SIEMENS

SB Encased Systems Breakers 400-2000 Ampere Frame Ratings

Information and Instruction Guide

Bulletin 2.20-4C

⚠ DANGER

Hazardous voltages are present inside the enclosures or panels in which the circuit breakers are installed. Serious injury, electrocution, and/or equipment damage will result if circuit breakers are improperly applied or precaution is not used.

De-energize all incoming power prior to installation of circuit breakers or associated accessories.

Only qualified personnel should work on or around this equipment.

Circuit breaker indicators shown in this booklet are for illustration purposes only. Circuit breakers are to be installed in "Discharged" and "Open" positions only.

IMPORTANT

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Siemens reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material or both, the latter shall take precedence.

NOTE

***Authorized and qualified personnel—**
For the purpose of this manual a qualified person is one who is familiar with the installation, construction or operation of the equipment and the hazards involved. In addition, he has the following qualifications:

(a) **is trained and authorized** to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.
(b) **is trained** in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.
(c) **is trained** in rendering first aid.

SUMMARY

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local sales office, listed on back of this instruction guide.

The contents of this instruction manual should not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens Energy & Automation, Inc. The warranty contained in the contract between the parties is the sole warranty of Siemens Energy & Automation, Inc. Any statements contained herein do not create new warranties or modify the existing warranty.

400-2000 Amp SB Encased Systems Breakers

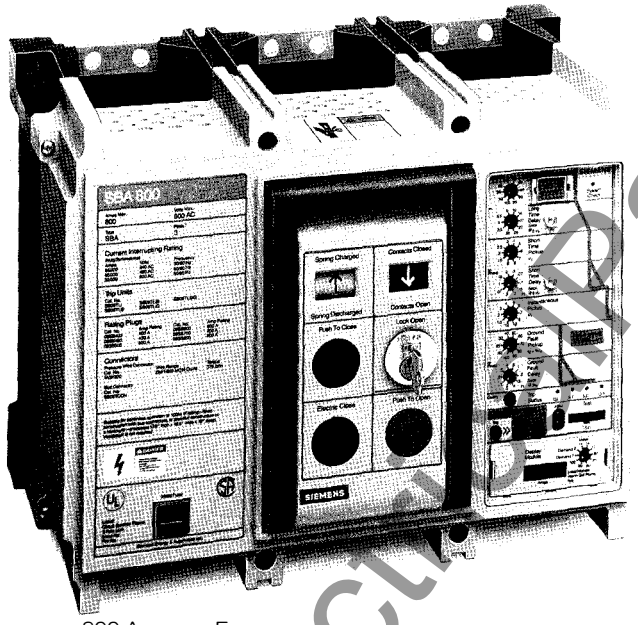
Table of Contents

Introduction

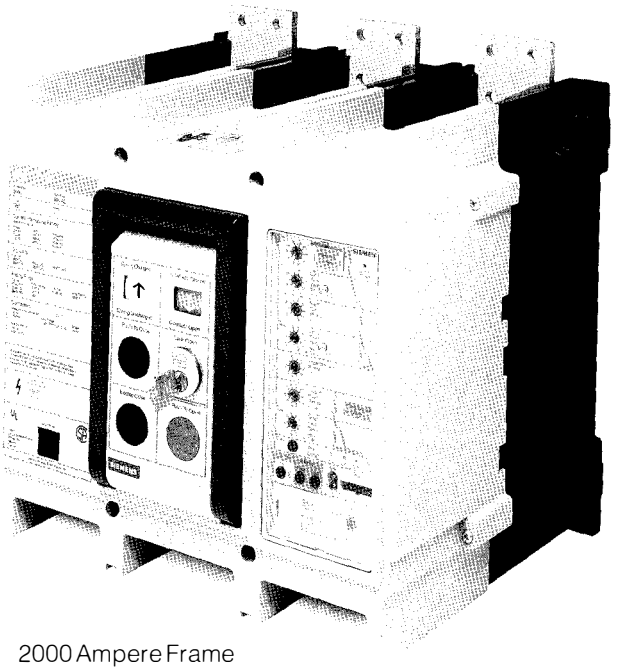
Siemens SB Encased Systems Breakers bridge the performance gap between Molded Case Circuit Breakers (MCCB) and Low Voltage Power Circuit Breakers (LVPCB). Modern computer-aided design and manufacturing tools were used to effectively blend the technologies of the MCCB and LVPCB. This combination has resulted in a family of encased systems circuit breakers that exhibit the most desirable characteristics of each of the parent technologies. Included in these characteristics are high interrupting capacities, high withstand capabilities (magnetic stress), high short-time capabilities (overcurrent heating), and high mechanical and electrical endurances, without maintenance.

Applications for SB breakers include main, tie, feeder, and emergency source breakers in industrial plants, large commercial complexes, and medical and health care facilities. The circuit breakers are constructed for either fixed or drawout installation. They can be physically grouped in central distribution switchboards, or used separately in stand-alone applications.

The SB breaker is equipped with a two-step stored energy mechanism for closing and opening the breaker contacts. After a closing operation, sufficient energy is retained in the two-step stored energy mechanism to perform the tripping function. The mechanism may be charged manually with the integrated low-force charging handle or electrically with the optional electric motor operator. Push-buttons, switches and color-coded indicators allow for easy close and open operations.



800 Ampere Frame
1200 Ampere Frame



2000 Ampere Frame

SB Encased Systems Breakers

Frame Sizes and Frame Ampere Ratings

SB breakers come in three frame sizes with frame ampere ratings ranging from 400 to 4000 amperes. All frames are rated for 100% continuous operation. This particular instruction guide provides detailed SB breaker information for the 800, 1200 and 2000 ampere frame sizes. Frame ampere ratings for these 3 (three) sizes range from 400 amperes to 2000 amperes.

Frame Sizes and Ratings Combinations

Breaker Frame Size	Breaker Frame Ampere Rating (I_n)
800 Amperes	400 Amperes 800 Amperes
1200 Amperes	1200 Amperes
2000 Amperes	1600 Amperes 2000 Amperes

Rating Plugs

SB breakers are designed to use interchangeable rating plugs. These rating plugs allow the user to customize the effective ampere rating of the breaker to meet specific applications. The label on the front of the breaker identifies the rating plugs that may be used with that particular breaker.

Available Rating Plugs

Frame Ampere Ratings (I_n)	Rating Plug Values (Amperes) (I_r)
400	200, 225, 250. 300, 350, 400
800	400, 450, 500, 600, 700, 800
1200	600, 700, 800. 1000, 1200
1600	800, 1000, 1200, 1600
2000	1000, 1200. 1600, 2000

Interruption and Short Time Ratings

Three short circuit interruption ratings are available to meet specific applications. The interruption ratings and short time ratings are given in the following table.

UL / IEC Symmetrical RMS Amperes Interruption①

				SB Encased Systems Breaker Frame Size Ampere Rating			
Standard	Measurement	Voltage AC		400	800	1200	2000
UL 489	Interrupting Ratings - Symmetrical RMS Amperes	Type SBA - Standard AIR (Black Label)					
		240		65,000	65,000	65,000	65,000
		480		65,000	65,000	65,000	65,000
		600		42,000	42,000	42,000	50,000
		Type SBS - Alternate AIR (Blue Label)					
		240		100,000	100,000	100,000	100,000
		480		100,000	100,000	100,000	100,000
		600		65,000	65,000	65,000	65,000
		Type SBH - High AIR (Red Label)					
		240		200,000	200,000	200,000	200,000
		480		150,000	150,000	150,000	150,000
		600		100,000	100,000	100,000	100,000
	Short Time Ratings KA T=0.5 secs.			25,000	25,000	25,000	35,000
IEC 947-2	Interrupting Ratings - Symmetrical RMS Amperes (50 Hz)	415	I_{cu}	100,000	100,000	100,000	100,000
			I_{cs}				
			I_{cw}	25,000	25,000	25,000	35,000
		690	I_{cu}	65,000	65,000	65,000	65,000
			I_{cs}				
			I_{cw}	25,000	25,000	25,000	35,000

The interruption rating of the SB breaker is specified on the front cover label, and is further identified by the use of a "color bar" at the top left of the breaker label. **Blue** indicates the "alternate" or the lowest interrupting category. **Black** indicates the "standard" or middle interrupting rating. A **Red** label indicates the highest available interrupting rating for the SB breaker.

Overcurrent Protection Configurations

Siemens Electronic Trip Units for SB breakers are available in six basic overcurrent protection configurations to meet specific protection requirements. All trip units come equipped with Adjustable Continuous Current and Long Time Delay functions. Optional protection configurations are:

Protection Configuration	Identifier
Long Time/Short Time	LS
Long Time/Instantaneous	LI
Long Time/Short Time/Instantaneous	LSI
Long Time/Short Time/Ground Fault	LSG
Long Time/Instantaneous/Ground Fault	LIG
Long Time/Short Time/Instantaneous/ Ground Fault	LSIG

The trip unit that may be used with a specific circuit breaker is identified on the front cover label.

RMS Current Sensing

The Siemens microprocessor controlled Electronic Trip Unit executes the overcurrent fault protection functions of Siemens SB Encased Systems Breakers. The adjustment flexibility provided by the trip unit allows the user to easily accommodate load changes and other protection requirements while still assuring optimum coordination. A standard feature of the trip unit is RMS current sensing. As opposed to peak-current sensing, RMS sensing measures the true heating potential of the current waveform. This allows for more accurate overcurrent protection and eliminates nuisance tripping due to harmonic distortion of the current waveform.

NOTE: For more complete information on other standard and optional features of the Electronic Trip Unit, see Siemens Electronic Trip Unit for SB Encased Systems Breakers Information and Instruction Guide, Bulletin 2.20-3A.

Accessories

A full family of internal, external, and remote accessories are available for Siemens SB Encased Systems Breakers. A breaker may be configured with all of the internal accessories without changing the external physical characteristics. Detailed description of the accessories are contained in the Accessories section, pages 36-81.

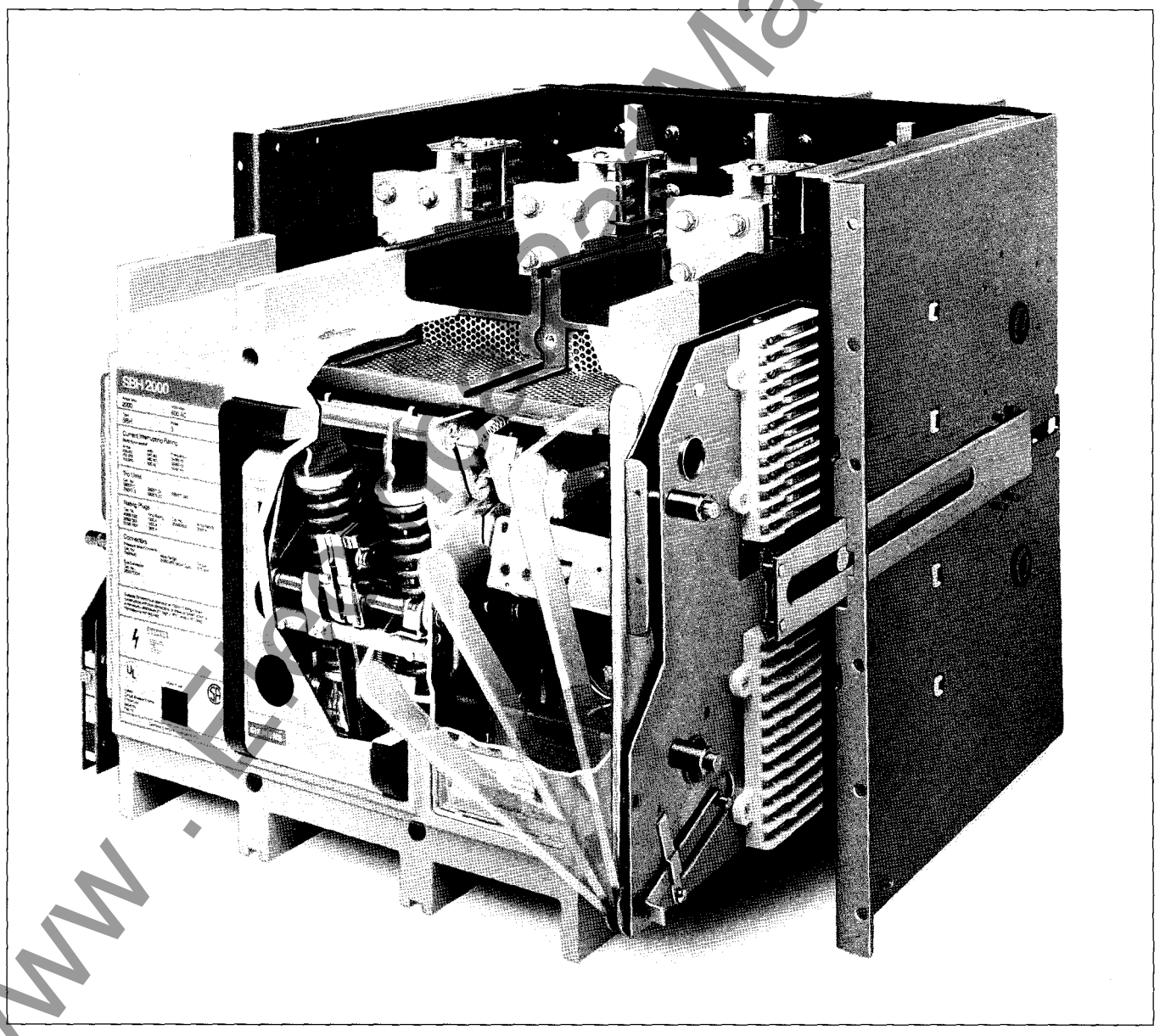
①The information contained herein refers to product instructions and procedures and is not intended to indicate availability.

Description

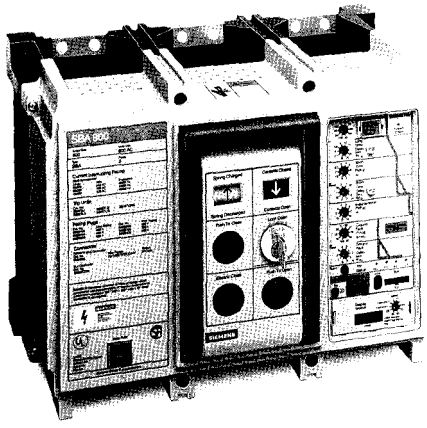
In addition to the performance achieved by combining the MCCB and LVPCB technologies, several installation, operation, and safety features have been incorporated into the SB breakers.

Insulated - Encased Construction
The SB breaker's housing, internal barrier, and front cover are molded from a thermoset material with a high-dielectric strength (electrical insulation). The one piece molded case (base and housing) provides enhanced structural integrity. A midbarrier provides outer wall reinforcement, integral arc baffling, and insulation/isolation between the two compartments of the circuit breaker. This patented construction has allowed for a higher interrupting capacity within a smaller size than could have been achieved by more con-ventional construction. The electrical insulation property of the thermoset material enhances the safety of operation. The insulated case physically isolates and electrically insulates the user from the internal high voltage contacts.

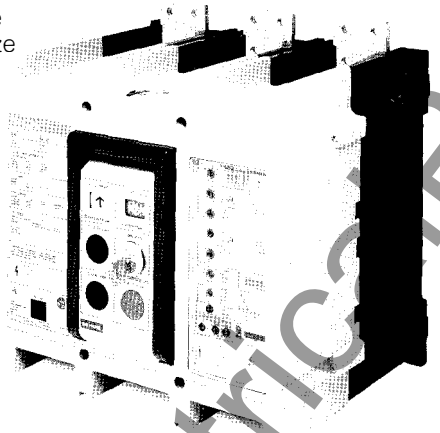
The arc chambers and main contact structure are encased in the back compartment. The trip unit, controls, springs of the stored energy mechanism, and optional internal ac-cessories are located in the front compartment. Access to the front compartment is by the removable front cover. Since the barrier between the two compartments is made from the same insulating thermoset material as the housing, the user is physically isolated and electrically insulated from the main breaker mechanism and contacts when the front cover is removed.



Compact Size
The 800A, 1200A and 2000A frame sizes have a common width of 15½ inches, a common depth of only 12⅛ inches, common bus center lines, and a common mounting footprint. This compact, shallow-depth (even with drawout breakers) permits stacking of six 800 ampere, 1200 ampere or four 2000 ampere breakers in a standard switchboard. This compact packaging is made possible by the insulated-encased construction and thermal performance of the SB breaker. Even when operated at 100% of the frame rating, no additional ventilation is required for the 800A, 1200A and 2000A frames. Detailed outline drawings of the breakers and drawout elements are included in the Outline Dimensions section, pages 82-93.



800A Frame Size
1200A Frame Size

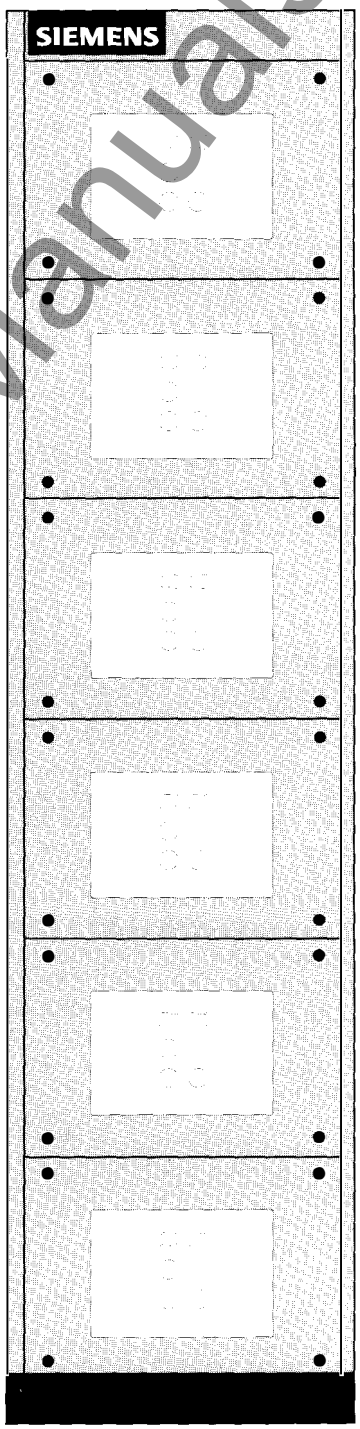


2000A Frame Size

800A Frame Sizes
1200A Frame Sizes

2000A Frame Sizes	0	1	2	3	4	5	6
0	N/A	✓	✓	✓	✓	✓	✓
1	✓	✓	✓	✓	✓		
2	✓	✓	✓	✓			
3	✓	✓					
4	✓						

Possible number of 800A and 2000A Frame Sizes in a 90-inch Switchboard



Example: Six 800A Siemens SB Encased Systems Breakers can be stacked in a 90-inch switchboard

Bus Spacing and Connections

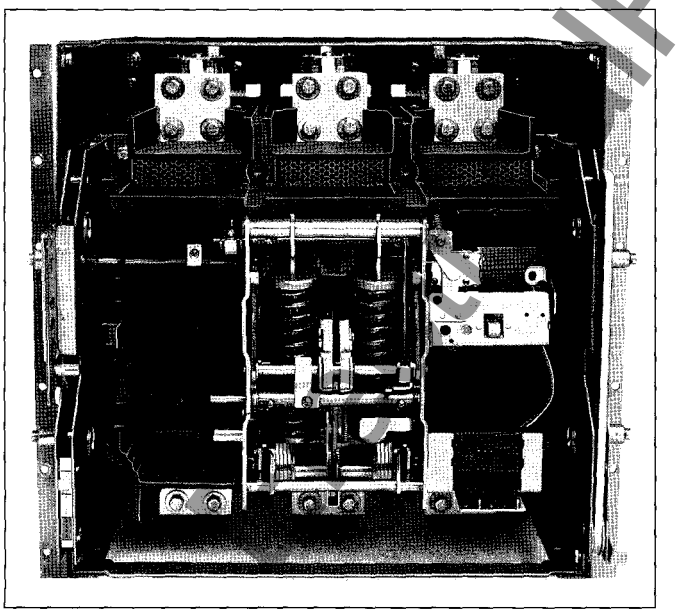
Specific installation features of the SB breakers include 5-inch pole spacing, and vertical or horizontal bus connections. The 5-inch pole spacing allows for a standard bus connection as specified in UL 891, eliminating the requirement for additional thermal testing. The optional vertical or horizontal bus connection is available on both fixed or drawout constructed breakers. Detailed outline drawings are contained in the Outline Dimensions section, pages 82-93.

Two-Step Stored Energy Mechanism

A two-step stored energy mechanism is used to close and open the breaker. Energy is initially stored in the main springs of the stored energy mechanism. When the breaker is closed, spring energy is consumed, and sufficient energy is retained in the breaker to perform the tripping function.

The stored energy mechanism may be charged manually (standard) or electrically (optional). Pushbutton controls allow for easy opening and closing. Color-coded indicators clearly display the opened or closed status of the circuit breaker and charged or discharged status of the stored energy mechanism.

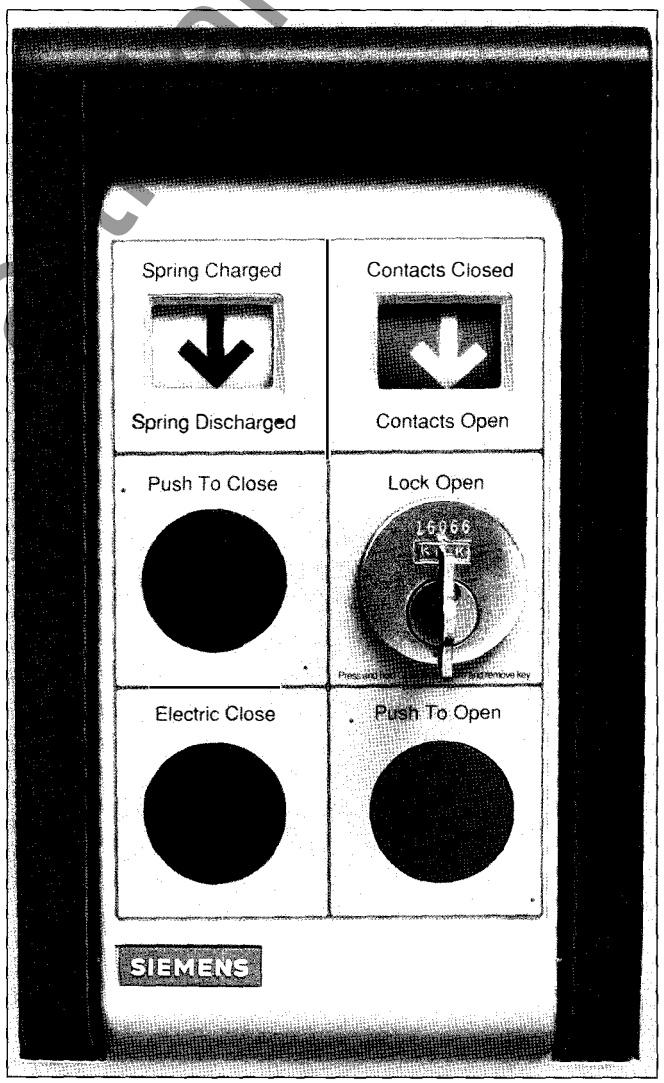
Once the breaker is closed, the mechanism can be recharged. The breaker is now prepared for a rapid open-close or open-close-open operation.



Main stored energy springs located in the front compartment

Centralized Controls

The manual charging handle, pushbutton control switches, and color-coded indicators are grouped in the central escutcheon on the front cover. The U-shaped construction of the charging handle provides for a firm grip regardless of the position of the breaker in the switchboard. For safety, the charging handle and push-to-close pushbutton are interlocked. This interlock prevents the breaker from being closed unless the charging handle is in the stowed position, the position to which it will automatically return when it is released. The interlock also prevents the breaker from being manually charged if the Close button is depressed. Operating instructions for the stored energy mechanism and controls are in the Operating Instructions section, pages 16-27.

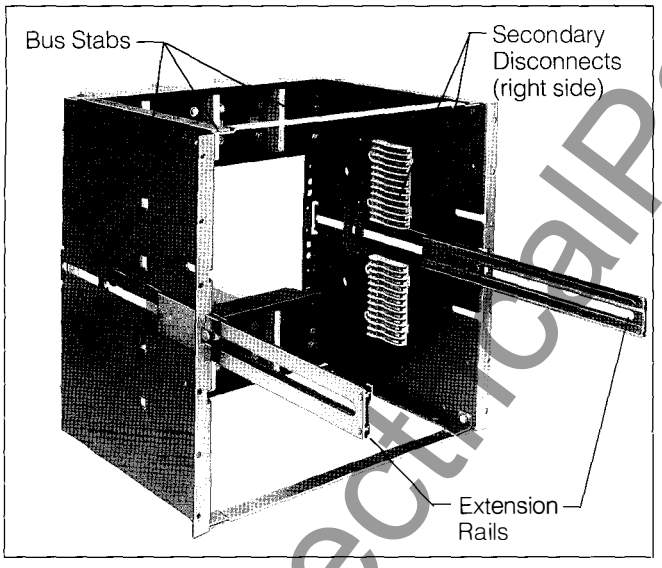


Centralized controls and color-coded indicators

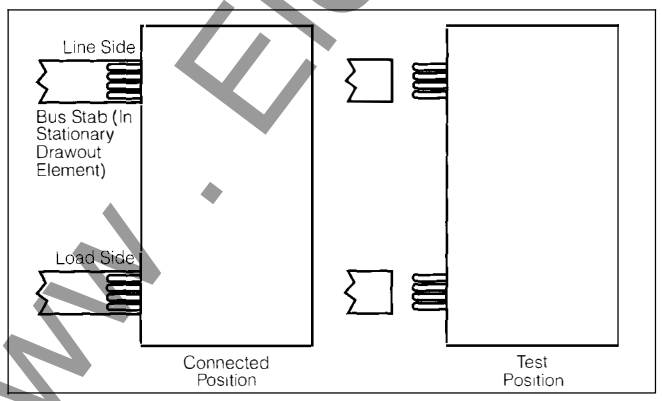
Stationary and Moveable Drawout Elements

Simplified Minimum Depth Drawout Mechanism
The two elements of a drawout constructed SB Encased Systems Breaker are referred to as the Stationary Drawout Element and the Moveable Drawout Element. The stationary drawout element mounts from the front or bottom into a standard switchboard. Bottom mounting flanges are provided for optional mounting arrangements. The moveable drawout element mounts onto the stationary drawout element's two extension rails. This allows the moveable drawout element to be racked into and out of the stationary drawout element. For inspection purposes, the moveable drawout element may be rotated on the extension rails when the rails are fully extended. Detailed outline drawings of the stationary and moveable drawout elements are in the Outline Dimensions section.

There are four positions of the moveable drawout element: 1.) connected, 2.) test, 3.) unlocked (only), and 4.) unlocked/withdrawn. A "racking" mechanism with a low-force pump handle is used to move the moveable drawout element between the connected, test, and unlocked positions. Since the pump handle is an integral part of the racking mechanism, no auxiliary racking device or tool is required. In the unlocked position the moveable drawout element is disengaged from the racking mechanism. The moveable drawout element can be easily pulled between the unlocked position and the withdrawn position. A color coded indicator displays the position of the moveable drawout element.



Stationary Drawout Element

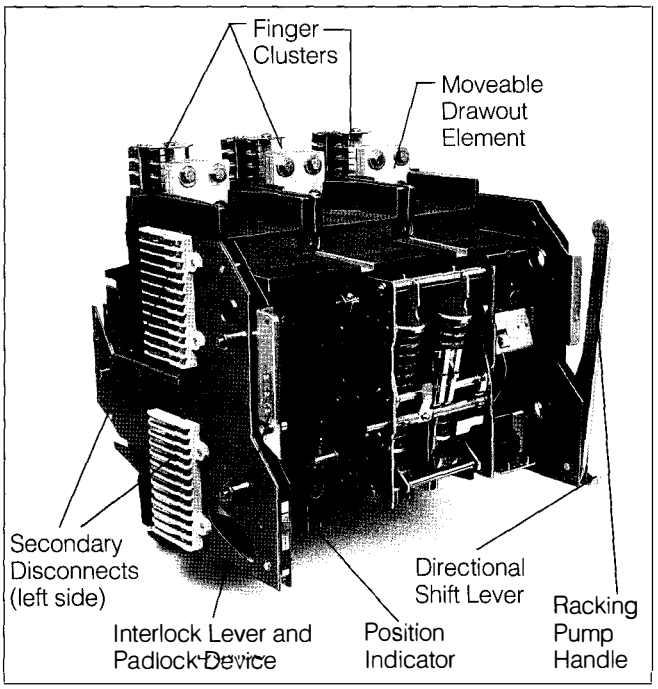


Side View Shown

In addition to the integral pump handle, two levers are used to control the movement of the moveable drawout element. A single interlock lever automatically locks the moveable drawout element when it reaches the test or the connected position. The moveable drawout element is released to move to the next position by simply pushing and releasing the interlock lever. **Pushing and releasing the interlock lever with the SB breaker contacts closed will open the breaker.** It is not necessary to hold the interlock lever to rack the moveable drawout element. A directional shift lever determines the direction the moveable drawout element will move when the pump handle is pulled or pushed.

Secondary disconnect sliding terminal blocks for terminating internal accessories are mounted on the sides of the stationary and moveable drawout elements. The secondary disconnects are mated as the moveable drawout element is moved from the withdrawn position to the unlocked position. The terminal points of the secondary disconnects are identified in the Accessories section.

Step by step instructions on operating the racking mechanism and rotating the moveable drawout element are contained in the Operating Instructions section.



Moveable Drawout Element

Description

Electronic Trip Units For Siemens SB Encased Systems Breakers

Information
The Electronic Trip Unit is a microprocessor controlled multi-function overcurrent protective device for application with Siemens state-of-the-art family of SB Encased Sys-tems Breakers. The adjustment flexibility provided by the trip unit allows the user to easily accommodate load changes and other protective requirements while still assuring optimum coordination. In addition to the adjustable protection functions, the trip unit is designed to use field interchangeable rating plugs. These rating plugs allow the ampere rating of the breaker to be changed to meet specific applications.

For ease of installation and interchangeability in the field, the trip unit has been designed as a plug-in unit to mount directly into a SB breaker frame.

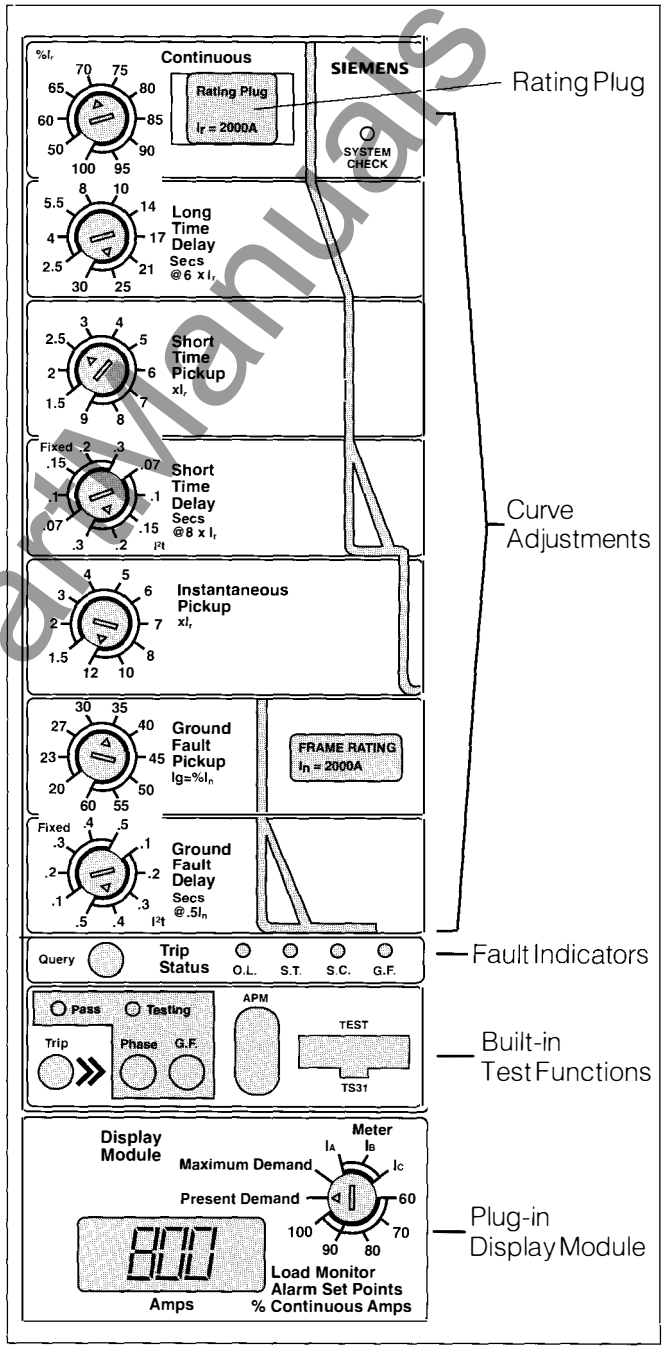
Current sensors within the SB breakers provide signal currents and operating power for the trip unit. Therefore, when the breaker is closed, the trip unit requires no external connections or control power to perform its protection functions.

Overcurrent Protection Configurations
Trip units are available in six basic overcurrent protection configurations to meet specific protection requirements. All trip units have Adjustable Continuous Current and Long Time Delay. Optional protection configurations are:

Protection Configuration	Identifier
Long Time/Short Time	(LS)
Long Time/Instantaneous	(LI)
Long Time/Short Time/Instantaneous	(LSI)
Long Time/Short Time/Ground Fault	(LSG)
Long Time/Instantaneous/Ground Fault	(LIG)
Long Time/Short Time/Instantaneous/ Ground Fault	(LSIG)

As standard features, the trip unit has two built-in-test functions and a fault identification function. System Check is a built-in-test function that continuously checks the status of the microprocessor and protective algorithms. A green LED on the front panel blinks approximately every 3 seconds when the microprocessor is properly cycling through its protection routines. Integral Test is a built-in-test that allows the user to exercise the trip unit electronics. LED indicators display the testing status. Trip Status is a fault identification function that stores information when a fault current causes the trip unit to trip the circuit breaker. By pressing the Query button the user can display the cause of the breaker trip by illuminating one of four LED's: OL (overload), ST (short time), SC (short circuit), or GF (ground fault).

Additional optional features include:
Display Module for local current monitoring (field addable)
Zone Selective Interlocking
Communications for remote monitoring



Electronic Trip Unit Adjustment Panel (2000A illustrated)

Stationary Drawout Element

⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn system power off before installing device.

General Instructions

Installation instructions for systems breakers, trip units, and rating plugs are presented in this section. Installation instructions for accessories that may be installed in the field are presented in the Accessories section.

Installing Drawout Constructed SB Breakers

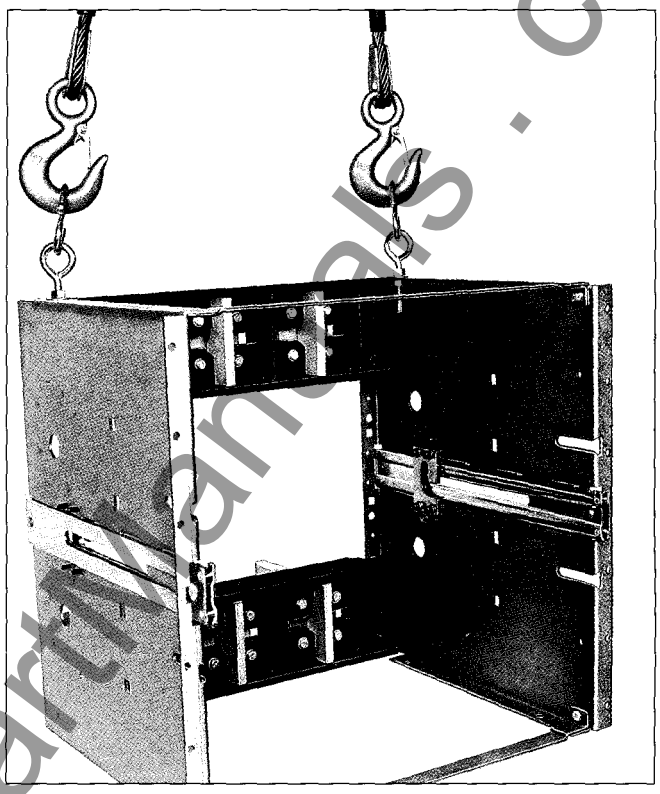
Drawout constructed SB breakers are designed to be installed from the front into a switchboard with a minimum width opening of 19 inches. The stationary drawout element may be secured in the switchboard at the front and rear to vertical supports, or at the top and bottom to horizontal supports.

Installing the Stationary Drawout Element

Prepare the switchboard for installation of the stationary drawout element in accordance with the outline drawings located in the Outline Dimension Drawings section, pages 82-93. The outline dimension drawing of the stationary drawout element for the 800A and 1200A frame is located on pages 82-83; for the 2000A, pages 86-87. The locations of the mounting holes and the recommended screws are depicted on the drawings. If the stationary drawout element is secured to vertical supports, a minimum of eight screws and bolts should be used, four at the front and four at the rear.

