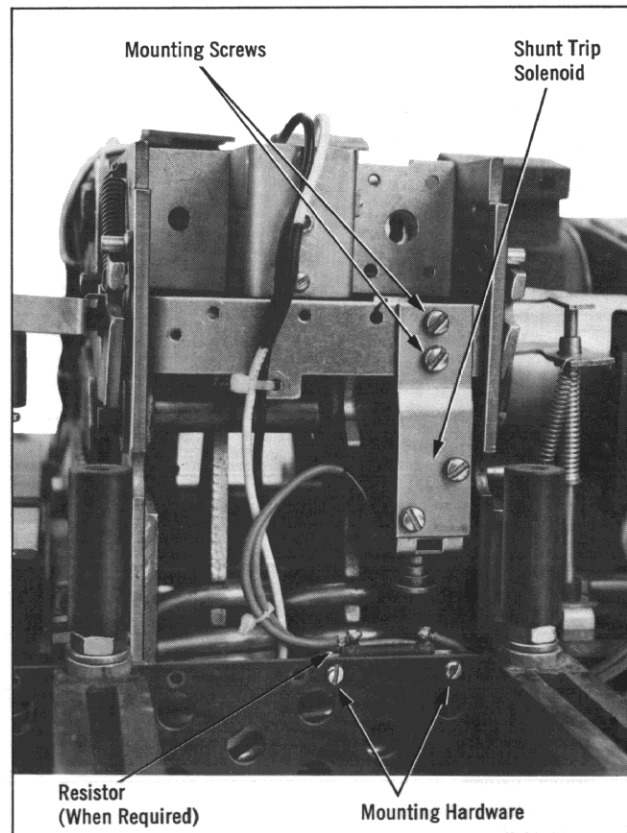


Fig. 47 Shunt Trip Solenoid and Resistor (When Required) Installed.

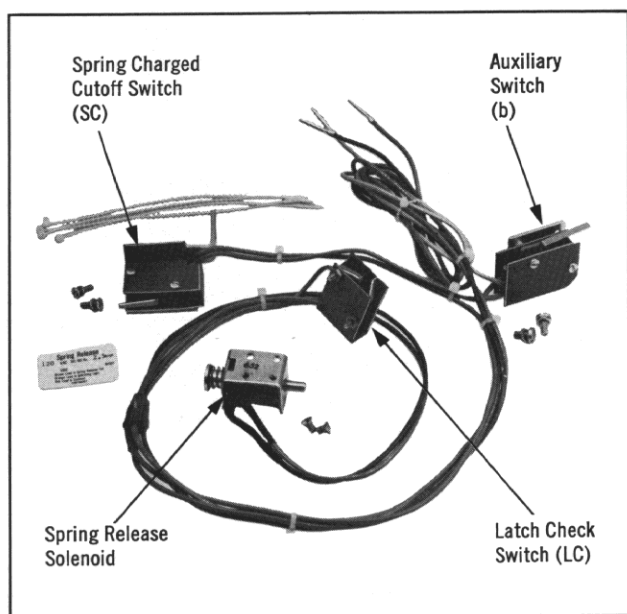
## 5.2 SPRING RELEASE FOR MANUAL BREAKERS

Refer to Figures 48, 49, 50, and 51.

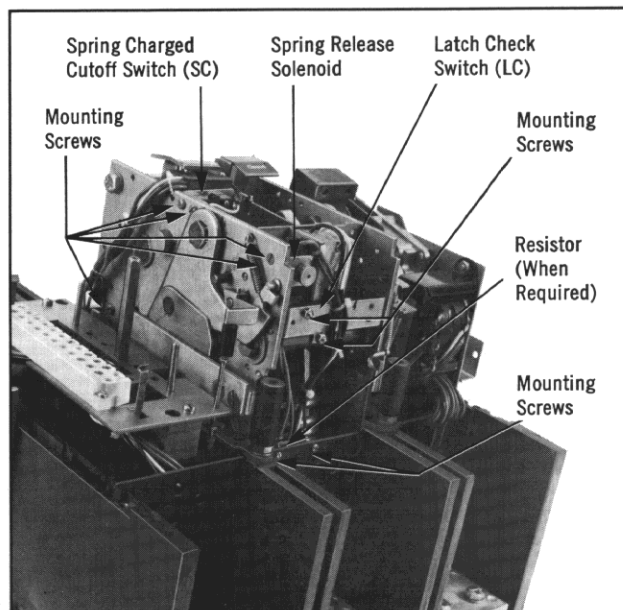
The spring release accessory is used in conjunction with an auxiliary switch, a spring charged contact and a latch check contact to provide remote closing of the breaker following either a manual or electrical spring charging operation. The spring release is optional on manual breakers but is supplied 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.

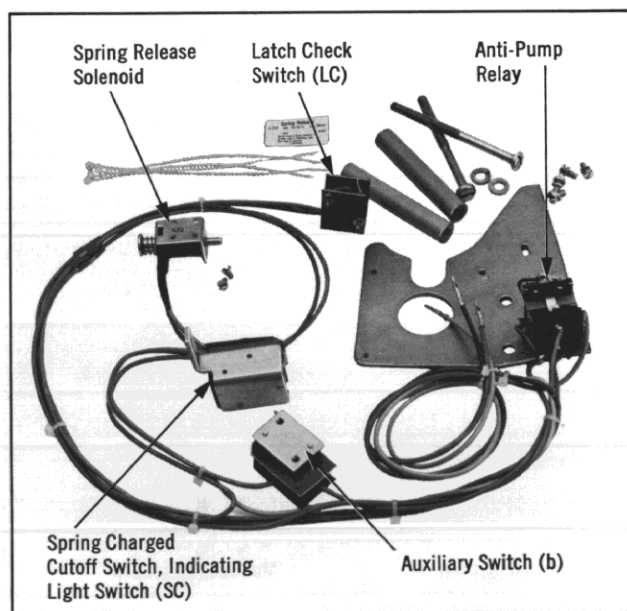
For remote signal purposes a normally open spring charged contact in series with the latch check con-