Carefully uncrate the stationary drawout element. Remove all packing material with the exception of the tie wraps holding the extension rails in place. Depending upon the installation scheme, it may be necessary to remove the tie wraps on the extension rails just prior to securing the stationary drawout element in the switchboard. If the stationary drawout element is secured to a pallet, remove the securing device.

If the preferred rear mounting surface is to be used (see Outline Dimension Drawings section), remove the eight (8) 3/8"-16 bus support bolts. **Do not loosen or remove 1/4"-20 bus support screws.** Use the 3/8"-16 bolts to secure the rear of the stationary drawout element when it is installed. Torque 3/8"-16 bolts to 18-22 ft. lbs.



Attach lifting device to identified lifting points only.

The stationary drawout element can be manually lifted and held in position as it is being installed. However, if preferred, the two holes identified as lifting points on the outline drawing may be used to attach a lifting device. (NOTE: The two (2) rear holes are located such that the stationary drawout element can be easily balanced as it is being lifted by a crane or hoist. **Do not** lift stationary drawout element by only the two (2) top front holes. If preferred, device can be lifted by utilizing all four (4) top holes.) Lifting devices should not be attached to any other points. The stationary drawout element should not be lifted by the primary stabs.

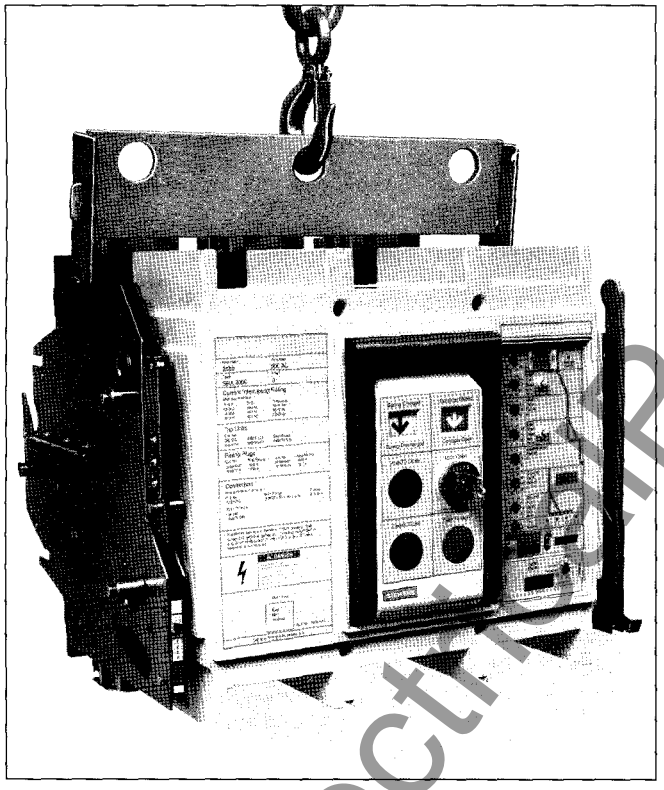
Lift the stationary drawout element into position and secure it in place. Remove the lifting device.

Remove the tie wraps securing the extension rails. Check to ensure that no packing or other foreign material impedes rail movement.

Moveable Drawout Element

Installing the Moveable Drawout Element
The outline drawing of the moveable drawout element for the 800A and 1200A frame is located on pages 84-85. The outline drawing of the moveable drawout element for the 2000A frame envelope is located on pages 88-89.

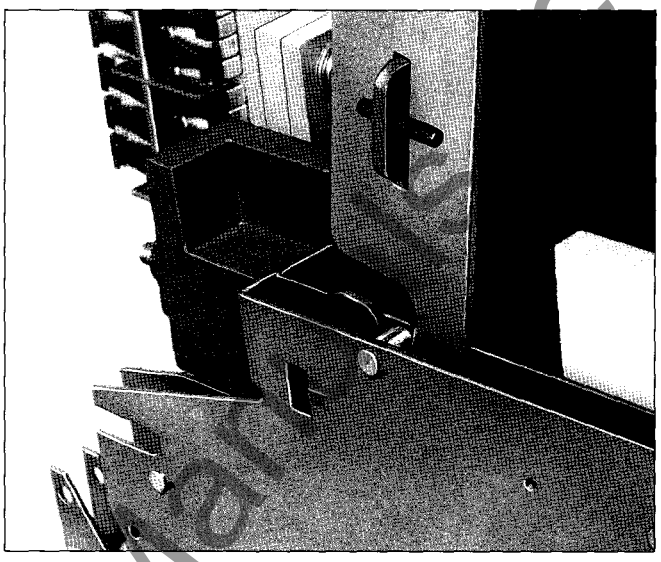
Carefully uncrate the moveable drawout element and remove all packing material with the exception of the colored tape holding the racking pump handle in place. Items such as a label for a dead front shield and keys for the SB breaker with a key interlock accessory will be taped to the top of the moveable drawout element. If the moveable drawout element is secured to a pallet, remove the securing device.



Preferred Lifting Arrangement

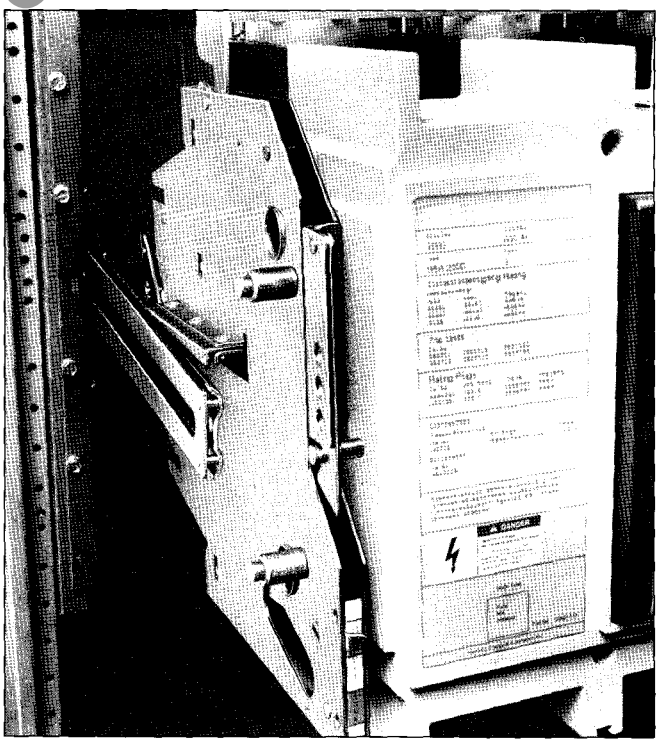
Attach the lifting device accessory as illustrated. If lifting straps are used instead of the lifting device accessory, the lifting straps should go between the primary contacts. In either of these arrangements, the moveable drawout element may be balanced as it is being lifted by a crane or hoist. The moveable drawout element should not be lifted by the primary contacts.

Pull out the extension rails on the stationary drawout element fully to the withdrawn position.



Lift by using rear guide post.

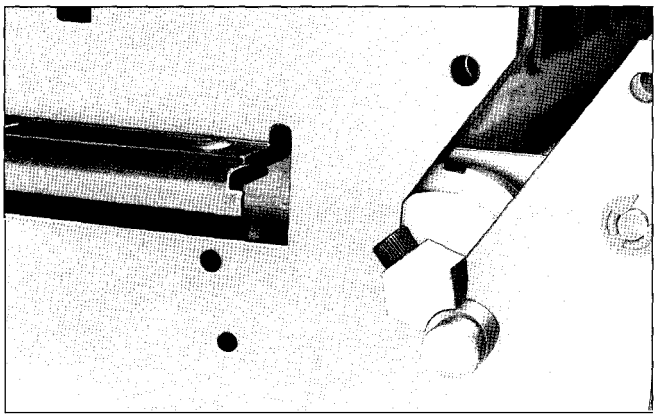
Lift the moveable drawout element over the extension rails. Align the moveable drawout element such that the support brackets straddle the inside guide rails. Carefully lower the moveable drawout element onto the rail guides. Remove the lifting device. Remove the tape holding the racking pump handle.



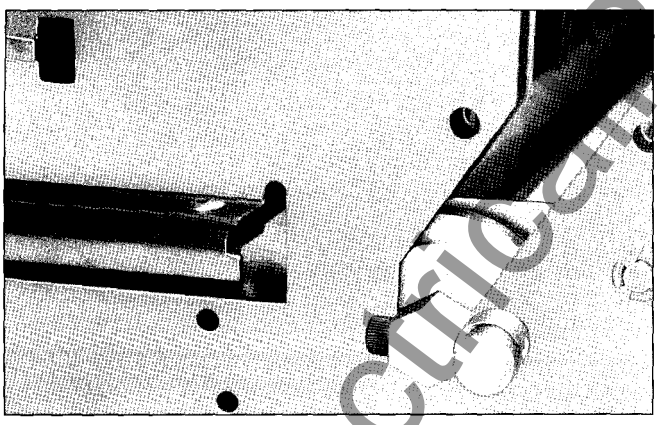
Support Bracket and Guide Rail

Moveable Drawout Element and Fixed-Mounted SB Breakers

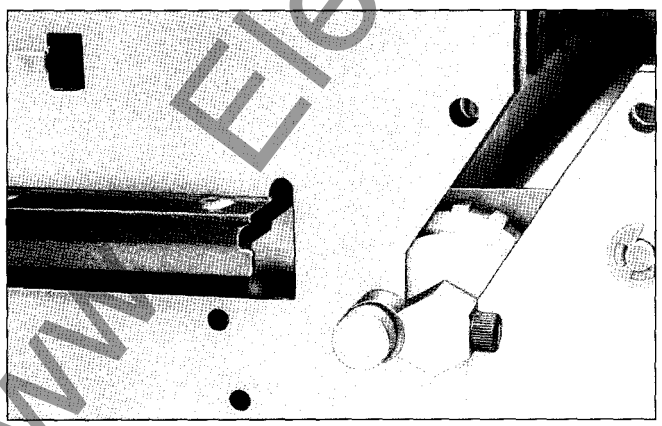
To properly engage the moveable drawout element with the racking mechanism, the crank pins on the sides of the moveable drawout element must be in the "unlocked" position as illustrated and the interlock lever is in the "up" position. During shipping and handling the crank pins may have rotated out of position. If so, rotate them to the proper position. The moveable drawout element may now be moved/racked into the stationary drawout element. Racking instructions are located in the Operating Instructions section.



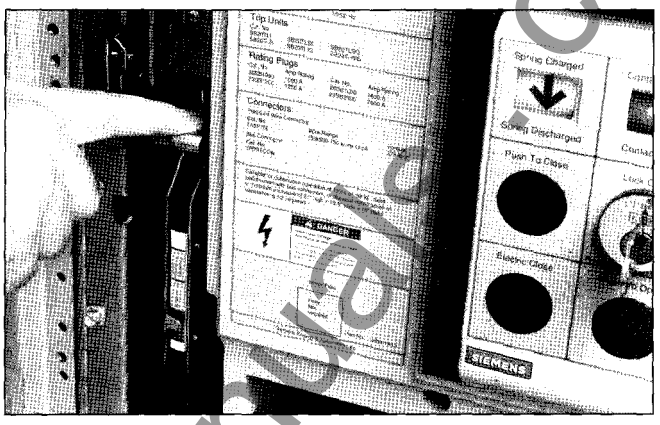
Crank Pin in Unlocked position.



Crank Pin in Test position.



Crank Pin in Closed or Connected position.

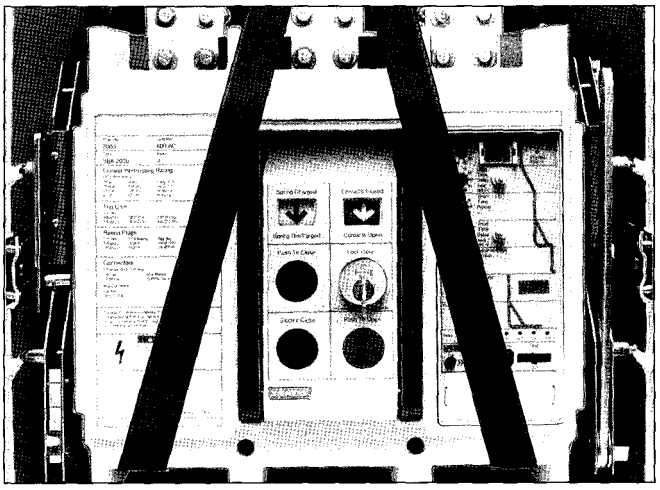


Interlock Lever mechanism

Installing Fixed-Mounted SB Breakers

Prepare the switchboard for installation of the SB breaker in accordance with the outline drawings at the end of this section. The outline drawing for the 800A and 1200A frame is located on pages 90-91. The outline drawing for the 2000A frame is located on pages 92-93. The locations of the mounting holes and the recommended screws are depicted on the drawing. All four mounting screws will be used to secure the breaker to the switchboard.

Carefully uncrate the breaker and remove all packing material. The keys for a breaker with a key interlock accessory will be taped to the top of the breaker. If the breaker is secured to a pallet, remove the securing device.



Lifting straps should go between the stabs.

Attach the lifting straps as illustrated. The breaker should not be lifted by the primary stabs; the lifting straps should go between the stabs. In this arrangement the breaker may be easily balanced while it is being lifted by a crane or hoist.

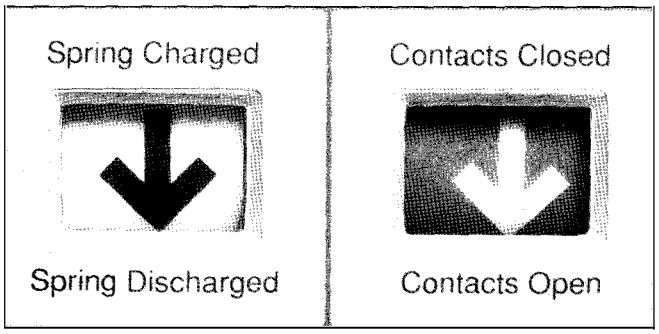
Lift the breaker into position and secure it with all four mounting screws torqued to 15 ft. lbs. max. Remove the lifting straps.

Electronic Trip Unit

⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

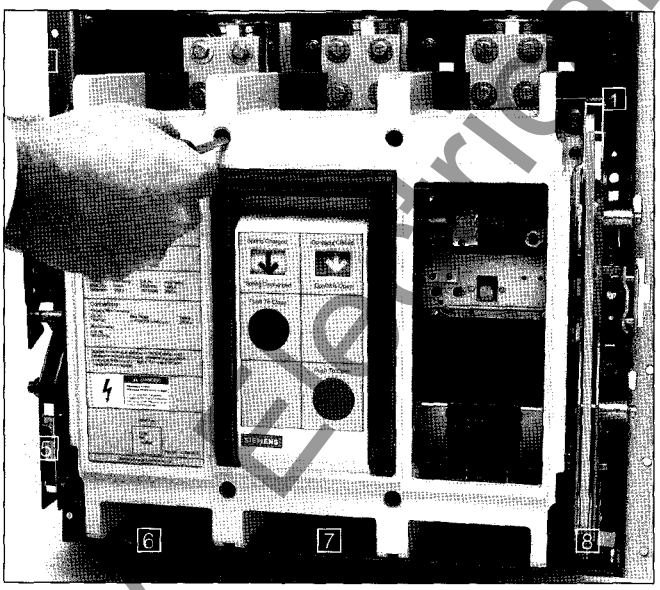
Turn power off and lock out supplying device before installing.



CAUTION: Do not attempt to install a trip unit with the breaker "Closed" or "Charged". Make certain breaker is "Open" and "Discharged" as shown above. Personal injury or mechanical damage may occur.

Installation of Electronic Trip Unit

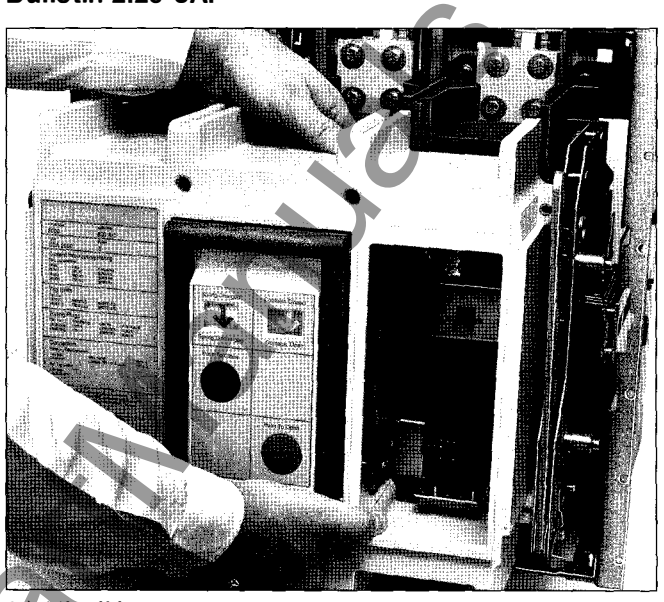
The SB Breaker has a built-in interlock device that prevents the breaker from being closed when there is not an installed trip unit. This same interlock device will trip the breaker when the trip unit is removed.



1.) Remove the 8 screws from breaker front cover.

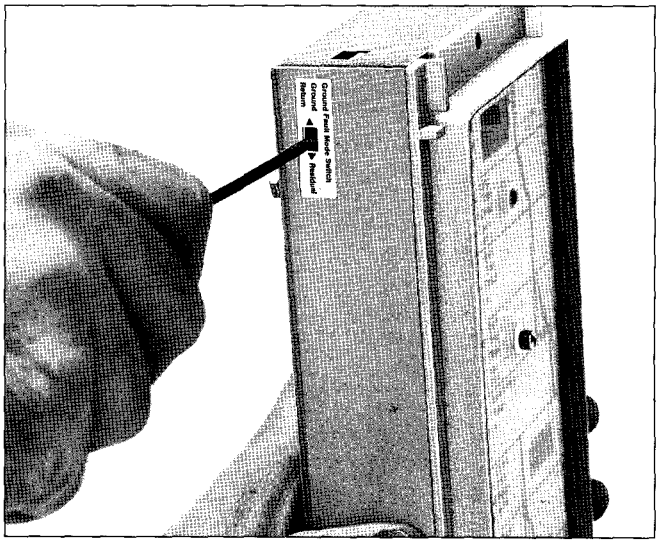
To install the trip unit, the front cover of the breaker must first be removed. This is done by removing the four (4) recessed Phillips head screws in positions 2, 3, 6, and 7 and the four (4) Phillips head screws in positions 1, 4, 5 and 8 that hold the front cover in place.

NOTE: For more complete information on other standard and optional features of the Electronic Trip Unit, see Siemens Electronic Trip Unit for Type SB Circuit Breakers Information and Instruction Guide, Bulletin 2.20-3A.



2.) Lift off front cover.

On trip units with ground fault protection, the ground fault selection switch on the side of the trip unit must be set to the appropriate sensing scheme—Residual or Source Ground/Zero Sequence—prior to installing the trip unit. The trip unit is pre-set at the factory to a residual sensing

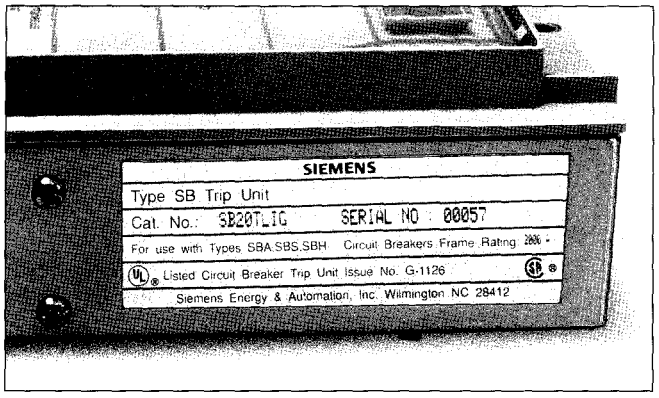


3.) Set Ground Fault Selection Switch

Electronic Trip Unit

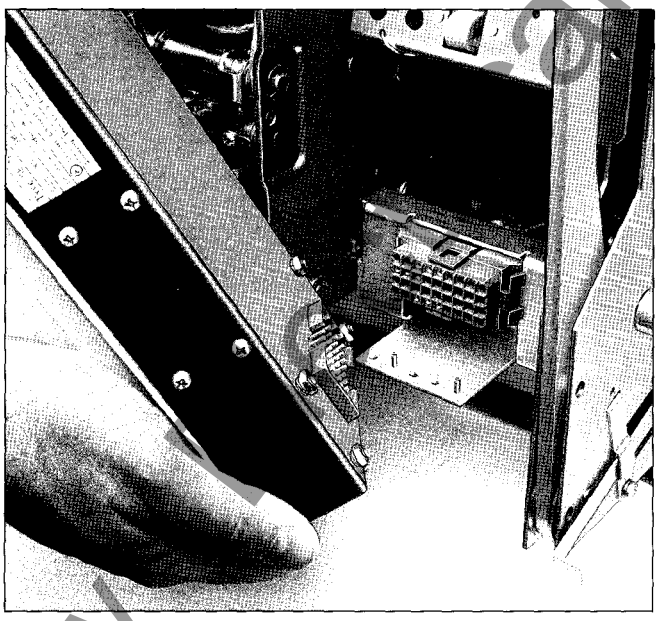
scheme.

Before attempting to install the trip unit, check the label on the side of the unit to make sure that it is the proper unit for the SB breaker. A built-in rejection scheme will prevent the installation of a trip unit into a breaker for which it is not intended.

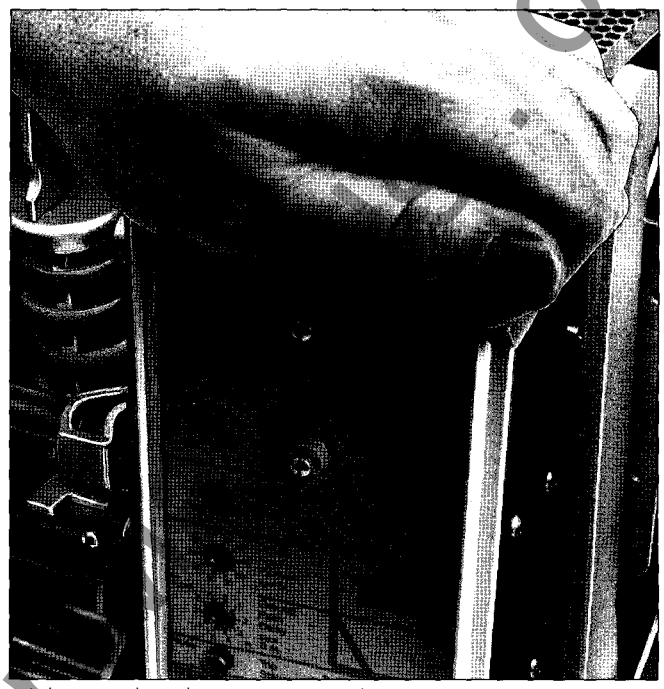


4.) Check label on side of trip unit.

This scheme consists of two pins on the support plate on which the trip unit will set into two matching holes in the bottom of the trip unit. If the holes in the bottom of the trip unit cannot be aligned with the pins, the trip unit cannot be installed in the SB breaker. If there is any doubt about a trip unit being the proper trip unit for a breaker, hold the trip unit upside down and check the alignment of the pins and holes.

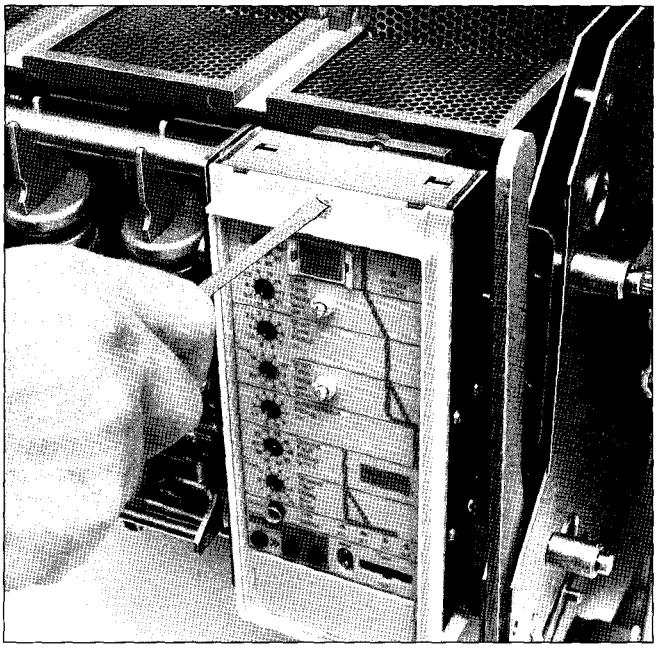


5.) Check for proper pin alignment.



6.) Lower trip unit onto support plate.

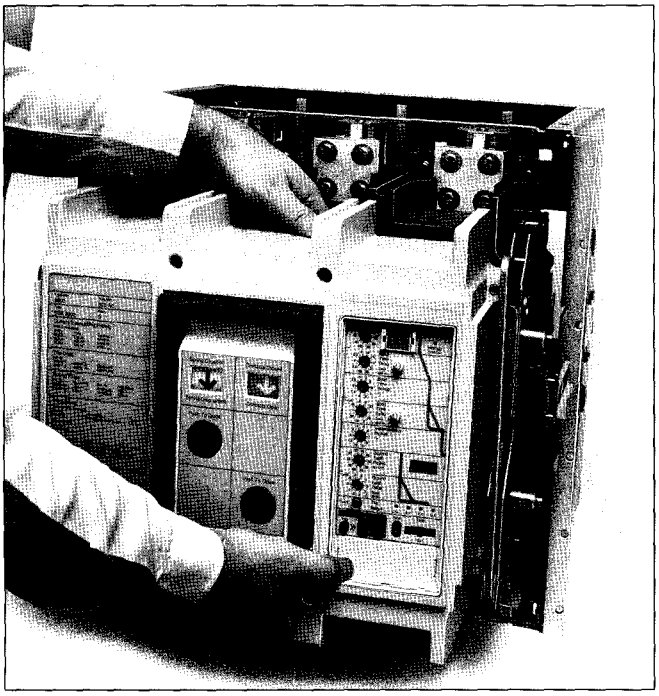
After the connector has been mated, lower (push) the trip unit onto the support plate. The pins on the support plate will fit into the holes in the bottom of the trip unit.



7.) Secure trip unit.

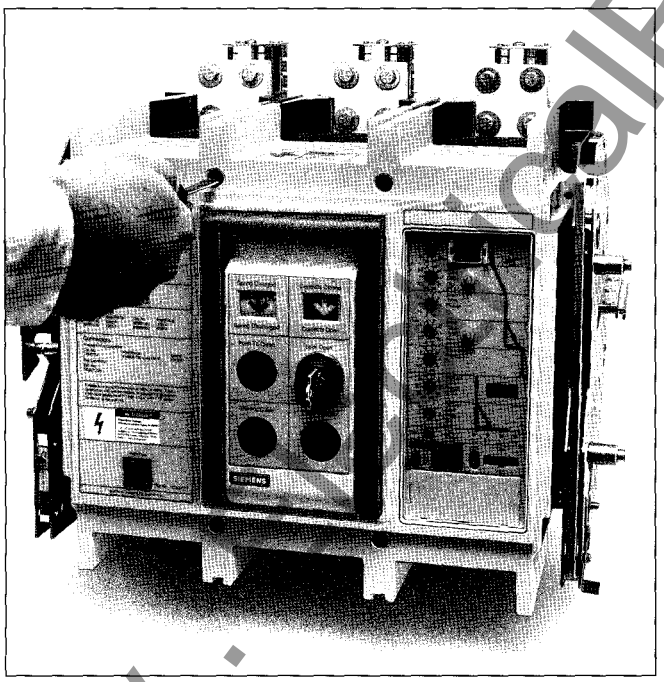
Secure the trip unit in place with the retaining screw located at the top of the trip unit. Torque to 6-8 in. lbs. If trip unit top is not secured properly, the interlock will prohibit closing of the breaker.

Electronic Trip Unit and Rating Plug

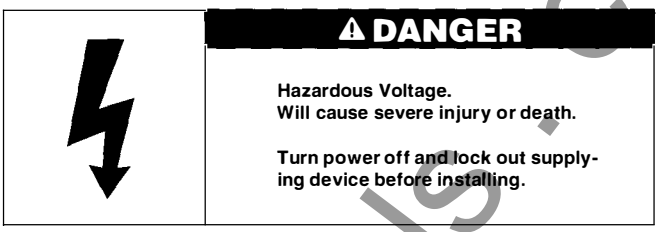


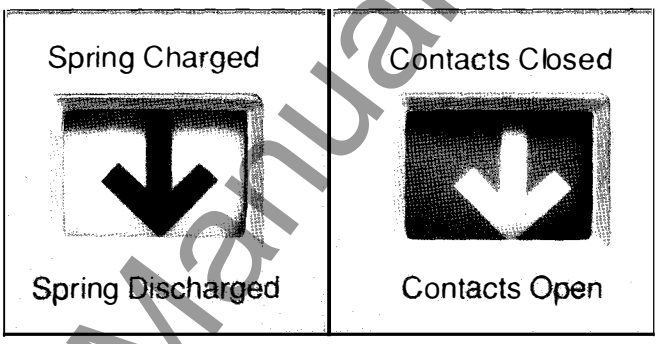
8.) Replace circuit breaker front cover.

Replace the front cover. Then, replace the eight (8) front cover screws.



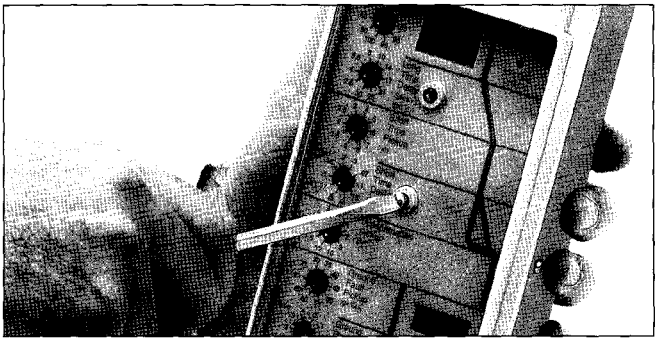
9.) Re-install the eight screws that hold the front cover in place.





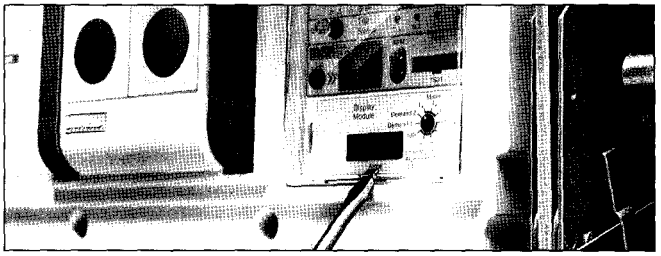
CAUTION: Do not attempt to install a rating plug with the breaker "Closed" or "Charged". Make certain breaker is "Open" and "Discharged" as shown above. Personal injury or mechanical damage may occur.

Check to see that the breaker is open before inserting or removing a rating plug. The breaker should always be in the open position when there is not a rating plug in the trip unit.



1.) Remove the trip unit screws that hold the transparent cover.

The rating plug and adjustments on the front panel of the trip unit are protected by a transparent cover. Prior to installing a rating plug or setting the adjustments on the trip unit, this cover must be removed. Unscrew the two screws that hold it in place.

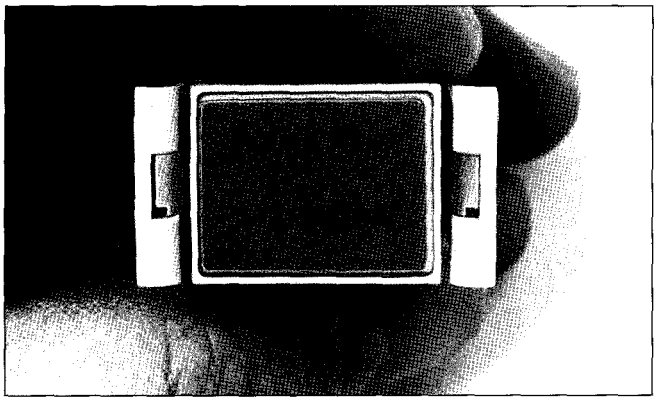


2.) With a small screwdriver, gently pry the cover loose at one end and remove it carefully.

Rating Plug

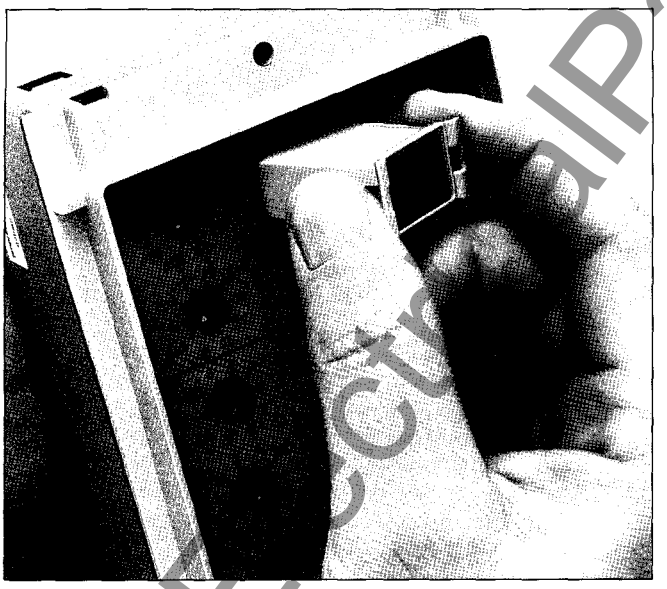
CAUTION: Do not attempt to force an improper rating plug into a trip unit, mechanical damage may occur.

To prevent the insertion of a rating plug into a trip unit for which it is not intended, the receptacle in the trip unit has been keyed to reject improper rating plugs.



3.) Check label on the rating plug.

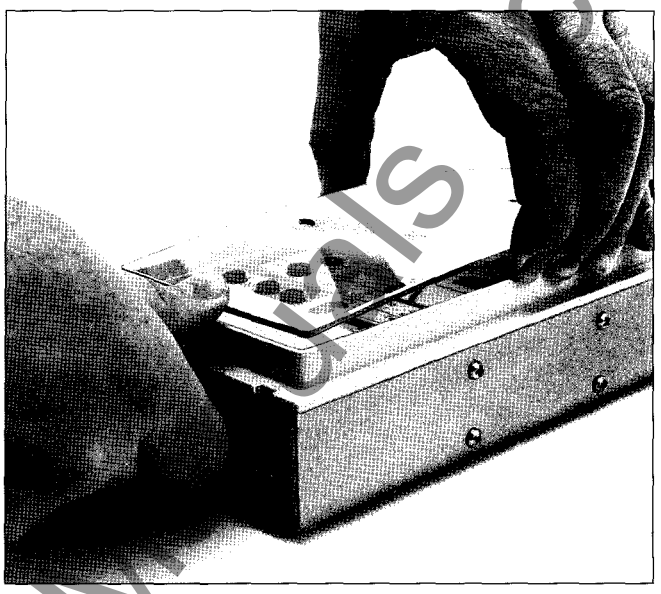
Check the rating plug label to verify that it is the proper plug for the trip unit. If it is not a proper plug, the pins will not mate with the plug receptacle.



4.) To insert rating plug, align plug with plug receptacle and press into place.

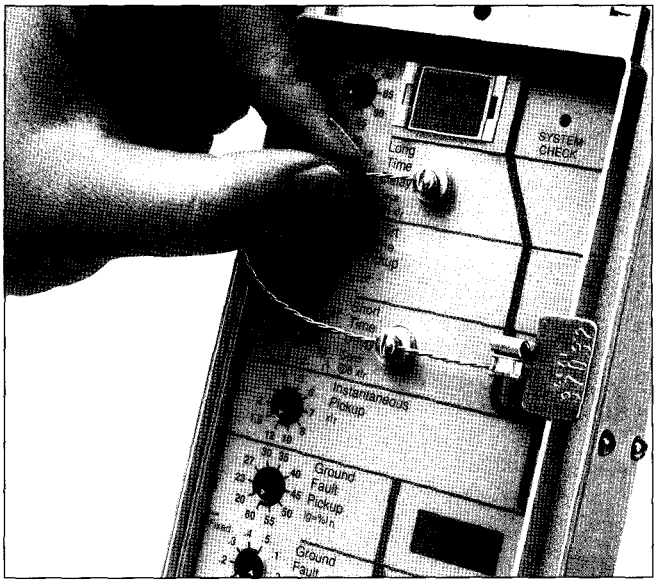
To **insert** a rating plug in the trip unit, align the plug with the plug receptacle and press the plug into place. The clips on the plug and the compression fit hold the plug in place, eliminating the need for screws or latches.

To **remove** a rating plug, squeeze the clips and pull the plug from the plug receptacle. Since the plug is held in place by compression, some force will be required to remove the plug. **Do not close** the breaker with the rating plug removed from the trip unit.



5.) To replace the cover, bow slightly in the middle, and snap into place.

After the rating plug has been inserted and the necessary setting adjustments have been made (see Fault Protection Adjustments, pages 29-33), replace the cover by sliding the protective shield into the top lip of the trip unit, bow slightly in middle, and press down with thumb on bottom to snap shield into place. Replace the two (2) special retaining screws.



6.) The cover may be sealed with a lead seal for tamper evident protection.

After the cover has been replaced, a wire may be inserted through the holes in the screws and secured with a meter seal. This will help prevent tampering.

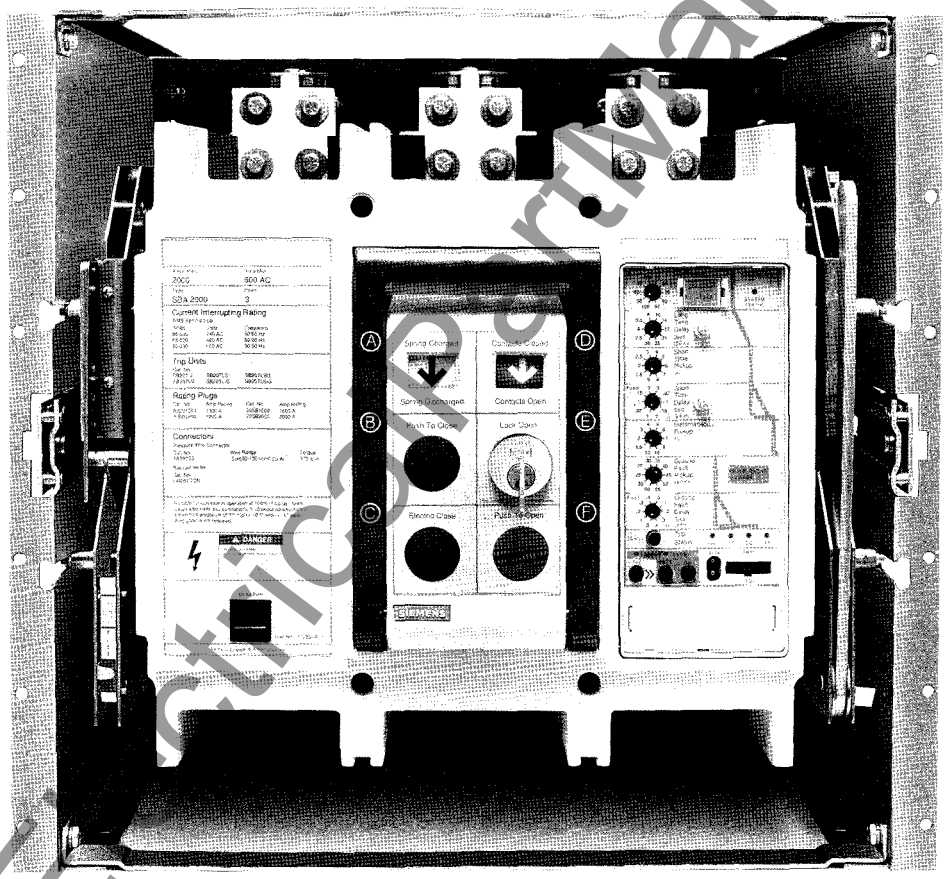
Part One – Operating the SB Encased Systems Breaker

General Instructions

The instructions for charging the stored energy mechanism, closing and opening the breaker, and positioning and rotating the moveable drawout elements of the drawout-constructed SB breakers are presented in this section. The trip unit's standard test and monitoring functions are also presented. These instructions are grouped into three parts: Part One - Operating the SB Breaker, Part Two - Manipulating the Moveable Drawout Element, and Part Three - Monitoring the Electronic Trip Unit. Before bringing the SB breaker on-line, the user should be familar with the test and monitoring functions presented in Part Three. Operating instructions for the accessories are presented in the Accessories Section.

Operating the SB Breaker

The SB breaker controls and charging handle for the stored energy mechanism are located in the central escutcheon of the front panel. Standard controls are Push To Close and Push To Open pushbutton switches. Color-coded indicators display the charged/discharged status of the stored energy mechanism and the closed/open status of the breaker. Positions are available in the central escutcheon for a key interlock and an Electric Close pushbutton.



Ⓐ Stored energy mechanism spring charged/ spring discharged status indicator

Ⓑ Push To Close pushbutton switch

Ⓒ Position for Electric Close push-button

Ⓓ Circuit breaker Closed/Open status indicator

Ⓔ Position for Key Interlock

Ⓕ Push To Open pushbutton switch

SB Encased Systems Breaker controls and indicators

Part One – Operating the SB Encased Systems Breaker

⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn power off supplying device before installing.

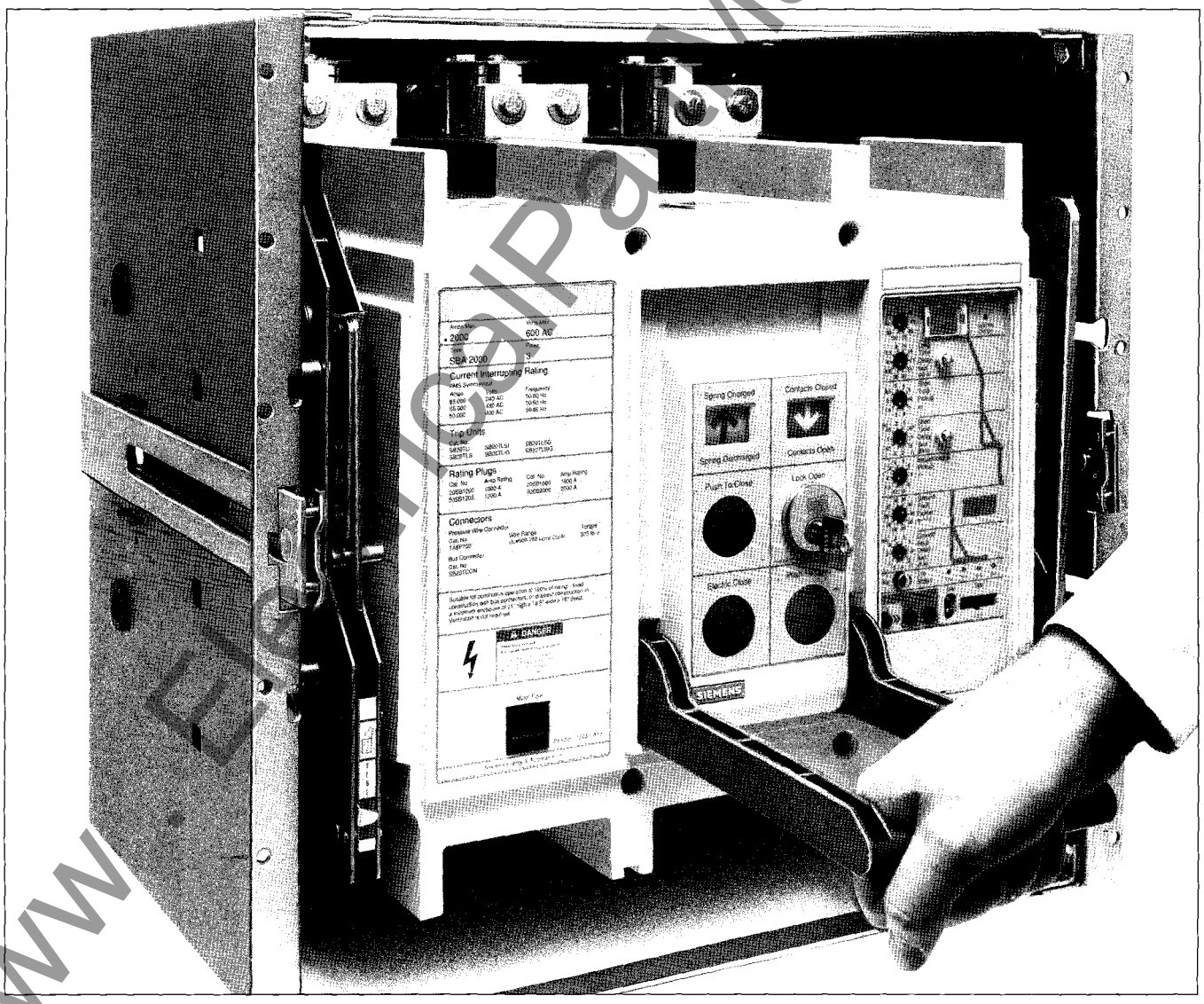
Manually Charging the Stored Energy Mechanism

The stored energy mechanism may be charged with the SB breaker open or closed. If the stored energy mechanism is charged with the breaker open, sufficient energy is stored to close and then open the breaker without recharging. If the stored energy mechanism is charged with the breaker closed, the operating sequence of open-close-open may be executed without recharging

To manually charge the stored energy mechanism, pull the charging handle. Four or five full strokes, or several partial strokes are required to fully charge the stored energy mechanism. When the stored energy mechanism is fully charged, the charging handle will be restrained by an internal stop, and the "Spring Charged"/"Spring Discharged" indicator will point to "Spring Charged." The charging handle will return to the stowed position when released.

If an optional electric motor operator is employed the electric operator will automatically recharge the stored energy mechanism when the breaker is closed. If the electric operator is disabled, the stored energy mechanism may be charged manually.

CAUTION: When handle is against bottom stop as illustrated, do not exert further downward pressure - potential damage to housing or handle may occur.



To manually charge the stored energy mechanism, pull the charging handle downward four or five strokes.

Part One – Operating the SB Encased Systems Breaker

Discharging the Stored Energy Mechanism Without Closing the SB Breaker

Discharging the energy in the stored energy mechanism without closing the SB breaker creates an abnormally high shock condition on the breaker. **The procedure should be avoided except for safety and/or emergency reasons.** To discharge the energy, push and hold the "Open" pushbutton then push the "Close" pushbutton.

On electrically-operated SB breakers, the electric operator should be disabled (one way is to remove the fuse) prior to discharging the stored energy. Otherwise, the electric operator will automatically recharge the springs.

Standard closing-prevention devices require that to close the breaker there be a trip unit in the SB breaker, the stored energy mechanism be fully charged and the charging handle be in the stowed position. On drawout constructions, the interlock lever must be in the interlock engaged position.

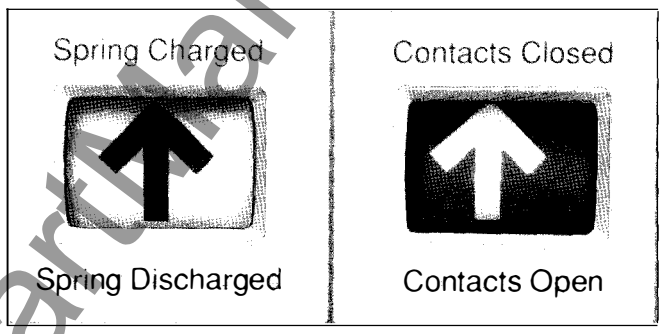
Accessories that inhibit the breaker from being locally closed are presented in the Accessories section. Included are a closing-blocking device for use with remotely-operated circuit breakers, key interlocks, and other locking devices.

Discharging energy in the stored energy mechanism.

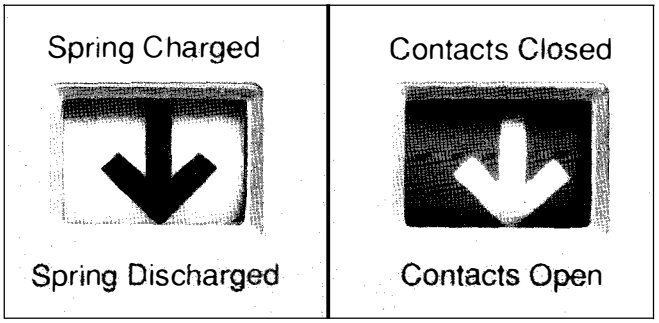
Closing the SB Breaker Locally

Before the breaker can be closed, the stored energy mechanism must be fully charged and all of the closing-prevention devices (and accessories) must be in the non-inhibiting state or position. In this condition, all that is required to close the breaker is to push the "Close" pushbutton. When the breaker is closed the "Contact Closed"/"Contact Open" indicator will point to "Contact Closed."

WARNING - If the "Close" pushbutton is depressed when the breaker is closed and the stored energy mechanism charged, the stored energy will be discharged. This will create an abnormally high shock condition which may result in a nuisance opening of the breaker.



Indicates that the circuit breaker is "closed" with the springs in the charged position.



Indicates that the circuit breaker is "open" with the springs in the discharged position.

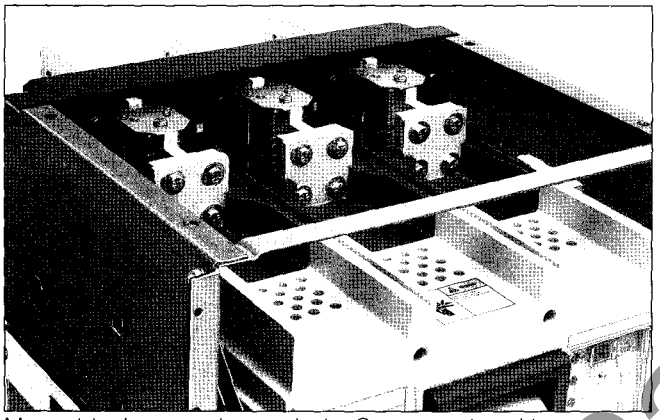
Opening the SB Breaker Locally

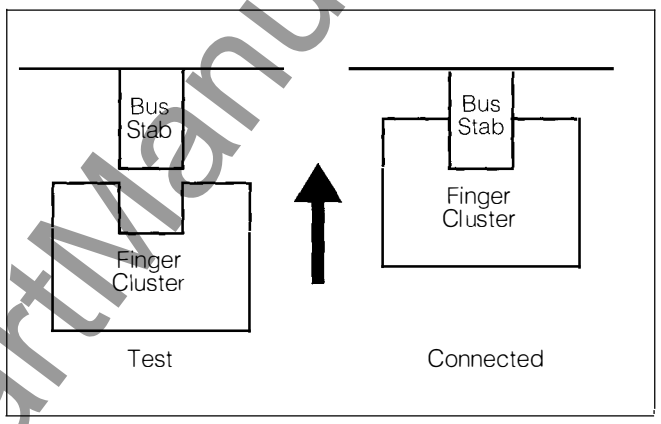
To locally open the breaker, push the "Open" pushbutton. When the breaker is open, the "Contact Closed"/"Contact Open" indicator will point to "Contact Open."

Built-in safety devices will trip the SB breaker when the trip unit is removed, or if the interlock lever on the drawout mechanism is depressed. Performing the trip unit integral test in the trip mode will also trip the breaker.

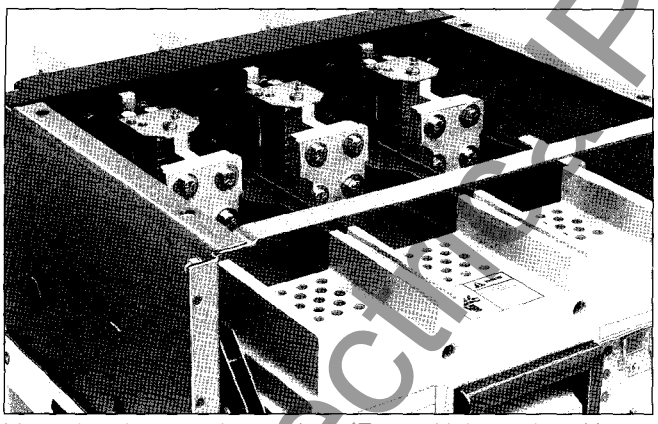
Part Two – Manipulating the Moveable Drawout Element

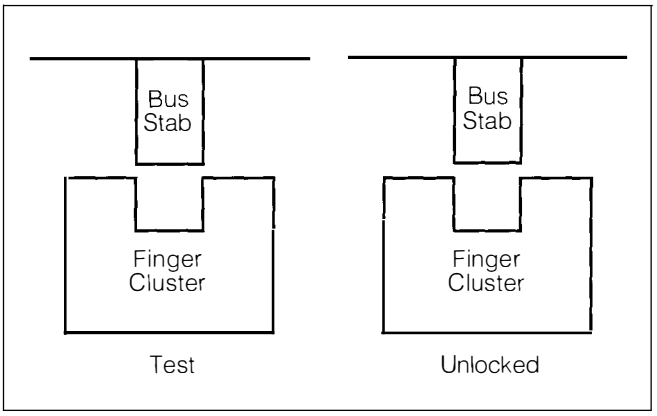
Manipulating the Moveable Drawout Element
There are four positions of the moveable drawout element. These four positions are defined as Connected, Test, Unlocked, and Withdrawn. The **connected** position is the normal operating position of the breaker. In this position the primary stabs and secondary contacts are connected and the moveable drawout element is locked into position. In the **test** position, the primary stabs are disconnected, the secondary contacts are connected, and the moveable drawout element is locked into position. The **unlocked** position is a transition position between the test position and the withdrawn position. Physically, the unlocked position and test position are the same. However, in the unlocked position, the moveable drawout element is disengaged from the interlock mechanism. The breaker should not be tested when the moveable drawout element is in the unlocked position. In the **withdrawn** position, the secondary contacts are disconnected and the moveable drawout element is disengaged from the interlock mechanism. The moveable drawout element can be pulled to the fully withdrawn position where it can be inspected or removed from the stationary drawout element.


Moveable drawout element in the Connected position

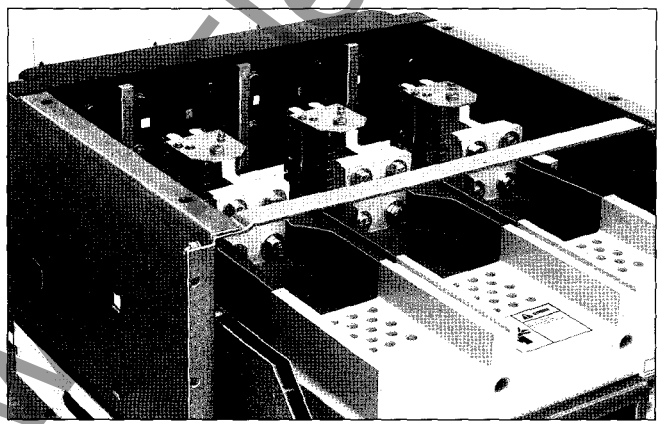


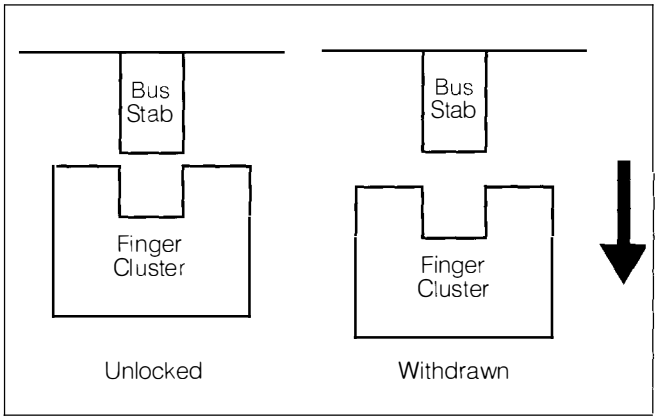
Connected Position


Moveable drawout element in the Test or Unlocked position



Test and Unlocked Position


Moveable drawout element in the Withdrawn position



Withdrawn Position

Part Two – Manipulating the Moveable Drawout Element

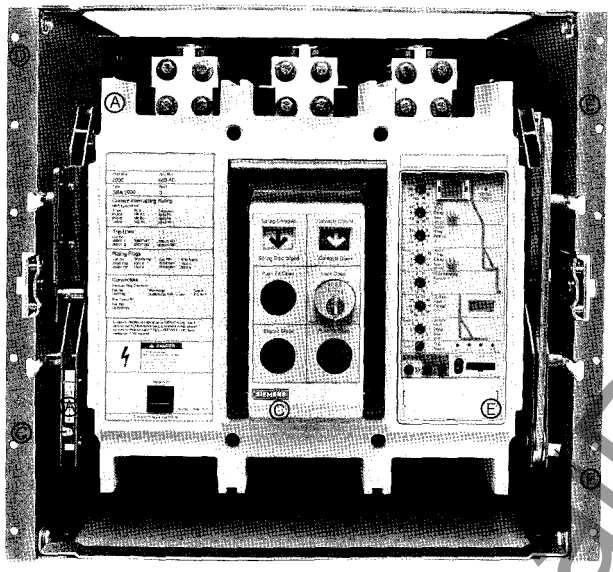
⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

If practical turn power off and lock out supplying device before manipulating the Moveable Drawout Element.

Racking Controls

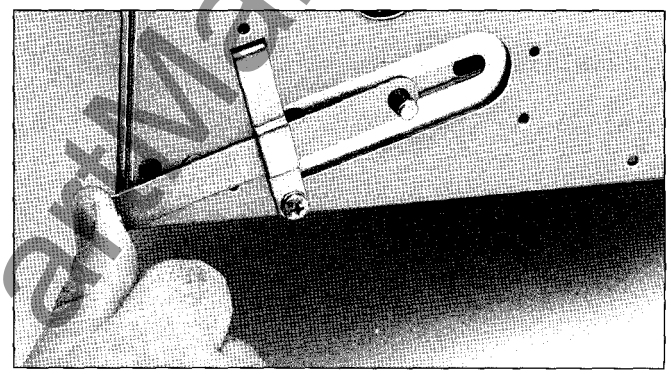
A built-in, low-force pump handle and two control levers are used to rack the moveable drawout element between the connected, test, and withdrawn positions.



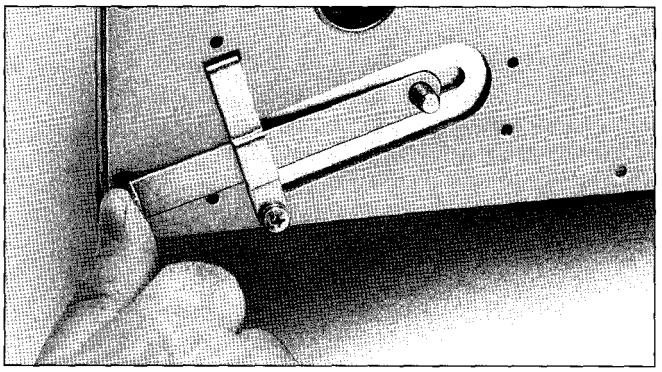
Racking Controls Locations

Directional Shift Lever

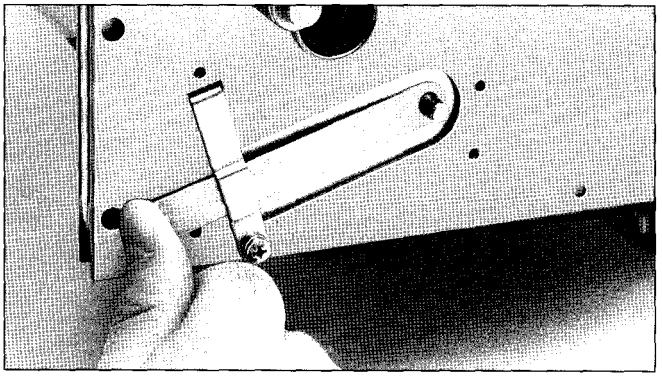
The directional shift lever determines the direction the movable drawout element will move when it is racked. The lever has three positions: racking-out, neutral, and racking-in. When the lever is in the **racking-out** position (pulled all the way out), the moveable drawout element may be racked from the connected position to the test position, and from the test position to the unlocked position. When the lever is set in the **neutral** position (located midway between the racking-in and racking-out positions), the racking pump handle is disengaged from the racking mechanism. In the **racking-in** position (pushed all the way forward), the moveable drawout element may be racked from the unlocked position to the test position, and from the test position to the connected position.



1.) Racking-out position



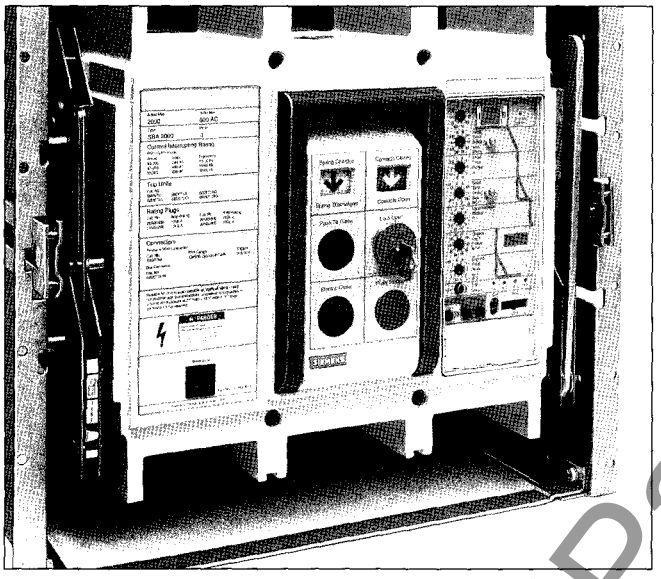
2.) Neutral position



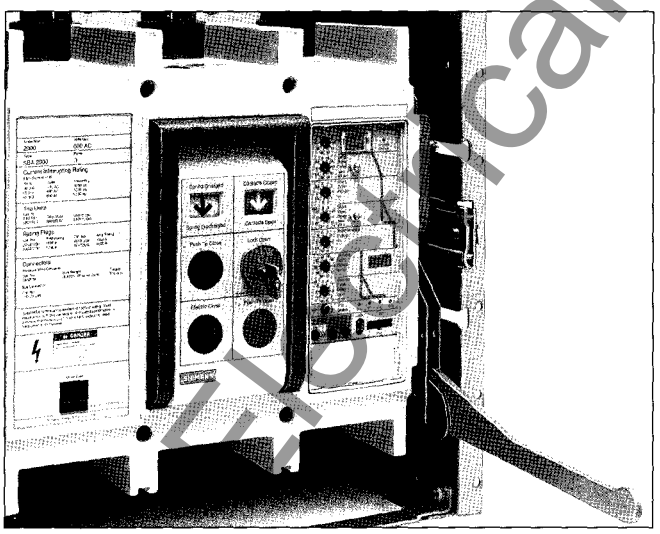
3.) Racking-In position

Part Two - Manipulating the Moveable Drawout Element

Racking Pump Handle
A low-force pump handle is used to rack the moveable drawout element. The pump handle is an integral part of the racking mechanism, eliminating the need for an auxiliary racking device. If there is any resistance in returning the pump handle to the stowed position, set the directional shift lever to the neutral position. The racking pump handle can then be returned to the stowed position.



Racking Pump Handle in stowed position



Racking Pump Handle in full stroke position

Drawout Position Indicator
A color-coded indicator displays the position of the moveable drawout element: connected (red), test (yellow), and unlocked (yellow). When the moveable drawout element is being racked from one position to another position, the indicator will display the more critical position. The connected position is defined to be more critical than the test position and the test position to be more critical than the unlocked position. This means that when racking the moveable drawout element from the connected position to the test position, the indicator will continue to display the connected position until the moveable drawout element has been racked all the way to the test position. Conversely, when racking from the test to the connected position, the indicator will display the connected position as soon as the SB breaker is moved toward the connected position. The process is the same when racking between the test and unlocked positions.

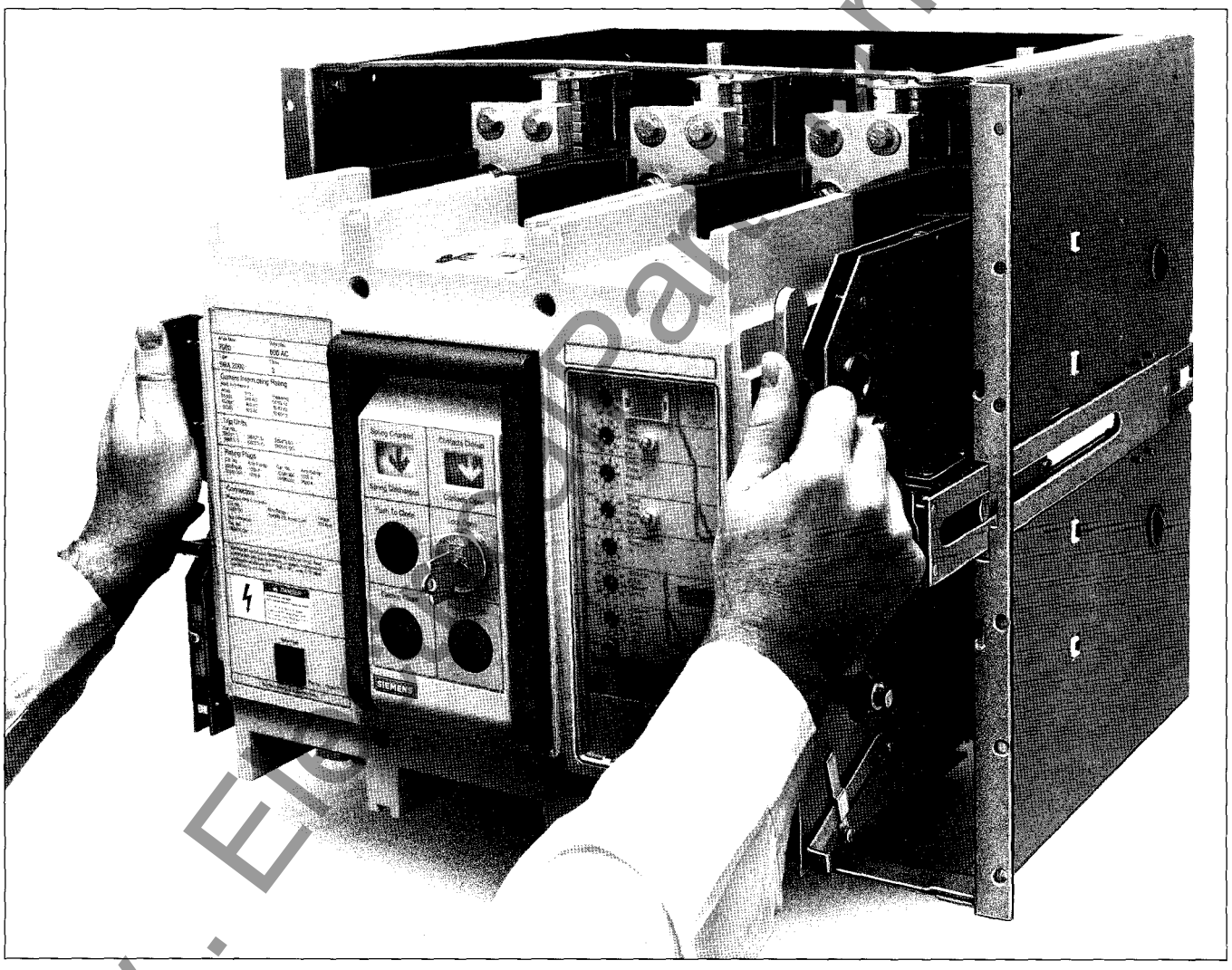
Unlocked Position (Yellow) | Test Position (Yellow) | Connected Position (Red)

Drawout Position Indicator

Part Two – Manipulating the Moveable Drawout Element

Fully Withdrawn and Unlocked Positions

To move the moveable drawout element from the fully withdrawn position to the unlocked position, push toward the bus connections until the moveable drawout element hits a solid stop. The secondary disconnects on both sides of the moveable and stationary drawout elements will mate as the moveable drawout element moves into the unlocked position. When the moveable drawout element is in the unlocked position, the pointer on the position indicator will point to the unlocked symbol. To move the moveable drawout element from the unlocked position to the fully withdrawn position, pull the moveable drawout element outward until the extension rails are fully extended.



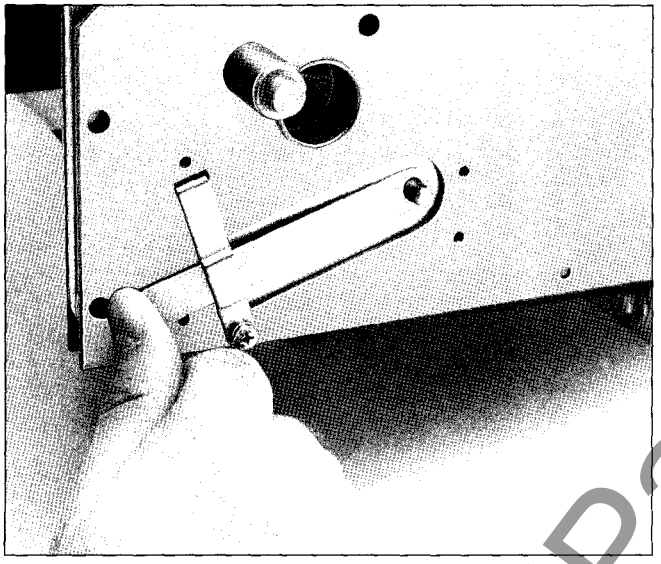
Pushing and pulling the moveable drawout element between the withdrawn and unlocked positions

Part Two – Manipulating the Moveable Drawout Element

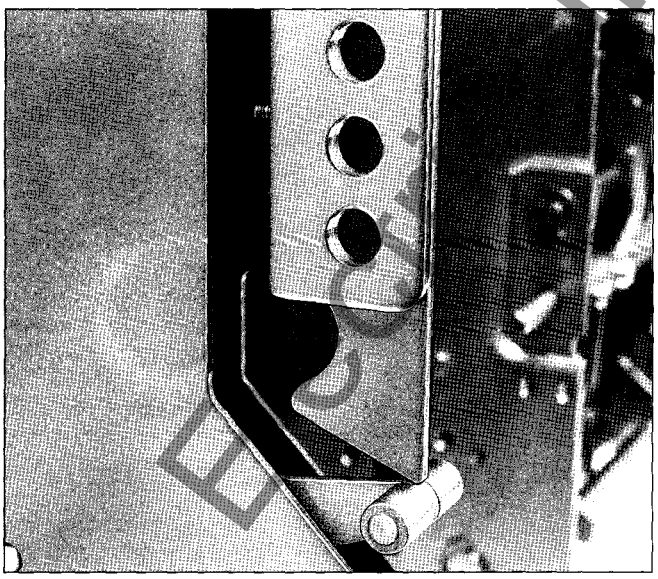
Unlocked Position to Test Position

Racking the moveable drawout element from the unlocked position to the test position engages the moveable drawout element with the stationary drawout element. The physical position of the moveable drawout element will be unchanged.

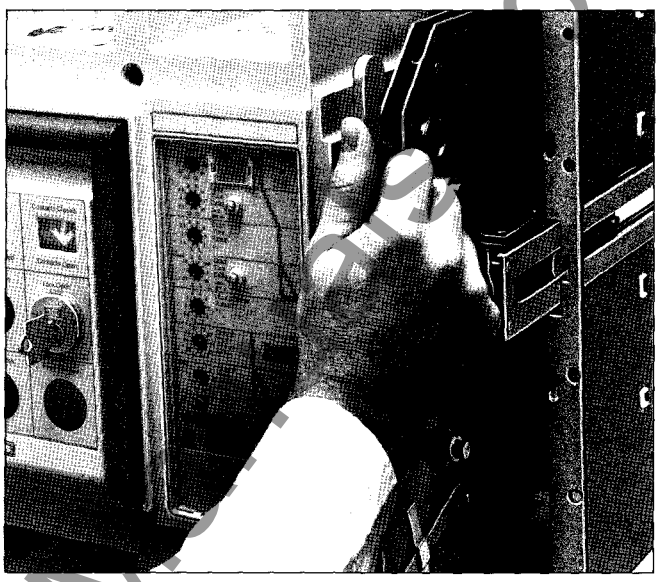
To rack the moveable drawout element from the unlocked position to the test position:



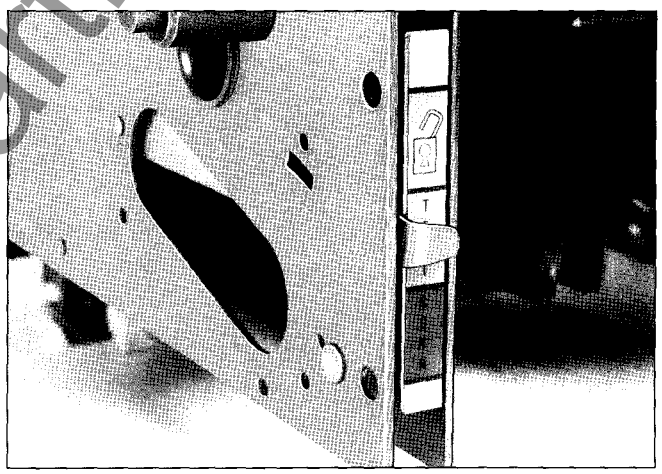
1.) Set the directional shift lever to the racking-in position.



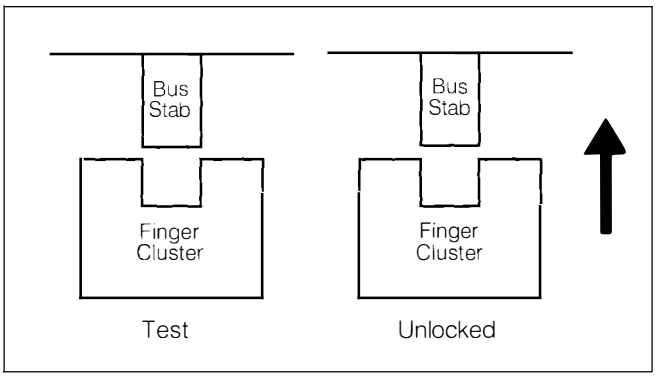
2.) Pull the interlock lever down to the interlock disengaged position. (Illustrated beneath padlock device.) If the breaker contacts are closed, pulling the interlock lever down will trip the breaker.