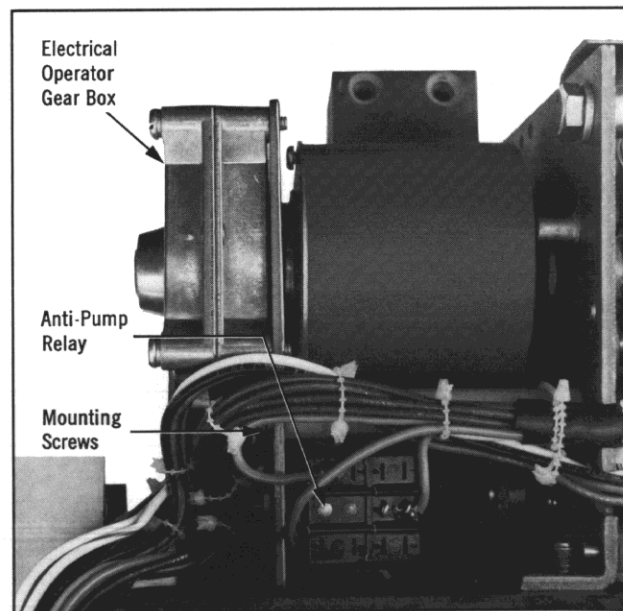
**Fig. 48** *Spring Release Kit without Anti-Pump Relay.*



**Fig. 50** *Spring Release Kit Installed.*



**Fig. 49** *Spring Release with Anti-Pump Relay Kit.*



**Fig. 51** *Anti-Pump Relay Installed.*

tacts is provided as standard to allow 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.

### 5.3 ELECTRICAL OPERATOR

Refer to Figures 52, 53, and 54.

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 any closing operation. The standard charging motor is DC rated. For AC control sources, a bridge rectifier and control power transformer are supplied as required to match the voltage source.

Motor operation is initiated through a charging relay. When the springs are completely charged, the motor circuit is disconnected by a spring charged contact and a yellow mechanical target indicator shows the "spring charged" position of the mechanism. For an optional mode of operation, provisions are included for either electrical charging from a remote location or automatic re-charging following a breaker opening or closing operation. For the latter, an auxiliary switch may be required, see connection diagram 1366D30.

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.

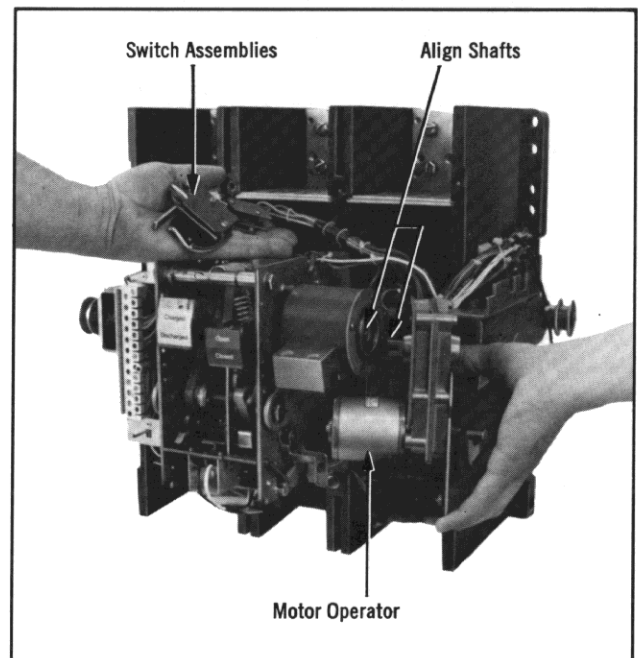


Fig. 53 Installation of Electrical Operator.

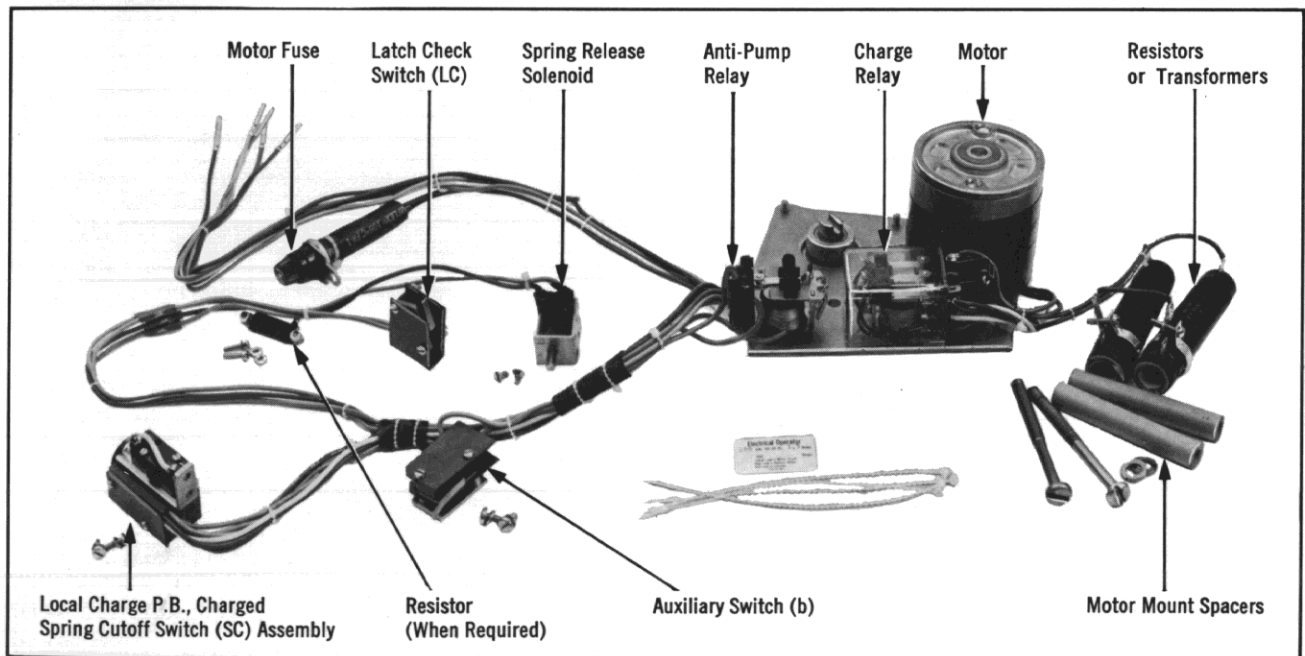
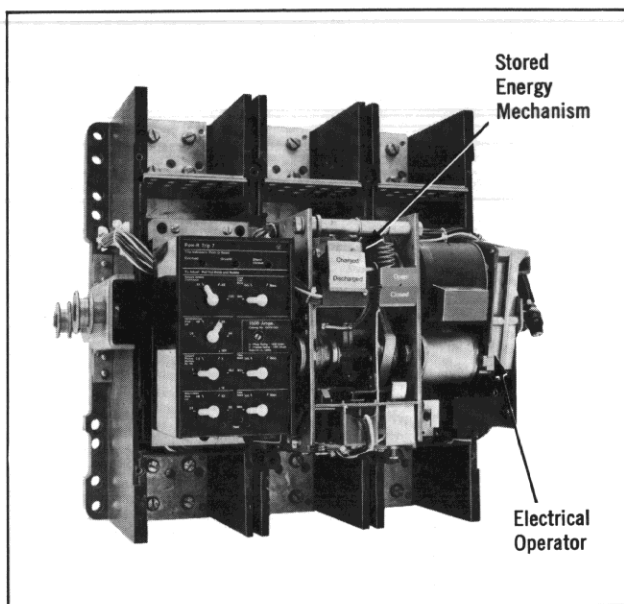


Fig. 52 Electrical Operator Kit.