3.) Pump the racking pump handle until the moveable drawout element has reached the test position.



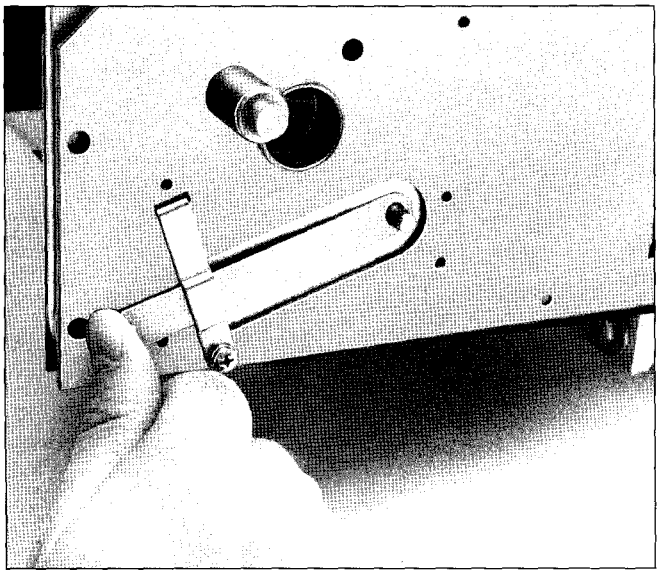
4.) When the moveable drawout element reaches the test position, the interlock lever will automatically return to the interlock engaged position, the racking pump cannot be pumped, and the position indicator will display that the moveable drawout element is in the test position.



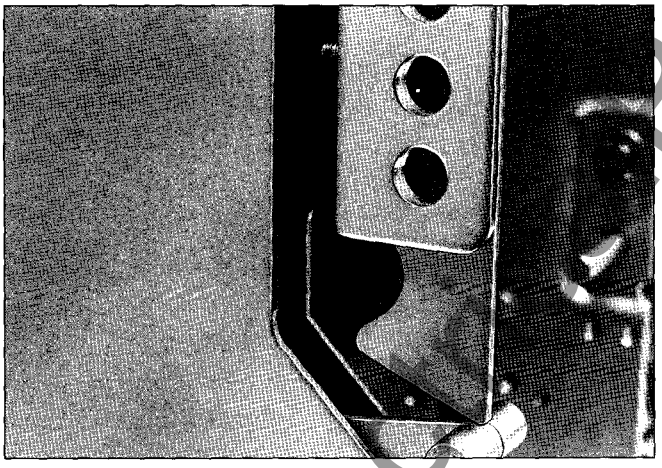
Relative position of finger clusters to bus stabs.

Part Two – Manipulating the Moveable Drawout Element

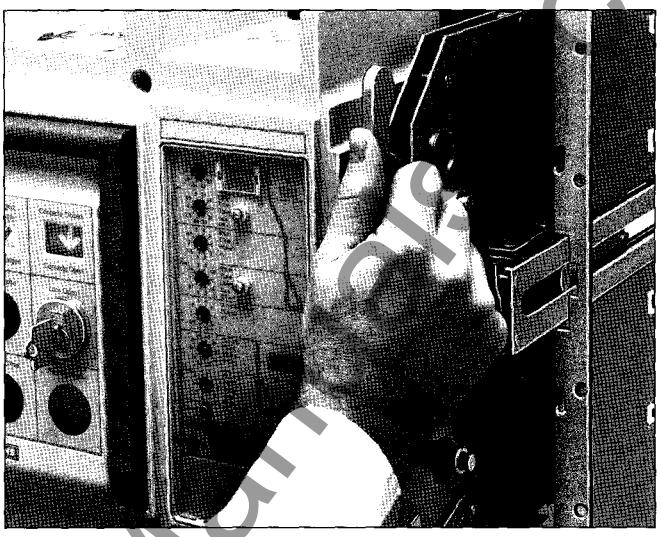
Test Position to Connected Position
To rack the moveable drawout element from the test position to the connected position:



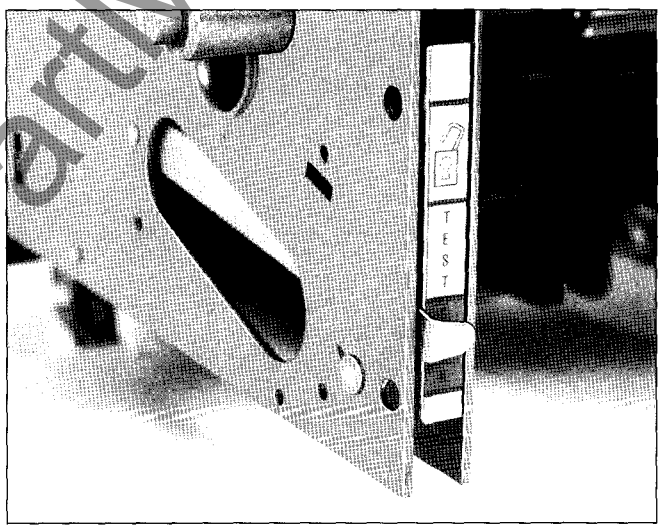
1.) Set the directional shift lever to the racking-in position.



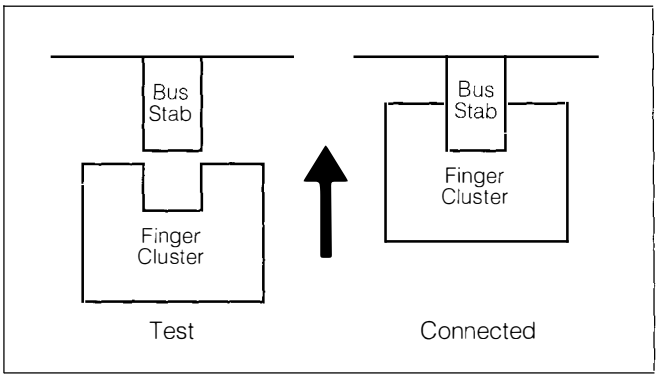
2.) Pull the interlock lever down to the interlock disengaged position. (Illustrated beneath padlock device.) If the breaker contacts are closed, pulling the interlock lever down will trip the breaker.



3.) Pump the racking pump handle until the moveable drawout element is in the connected position.



4.) As soon as the moveable drawout element is racked from the test position, the position indicator will display that the moveable drawout element is in the connected position. However, the moveable drawout element will not be completely in the connected position until the interlock lever has automatically returned to the interlock engaged position.



Relative position of finger clusters to bus stabs.

Part Two – Manipulating the Moveable Drawout Element

⚠ DANGER

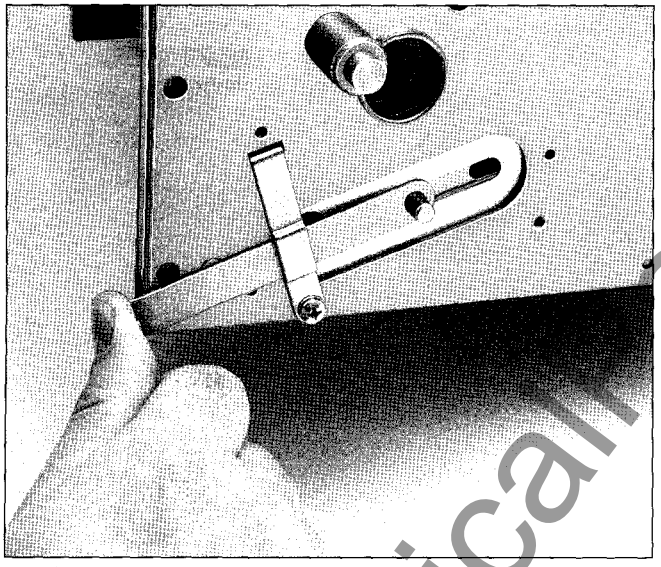
Hazardous Voltage.
Will cause severe injury or death.

If practical turn power off and lock out supplying device before manipulating the Moveable Drawout Element.

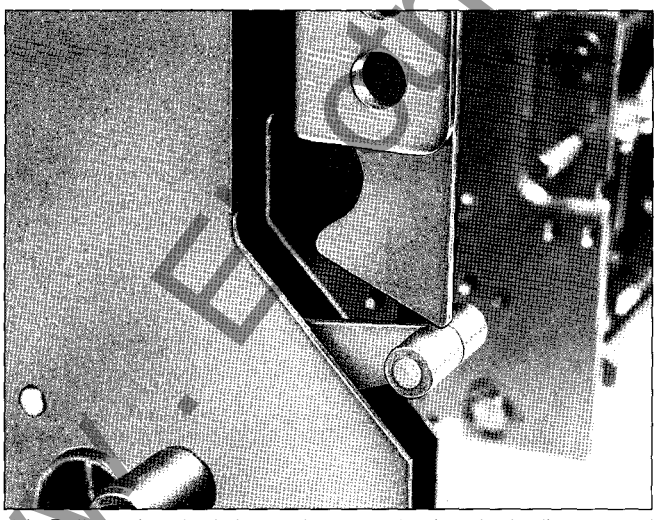
Connected Position to Test Position

To rack the moveable drawout element from the connected position to the test position:

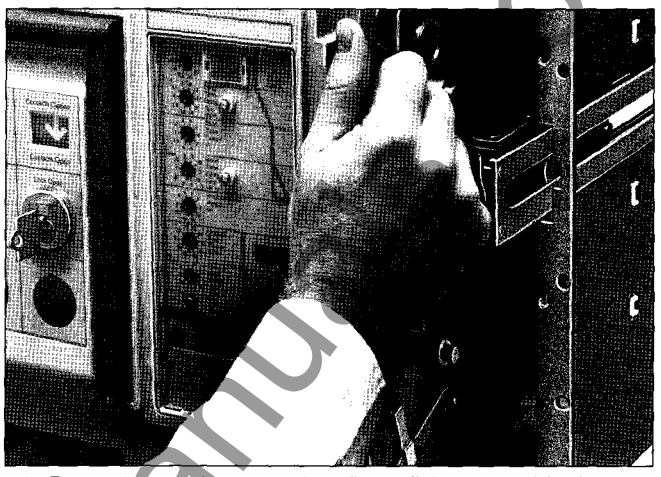
Check to ensure that the SB breaker is open (if the breaker is closed and the interlock lever is moved to the interlock disengaged position, the breaker will trip).



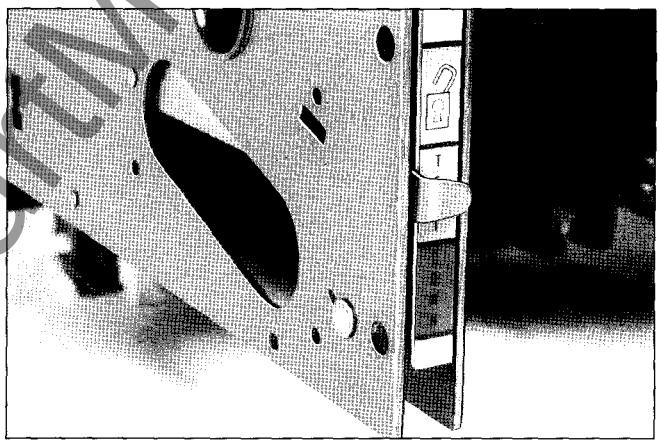
1.) Set the directional shift lever to the racking-out position.



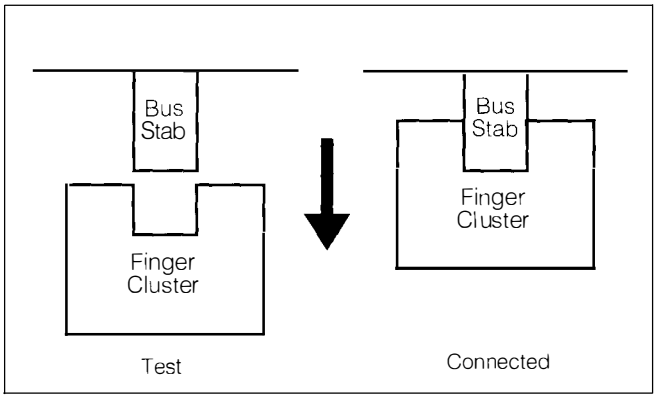
2.) Pull the interlock lever down to the interlock disengaged position. (Illustrated beneath padlock device.) If the breaker contacts are closed, pulling the interlock lever down will trip the breaker.



3.) Pump the racking pump handle until the moveable drawout element is in the test position.



4.) When the moveable drawout element reaches the test position, the interlock lever will automatically return to the interlock engaged position; the racking pump handle cannot be pumped; and the position indicator will display that the moveable drawout element is in the test position.



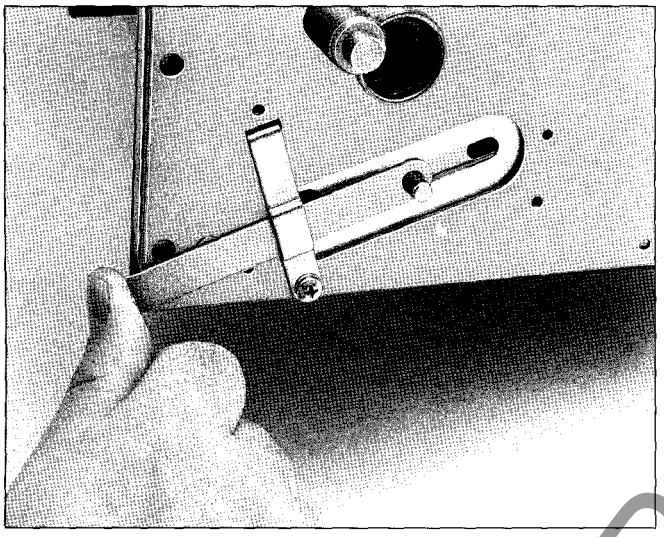
Relative position of finger clusters to bus stabs.

Part Two – Manipulating the Moveable Drawout Element

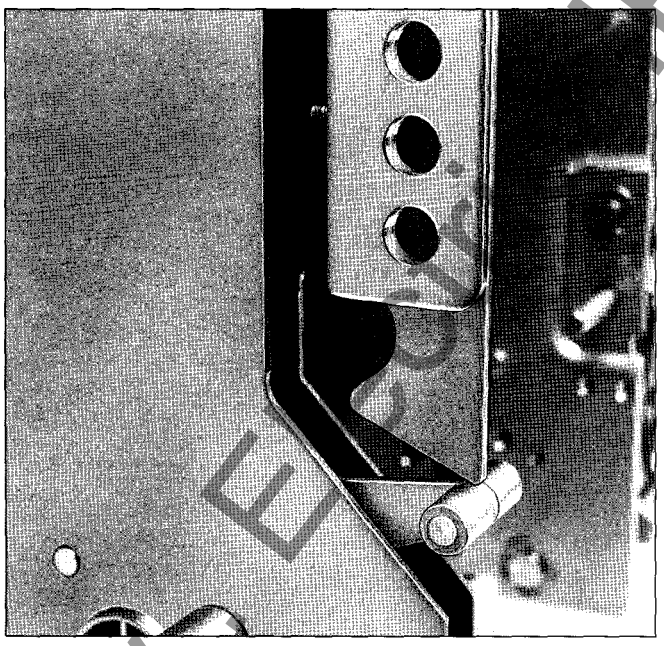
Test Position to Unlocked Position

Racking the moveable drawout element from the test position to the unlocked position disengages the moveable drawout element from the stationary drawout element. The physical position of the moveable drawout element will be unchanged.

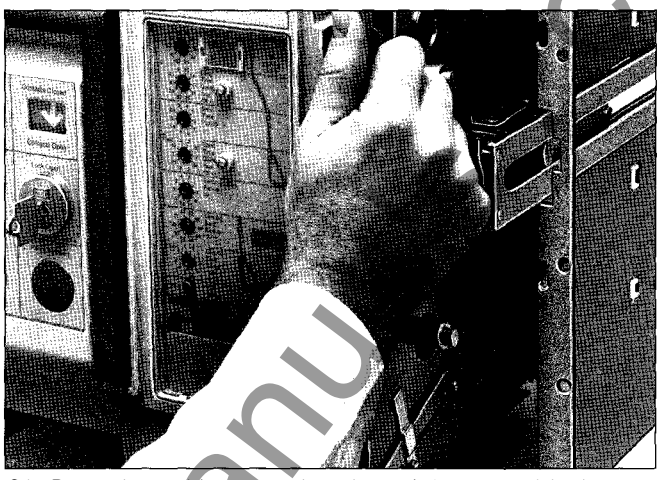
To rack the moveable drawout element from the test position to unlocked position:



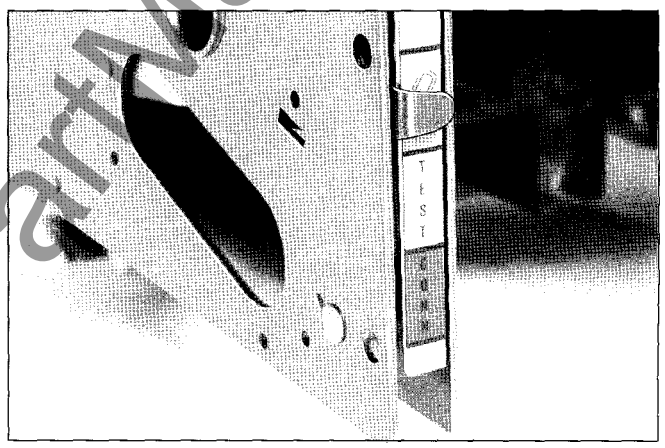
1.) Set the directional shift lever to the racking-out position.



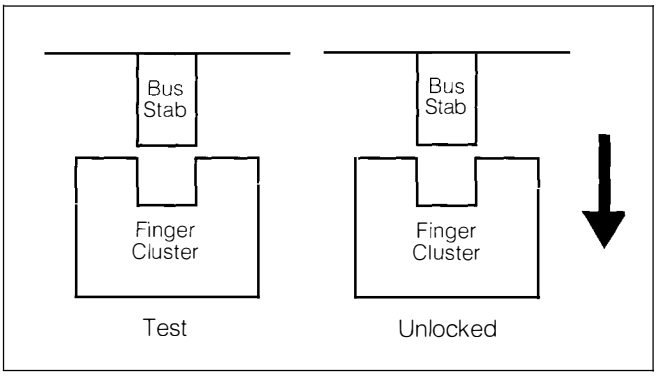
2.) Pull the interlock lever down to the interlock disengaged position. (Illustrated beneath padlock device.) If the breaker contacts are closed, pulling the interlock lever down will trip the breaker.



3.) Pump the racking pump handle until the moveable drawout element is in the unlocked position.



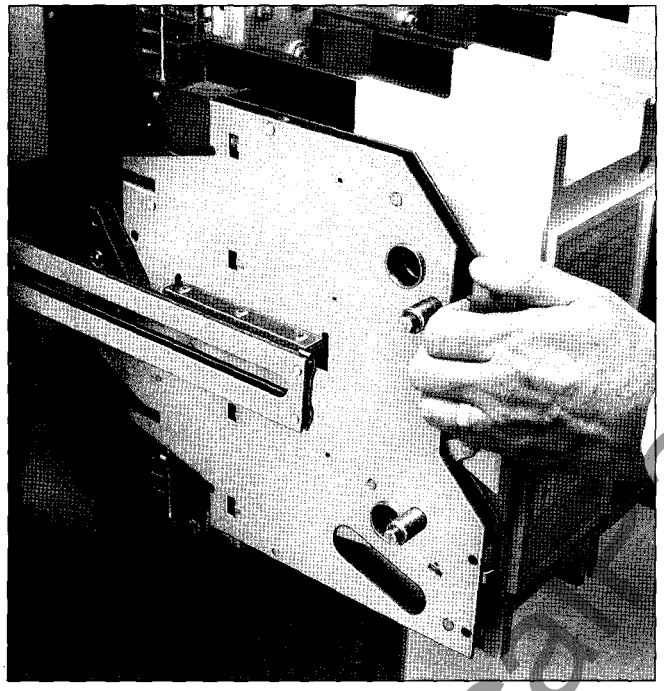
4.) When the moveable drawout element reaches the unlocked position, the interlock lever will automatically return to the interlock engaged position, and the position indicator will display the unlocked position.



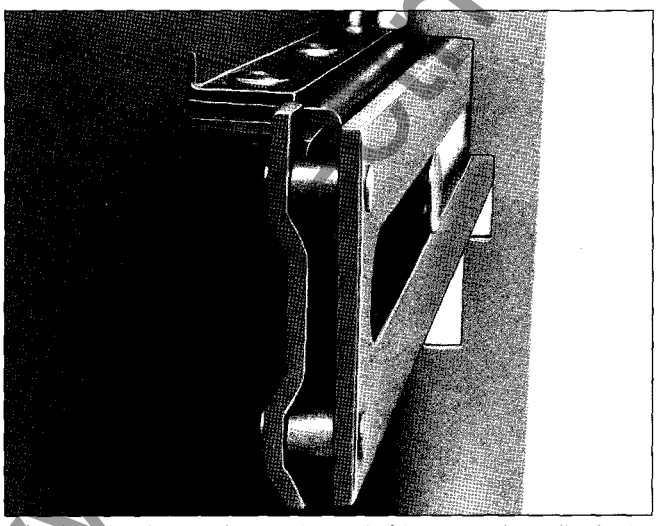
Relative position of finger clusters to bus stabs.

Part Two – Manipulating the Moveable Drawout Element

Rotating the Moveable Drawout Element
For inspection purposes, the moveable drawout element can be rotated on the extension rails. Clearances required to rotate the moveable drawout element are on drawings located in the Outline Dimension Drawing section. Note that the moveable drawout element is designed to be rotated only in the illustrated direction. Do not attempt to rotate the moveable drawout element in the opposite direction.



1.) Pull the moveable drawout element to the fully withdrawn position, holding the moveable drawout element as depicted above.

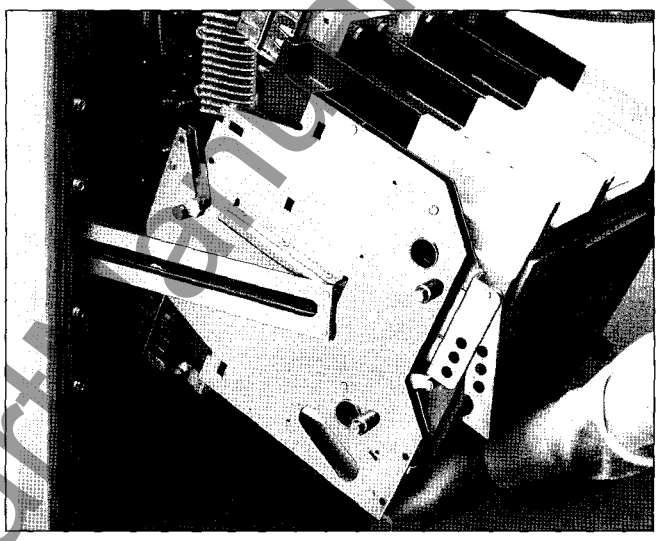


2.) Note the depressions at the end of the extension rails. As the moveable drawout element is rotated, the ends of the support brackets will rest in these depressions, preventing the moveable drawout element from sliding on the extension rails.

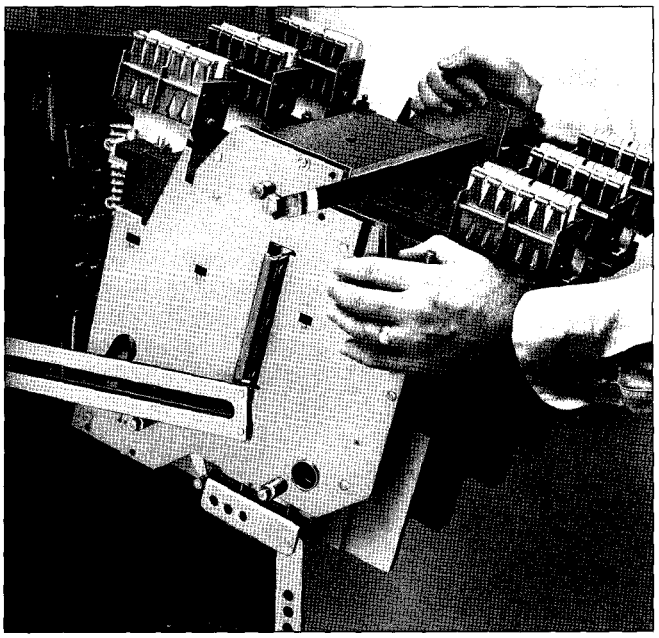
⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Prior to rotating the Moveable Element turn power off and lock out supplying device.



3.) Rotate the moveable drawout element forward to the desired position for inspection.



4.) When the inspection is complete, carefully lower the moveable drawout element to its normal position on the extension rails. (Above photo depicts maximum rotation.)

CAUTION: Use extreme care when rotating circuit breaker assembly, unit may dislodge – personal injury or equipment damage may result.

Part Three – Monitoring the Electronic Trip Unit

General Instructions

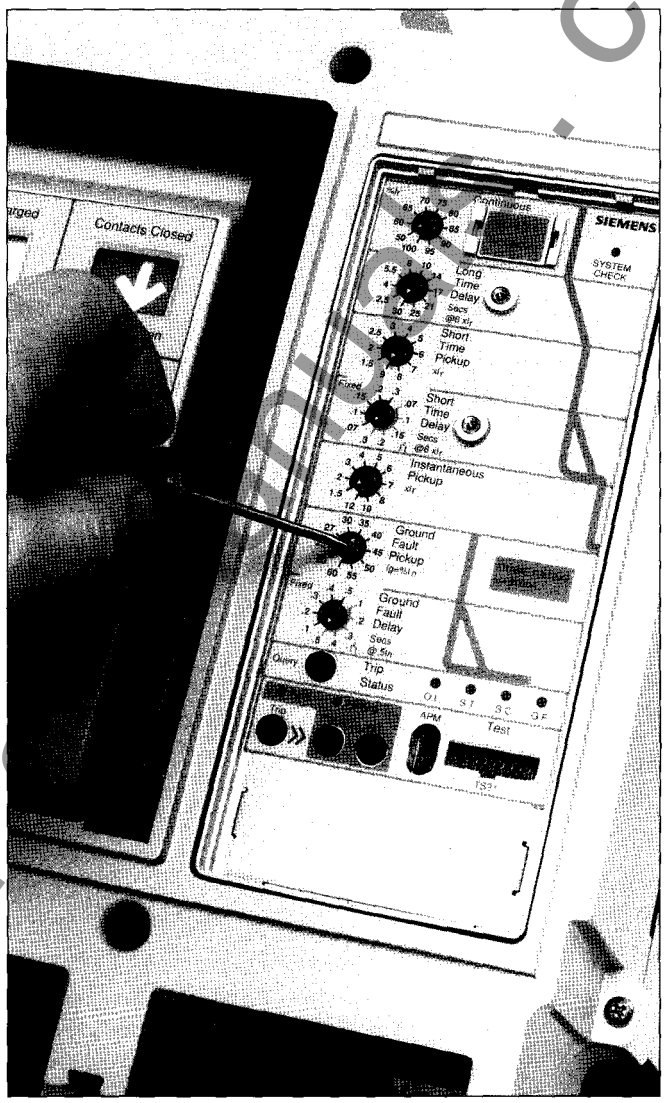
The trip unit executes its overcurrent protection functions based on the rating plug value and the settings of the current adjustments. Therefore, care should be taken by the user to make proper selections and settings.

An adjustment will automatically revert to its minimum possible setting whenever a change to the adjustment is being made. This may cause inadvertent tripping of the breaker if the adjustment is made with the breaker in the closed position. Therefore, Siemens recommends that all adjustment changes be made with the breaker open.

To set an adjustment, place a slotted screw driver onto the point-to-point adjustment switch and rotate the switch to the desired setting.

The figure on the following page describes the region of the time current curve that is being effected by each adjustment.

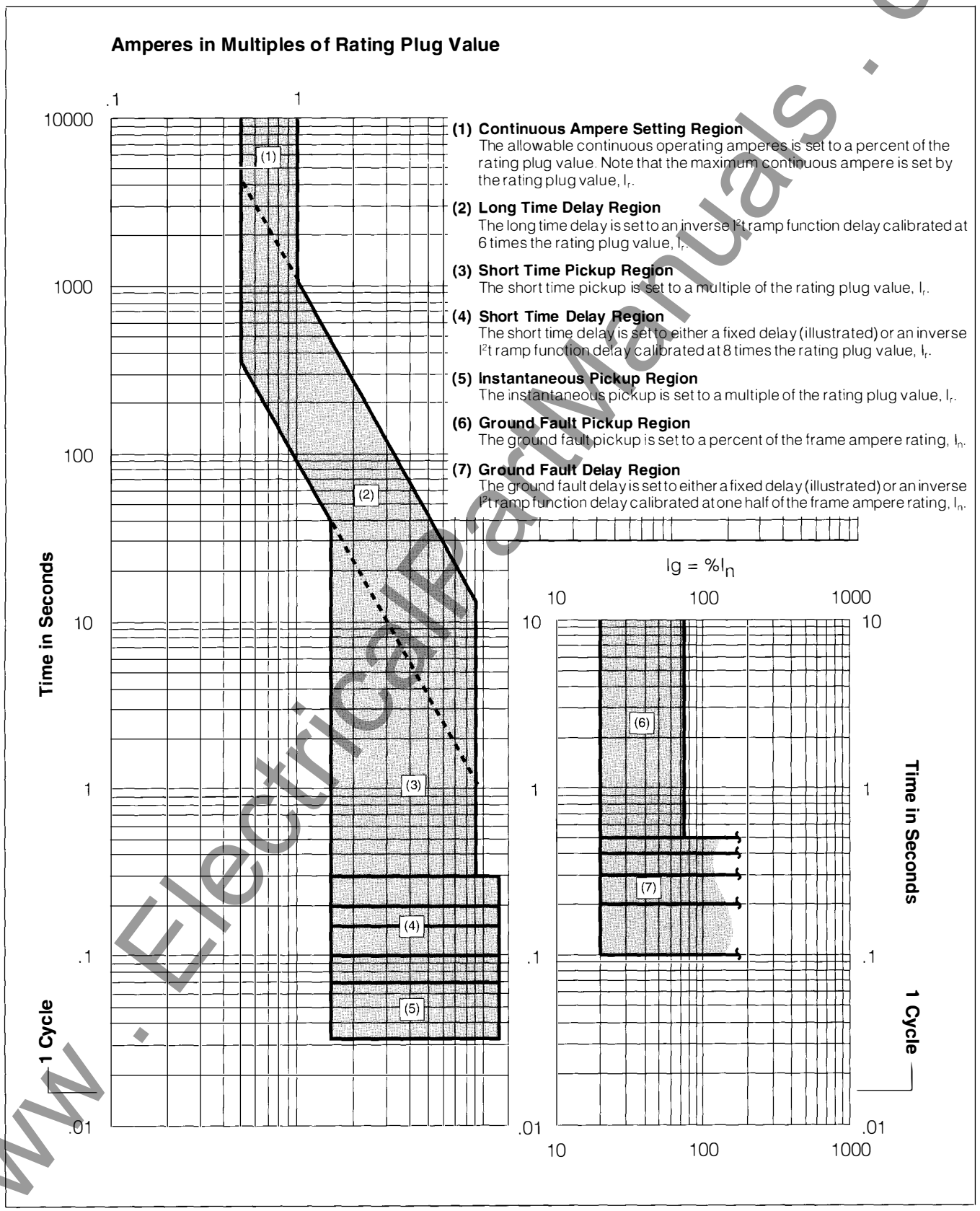
For complete information on setting the individual adjustments see the Information and Instruction Guide for the Electronic Trip Unit, Bulletin 2.20-3A. For time current trip curves contact your local Siemens sales office.



2000A Electronic Trip Unit (Photo for illustrative purposes)

Trip Unit Current Shaping Adjustments

(This curve is for illustration purposes only)



(1) Continuous Ampere Setting Region
The allowable continuous operating amperes is set to a percent of the rating plug value. Note that the maximum continuous ampere is set by the rating plug value, I_r.

(2) Long Time Delay Region
The long time delay is set to an inverse I^2t ramp function delay calibrated at 6 times the rating plug value, I_r.

(3) Short Time Pickup Region
The short time pickup is set to a multiple of the rating plug value, I_r.

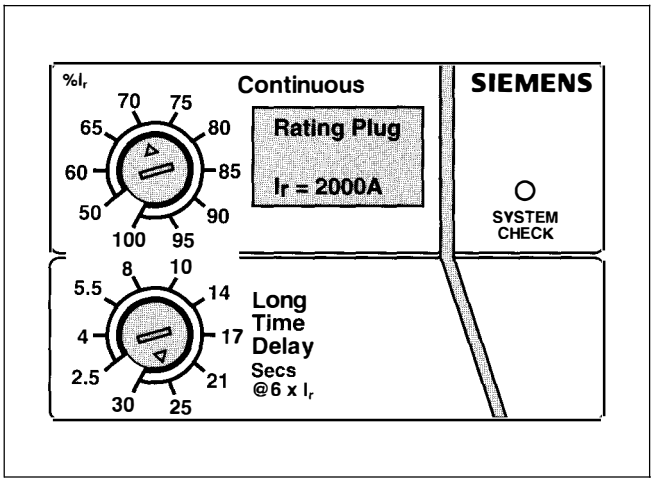
(4) Short Time Delay Region
The short time delay is set to either a fixed delay (illustrated) or an inverse I^2t ramp function delay calibrated at 8 times the rating plug value, I_r.

(5) Instantaneous Pickup Region
The instantaneous pickup is set to a multiple of the rating plug value, I_r.

(6) Ground Fault Pickup Region
The ground fault pickup is set to a percent of the frame ampere rating, I_n.

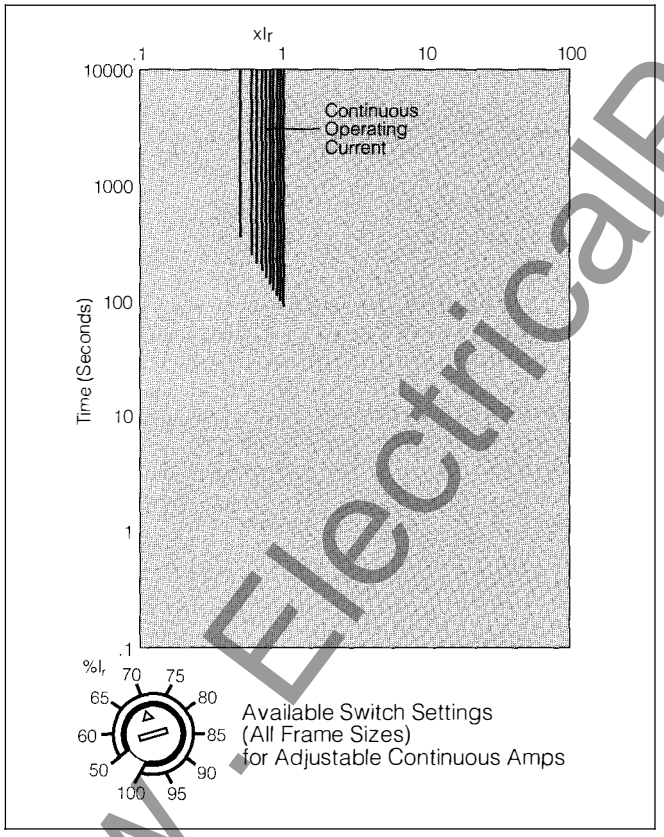
(7) Ground Fault Delay Region
The ground fault delay is set to either a fixed delay (illustrated) or an inverse I^2t ramp function delay calibrated at one half of the frame ampere rating, I_n.

Adjustable Continuous Amps and Adjustable Long Time Delay



Adjustable Continuous Amps

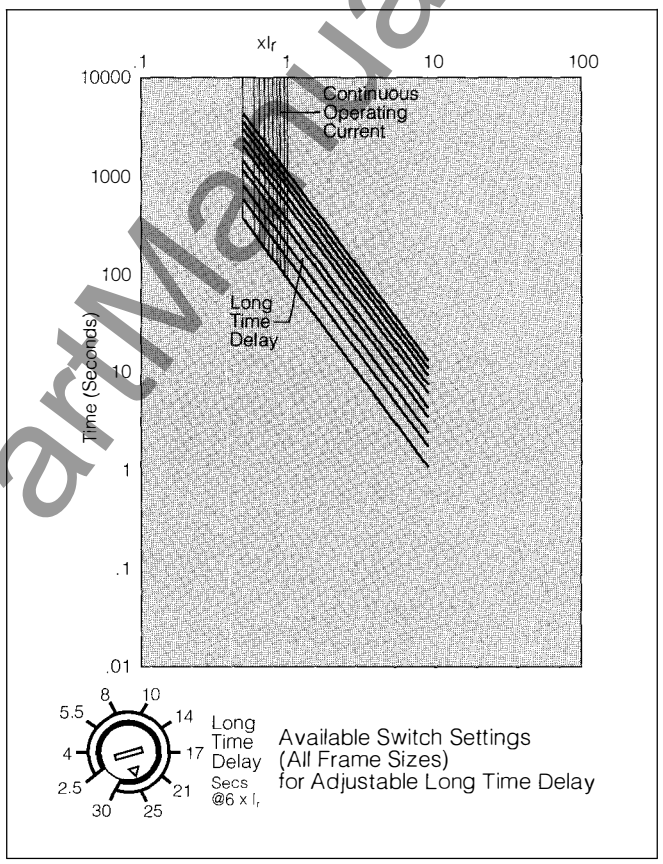
The Continuous ampere adjustment sets the current level at which the breaker will continuously operate without initiating a tripping sequence. On Siemens Electronic Trip Units, the continuous operating current may be set to 50, 60, 65, 70, 75, 80, 85, 90, 95, and 100% of the rating plug value I_r.