**Fig. 54** *Electrical Operator Installed in Draw-out Breaker with Cover Removed.*

#### 5.4 AUXILIARY SWITCH

Refer to Figures 55 and 56.

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.

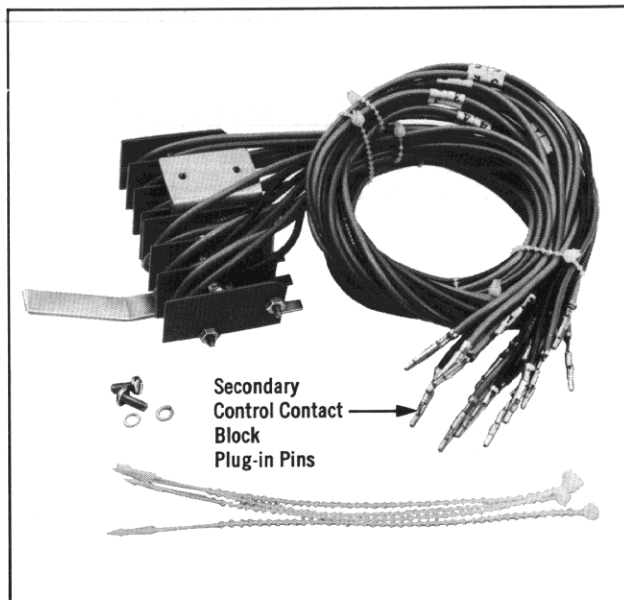
“b” contacts—Closed when breaker is open and open when breaker is closed.

A maximum of six S.P.D.T. spare auxiliary switches may be installed in a single breaker. All components are internally mounted in the right-hand pole.

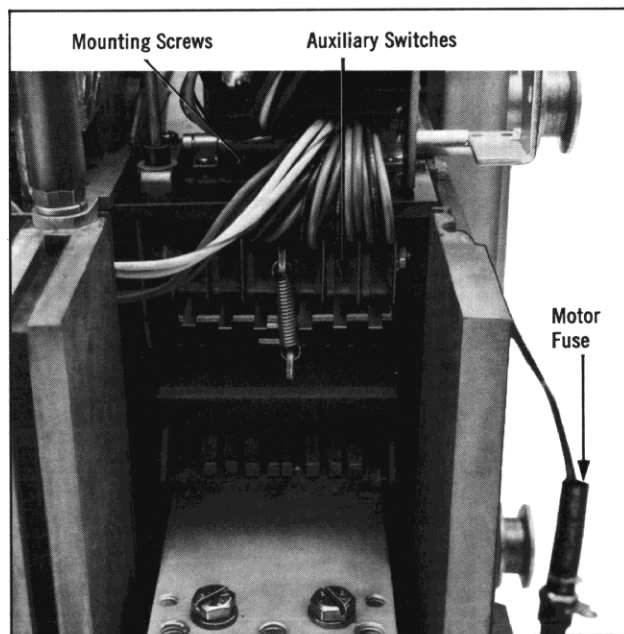
#### 5.5 UNDERVOLTAGE RELEASE

Refer to Figures 57 and 58.

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 will not make contact.



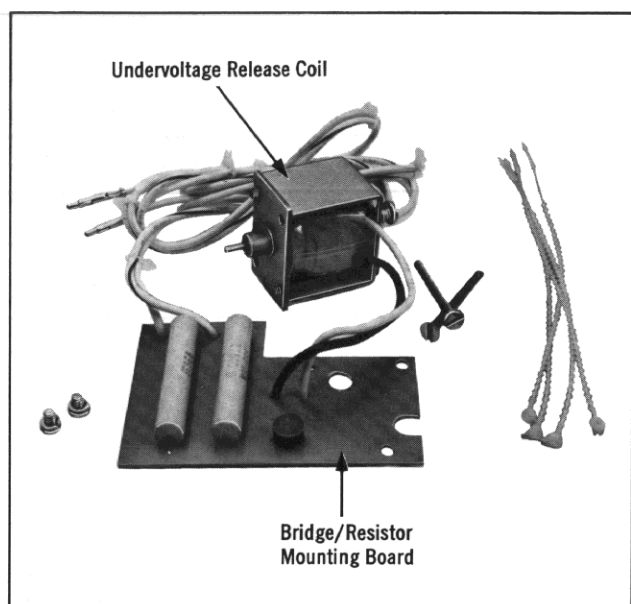
**Fig. 55** *Auxiliary Switch Kit.*



**Fig. 56** *Auxiliary Switch Kit Installed.*

The undervoltage release will operate instantaneously if the monitored voltage should dip into the drop-out voltage range. A time delay of up to 0.5 seconds may be obtained with the addition of a remote mounted time delay device. See Section 5.6.

The undervoltage release including the supplemental resistors and/or bridge as required are internally mounted in the center pole.