Continuous Operating Current

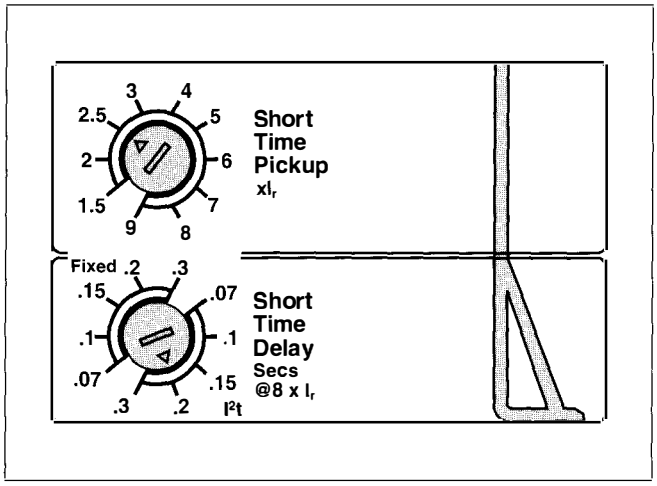
Adjustable Long Time Delay

The Long Time Pickup is nominally set at 115 percent of the continuous amps setting. The Long Time Delay adjustment is used to set the tripping delay of the SB breaker based on the magnitude of the overcurrent condition. On Siemens Electronic Trip Units, the long time delay, which is an inverse I^2t ramp function, may be set to a calibrated value of 2.5, 4, 5.5, 8, 10, 14, 17, 21, 25, or 30 seconds at a current equal to 6 times I_r.



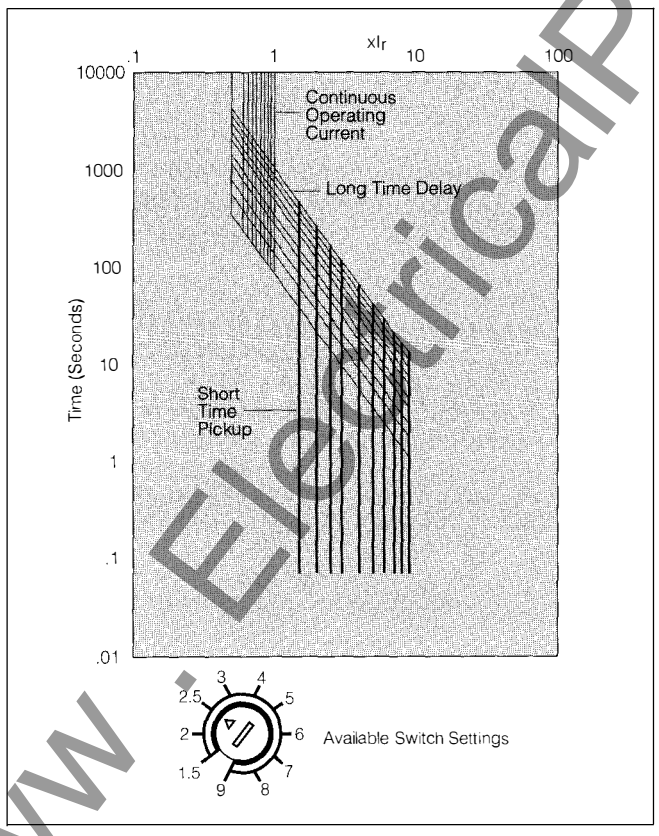
Long Time Delay

Adjustable Short Time Pickup and Adjustable Short Time Delay



Adjustable Short Time Pickup

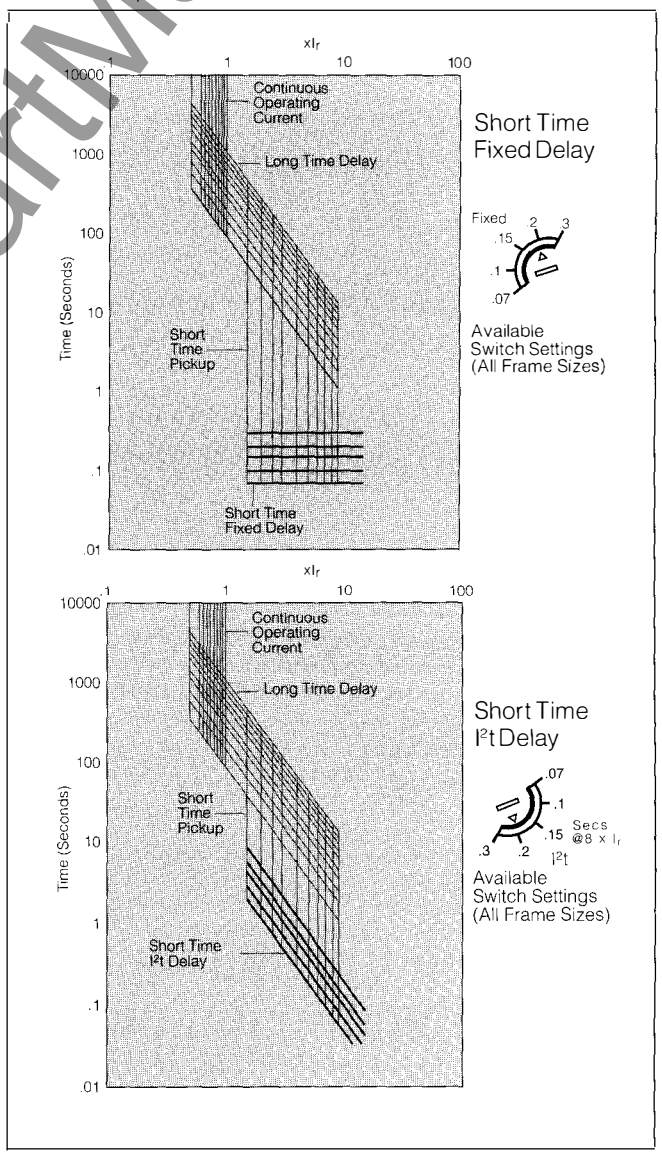
The Short Time Pickup adjustment is used to set the level of high current the breaker will carry for a short period of time without tripping. This adjustment, together with the Short Time Delay, allows downstream breakers time to clear short circuit faults without tripping the upstream breakers. On Siemens Electronic Trip Units, the Short Time Pickup may be set to 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, or 9 times I_r.



Short Time Pickup

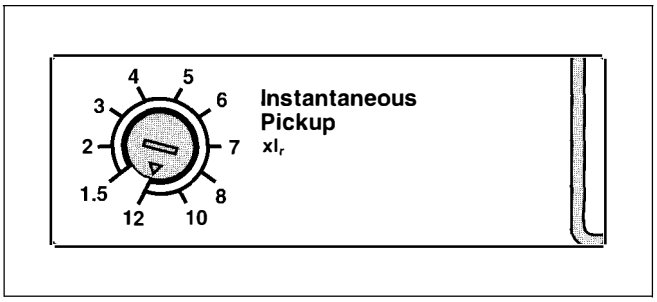
Adjustable Short Time Delay

The Short Time Delay adjustment is used to set the time interval the breaker will wait before responding to the current value selected on the Short Time Pickup adjustment. There are two modes of operation of this adjustment on all Siemens Electronic Trip Units; one is a fixed delay, the other is an inverse I^2t ramp delay. The I^2t Delay has the characteristic of being inversely proportional to the square of the magnitude of the overcurrent condition. This means that higher overcurrent conditions have shorter delays and conversely lower overcurrent conditions have longer delays. This characteristic allows for better coordination with downstream circuit breakers and fuses. In the fixed delay mode, the Short Time Delay may be set to .07, .1, .15, .2, or .3 seconds. In the inverse I^2t ramp Short Time Delay mode, the delay may be set to a calibrated value of .07, .1, .15, .2, or .3 seconds at a current equal to 8 times I_r.

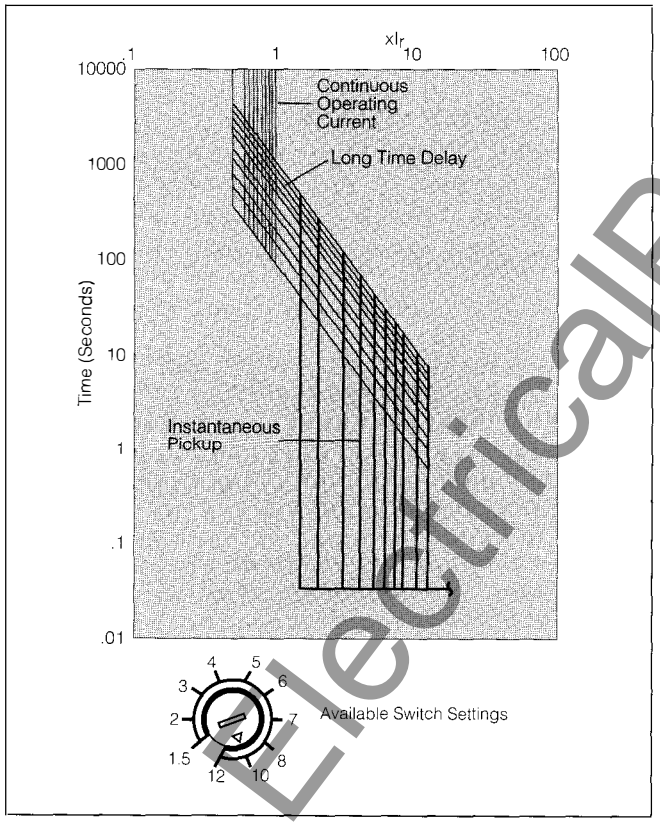


Short Time Delay

Adjustable Instantaneous Pickup



Adjustable Instantaneous Pickup
The Instantaneous Pickup adjustment is used to set the current level at which the breaker will trip without an intentional time delay. Non-delayed tripping, as a result of a severe overcurrent condition, minimizes potential damage to electrical systems and equipment. On Siemens ElectronicTrip Units,theInstantaneousPickup adjustment may be set to 1.5, 2, 3, 4, 5, 6, 7, 8, 10, or 12 times I_r.

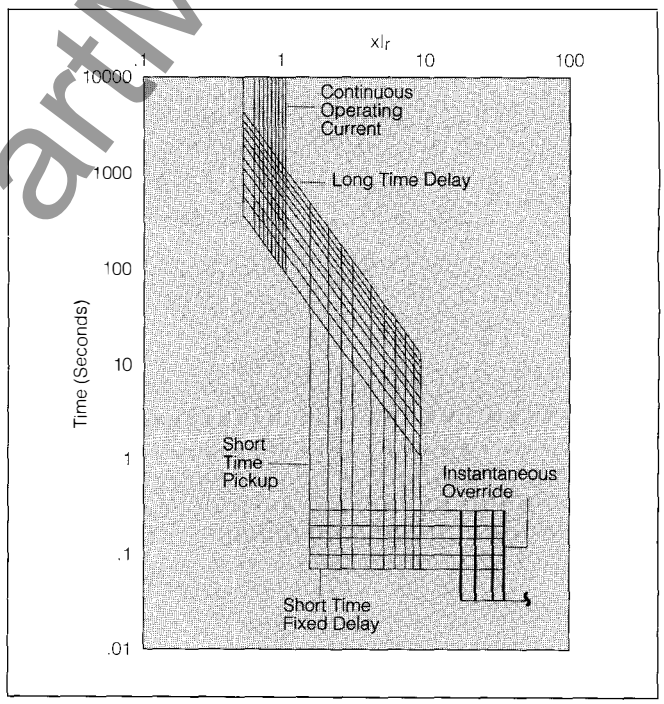


Instantaneous Pickup

Instantaneous Override
On all trip units, an instantaneous override function has been provided. It is set nominally at the short time rating of the respective breaker frame size. This allows the breaker to ride through high faults up to its short time capability; however, it is self-protecting above these values.

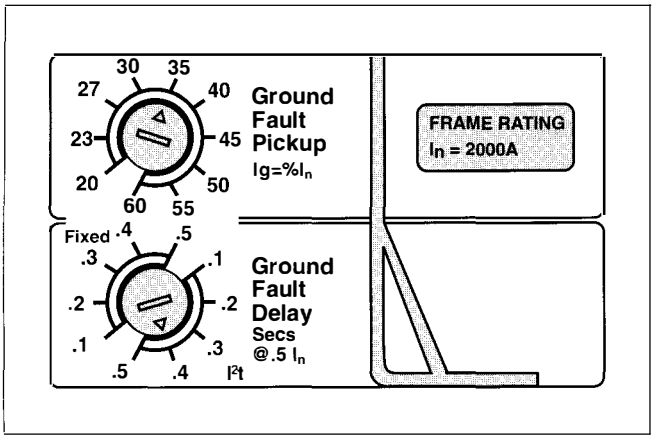
Breaker Frame Size	Short Time kA Rating (.500 seconds max.)
800A	25
1200A	25
2000A	35

Discriminator Circuit (Making Current Release)
This circuit overrides the short time delay function should the breaker attempt to close into a faulted system, tripping the breaker instantaneously. The discriminator function is enabled for the first 6 cycles of current flow, after which normal short time characteristics operate.



Instantaneous Override (Illustrated with Short Time Fixed Delay)

Adjustable Ground Fault Pickup and Adjustable Ground Fault Delay



Adjustable Ground Fault Pickup

The Ground Fault Pickup adjustment is used to set the level of ground current at which circuit interruption will be initiated. Together with the Ground Fault Delay, this adjustment allows selective tripping between main and feeder or other downstream breakers. The available ground fault pickup settings, as a percent of the SB breaker frame ampere rating I_n are given in the table below. In compliance with the National Electric Code (NEC 230-95), no trip point setting exceeds 1200 amperes.

Frame Ampere Rating I_n	Available Setting % I_n									
400A	20	25	30	40	50	60	70	80	90	100
800A	20	25	30	40	50	60	70	80	90	100
1200A	20	25	30	40	50	60	70	80	90	100
1600A	20	26	32	38	44	50	56	62	68	75
2000A	20	23	27	30	35	40	45	50	55	60

Adjustable Ground Fault Delay

The Ground Fault Delay adjustment is used to set the time interval the breaker will wait before responding once the ground fault pickup level has been reached. There are two modes of operation of this adjustment for Siemens Electronic Trip Units; one is a fixed delay and the other is an inverse I^2t ramp delay. In the fixed delay mode, the Ground Fault Delay may be set to .1, .2, .3, .4, or .5 seconds. In the inverse I^2t ramp delay mode, the delay may be set to a calibrated value of .1, .2, .3, .4, or .5 seconds at a current equal to 0.5 times the frame ampere rating I_n. The inverse I^2t ramp delay reverts to a fixed delay of the same value when the ground current (I_g) exceeds 50 percent of the frame rating (I_n)

Ground Fault Memory Circuit

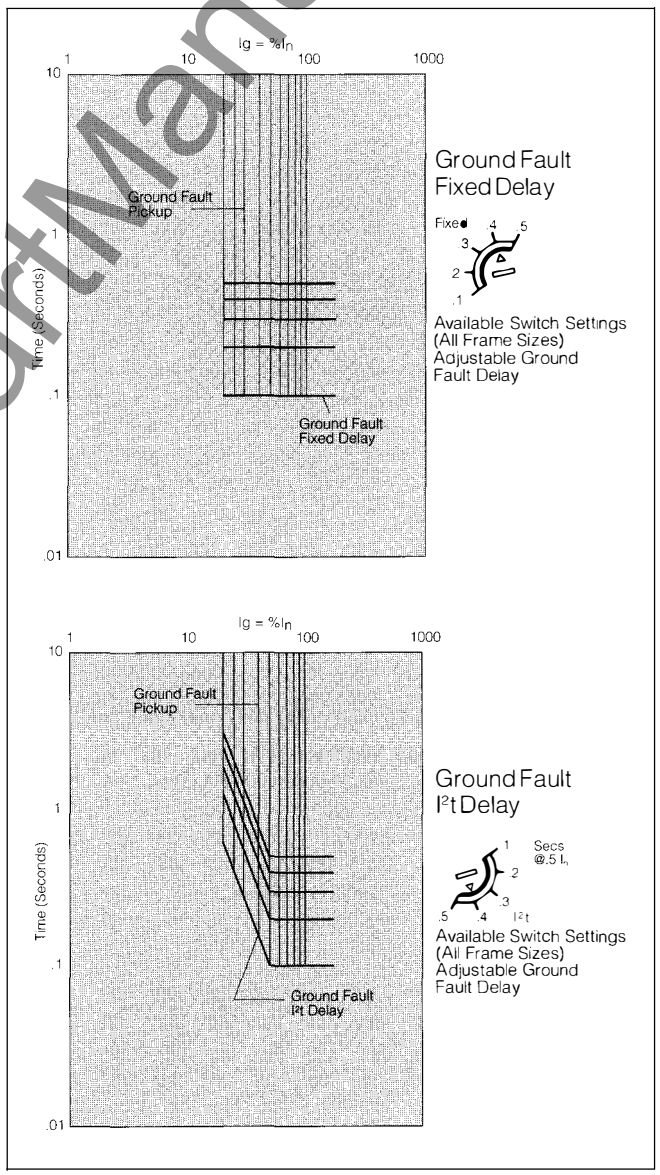
All Siemens Electronic Trip Units with ground fault protection come equipped with a ground fault memory circuit. This circuit effectively integrates ground fault currents with time. This provides an added protection by preventing the ground fault delay circuits from being reset to zero when the ground fault currents are intermittent and erratic. The time constants for the current integration are preset within the trip unit as a function of the Ground Fault Delay.

Ground Fault Sensing Schemes

The trip unit can be configured to accommodate the following ground fault sensing schemes.

- 3-Phase, 3-Wire Residual
- 3-Phase, 4-Wire Residual
- Source Ground
- Zero Sequence

All that is required by the user to configure the trip unit to support these protection schemes is to set the ground fault selection switch to the desired configuration. The selection switch is on the left side of the trip unit and must be set prior to the trip unit being installed in the SB breaker.

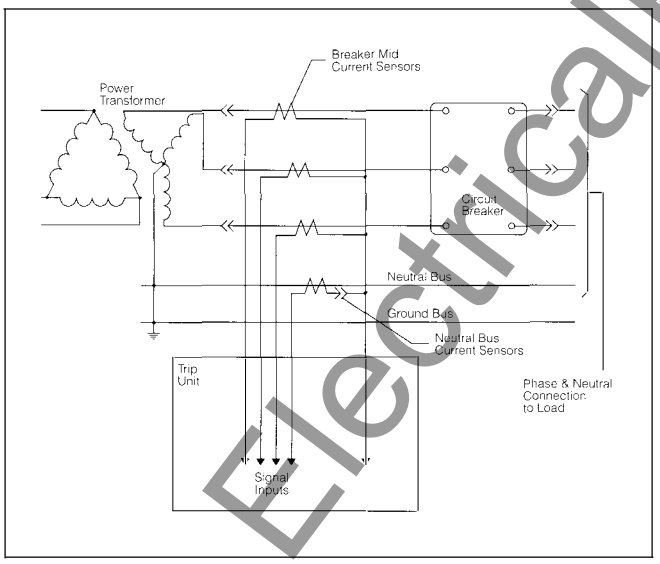


Ground Fault Delay

Ground Fault Sensing Scheme
The following are brief descriptions of the ground fault sensing schemes as they relate to the Siemens Electronic Trip Unit. Detailed technical and application information of the ground fault sensing schemes is contained in NEMA Standard No. PB 2.2 "Application Guide for Ground Fault Protective Devices for Equipment".

Residual (3-Phase, 3-Wire). Under normal system conditions (without ground fault), the vector sum of the phase currents being monitored by the trip unit is zero. This is also true under the condition of an overcurrent phase-to-phase fault and phase-unbalance condition. When a phase-to-ground fault occurs, the vector sum of the phase currents is directly proportional to the magnitude of the fault. The trip unit's microprocessor uses this vector sum data in the execution of the ground fault protection function. The trip unit utilizes the internal breaker current transformers. No external current transformers are required.

Residual (3-Phase, 4-Wire). In the 3-Phase, 4-Wire Residual scheme a fourth current transformer is connected in the neutral conductor to "Sense" normal neutral currents. Under normal system conditions the vector sum of the currents in all phases equals the neutral current. This is also true under the condition of an overcurrent phase-to-phase fault and phase-unbalance condition. When a phase-to-ground fault occurs, the fault current returns via a path other than the neutral. Therefore, the vector sum of the phase currents no longer equals the neutral current. This current differential is detected by the trip unit and used in the execution of the ground fault protection function.

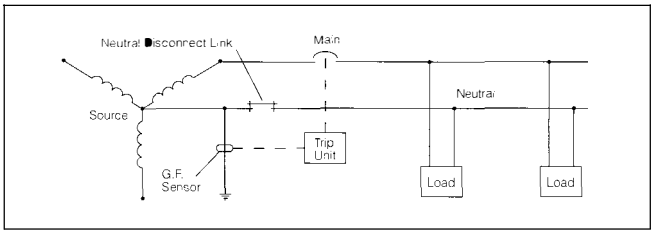


Residual Sensing. Circuit Breaker Wiring for Ground Protection (3-Phase, 4-Wire System Shown).

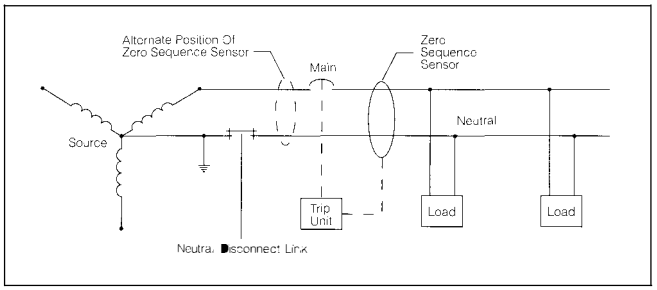
Source Ground. In this scheme, the phase currents are not used in detecting and processing ground faults. The trip unit executes the ground fault protection function based on data from a ground current sensor. This sensor is located on the neutral connection to ground at the service entrance, and is connected to the neutral transformer input terminals on the trip unit.

Zero Sequence. This scheme is very similar to the Residual Schemes. A core balance type current sensor encircles all phase conductors and neutral on a 4-wire system. Under normal system conditions or a phase-to-phase fault condition, there is no output from the sensor to the trip unit because the vector sum of the currents through the sensor window is zero. If a ground fault occurs, the ground current is not seen by the sensor, which returns to the source by a path other than through the sensor window. The sensor detects this current unbalance and provides the data required by the trip unit to execute the ground fault protection function. The zero sequence sensor is connected to the neutral transformer input on the trip unit.

NOTE: For Neutral Sensor installation, see pages 64-65.



Source Ground Current.



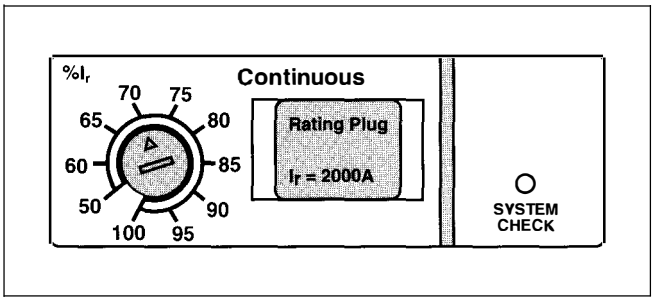
Zero Sequence Ground Fault Protection.

Part Three – Monitoring the Electronic Trip Unit

Trip Unit Test and Monitoring Functions

Siemens Electronic Trip Unit is equipped with three standard test and monitoring functions to aid the user in the installation and operation of the SB breaker.

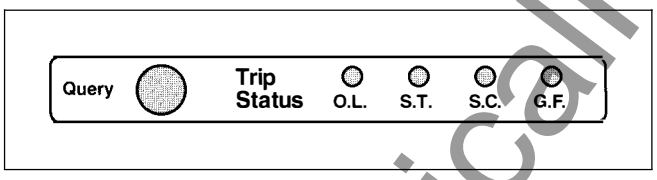
System Check Indicator



The System Check Indicator is a green LED that blinks approximately once every 3 seconds when the microprocessor is properly cycling through its protection routines.

The trip unit derives its operating power from the phase currents in the SB breaker. The phase current required to operate the trip unit is approximately 20 percent of the frame rating (I_r). If the microprocessor is not properly cycling through its protection routines, the phase current is below 20% I_n, the LED will not light.

Trip Status



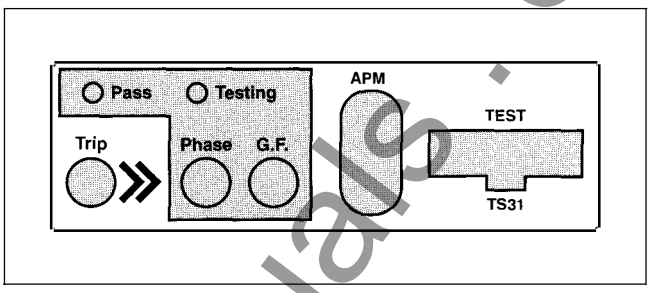
The trip Query button and Trip Status indicator lights provide the user the means for determining what type of fault caused the trip unit to trip the breaker. Fault indicators are provided for:

O.L. - Overload or Long Time Fault
S.T. - Short Time Fault
S.C. - Short Circuit or Instantaneous Fault
G.F. - Ground Fault

When a fault occurs, the fault information is stored in the trip unit by latching the appropriate red LED fault indicator to the "On" position. When the Query button is depressed, the latched fault indicator will light. The electrical power to the indicators is automatically stored in the trip unit, eliminating the need for a battery pack. A hole is provided in the transparent cover to allow the user access to the Query button.

NOTE: During trip unit power up, a fault indicator LED will latch, providing a means to check that the circuitry is properly operating. In the case of a fault, the proper indicator will be latched to the fault position. The indicator circuitry always latches the most recent event.

Integral Test Modes



The integral test function enables the user to "exercise" the trip unit electronics, the magnetic latch, and the breaker mechanism. The purpose of the integral test function is to provide the user an easy means to conduct a "go/no go" type test before bringing the breaker on-line. After the breaker has been brought on-line, it may be used during routine inspection and maintenance.

Both phase fault current protection and ground fault current protection may be tested. The integral ground fault test function tests the circuit breaker's ground fault protection system in accordance with NEC Article 230-95(c).

Electrical power to operate the integral test function is provided internally, if the breaker is closed and the phase currents are greater than 20% of the frame ampere rating I_n, or by a plug-in power source (see Accessories section).

The user may execute the test function in either a "no trip" mode, which will test only the trip unit electronics, or a "trip" mode, which will also test the magnetic latch and breaker mechanism. The execution of the integral test function in both the "no trip" and "trip" modes is based on the settings of the long time delay and ground fault delay adjustments. Therefore, the Phase Test will take several seconds to execute and the Ground Fault Test will appear to be nearly instantaneous. To execute a test function in the "no trip" mode, depress the appropriate pushbutton test switch, **Phase** or **GF**. As the trip unit is performing the test, the **Testing** Indicator will light. If the trip unit successfully passes the test, the **Pass** Indicator will light. If the Pass Indicator does not light after the Testing Indicator indicates that the test is complete, a more extensive test should be run with Siemens TS-31 Universal Test Kit (see Accessories).

CAUTION: Before conducting a "Trip" test on a SB breaker which is "Closed" and in service, caution should be taken to evaluate effects on downstream loads. The breaker *will* open during testing, resulting in a disruption of service.

Preliminary Installation Procedures

⚠ DANGER

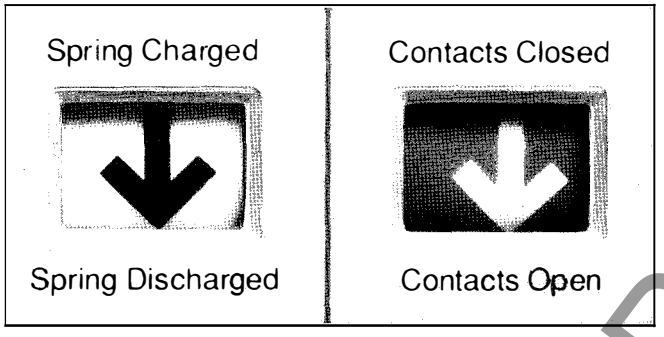
Hazardous Voltage.
Will cause severe injury or death.

If practical turn power off and lock out supplying device before manipulating the Moveable Drawout Element.

⚠ WARNING

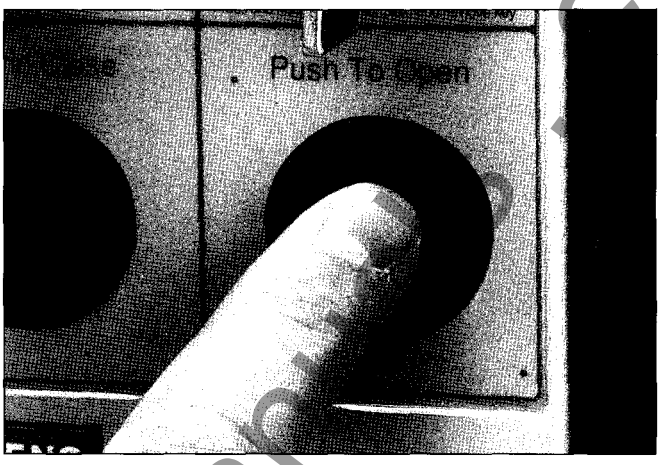
Mechanism can cause severe injury when cover is removed.

Before removing cover, push open button, push close button, push open button again.

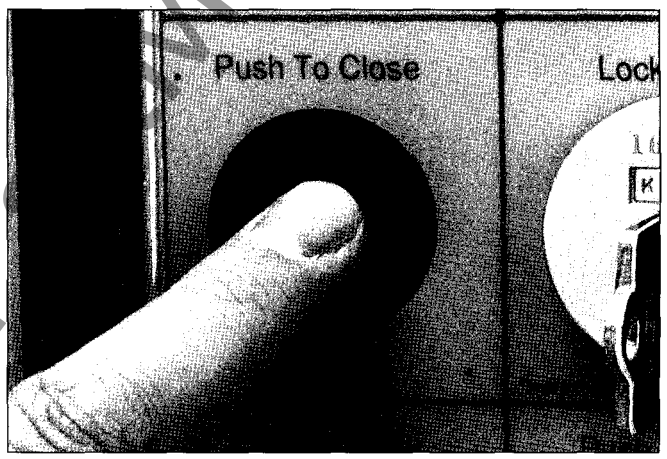


CAUTION: All internal accessories should be installed with the circuit breaker removed from service. If accessories are to be installed while circuit breaker is in service, turn off and lockout power supplying the circuit breaker prior to cover removal and accessory installation.

NOTE: The accessory installation procedures outlined in this booklet are general by nature and may not contain the latest up to date information for complete installation. Therefore it is Siemens' recommendation that all accessories be installed utilizing the instruction information accompanying the accessory.

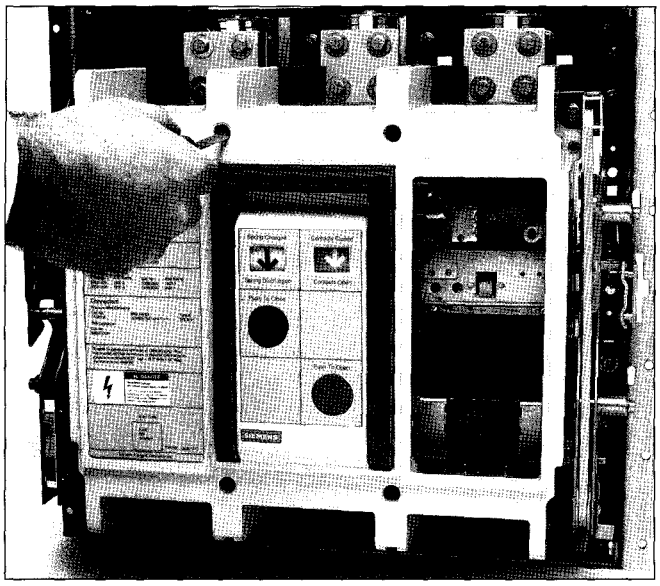


1.) Prior to cover removal check to be sure the circuit breaker main contacts are open and the closing springs are discharged by first pushing the open button.

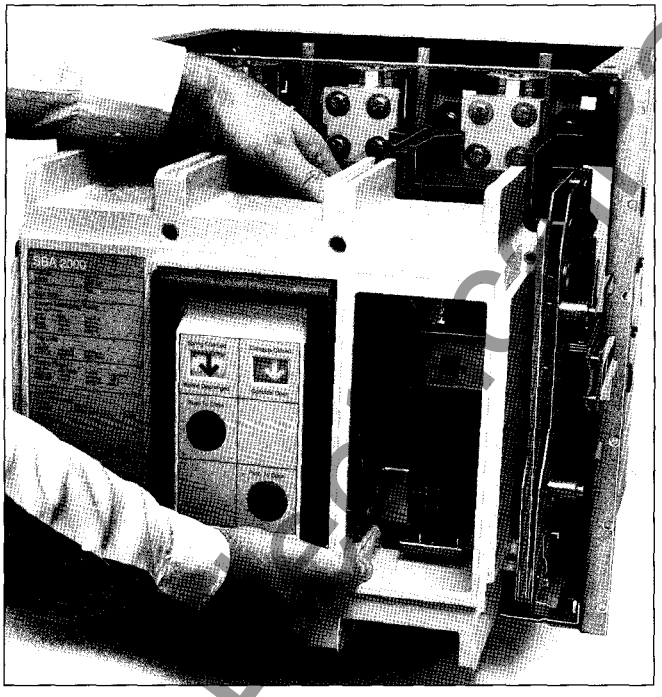


2.) Push the close button and then repeat pushing of the open button.

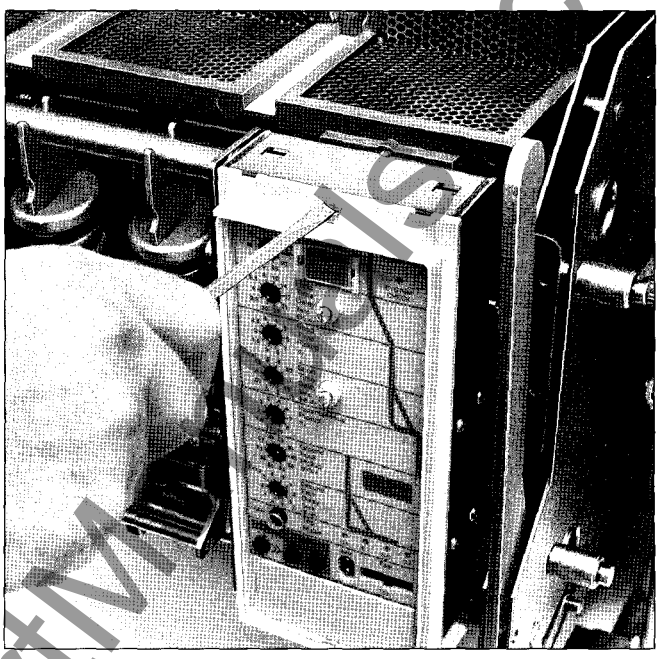
Preliminary Installation Procedures



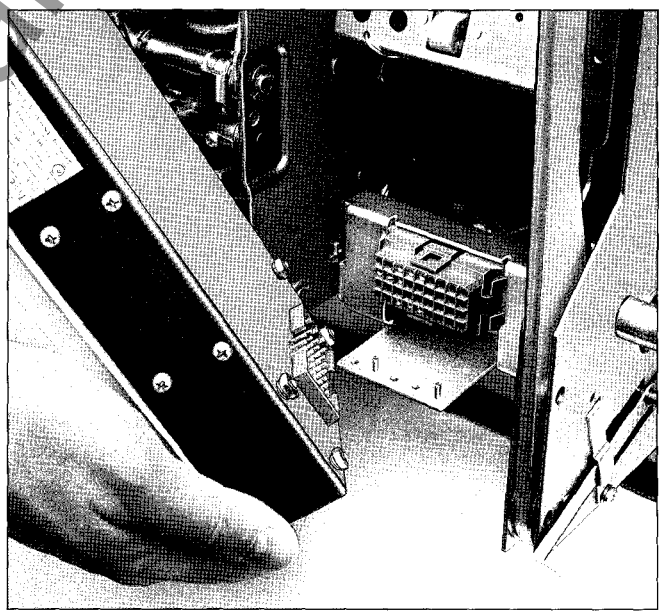
3.) Remove the breaker cover by first removing the (4) #10 Phillips head screws at the corners and the (4) 1/4" Phillips head screws in recesses in cover.



4.) Remove cover.

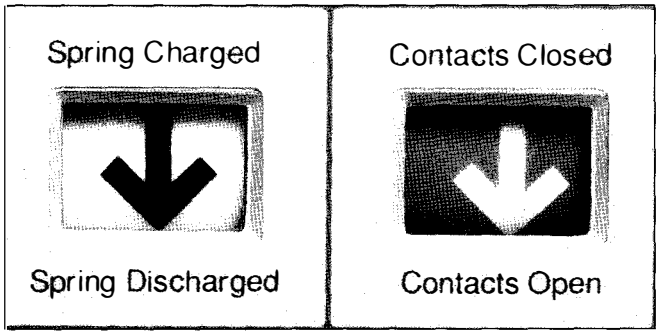


5.) Remove the trip unit if installed, by removing trip unit retaining screw.



6a.) Slide the trip unit up to clear the support bracket pins.
b.) Remove the trip unit by pulling the trip unit away from the trip unit plug.

Preparation For Installation of Electric Motor Operator



CAUTION: Siemens advises that all internal accessories should be added with the breaker removed from service and properly secured to a work surface. Do not attempt to install accessories with the breaker in a "Closed" or "Charged" position. Personal injury or mechanical damage may occur.

Accessories

The full family of accessories available for Siemens SB breakers are presented in this section. The accessories are divided into two groups: accessories that are installed in the front compartment of the circuit breaker (Internal Accessories) and accessories that are installed or used outside of the front compartment (External Accessories). The External Accessories are installed on the exterior of the circuit breaker, on the drawout elements, or at remote locations. When the installation location is referred to as the "right side" or "left side," it is with reference to the user's right or left side when facing the front of the breaker.

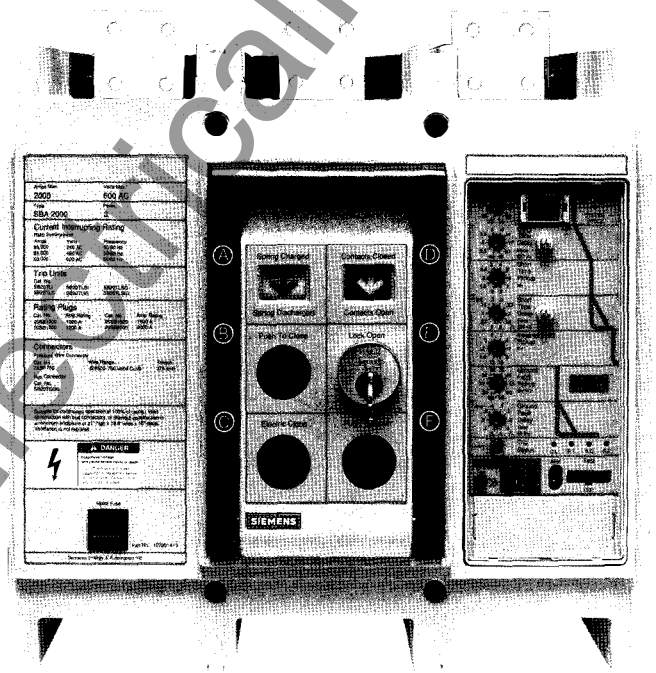
Components required to access or activate an accessory such as a switch or indicator at a remote location are assumed to be user supplied unless otherwise stated.

Group One - Internal Accessories

Secondary connections to remote locations are made to "secondary disconnects" on drawout breakers and to "control terminal blocks" on fixed-mounted breakers. The terminal points for all internal accessories are defined in the External Accessories section, pages 72-73. Control power connections for accessories are made through terminal blocks mounted on the sides of the breaker (see page 72). Drawout constructed breaker control power connections are made through secondary disconnects mounted on the stationary and moving elements.

SB Drawout Breaker Preparation

Installation or removal of the electric motor operator requires the removal of the left drawout mechanism assembly. Installation or removal of the undervoltage release solenoid or shunt trip may require the removal of the right drawout mechanism assembly. Following are instructions for the removal and reinstallation of assemblies.



Ⓐ Stored energy mechanism spring charged/ spring discharged status indicator

Ⓑ Push To Close pushbutton switch

Ⓒ Position for Electric Close push-button

Ⓓ Circuit breaker Closed/Open status indicator

Ⓔ Position for Key Interlock

Ⓕ Push To Open pushbutton switch

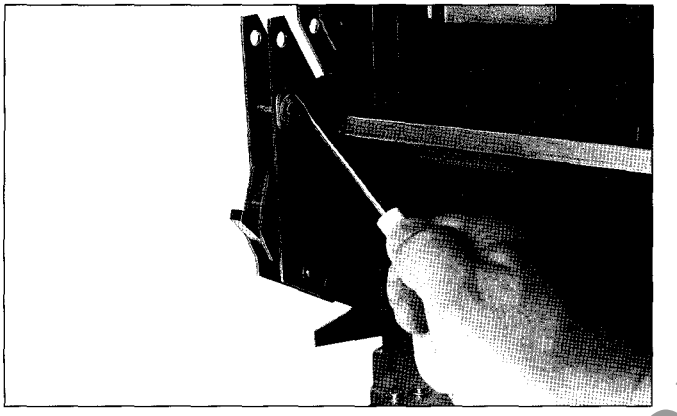
SB Encased Systems Breaker controls and indicators

Preparation For Installation of Electric Motor Operator

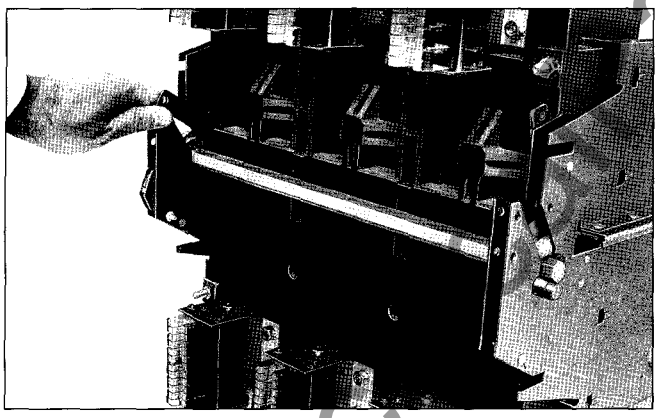
SB Breaker Cover Removal
(See page 37, steps 3 and 4)

NOTE: When placing the drawout removable element on a workbench, ensure that the plug-in finger clusters are not supporting the weight of the breaker.

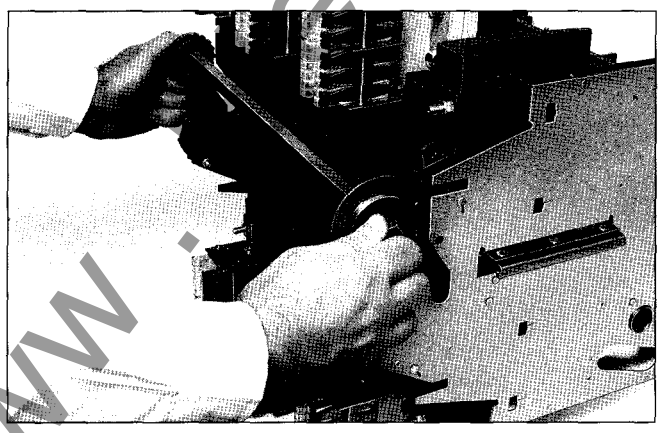
Removal of Left and Right Drawout Mechanism Assemblies
To remove the crankshaft:



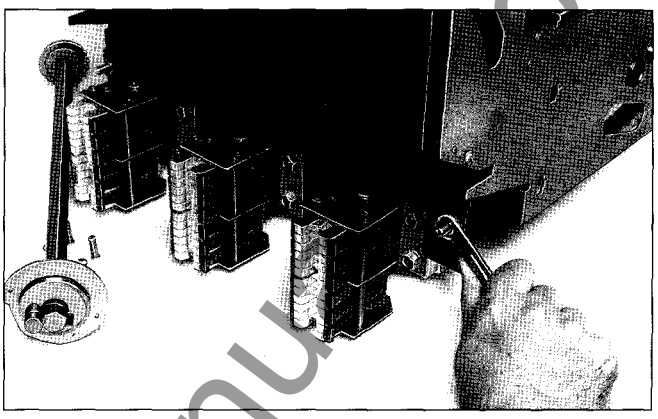
1.) Remove the "E" rings from the bar cap pin on each side.



2.) Remove the bar cap pin from each side.
3.) Rotate the bar caps upward.

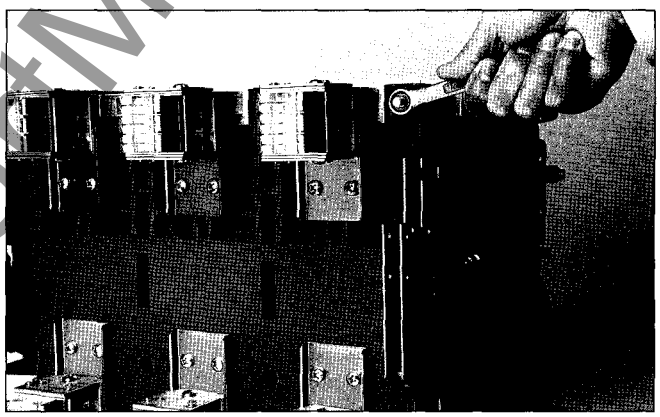


4.) Lift out the crankshaft assembly. (Rotating the crankshaft back and forth will make removal easier.)

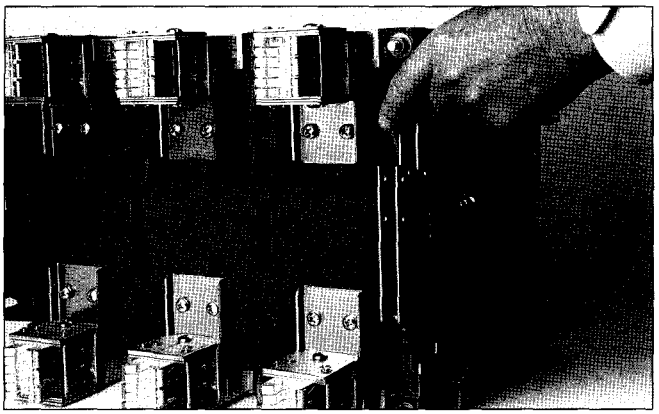


5.) Remove the left and/or right mechanism assemblies as required by removing two (2) $^{5}/_{16}$" bolts and nuts on each side.

Re-installation of Left and Right Drawout Mechanism Assemblies

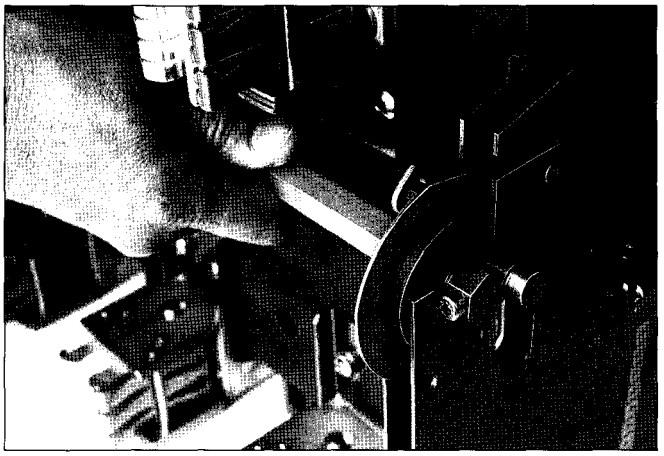


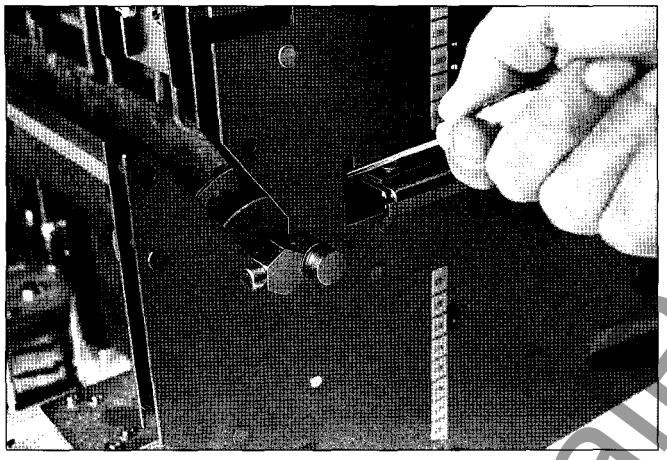
1.) Attach the left and/or right mechanism assemblies to the breaker using two $^{5}/_{16}$" bolts and nuts on each side. Torque the bolts to 16-20 foot-pounds. (The left and right mechanism assemblies can not be installed with the front cover on the breaker.)



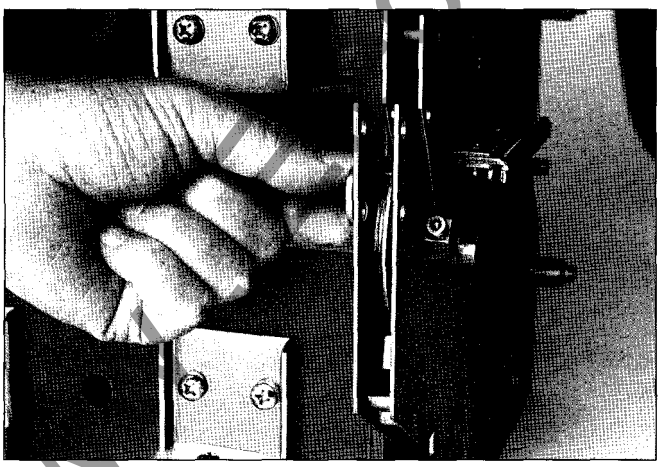
2.) Rotate the bar caps upwards.

Preparation For Installation of Electric Motor Operator

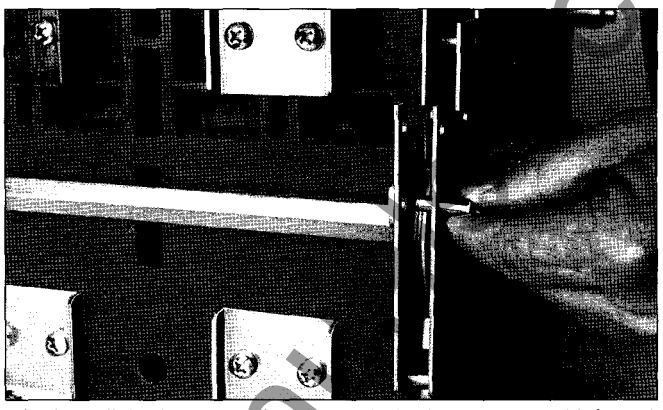




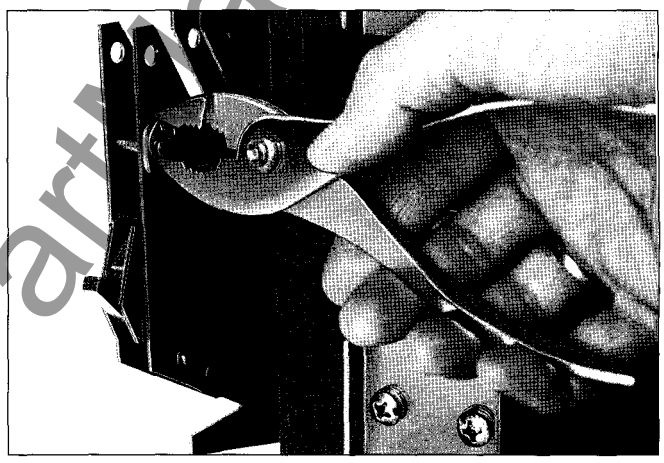
3.) Install the crankshaft assembly by positioning the crank pin anywhere between the unlocked and connected positions as shown and lowering the crankshaft to the bottom of the slot. During crankshaft assembly installation the lock bar must be held in the proper position. This may be done by inserting a screwdriver into the double-d hole (if present) and pushing until a solid stop is felt. If the double-d hole is not present use the rectangular cutout to gain access to the lockbar.



4.) Rotate the bar caps downward.



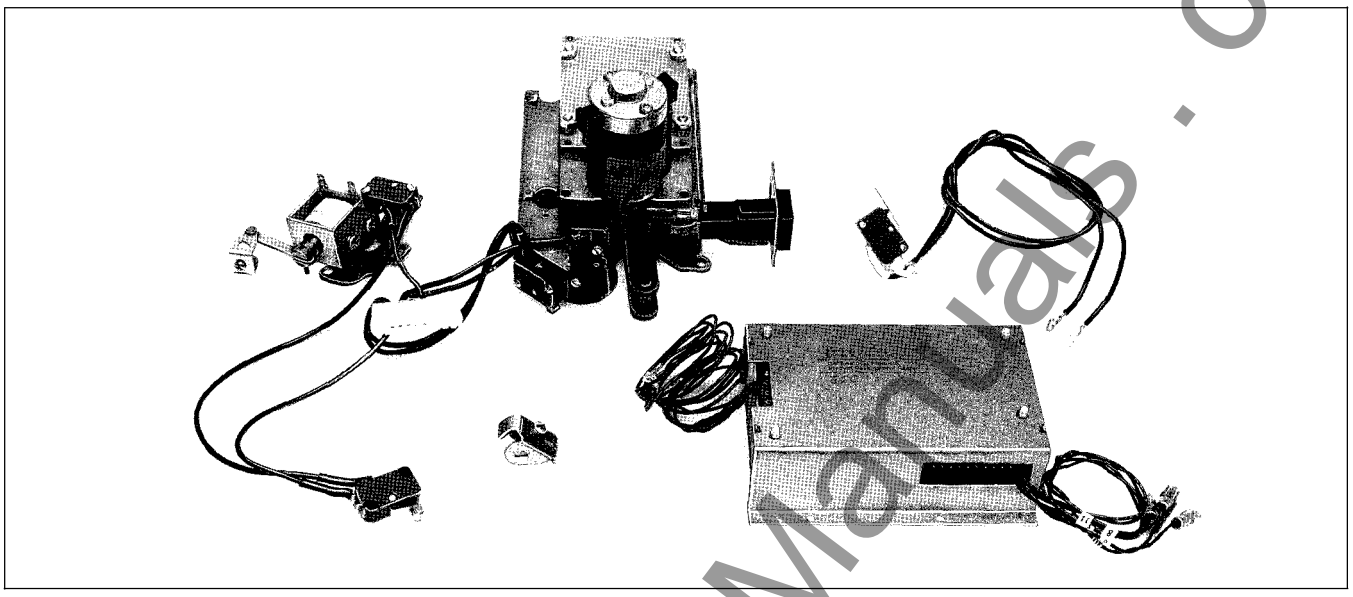
5.) Install the bar cap pins through the bar caps and left and right mechanism assemblies with the head of the pins toward the center of the breaker.



6.) Install an E-ring on each bar cap pin.

7.) Complete steps 1 to 4 on pages 23-26 to verify the lock bar is in the proper position. It should be necessary to pull the interlock lever down before racking the drawout and the lever should return to the engaged position when the drawout reaches the unlocked, test, or connected position. If the interlock lever does not operate in this manner the lock bar is not in the proper position and step 3 above must be repeated. Failure to ensure proper drawout operation may result in the drawout not locking in the proper position with possible injury to personnel and damage to equipment.

Electric Motor Operator



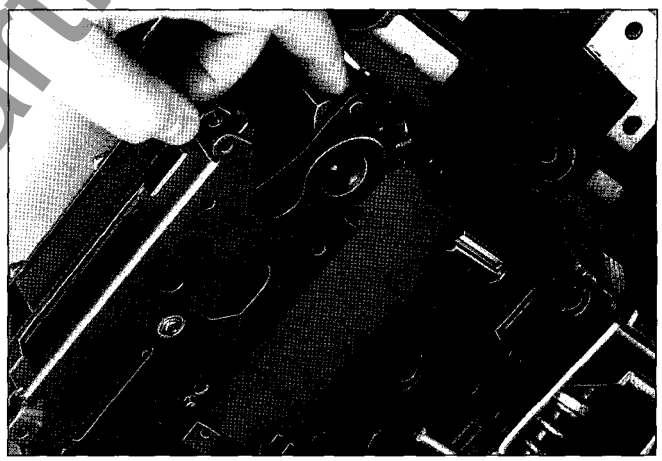
Electric Motor Operator Kit

Electric Motor Operator

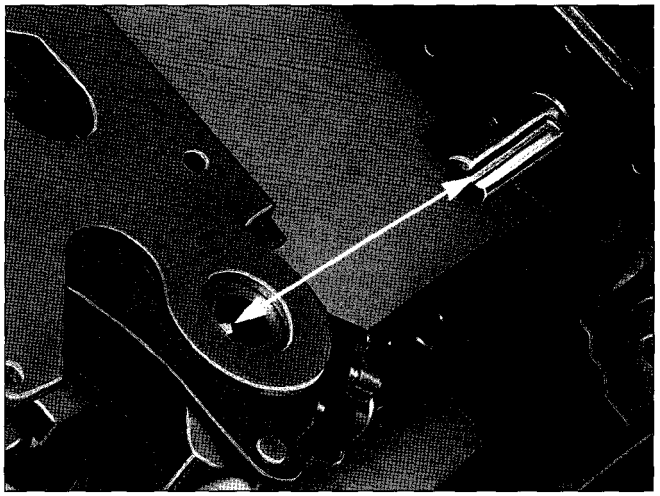
An electric operator provides for electric charging of the springs of the stored energy mechanism, remote closing, spring charging status indication, latch checking, and anti-pump functions. The standard wiring scheme of the electric operator is such that the springs are automatically recharged after each closing operation. This can be modified by the customer if desired.

The electric operator is installed in the front compartment of the SB breaker. The main contact status check switch is installed on the right side, behind the trip unit and beneath the reset plate. All other components of the electric operator are installed on the left side. The motor fuse is accessible from the front panel.

The principal components of the electric operator are a charging motor, motor controller, gear box, cam mechanism, closing solenoid, motor fuse, and check switches to monitor the positions of the mechanical components. The charging motor, gear box, and cam mechanism are integrated into a single assembly at the factory. Electric operators may be selected to operate with a source power of 120V ac or 24, 48, or 125V dc. The microprocessor based controller provides voltage-independent charging time, charging status indication, and software-controlled closing logic for the electric close function.

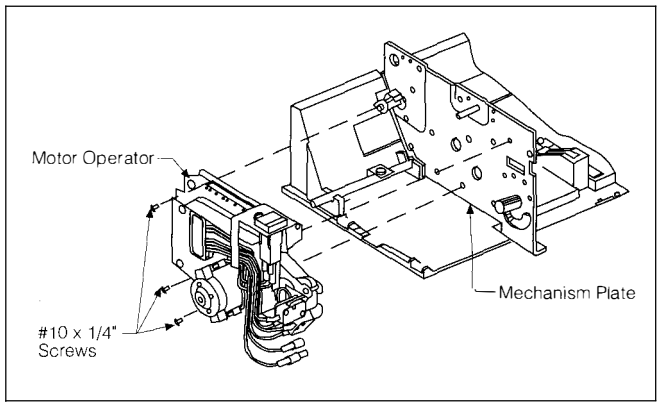


1.) Install the cam mechanism, gear box and motor assembly.

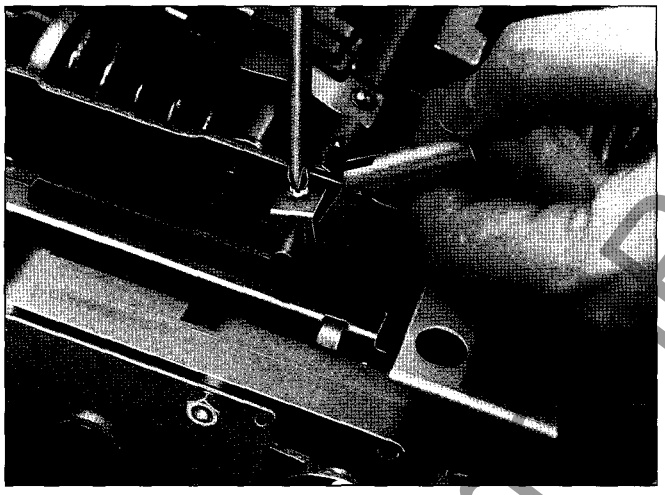


2.) Align the keyway of the shaft with the keyway of the charging arm.

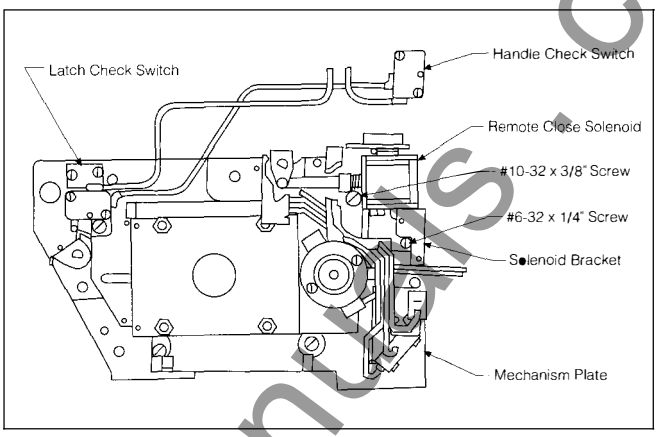
Electric Motor Operator



3.) Install the Motor Operator Assembly on the mechanism plate with the three #10 x 1/4" screws. Align the keyway of the charging shaft with the keyway of the charge arm. All mounting screws are Long-Lok® self-locking screws. (Torque screw to 25-32 in. lbs.).

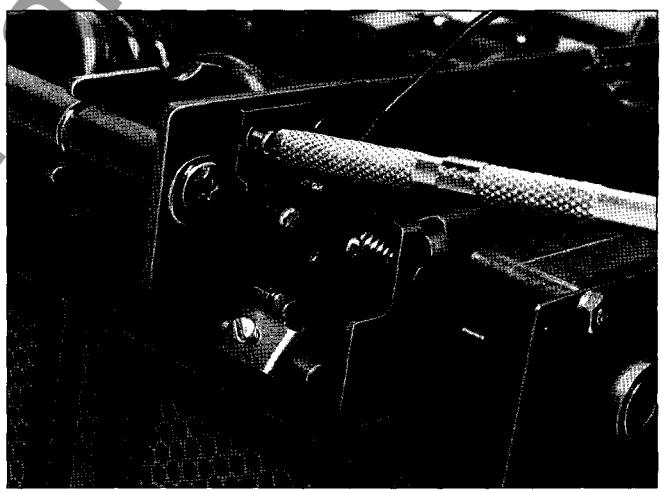


4.) Locate and slide the Remote Close Lever on the Closing D Shaft located on the Mechanism. Secure the Lever by tightening the Set Screw to 6-8 in-lbs.



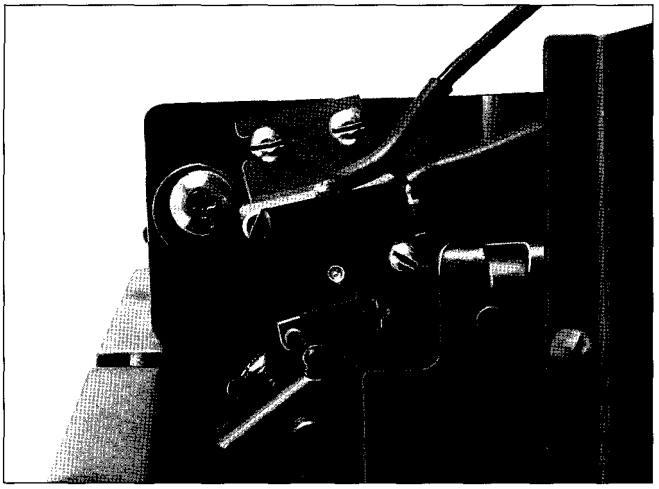
5.) Locate the Remote Close Solenoid. Remove the Handle Check Switch from the Solenoid Bracket. Mount the Remote Close Solenoid to the mechanism plate. Make sure that the Solenoid Plunger is seated inside the Solenoid. Secure the assembly with the #6-32 x 1/4" screw (torque to 9-10 in-lbs) and #10-32 x 3/8 screw (torque to 25-32 in-lbs). Reattach the Handle Check Switch to the Solenoid Bracket with the #4-40 x 1/2 screws (torque to 4-6 in-lbs).

NOTE: If the handle check switch was removed from the solenoid bracket, it should be re-installed at this point.

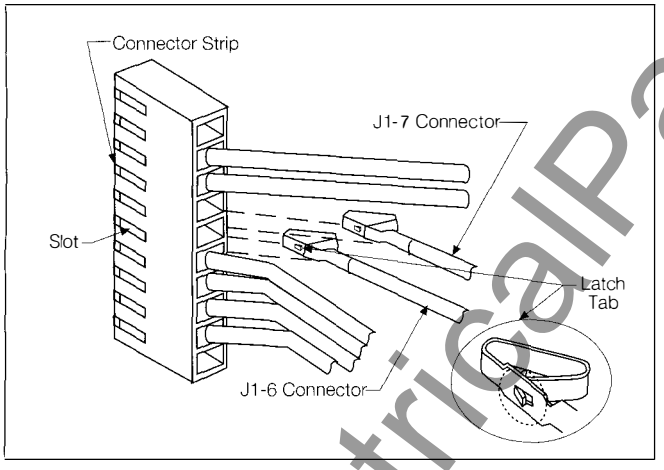


6.) Attach the Latch Check Switch on the mechanism plate with the two #6-32 x 1/4" screws. Adjust the switch while holding the Actuator against the switch body.

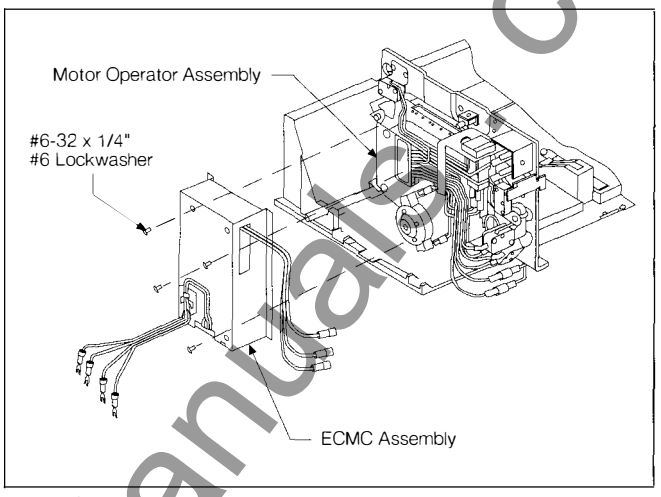
Electric Motor Operator



7.) Adjust the switch while holding the Actuator against the switch body. Adjust the switch so that there is .11-.12 inch clearance between the switch Actuator and the Latch Lever. Tighten screws to 9-11 in. lbs. Check adjustment after tightening screws and readjust if necessary.

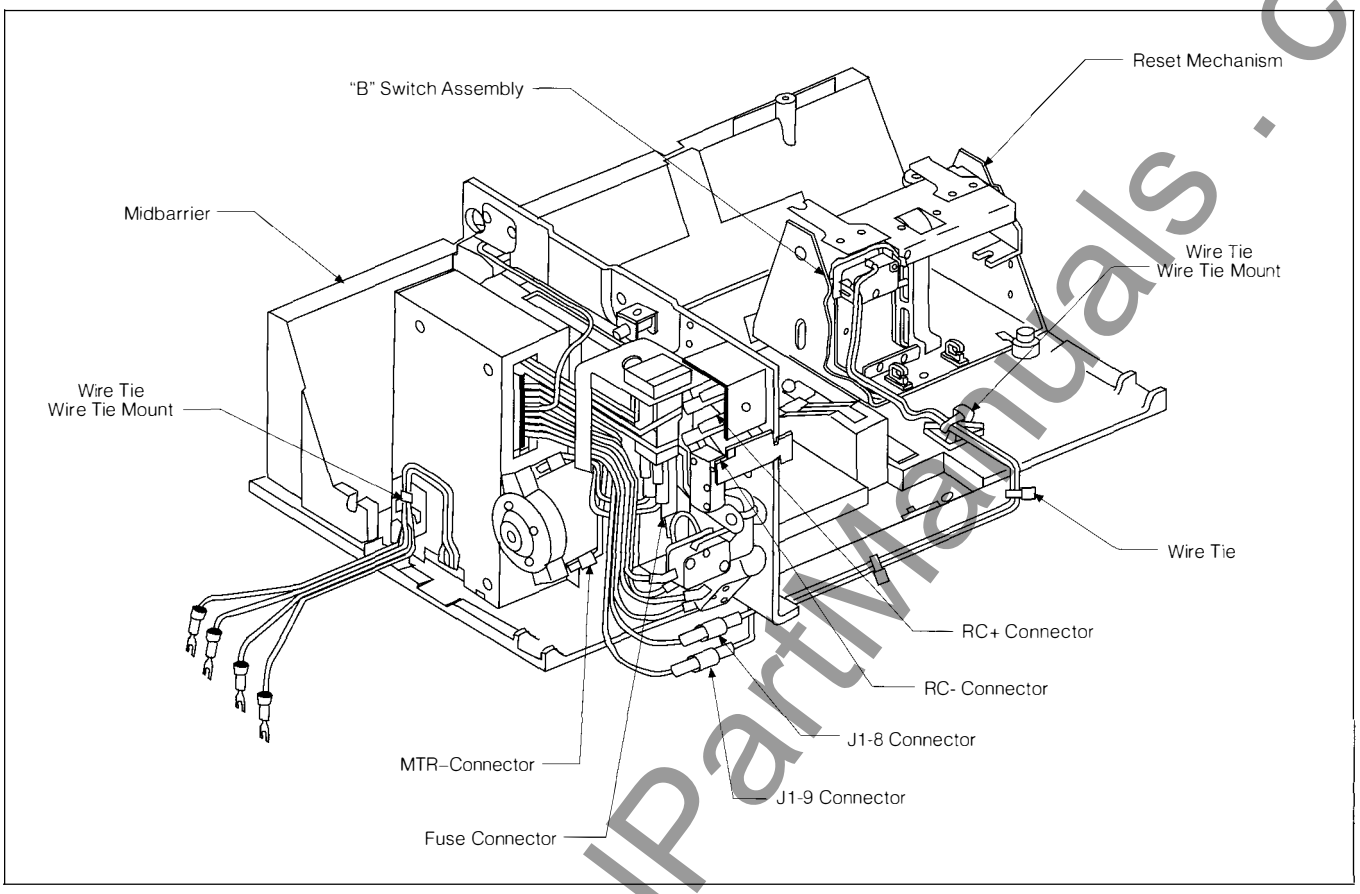


8.) Plug J1-6 and J1-7 Connectors into the Connector Strip until latch tabs snap into slots. Gently pull wires to ensure they are latched into the Connector Strip.

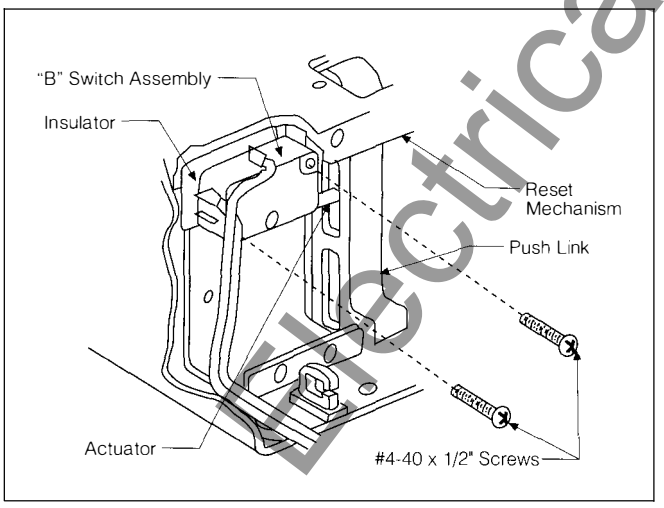


9.) Install the Electric Motor Controller (ECMC Assembly) to the Motor Operator Assembly with the four #6-32 x 1/4" screws and #6 lockwwashers. Torque screws to 9-11 in.-lbs.

Electric Motor Operator



Mounting of "B" Switch



"B" Switch Assembly

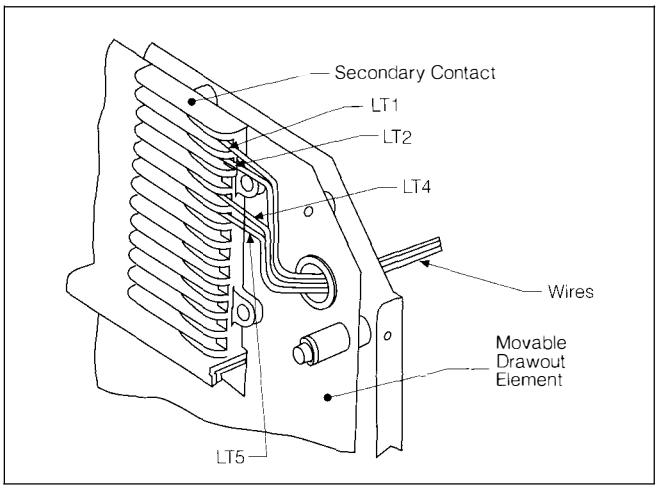
10.) Connect the MTR-Connector and the Fuse Connector to the Motor and Fuse Holder. Connect the RC+ Connector and RC- Connector to the Remote Close Solenoid.