**Fig. 57** *Undervoltage Release Kit.*

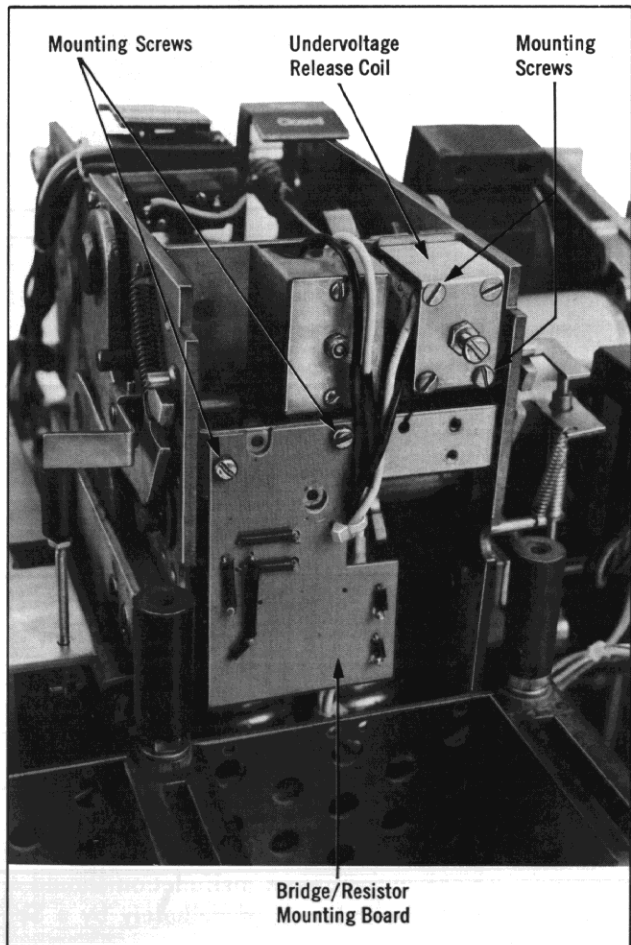
## 5.6 UNDERVOLTAGE RELEASE TIME DELAY DEVICE

Refer to Figure 59.

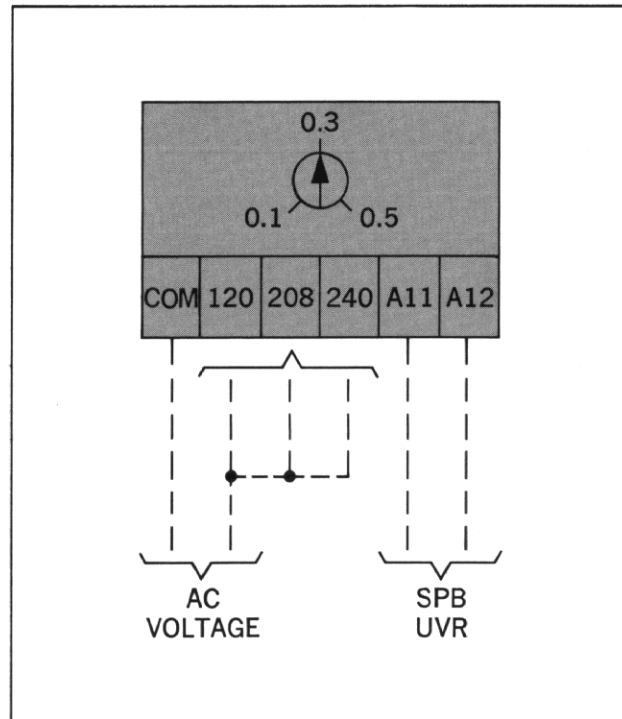
An undervoltage release time delay device used in conjunction with the instantaneous undervoltage release accessory will provide the necessary time delay operation to avoid nuisance breaker openings resulting from momentary dips in the monitored AC voltage source.

The device is provided with AC voltage taps at 120, 208, and 240 volts with an adjustable time delay setting range from 0.1 to 0.5 seconds. 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 adaptor.



**Fig. 58** *Undervoltage Release Installation.*



**Fig. 59** *Undervoltage Release Time Delay Device.*



## 5.7 GROUND FAULT TEST PANEL

Refer to Figure 60.

A remote mounted ground fault test panel is available for use with breakers with built-in ground fault protection provisions. The ground fault test panel is designed to functionally test the ground fault circuitry from a remote location in either of two operational modes: by opening the breaker, or by not opening the breaker. The test panel is provided with a selector switch for initiating the desired test sequence, a trip light to signify a ground fault trip operation, a control power light to indicate the availability of control power, and instruction nameplate.

Connection details are shown on drawing 1366D30. Caution: When the test panel is used at the same time with either an automatic trip relay or a combination automatic trip relay and trip mode indicator, then special wiring connections are required per Note 6 of the above drawing.

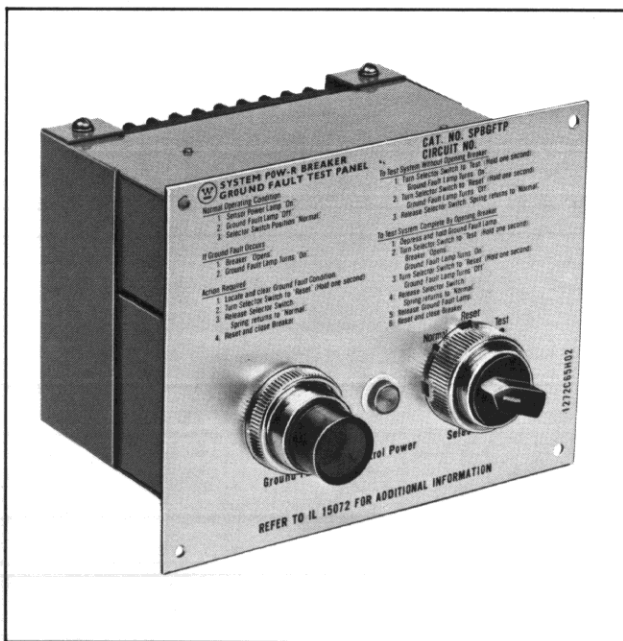


Fig. 60 Ground Fault Test Panel.

### 5.7.1 Operational Sequence #1—By Opening Breaker

1. *Depress and hold* ground fault indicator light, then *rotate* selector switch to “test” position. Hold for six seconds.\*\*
  - a. Breaker will “open.”

- b. Test panel Ground fault trip indicator will turn “on.”
- c. Optional Pow-R Trip 7 ground fault indicator—if supplied—will operate. *Reset required.*
- d. Optional indicators, alarm circuits and lock out circuits available with remote mounted trip mode indicators and/or automatic trip relays—if supplied—will operate. *Reset of each required.*

2. *Rotate* selector switch to “reset” position. *Hold* one second.
  - a. Ground fault trip indicator will turn “off.”
  - b. All related indicating circuitry must be reset.
3. *Release* selector switch and it will spring return to the “Normal” or ready position.
4. *Release* ground fault lamp.
5. *Reset* any and all indicators supplied with above-mentioned optional auxiliary devices.
6. *Reclose* the breaker as desired.

### 5.7.2 Operational Sequence #2—By Not Opening the Breaker

1. *Rotate* selector switch to “test” position. Hold one second.
  - a. Breaker will not open.
  - b. Ground fault trip indicator will turn “on.”
  - c. Any other optional indicator—if supplied—will not operate.
2. *Rotate* selector switch promptly after ground fault indicator turns on to Reset position and hold six seconds.\*
  - a. Ground fault trip indicator will turn “off.”
3. *Release* selector switch and it will spring return to the “Normal” or ready position.