11.) Install the "B" Switch assembly on the reset mechanism assembly. Make sure to install the Insulator between the Switch and metal bracket. Secure the assembly with the two #4-40 x 1/2" screws. Torque screws to 4-6 in-lbs. Check to be sure the Actuator fits into the slot in the push link and does not bind.

12.) Route the two wires attached to the "B" Switch from the right side of the breaker to the left side of the breaker. The wires need to be fed under the mechanism plates.

13.) Connect the J1-8 Connector and the J1-9 Connector.

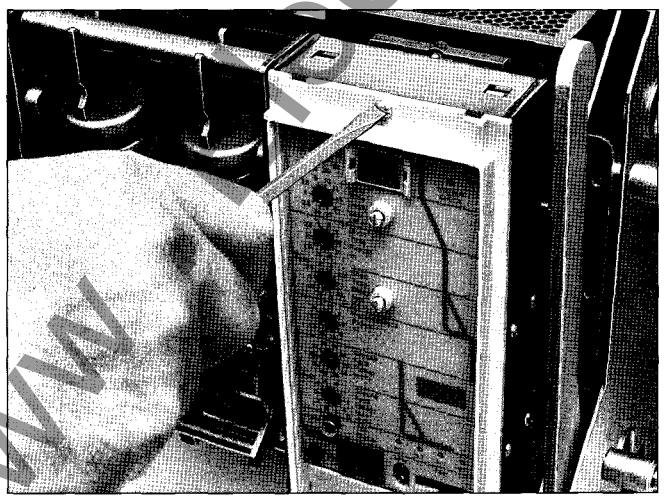
Electric Motor Operator



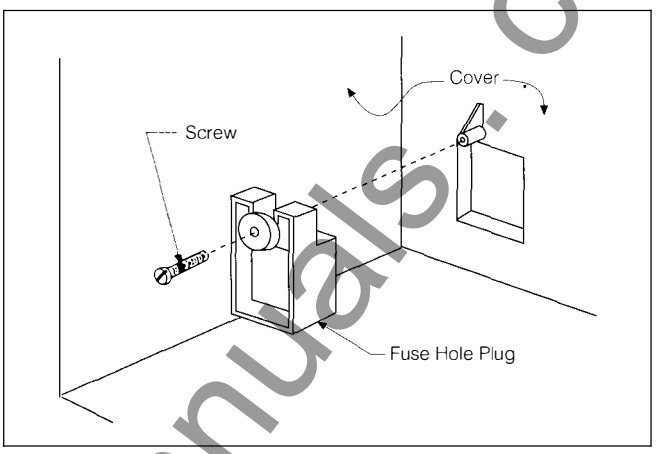
14.) Re-install the side plate mechanism assemblies if they had been removed.

15.) Feed wires through wire opening in side panel as illustrated above.

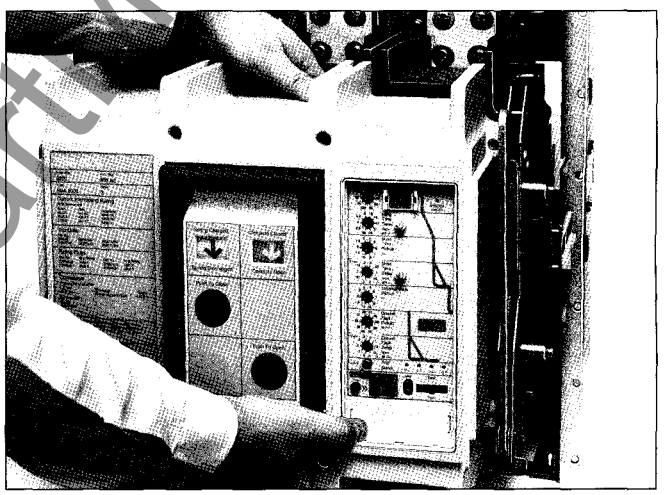
16.) Replace the trip unit by pushing it onto the plug. Slide the trip unit over the bracket pins.



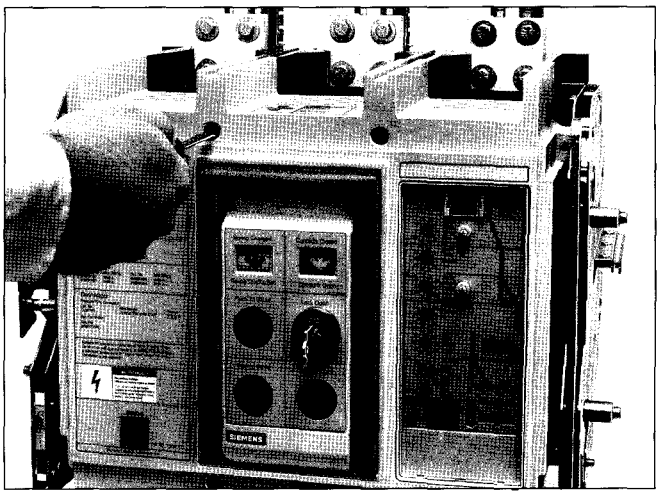
17.) Secure the unit by replacing the mounting screw. Torque screw to 6-8 in. lbs.



18.) Before replacing the breaker cover remove the fuse hole plug from the inside of the cover as illustrated above. Also cut out the "Fuse not installed" area of the rating label.

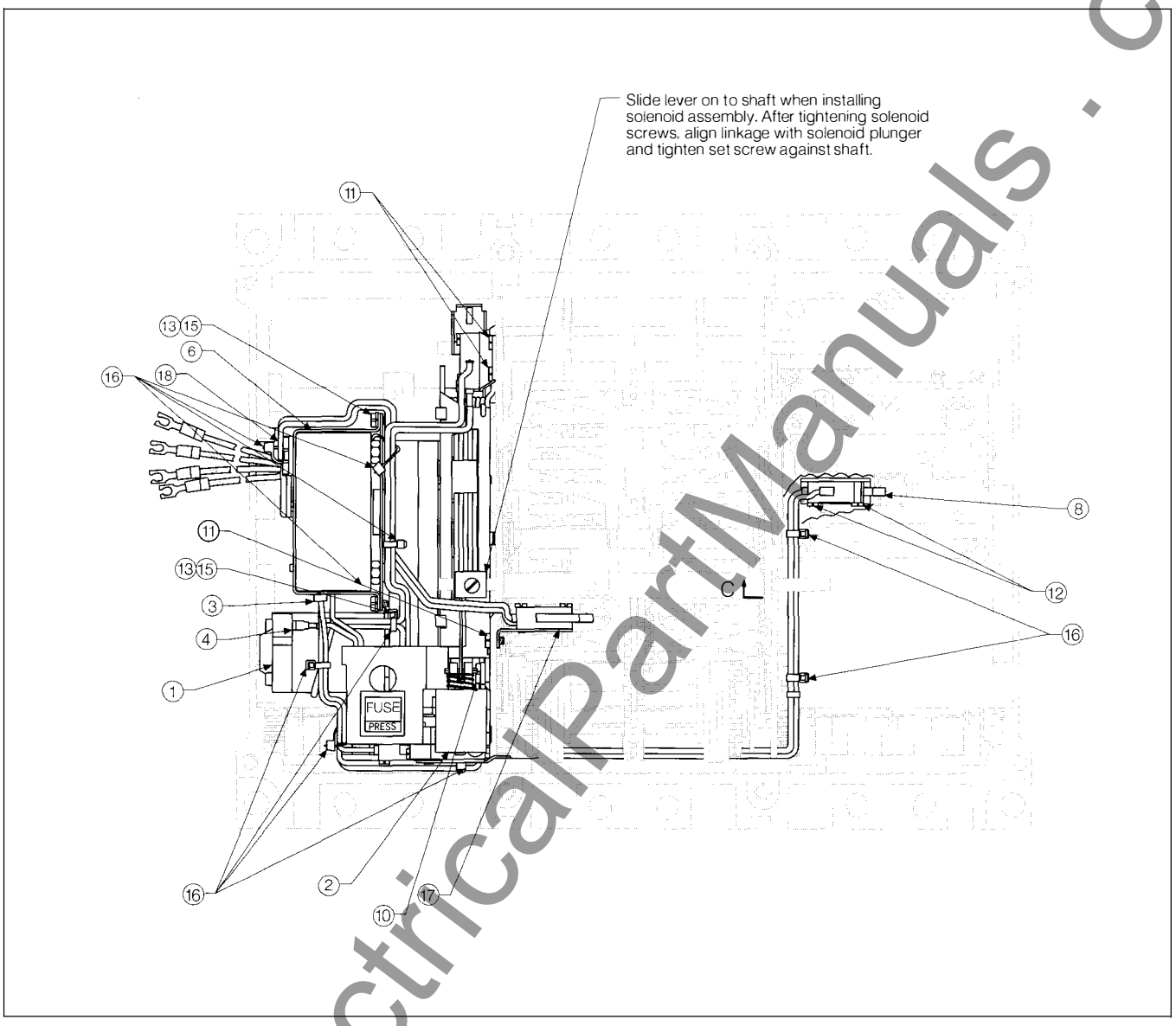


19.) Replace front cover being careful not to pinch the wires that are routed to the secondary discon-nects or terminal block.



20.) Replace the (4) #10 Phillips head screws at the corners and the (4) 1/4" Phillips head screws in recesses in cover.

Electric Motor Operator



Legend

1. Motor Operator Assembly
2. Remote Closing Solenoid Switch
3. Connector Strip
4. Motor Fuse Connector
5. UL Label
6. DC or AC ECMC Assembly
7. Electric Operator Label
8. "B" Switch Assembly (Motor Operator)
9. #10-32 UNC-2B x 1/4" PHMS
10. #10-32 UNC-2B x 3/8" PHMS
11. #6-32 UNC-2B x 1/4" PHMS
12. #4-40 UNC-2B x 1/2" PHMS
13. #6 Lockwasher
14. #6-32 UNC-2B x 1/4" PHMS
15. #6-32 UNC-2B x 1/4" Type F CPHS
16. Cable Tie
17. Local Close Switch Assembly
18. Wire Tie Adhesive Mounting Base

Electric Motor Operator and Local Electric Close

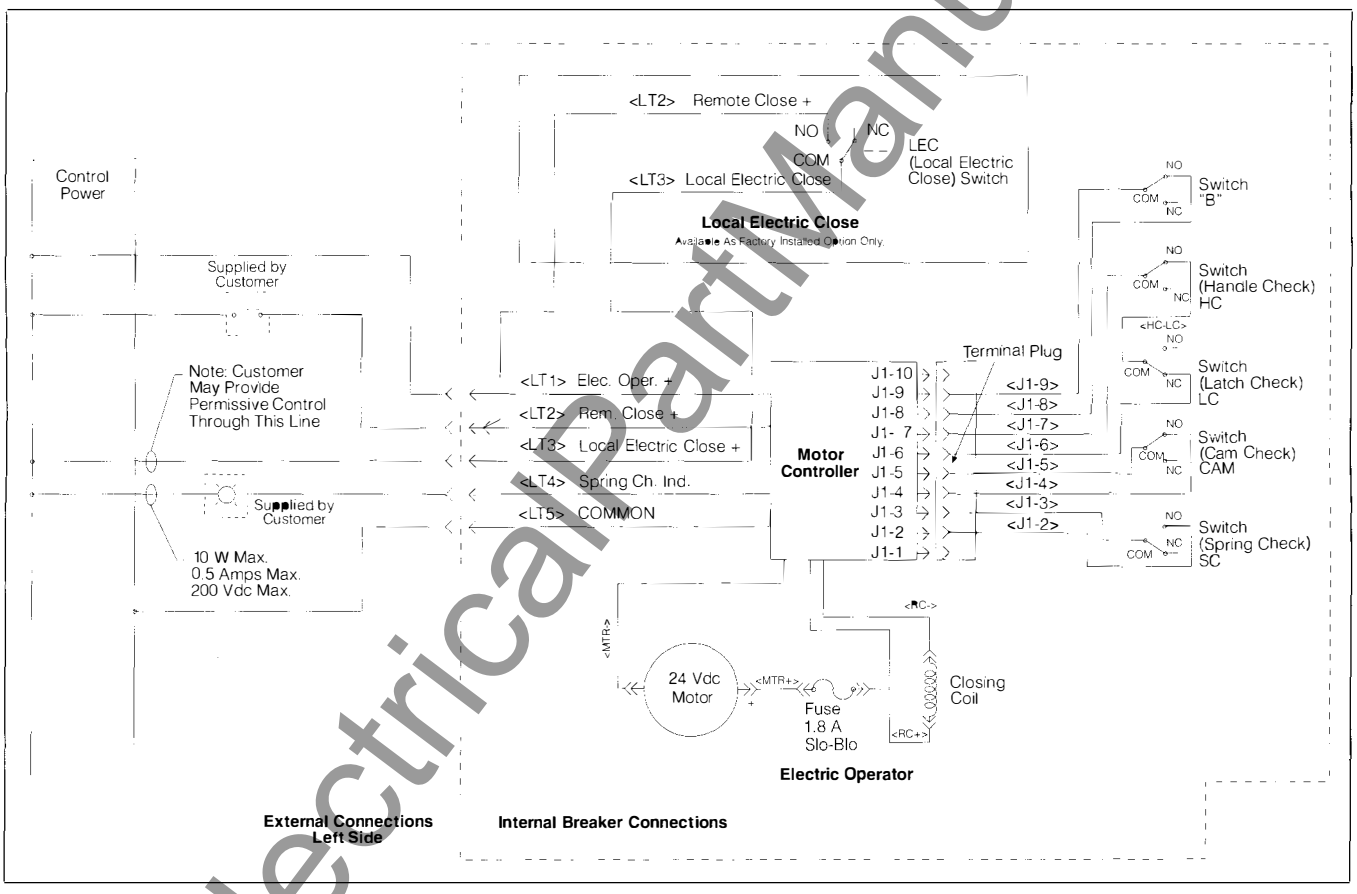
A charging status indication (contact accessible at terminal point <LT4>) provides the capability to remotely monitor the stored energy mechanism. The contact is "on" if the springs are fully charged. The contact will be alternately "on" for 300 milliseconds and "off" for 300 milliseconds as the springs are charging or until 20 seconds have elapsed, approximately twice the time required to charge the springs. If the springs are not charged after 20 seconds, the contact alternates between 1 second "on" and 1 second "off," indicating that there is a problem. SB breakers with an electric operator may be charged manually if the electric operator is disabled for any reason.

Local Electric Close

The local electric close allows the user to electrically interlock a local closing operation. It is available for breakers with either the electric operator or remote closing solenoid. The local electric close is commonly used in conjunction with a manual close-blocking device (see Closing Blocking Device, page 68).

The electric close pushbutton switch is installed in the center escutcheon of the front panel, directly below the push-to-close button switch.

The Local Electric Close accessory is **not** field installable.



Electric Motor Operator Schematic Diagram

Electrical Test Information

1.) Attach test circuit to accessory leads. Apply rated voltage to the LT1 and LT5 connections. The Electric Operator should charge the breaker. During charging the lamp connected to LT4 should flash. After charging is complete the lamp connected to LT4 should remain lighted.

2.) With voltage applied to LT1 and LT5, apply voltage to LT2. The breaker should close and the Electric Operator should recharge the breaker spring.

3.) If the Electric Operator does not function properly during check procedure check for incorrect installation or wiring.

NOTE: For Trouble Shooting Guide see page 97.

Remote Close Assembly

For preliminary installation procedures review procedures outlined on pages 36 and 37.

1.) Remove the rubber band from the solenoid plunger. Slide the remote close lever on the closing D-shaft but do not tighten the set screw at this time (Figure 1).

2.) Place the return spring over the solenoid plunger and slide the solenoid over the solenoid plunger (Figure 1).

3.) Attach the remote close assembly to the mechanism plate using the (2) # 10 screws provided. The assembly is aligned by a set-out in the mechanism plate that fits in a hole in the remote close bracket.
Note: Torque screws to 24-32 in. lbs.

4.) Align remote close link with solenoid and tighten set screw (see TOP VIEW Detail in Figure 1).
Note: Torque set screw to 6-8 in. lbs.

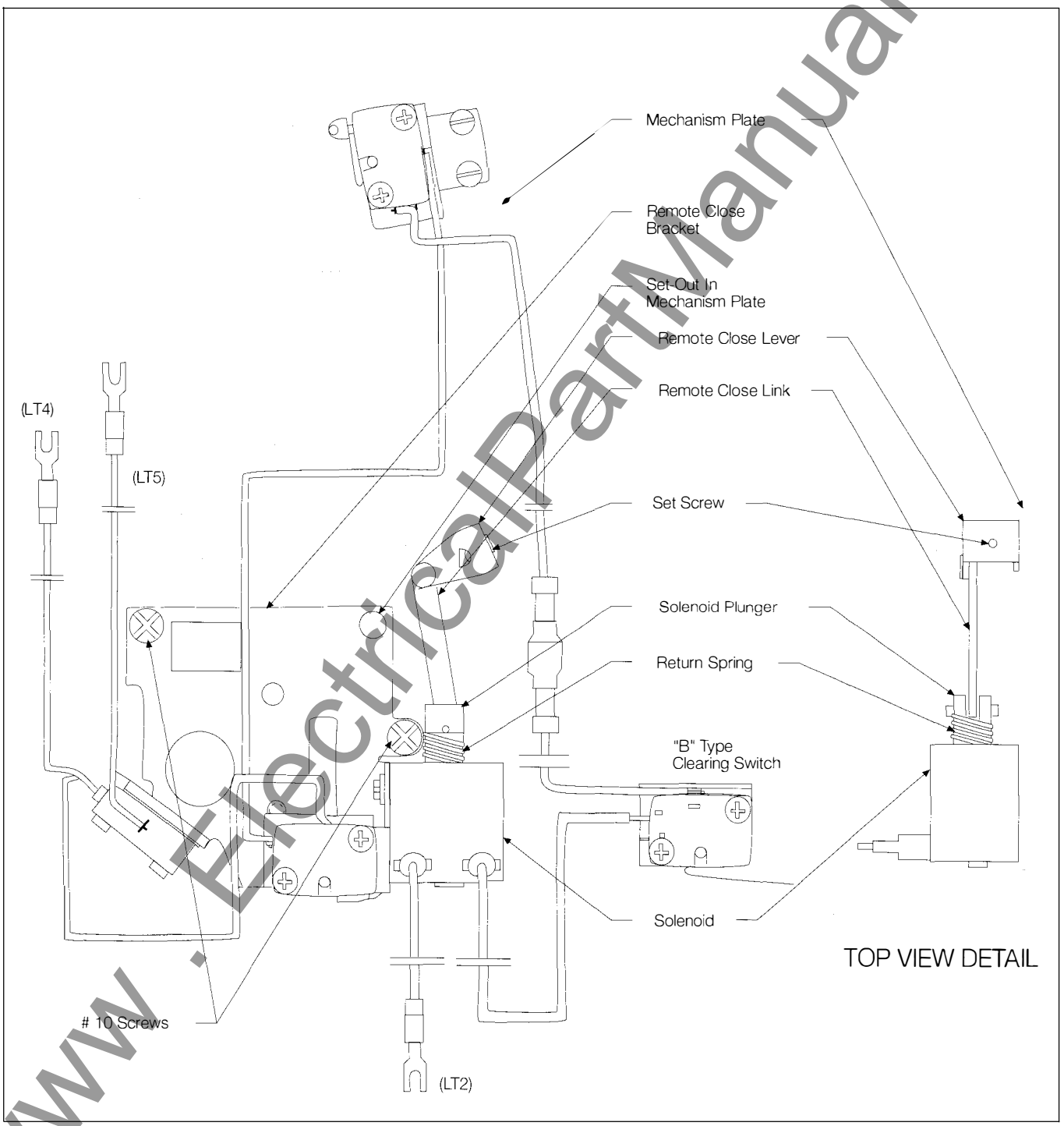


Figure 1. Remote Close Accessory and Bracket Mounting

Remote Close Assembly

5.) Install the latch check switch assembly (see Figure 2). Secure the latch check switch assembly to the mechanism plate using (2) #6 screws provided. Do not tighten screws until the latch check switch assembly is properly adjusted.

6.) Adjust switch (see Figure 3). When switch is properly adjusted tighten screws.
Note: Torque screws to 8-11 in. lbs.

7.) After tightening screws check to ensure that tightening of screws did not affect switch adjustment.

8.) Locate the reset mechanism (See Figure 5).

9.) To mount the "B" switch, first make sure that the switch lever is inside the top cavity of the pusher link (See Figure 4).

10.) Make sure that the switch lever rests on the pusher link when the breaker main contacts are open (See Figure 4). Place insulator between "B" switch and bracket. Secure that "B" Switch with the (2) #4 screws provided
Note: Torque screws to 5-6 in. lbs.

11.) Route wires from "B" switch (See Figure 5). Route wires beneath mechanism plates as shown. Install cable tie mounts and cable ties (See Figure 5).

12.) Connect wire marked RC from "B" switch to solenoid connector. (See Figures 4 and 5).
Connect wires marked LC-B together.

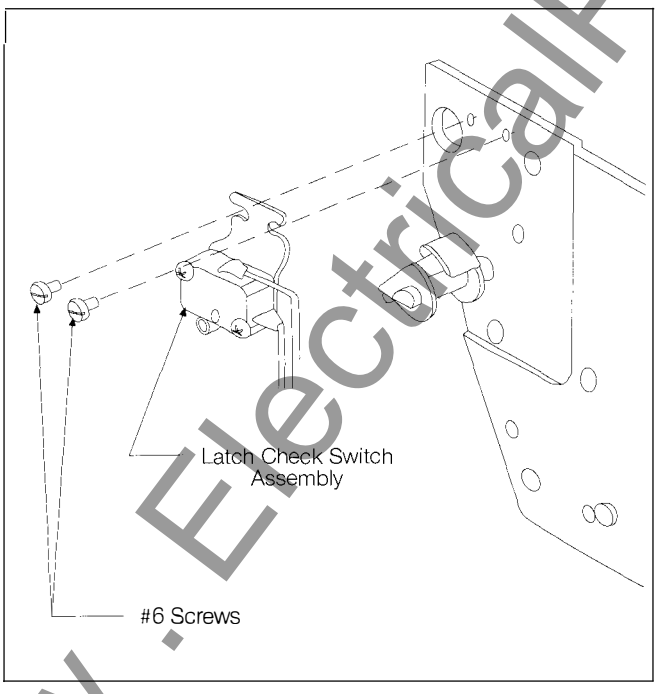


Figure 2. Latch Check Switch Adjustment

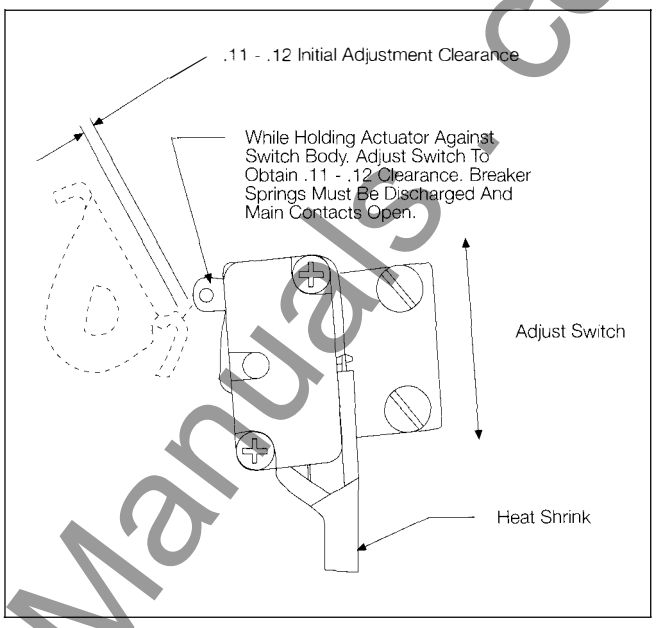


Figure 3. Latch Check Switch Assembly

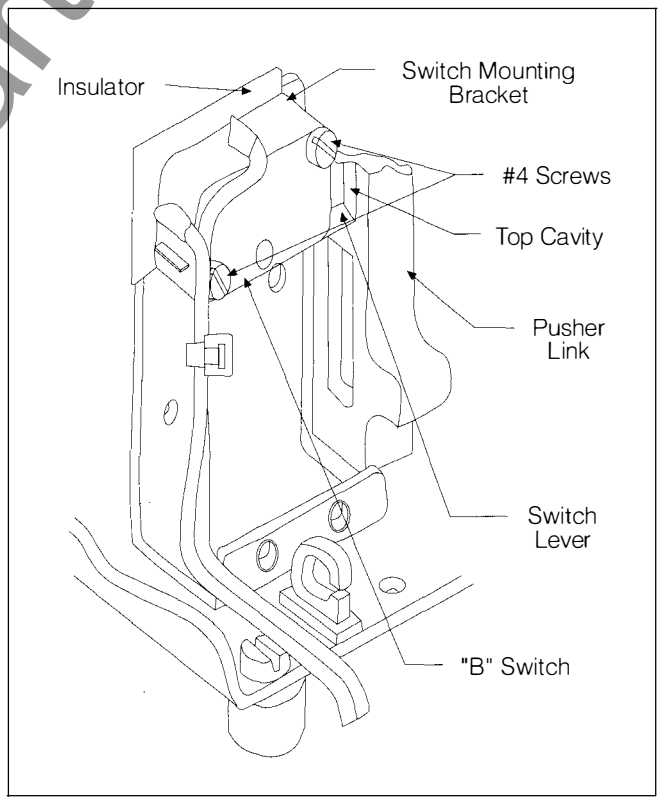


Figure 4. "B" Switch Mounting

Remote Close Assembly

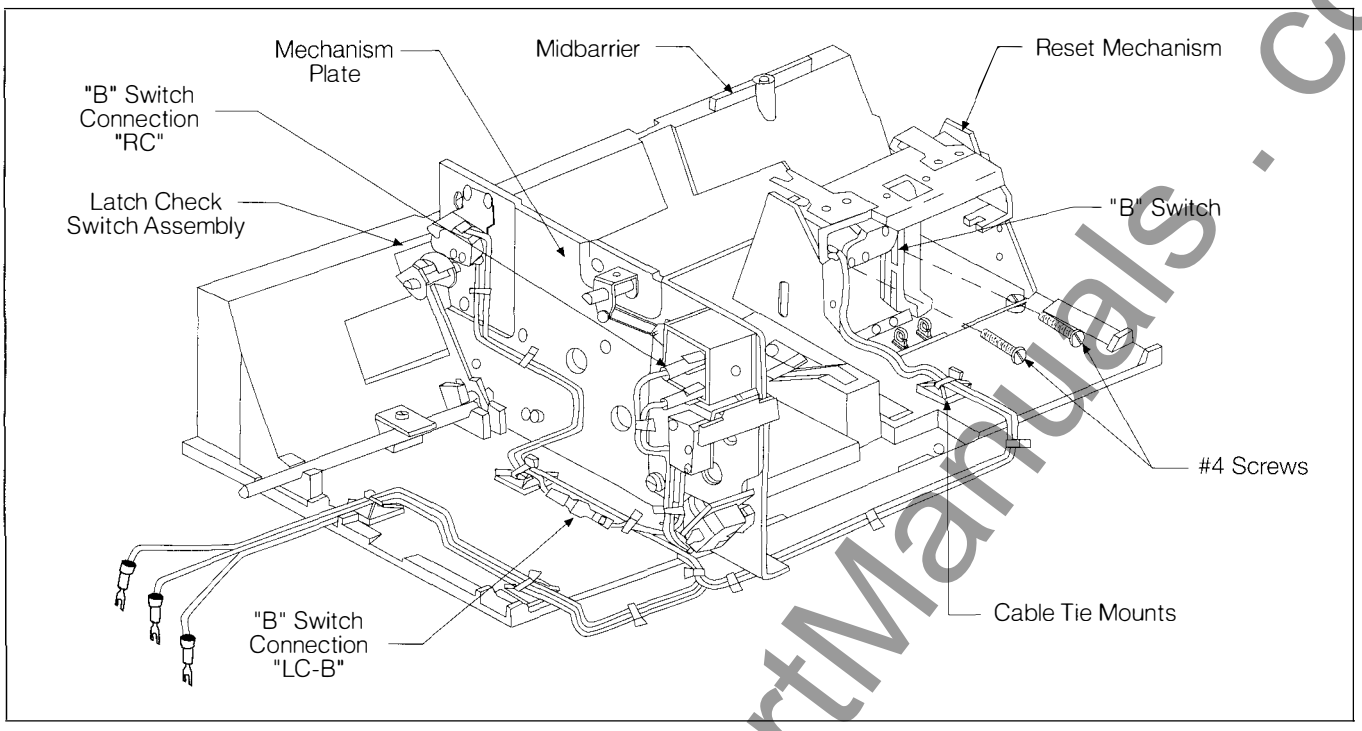


Figure 5. Mounting Of Remote Close Accessory and Wire Routing

13. Route and tie wires as shown in Figure 6.

14. Replace the trip unit by pushing it onto the plug. Slide the trip unit over the bracket pins. Secure the trip unit by replacing the mounting screws. Torque screw to 6-8 in. lbs.

15. Apply remote close accessory label to side of the breaker cover. Mark label on the opposite side of the cover to indicate that the remote close has been installed.

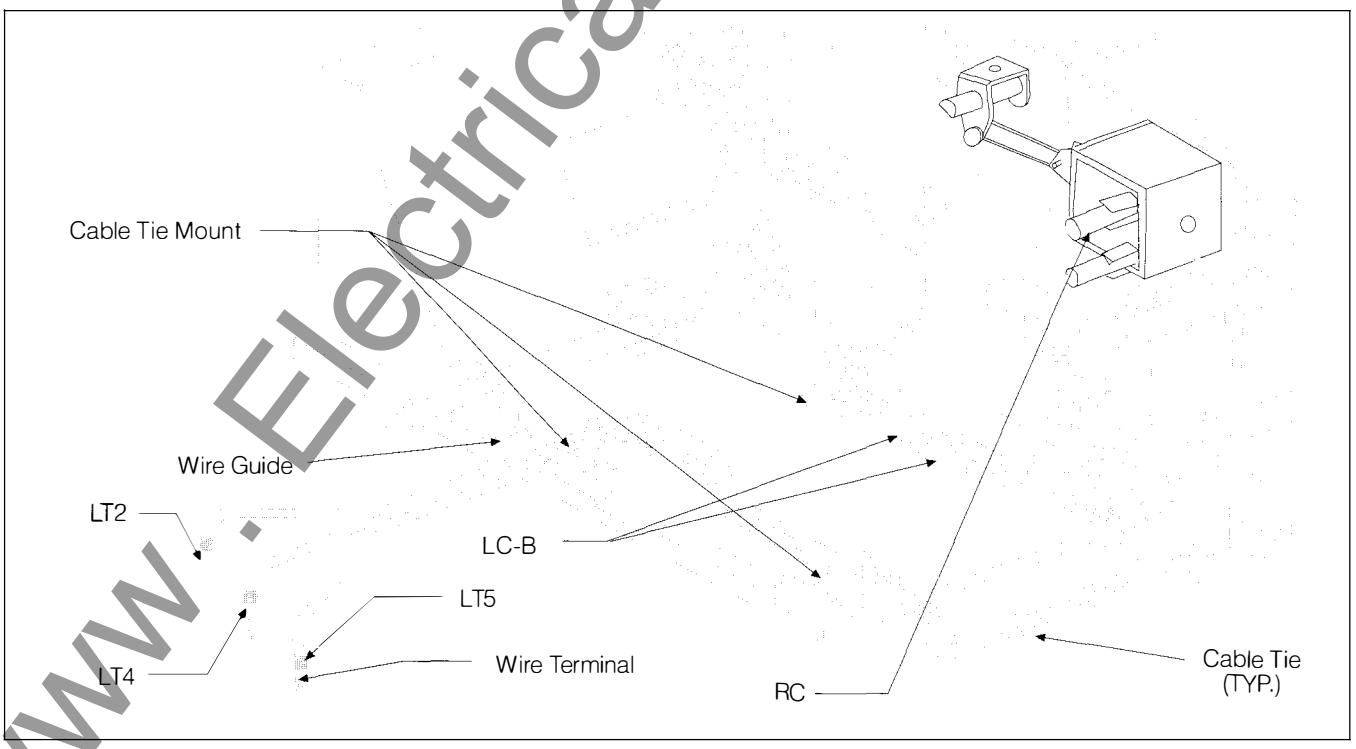
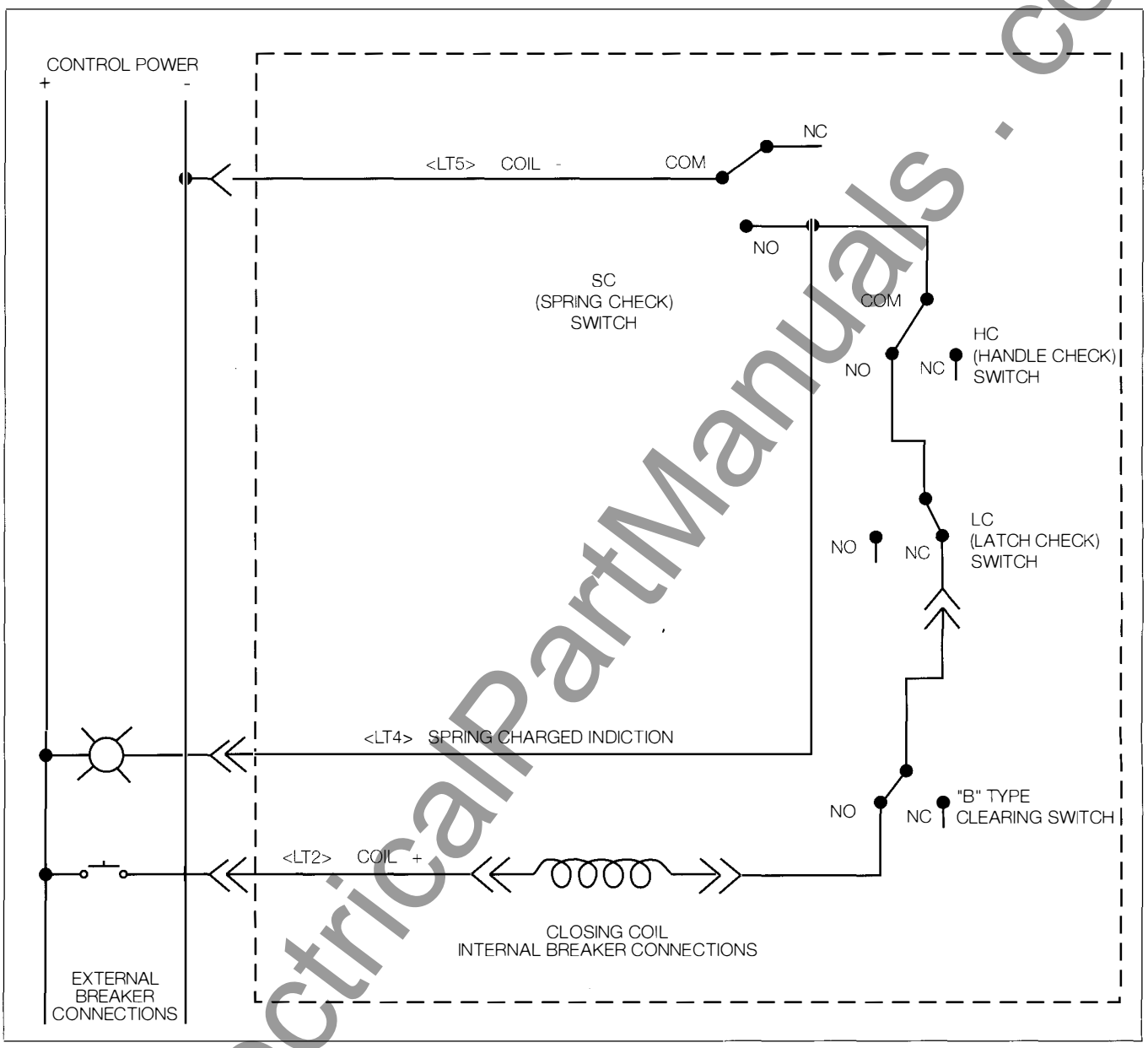


Figure 6. Wire Routing Assembly-Left Side

Remote Close Assembly



Remote Close Schematic

16. Replace the breaker cover. Check to ensure that wires exit the breaker through the wire guide and are not pinched by the breaker cover. Torque # 10 (corner) cover screws to 28-32 in.-lbs. Torque 1/4" cover screws to 68-75 in.-lbs.
17. For fixed mounted breakers connect the insulated terminals to the proper terminal block locations. For drawout breakers follow steps 18 and 19.
18. Route wires through the hole in the drawout movable element. (Figures 7).
19. Connect the insulated terminals to the proper secondary disconnect locations (See Figure 7).