\*Because of the ground fault memory circuit built into the Pow-R Trip 7 trip unit, any accidental release or failure to hold as instructed could cause false signals to any ATR remote devices, thus causing problems with any related alarm and/or lockout schemes.

\*\*Six seconds time delay is specified as “worst case condition” to prevent apparent malfunction should a Sequence #2 test be followed immediately by a Sequence #1 test.

### 5.8 FUNCTIONAL, IN-SERVICE TEST KIT

Every Systems Pow-R Breaker is equipped with test points that can be used with a hand-held test kit for "in-service" functional testing of the long-time (overload), short time or instantaneous (short circuit) and ground fault trip circuits provided, of course, the breaker is equipped with these optional functions. See Figure 61.

While tests may be conducted with the breaker "in-service" and carrying normal load current, it is recommended that functional test procedures be limited to normal maintenance test schedules during "off load" hours or during routine inspection schedules where a draw-out mounted breaker may be in the "Test," "Disconnected" or "Withdrawn" cell positions.

Any functional test initiated by the test kit will open the breaker. Reclosing time will be determined by the amount of time required to recharge the closing mechanism - if it is not already manually or automatically recharged - and the time required to depress the "Close" pushbutton. Caution: For breakers applied in generator synchronizing service, proper synchronizing procedures should be followed before reclosing

the breaker. Also, for breakers employed in automatic transfer schemes, routine in-service testing should be avoided to prevent unnecessary power transfer operations. For both of these types of service, functional testing of the breaker via the test kit should be conducted only with the draw-out breaker in the "Test" or more removed positions.

All tests performed by the test kit are functional tests only designed to electrically test the operating integrity of the trip unit, the flux transfer shunt trip and the mechanical operation of the breaker. Tests are not designed as a check of the calibration of the breaker. Calibration tests can best be done at the factory with precise calibration equipment.

Complete test operating instructions and required setting details are given in the cover of the test kit as well as in I.L. 15094. For convenience, the operating instructions are repeated below. Caution: The test plug prongs have been insulated with moving sleeves and the test kit provided with dual test switches to avoid the possibility of electrical shock. No problems should be encountered if the test plug is installed properly before the power cord is "plugged-in" and the test procedure followed.



Fig. 61 Test Kit for In-service Functional Testing.



### 5.8.1 Test Kit Operating Instructions

#### A. Before Hook-Up

1. Refer to this Instruction Leaflet for comments on in-service testing and special application including generator synchronizing and automatic transfer before initiating any tests. Some tests can best be done in the draw-out "Test" or more removed positions.
2. With above taken into consideration, the circuit breaker should be in the "Closed" position.
3. Place the mode selector switches in the "Off" position. See Figure 62.
4. Record the trip unit settings so they can be returned to their original settings after tests are concluded.
5. Remove the trip unit transparent cover and make the following setting changes:
  - a) Set Short Time Band to "Minimum."
  - b) Set Long Time Band per Test Setting Table.
  - c) Set Instantaneous Pick-up to "10X."
  - d) Set Short Time Pick-up to "8X."
  - e) Leave other settings "as is."



Fig. 62 Test Kit Operating Panel.

#### CAUTION

During a test of a circuit breaker with ground fault pop-out indication or an external ground fault test panel, false indication may occur in the ground fault indicator circuit following a normal test operation of long time. This situation could occur because the portable test kit uses external control power which during the course of the test may not be reset promptly enough. Should this occur, reset Switch No. 2 in test kit to "Off" and reset the ground fault indicator. This situation will not occur during normal breaker tripping operations.

#### B. Hook-up

1. Remove test lead from the test kit and insert it into the trip unit openings marked "Test."
2. Remove the test kit power cord and insert it into a 120 volt, 60 Hz. source. "Power-on" lamp should light. If the "Power-on" lamp should not light, check the source, then the test kit fuse.
3. The "Ready-to-Test" LED (see Figure 62) should turn "On" within one minute after the power cord is plugged into an available source.

#### C. Test Procedure

1. To functionally test the instantaneous or short time pick-up mode (short circuit):
  - a) Using both hands, move test Switch No. 1 and No. 2 (Figure 62) simultaneously to instantaneous. (Note: A test will not be made with only one switch actuated.) Results:
    - 1) The breaker should open instantaneously, and
    - 2) Trip unit optional short circuit indicator - if any - should operate, and
    - 3) Remote indicator in optional automatic trip relays - if any - should operate.
  - 4) Ready to test LED should go out.
- b) Release both switches (they will spring return to "Off").
- c) Ready to test light will turn on after a few seconds.
- d) Reset all indicator circuits - if any - and
- e) Reclose the breaker as required.

#### Test Setting Table

Breaker Frame	Trip Unit Plug	Long Time Band Setting
3000 Amp.	3000 Amp.	Intermediate
2500 Amp.	2500 Amp.	Intermediate
2000 Amp.	2000 Amp.	Intermediate
1600 Amp.	1600 Amp.	Intermediate
1600 Amp.	1200 Amp.	Intermediate
1600 Amp.	1000 Amp.	Intermediate
800 Amp.	800 Amp.	Intermediate
800 Amp.	700 Amp.	Intermediate
800 Amp.	600 Amp.	Intermediate
800 Amp.	500 Amp.	Maximum
800 Amp.	400 Amp.	Maximum
800 Amp.	300 Amp.	Maximum
250 Amp.	250 Amp.	Intermediate
250 Amp.	225 Amp.	Intermediate
250 Amp.	200 Amp.	Intermediate
250 Amp.	175 Amp.	Intermediate
250 Amp.	150 Amp.	Maximum

## 2. To functionally test the long time (overload) mode:

- a) Confirm that the long time band has been pre-set per Test Setting Table.
- b) Move selector switch No. 2 (Figure 62) to "Overload" (it will stay in this position after the hand is removed), then:
  - 1) The breaker should open in less than two minutes, and
  - 2) Trip unit optional "Overload" indicator - if any - should operate, and
  - 3) Remote indicator in optional automatic trip relays - if any - should operate.
  - 4) Ready to test light will remain on after breaker trips.
- c) Return selector switch to "Off" position, and
- d) Reset all indicator circuits - if any - and
- e) Reclose the breaker as required.

## 3. To functionally test the ground fault trip mode:

- a) Move selector switch No. 1 (Figure 62) to "ground fault" and move selector switch No. 2 to "ground fault" and hold for 1 second.
  - 1) The breaker should open instantaneously, and
  - 2) Trip unit optional "Ground Fault Indicator" - if any - should operate, and
  - 3) Remote indicator in optional automatic trip relays - if any - should operate, and
  - 4) Ground fault lamp in remote test panel - if used - should turn "On."
  - 5) Ready to test light will remain on after breaker trips.
- b) Release selector switch No. 2 (it spring returns to "Off").
- c) Return selector switch No. 1 to "Off" position, and
- d) Reset all indicator circuits - if any - and
- e) Reclose the breaker as required.

## D. Return to Normal Service

1. Unplug power cord from 120 V 60 Hz supply.
2. Remove test plug from trip unit. (Caution: Avoid contact with test plug prongs until power cord has been disconnected and internal capacitors discharged.)
3. Return all trip unit settings to their previous settings.
4. Replace the transparent trip unit cover. The test is concluded.
5. Consult the factory should the breaker not perform as expected.

## 5.9 AUTOMATIC TRIP RELAYS

Refer to Figure 63.

A remote mounted automatic trip relay when used in conjunction with a Pow-R Trip 7 trip device may be used to prove visual indication of a breaker automatic trip operation mode or as a contact for a remote audible alarm or as a contact for a remote lockout function. The automatic trip relay kit has three unit mounted individual LED's (light-emitting diodes) to indicate the exact trip mode: overload, short circuit, or ground fault. In addition, contacts are provided for remote indication of the same. Another automatic trip relay kit is available with a single LED which indicates an automatic trip operation without identification of the specific type.

A combination pilot light and reset pushbutton is provided to indicate "control power available." Following an automatic trip operation the relay must be reset for a subsequent operation. The relay and LED's are reset by depressing the "control power available" pilot light.

Each automatic trip relay 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 adaptor: 120 V., 50/60 Hz. control power is required for relay operation.

Complete electrical connections are shown on drawing 1366D30. Special connections per Note 6 of this drawing must be followed when automatic trip relays are used in conjunction with a remote mounted ground fault test panel.



**Fig. 63** Automatic Trip Relays.

## 5.10 KEY INTERLOCKS

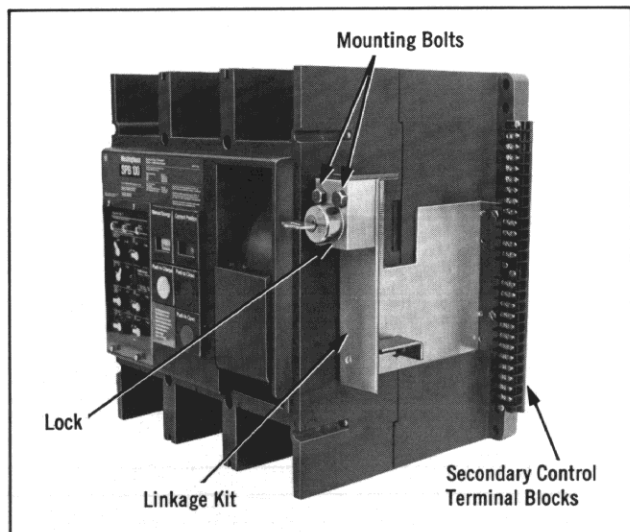
Refer to Figures 64, 65, and 66.

Key interlock mechanisms provide means for 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, Figures 64 and 65, and draw-out breakers, Figure 66. For fixed breakers the assembly is bolted to the right-hand side of the breaker. For draw-out breakers, the assembly is mounted to the right-hand side of the draw-out stationary racking mechanism. With either arrangement,

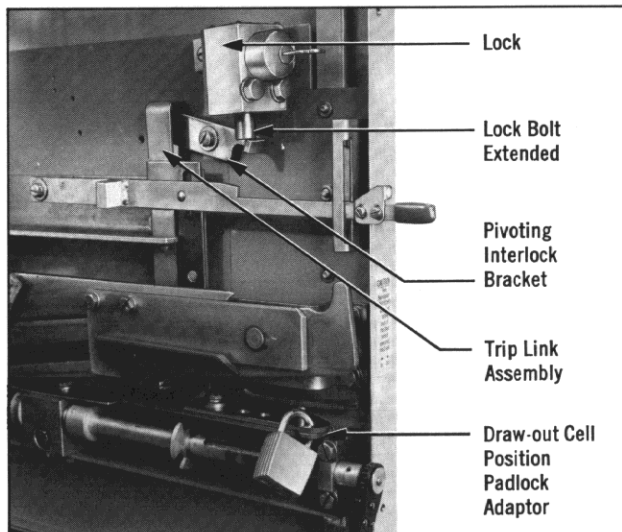
the charging and closing of the breaker is blocked. With the lock in the "bolt extended" position, the breaker may be racked to the "withdrawn" position.

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

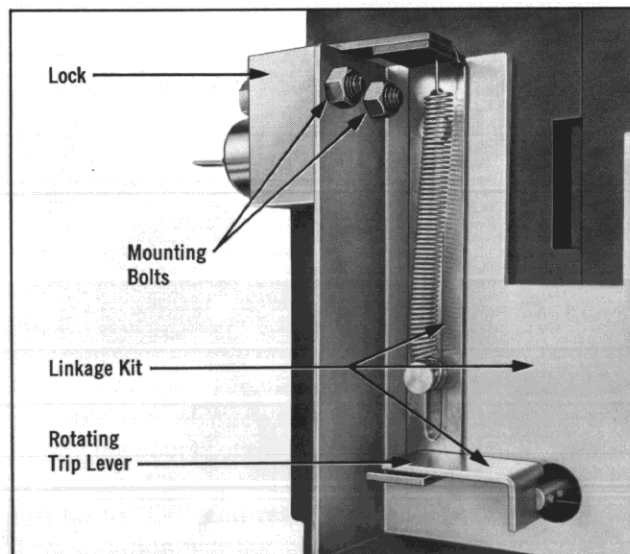
Ordinarily, the actual key interlocks are ordered separately and installed by the customer. However, complete lock provisions including the locks may be installed in the factory to satisfy customer requirements.



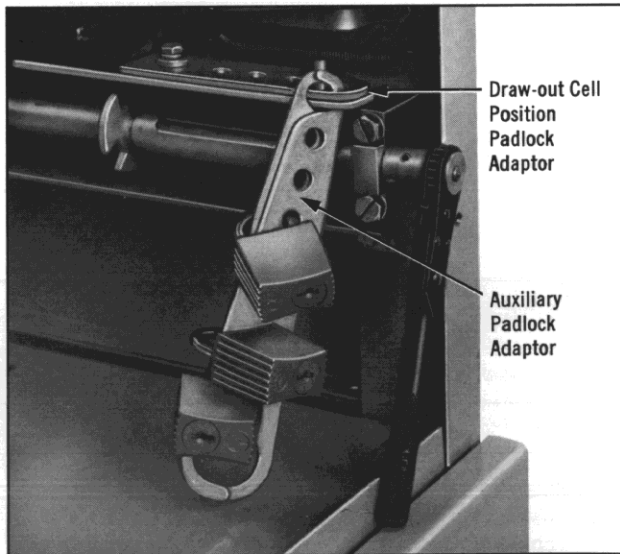
**Fig. 64** Key Interlock and Linkage Kits Installed on Fixed Mounted Breaker.



**Fig. 66** Key Interlock and Padlock Kits Installed on Draw-out Mechanism.



**Fig. 65** Rear View of Installed Key Interlock and Linkage Kit on Fixed Mounted Breaker.



**Fig. 67** Draw-out Cell Position Padlock Adaptor Used with Auxiliary Padlock Adaptor.

Locks supplied by the customer should be Kirk - or physical equivalent - Type "F", "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, sealing provisions are installed with the mounting bolts to prevent tampering. (Fixed mounted breakers only.)

A maximum of six lock cylinders may be used with any one fixed mounted breaker. A maximum of four may be used with all draw-out stationary mechanisms with the exception of the 800 amp frame, where only one lock may be used.

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 (see Figure 64).

### 5.11 DRAW-OUT CELL POSITION PADLOCK ADAPTOR

Refer to Figures 66 and 67.

A padlockable adaptor kit is available for factory installation to padlock the breaker in either the "Connected," "Test" or "Disconnected" position. For safety and maintenance purposes, this adaptor - 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 adaptor as shown in Figure 67 may be used.

### 5.12 PUSH-TO-OPEN PADLOCKABLE ADAPTOR KIT

Refer to Figures 68 and 69.

A padlockable adaptor 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 adaptor will accommodate up to four padlocks. The adaptor 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.

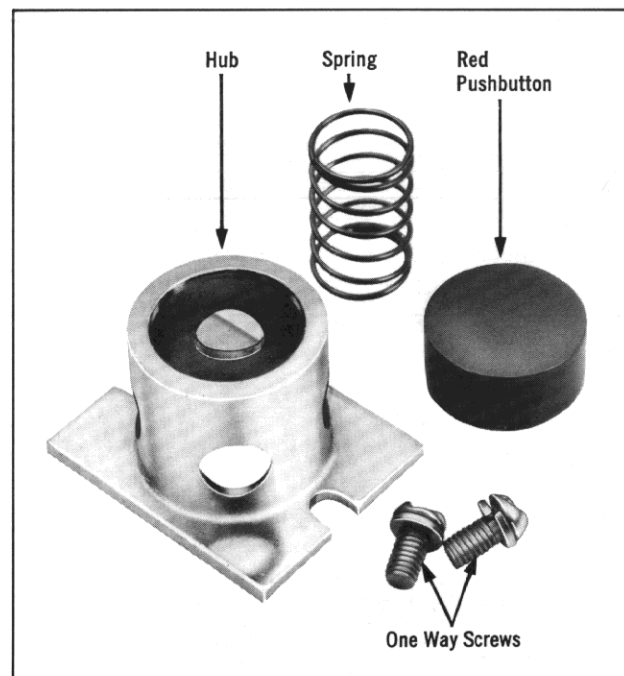


Fig. 68 Push-to-Open Padlockable Adaptor Kit.

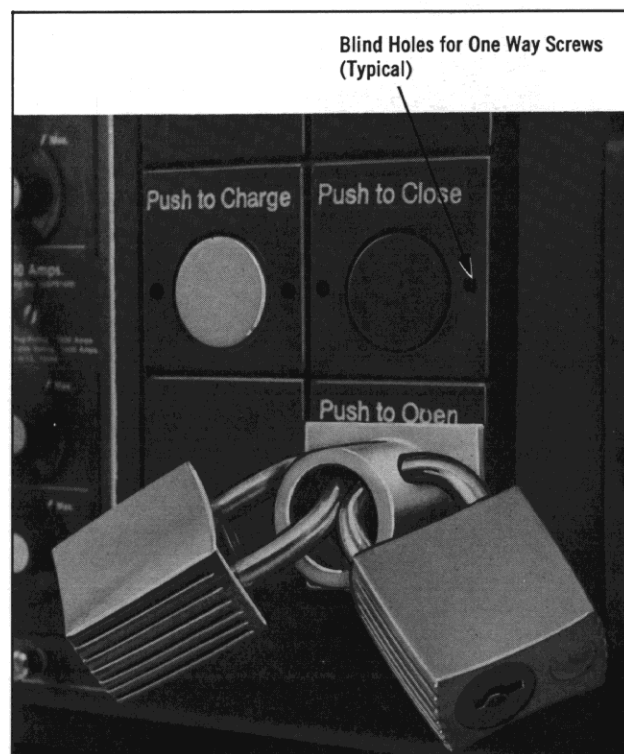


Fig. 69 Push-to-Open Padlockable Kit Installed. Four Locks Maximum.

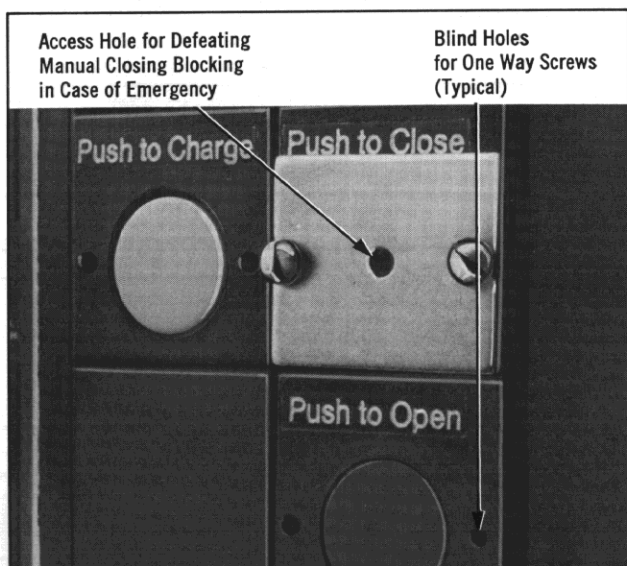
### 5.13 MANUAL CLOSING BLOCKING ADAPTOR KIT

Refer to Figure 70.

A manual closing blocking adaptor 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.

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

The adaptor 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.



**Fig. 70** Manual Closing Blocking Adaptor Kit Installed.

### 5.14 DRAW-OUT SECONDARY CONTROL STABS

Refer to Figure 71.

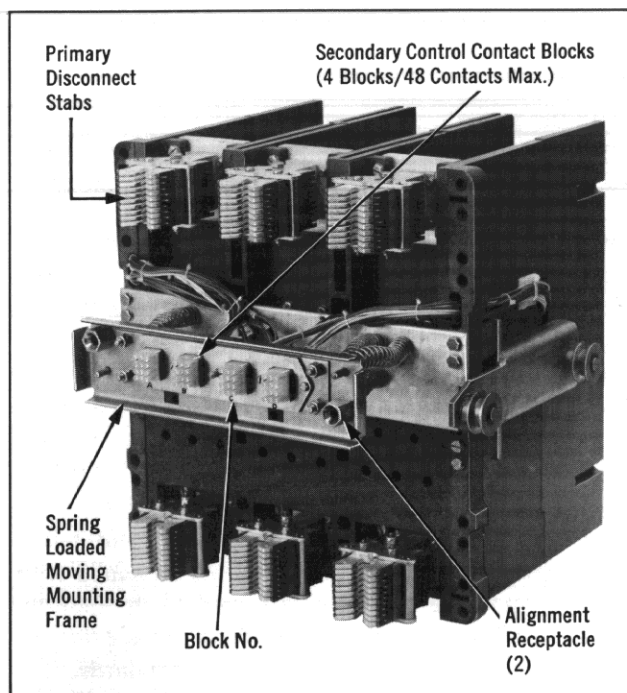
Draw-out secondary control stabs are plug-in disconnects that provide access means for control leads to enter the moving draw-out breaker element from the stationary breaker cell in the switchboard. Secondary control stabs are connected in the "test" and "connected" cell positions, and are disconnected in the "disconnect" draw-out position.

A maximum of 48—four 12 point blocks—secondary control stabs may be mounted on a single breaker. The rear mounting frames are spring loaded and prepositioned for accurate alignment.

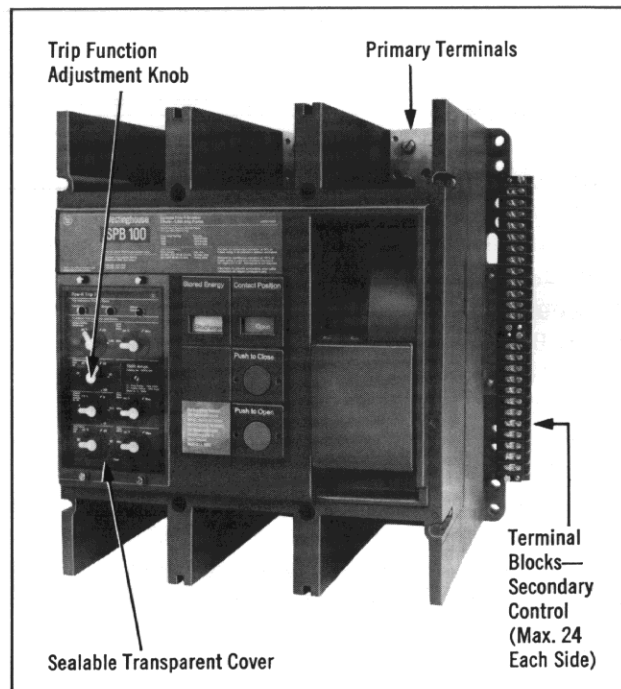
A sufficient quantity of secondary control stabs are supplied to satisfy the requirements of all factory installed accessories. Both the moving and stationary mounting frames plus the required number of contact blocks may be added in the field to any existing draw-out breaker as later required. Additional contact blocks may be added to match the needs of additional accessories which may also be field installed.

All control blocks and individual stabs are pre-numbered in accordance with the connection diagram 1366D30. The individual blocks are numbered right to left as viewed from the front of the breaker A-B-C-D as shown in Figure 71. Individual blocks are indexed and positioned to insure positive alignment. All accessory leads are provided with taper pins for proper positioning and retention in the block. Care should be exercised when installing each lead to insure proper location insertion and proper pin seating.

Secondary control leads will normally terminate in a control terminal block located in the cable compartment of the switchboard. Should the job condition dictate, space is available for these 12 point terminal blocks on the stationary racking side frame. Secondary control stabs and terminal blocks are rated 6 A, 600 volts.



**Fig. 71** Draw-out Breaker Secondary Control Stabs Shown Mounted on Rear of Moving Element.



**Fig. 72** Fixed Mounted Breaker with Control Terminal Blocks Installed.

### 5.15 CONTROL TERMINAL BLOCKS FOR FIXED MOUNTED BREAKERS

Refer to Figure 72.

Up to four 12 point terminal blocks used to terminate control leads leaving the breaker may be assembled to the sides of a fixed mounted breaker. The terminal blocks—2 on a side—are bracket mounted for convenience. Both the brackets and terminal blocks are field-installable to satisfy the field addition of internally mounted breaker accessories. The terminal block mounting bracket may be mounted simultaneously with the Kirk key interlock mounting bracket. Refer to Figure 64.

The terminal blocks are rated 6 A, 600 volts.

## Section 6 — Inspection and Maintenance

### 6.0 — GENERAL

The 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 Underwriters' 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 standards 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 placed upon these breakers for protection and the assurance of service continuity, inspection and maintenance checks on them should be made regularly.

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

With the availability of optional trip mode indicators for direct mounting within the trip unit (see Section 4.0 and Figure 34), and/or optional remote mounted trip mode indicators (5.9 and Figure 63), the number of "fishing" expeditions 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 heavy fault, at or near its rating, give it a visual inspection withdrawn from the compartment and 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 and 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. Draw-out mounted breakers should be racked to the "Test" or more removed positions for inspection and for conducting mechanical tests. Electrically operated draw-out breakers may be routinely operated electrically while in the "Test" position.

For functional testing of the trip unit using the recommended portable test kit, refer to detail instructions provided with the test kit. These steps are summarized in Section 5.8.1 of this book.

For details on optimum procedures for internal inspection, maintenance, and lubrication, refer to I.L. 15106.





**Westinghouse Electric Corporation**

Low Voltage Breaker Division, Beaver, PA 15009