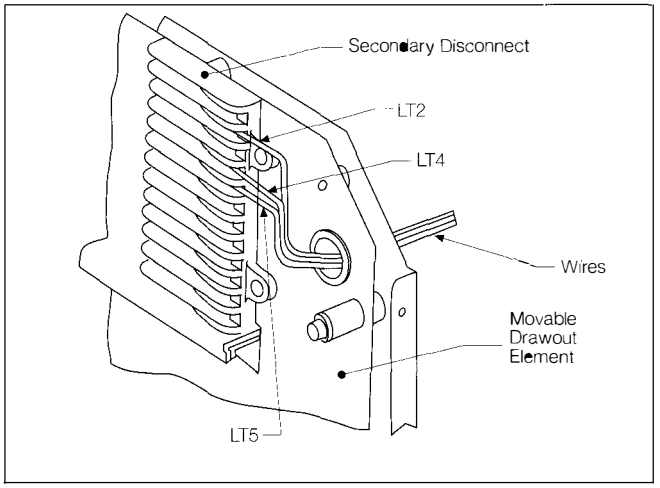
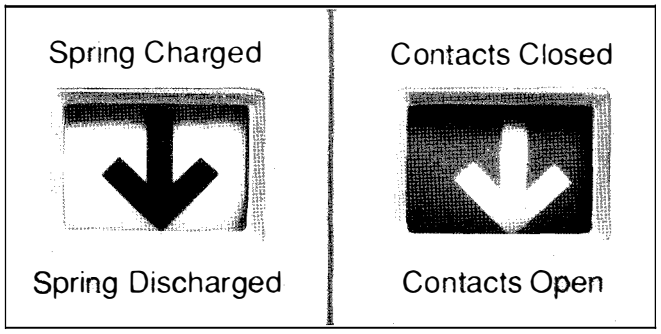
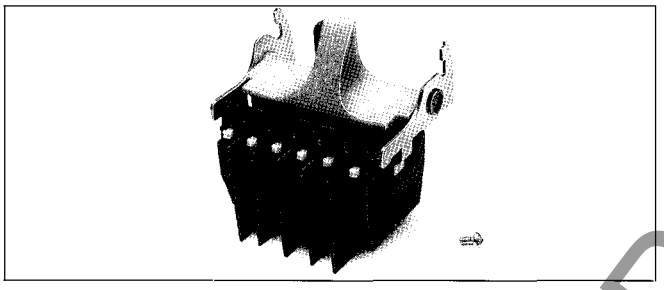


Figure 7.

Auxiliary Switches



CAUTION: Do not attempt to install an accessory with the breaker "Closed" or "Charged". Make certain breaker is "Open" and "Discharged" as shown above. Personal injury or mechanical damage may occur. Preliminary installation procedures are outlined on pages 36-37.



Auxiliary Switches Kit (6 switches shown)

Auxiliary Switches

Auxiliary switches are used as signal contacts to indicate the open/closed status of the breaker's main contacts. The status of the main contacts is indicated by the open/closed status of the auxiliary switches as follows:

"A" or "NO" Contacts: Open when main contacts are open. Closed when main contacts are closed.

"B" or "NC" Contacts: Closed when main contacts are open. Open when main contacts are closed.

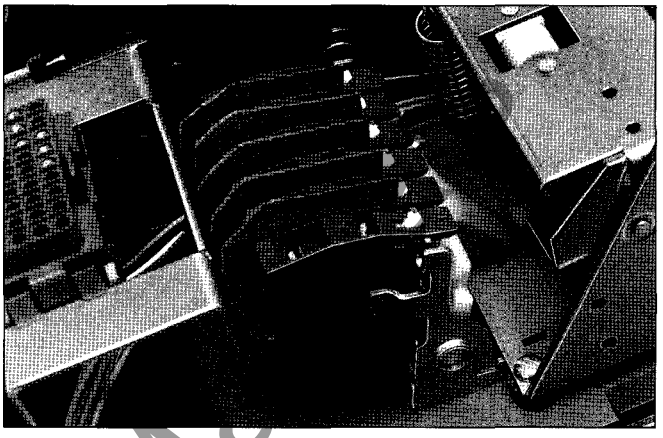
A maximum of six "A" and "B" auxiliary switches can be installed in the breaker. The switch contact ratings are:

Switch Contact Ratings

Supply Voltage	Ampere Rating
120V ac	10 Amps
240V ac	10 Amps
480V ac	6 Amps
24V dc	3 Amps
125V dc	0.5 Amps

If practical, the auxiliary switches should be installed prior to the SB breaker being installed in the switchboard. Before starting the installation, the breaker should be in the open position and the stored energy mechanism should be discharged. A drawout constructed SB breaker, already installed in the switchboard, should be placed in the fully withdrawn position to allow access to the secondary disconnects.

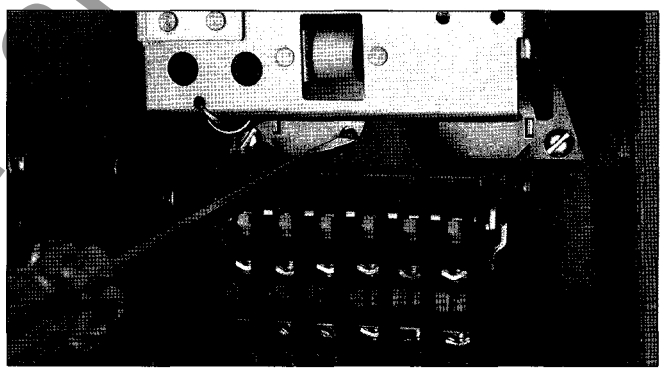
The auxiliary switches are installed on the right side of the front compartment, behind the trip unit and below the reset plate.



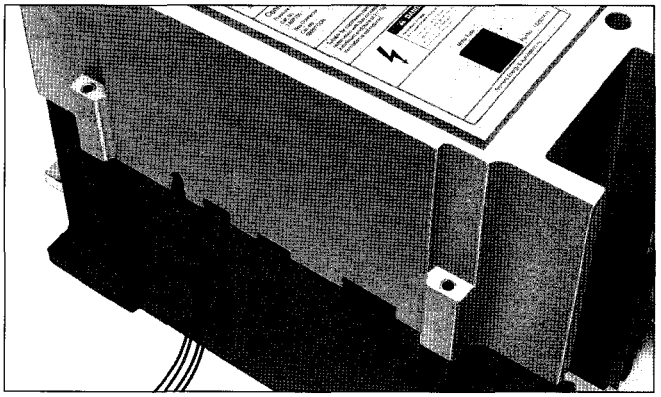
Auxiliary Switches are installed on the right side.

Follow these steps to install the auxiliary switches:

1.) Position the auxiliary switch assembly so that it is aligned with the retaining slot.
2.) Tilt the auxiliary switch assembly forward and slip the switch tab into the retaining slot.

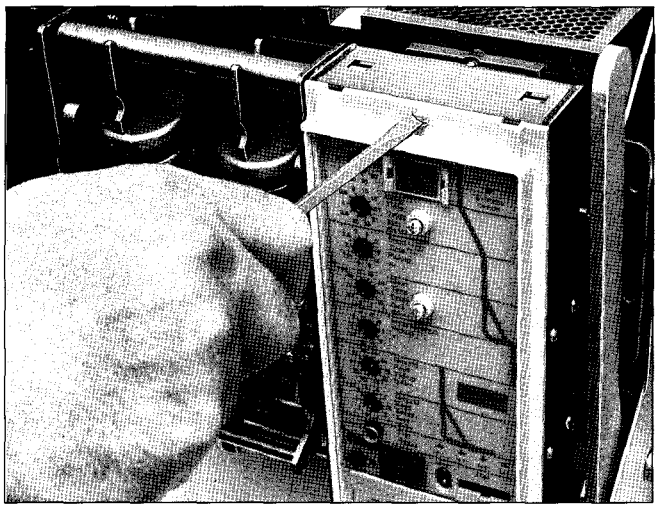


3.) Secure the assembly in place.

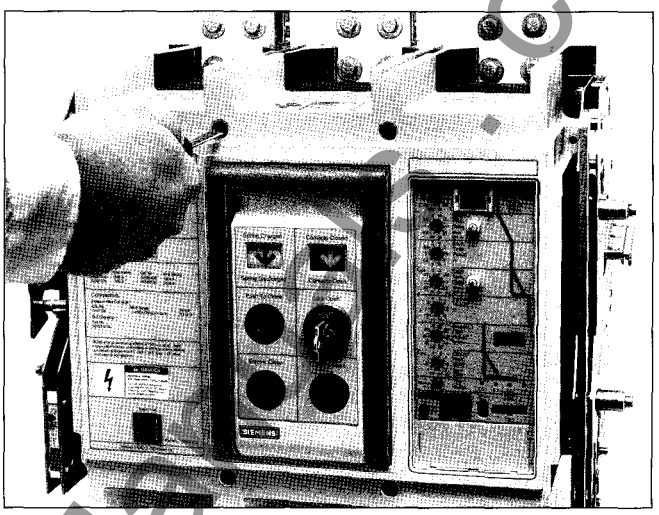


4.) Run the auxiliary switch wires:
   a.) Run the wires through the access hole to the secondary disconnects or terminal blocks on the right side.
   b.) Connect the wires to the designated terminal points.
   c.) Secure the wires in place with wiring straps as required. Wires for auxiliary switch(s) exit from the breaker right hand side - photo is for illustration purposes only.

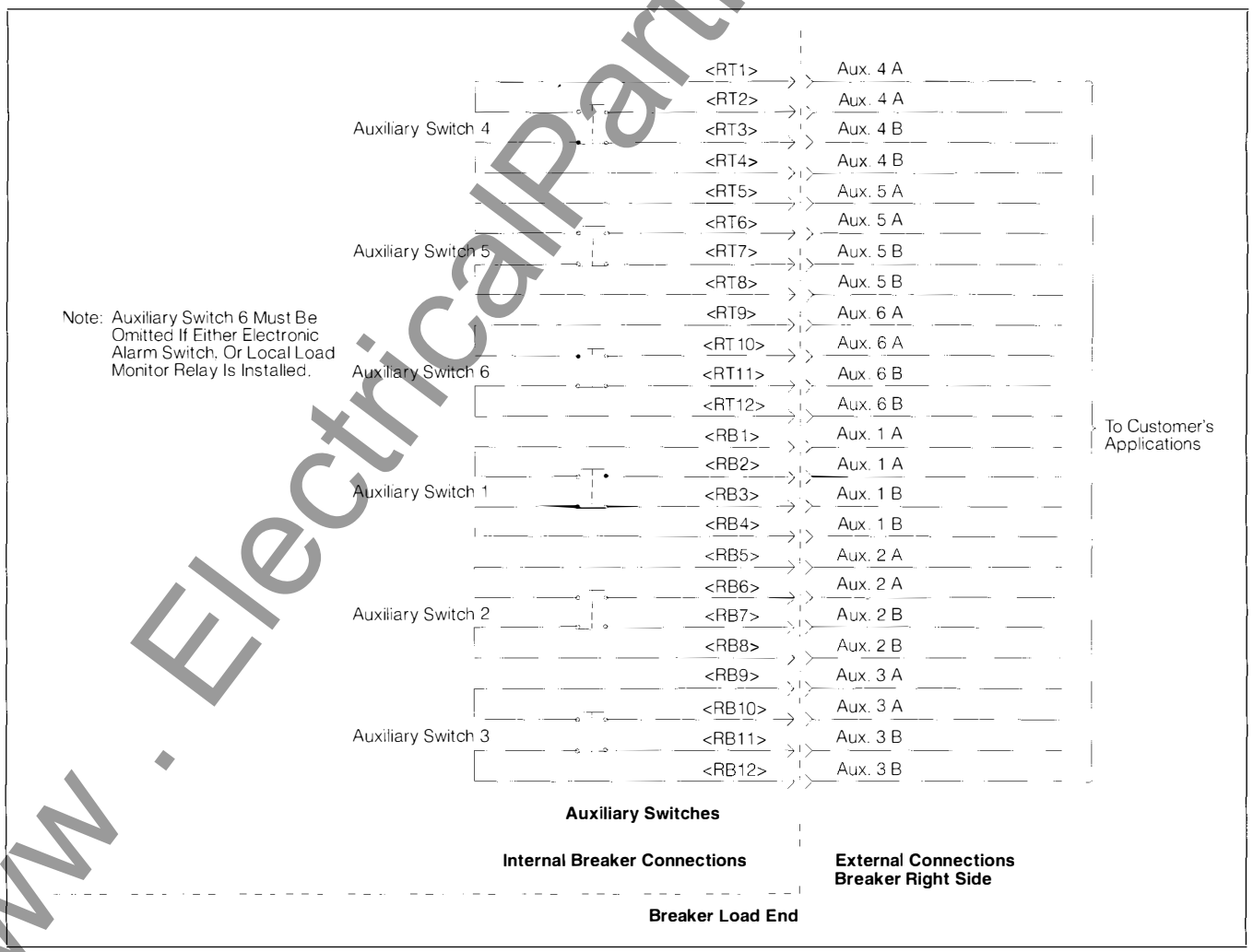
Auxiliary Switches



5.) Secure the trip unit in place with the retaining screw located at the top of the trip unit. Torque to 6-8 in. lbs. If trip unit top is not secured properly, the interlock will prohibit closing of the breaker.

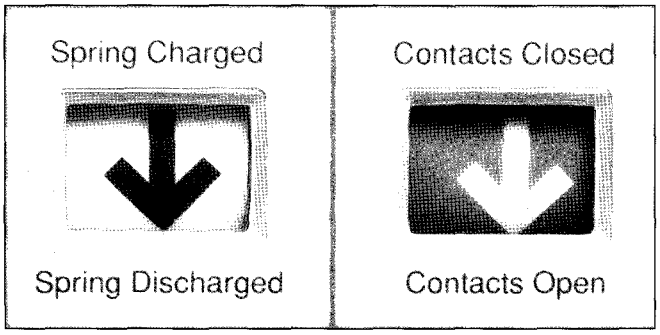


6.) Replace the front cover of the breaker, being careful not to pinch wire leads routed to secondary disconnects or terminal blocks. Secure with eight (8) Phillips head screws. Installation of the auxiliary switch is complete.

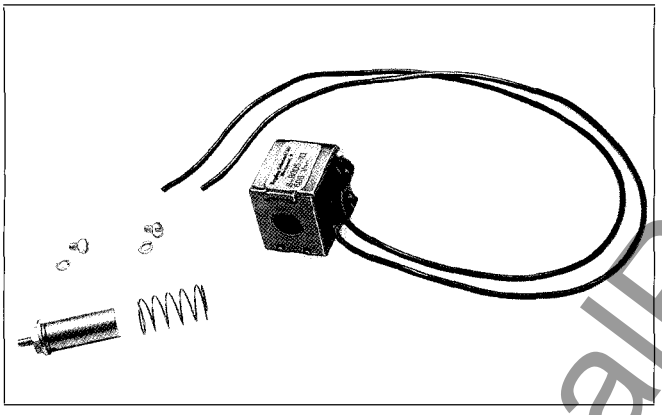


Wiring Information

Undervoltage Release (UVR) Solenoid



CAUTION: Do not attempt to install an accessory with the breaker "Closed" or "Charged". Make certain breaker is "Open" and "Discharged" as shown above. Personal injury or mechanical damage may occur. Preliminary installation procedures are outlined on pages 36-37.



Undervoltage Release Kit

Undervoltage Release

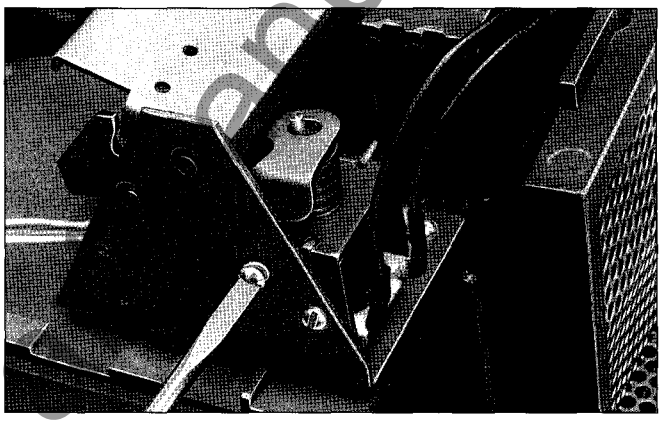
The undervoltage release (UVR) trips the SB breaker in accordance with the pick-up and dropout requirements of UL-489. The monitored voltage is normally the voltage on the line side of the breaker. Available UVR coil ratings are 120, 240, 480, or 600V ac or 12, 24, 48, or 125V dc. The UVR will instantaneously (no intentional delay) trip the breaker when the voltage drops below the trip value. Tripping can be delayed up to 0.5 seconds by using the external time delay undervoltage accessory with the UVR.

The UVR accessory kit consists of a trip solenoid to trip the breaker, mounting hardware, and internal wiring. The trip solenoid is installed on the right side of the front compartment, behind the trip unit and beneath the reset plate.

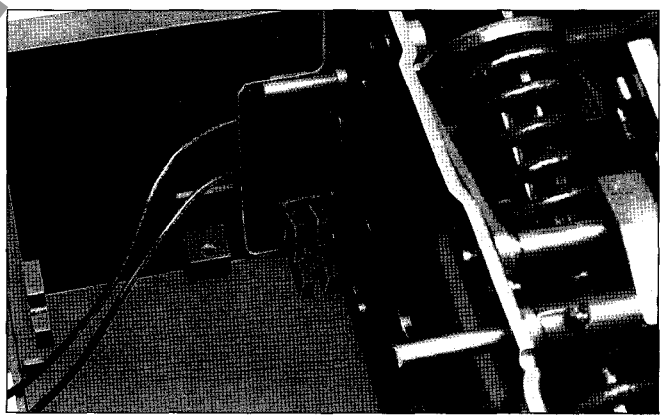
Notes:
1. Wire markings are shown in brackets <like this>.
2. LT indicates left-top terminal block or secondary connector.

If practical, the UVR should be installed prior to the SB breaker being installed in the switchboard. Before starting the installation, the breaker should be in the open position and the stored energy mechanism should be discharged. A drawout constructed breaker, already installed in the switchboard, should be placed in the fully withdrawn position to allow access to the secondary disconnects. If being installed in a drawout breaker, use access-hole in right side mechanism assembly.

To install the undervoltage release, first remove the SB breaker front cover and trip unit, if previously installed (see page 37).

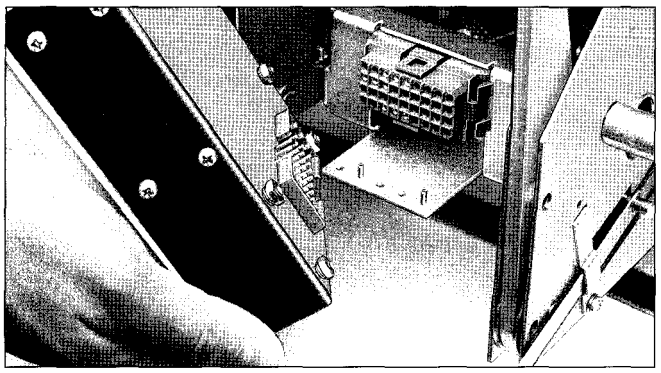


1.) Place UVR solenoid beneath breaker reset plate.
2.) Install UVR on top right side of reset mechanism.

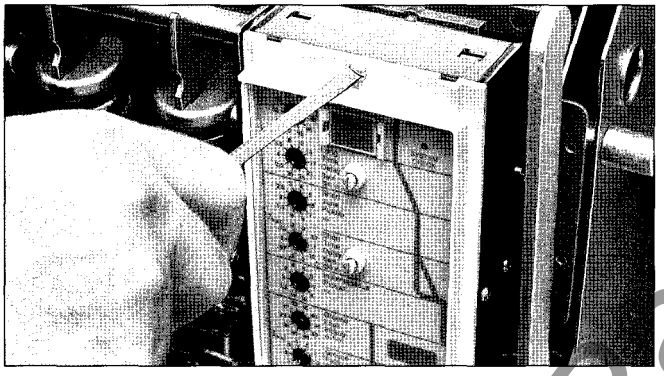


3.) Route the UVR solenoid wire leads across the back of the stored energy mechanism, located between the wire shield and the mid-barrier to the left side of the breaker.

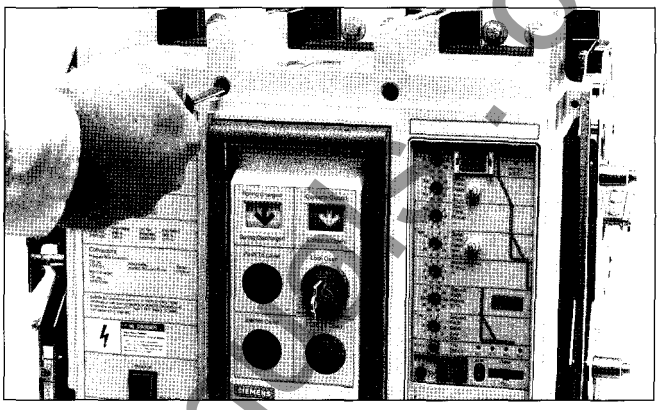
Undervoltage Release (UVR) Solenoid



4.) Re-install the trip unit.



5.) Secure the trip unit in place with the retaining screw located at the top of the trip unit. Torque to 6-8 in. lbs. If trip unit top is not secured properly, the interlock will prohibit closing of the breaker.

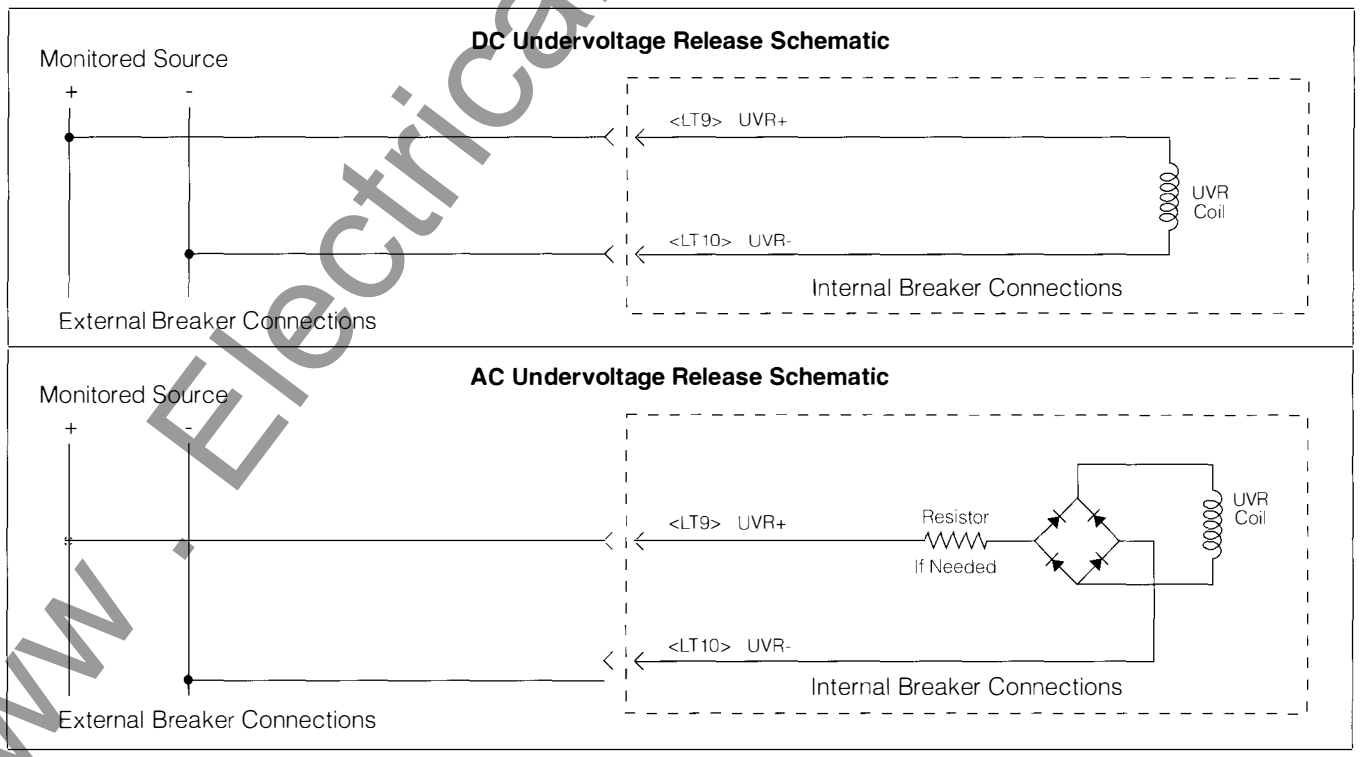


6.) Replace the front cover of the breaker, being careful not to pinch wire leads routed to secondary disconnects or terminal block. Secure with eight (8) Phillips head screws. Installation of the undervoltage release accessory is complete.

Undervoltage Release Ratings

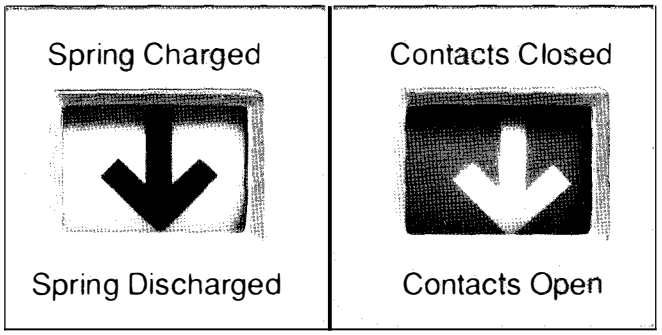
Catalog Number	Hold-in Current (Amperes)	Operating Voltage
SBUV12	.12	12V dc
SBUV24	.06	24V dc
SBUV48	.03	48V dc
SBUV125	.02	125V dc
SBUV120	.02	120V ac
SBUV240	.02	240V ac
SBUV480	.02	480V ac
SBUV600	.02	600V ac

Wire terminations on terminal block or secondary disconnect are shown below.

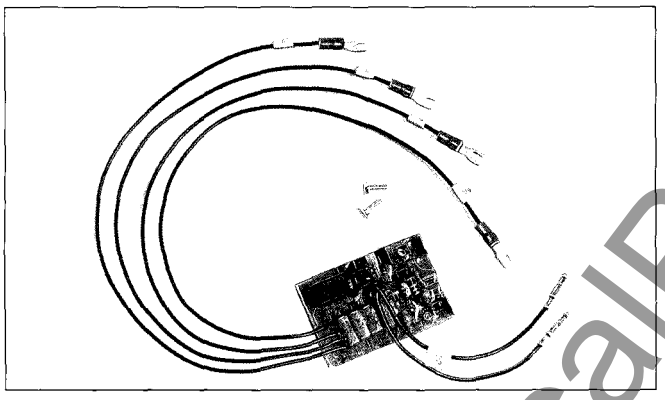


Undervoltage Release Solenoid Schematic Diagram

Electronic Bell Alarm - Display Module Relay



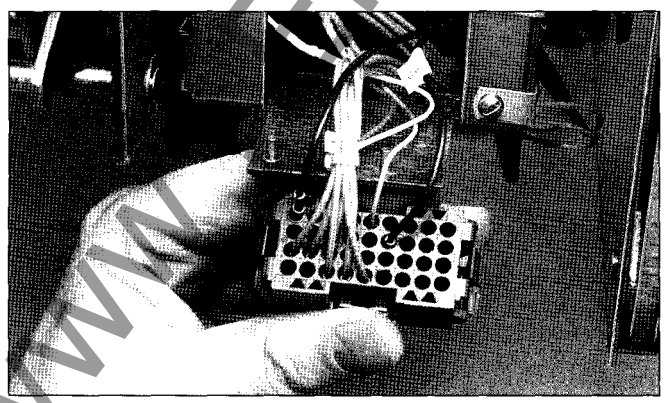
CAUTION: Do not attempt to install an accessory with the breaker "Closed" or "Charged". Make certain breaker is "Open" and "Discharged" as shown above. Personal injury or mechanical damage may occur. Preliminary installation procedures are outlined on pages 36-37.



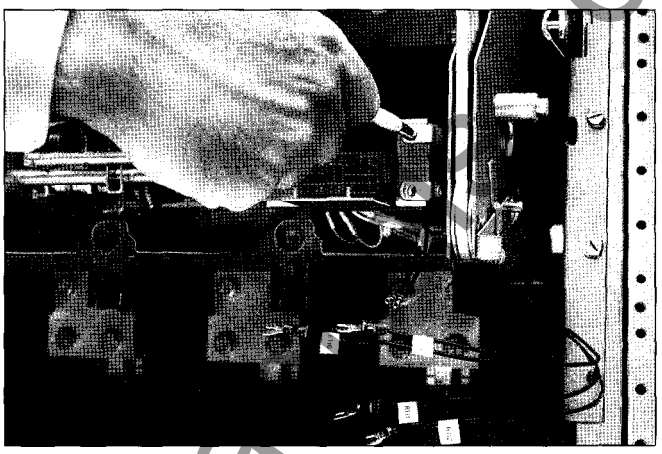
Electronic Bell Alarm Kit

Electronic Bell Alarm or Display Module Relay
The electronic bell alarm module is an internally mounted accessory which interfaces directly with the Electronic Trip Unit. It provides a solid state relay contact for remote indication of breaker tripping due to overload, short time, short circuit, or ground fault. The bell alarm contact is a latching type and remote reset capability is provided.

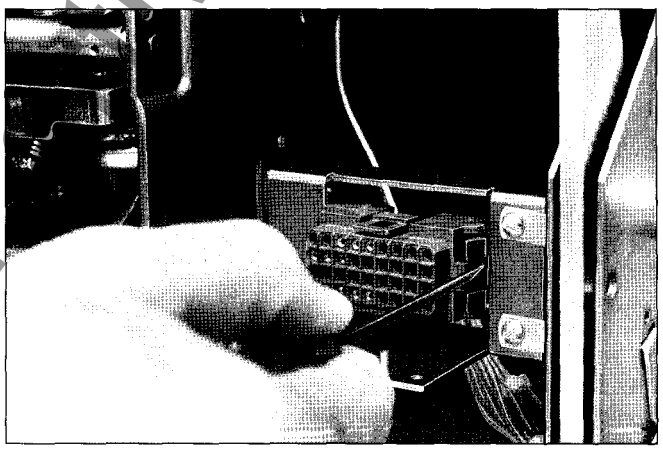
To install the bell alarm, first remove the breaker front cover and trip unit, if previously installed (see page 37).



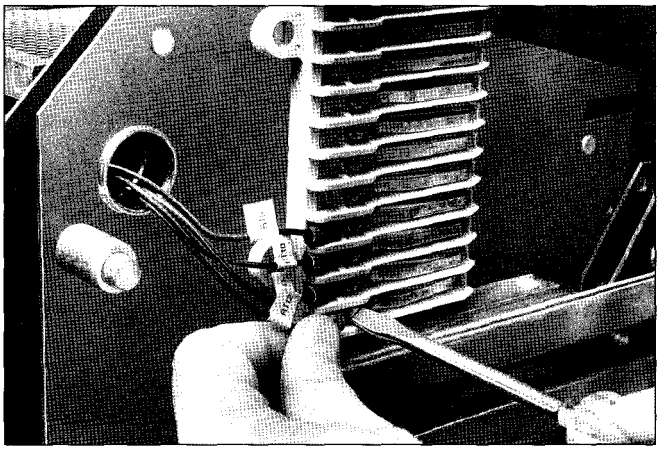
1.) With a small screwdriver, press in tab on right side of 36-pin trip unit connector and release from mounting bracket.



2.) Connect bell alarm lead wires (#1 and #22) to corresponding numbered holes in pin connector. (Note: If a display module relay is being installed instead of a bell alarm, connect lead wires to #4 and #22 holes respectively.)

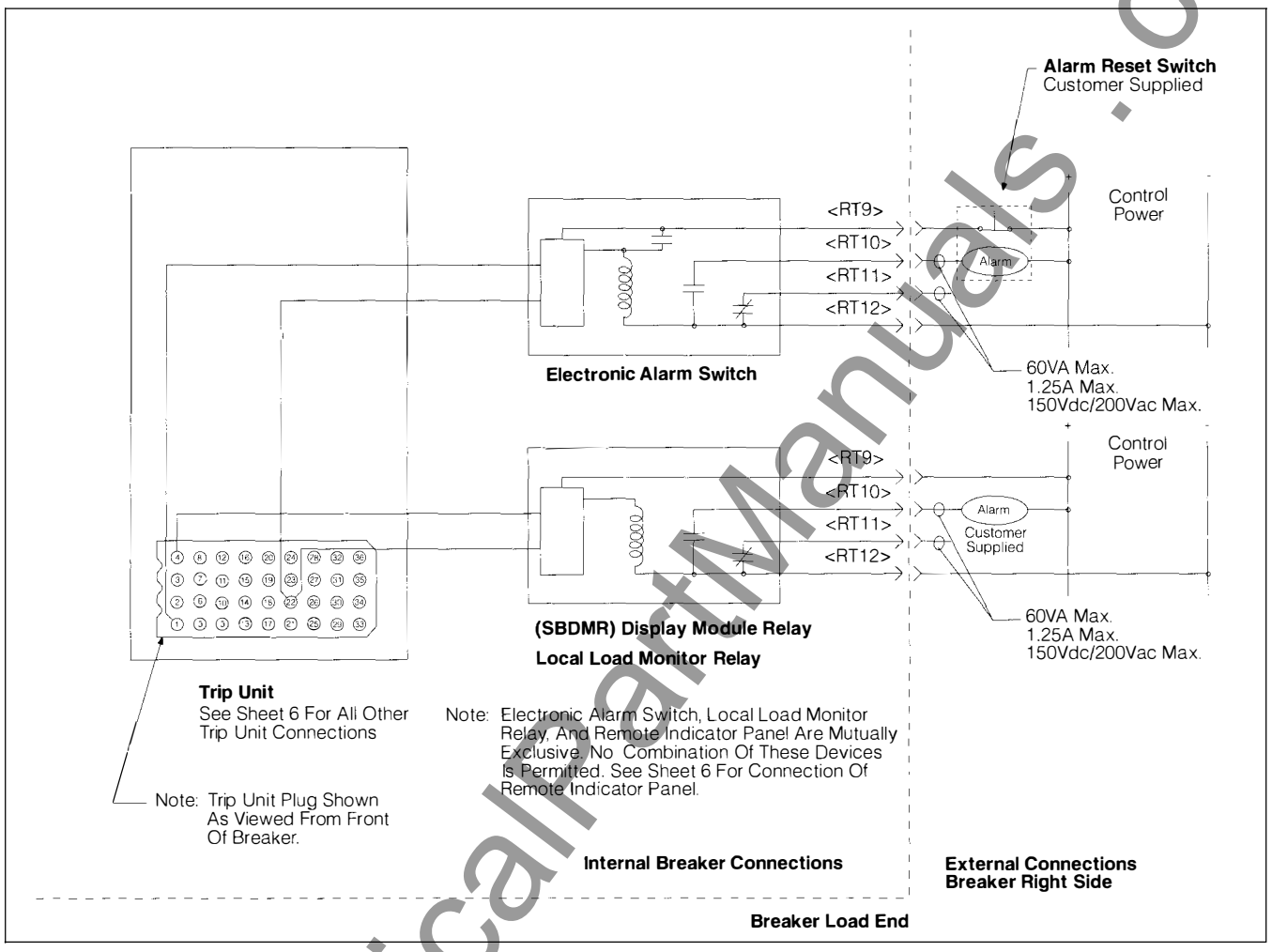


3.) Align bell alarm mounting holes as shown.



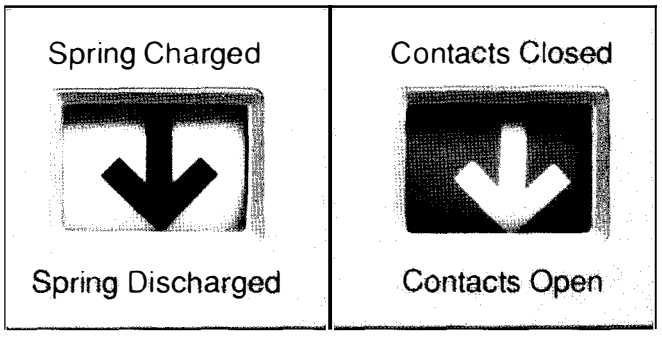
4.) Route bell alarm lead wires RT9 through RT12 through right side of the circuit breaker.
5.) Connect the four lead wires, in numerical sequence, to the bottom four positions of the secondary disconnect or terminal block, with RT12 installed on the bottom position.

Electronic Bell Alarm

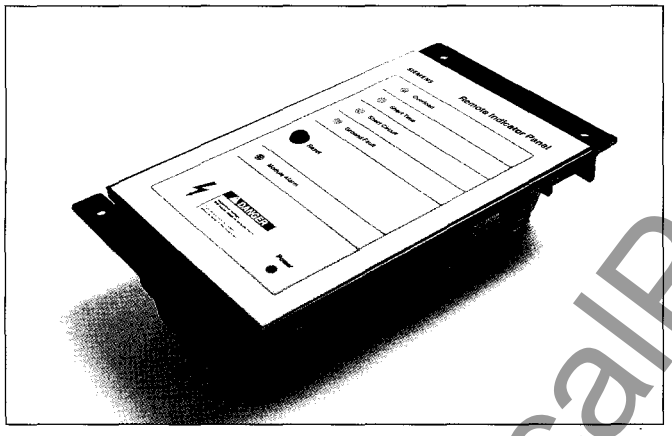


Electronic Bell Alarm or Display Module Relay Schematic Drawing (only 1 device per breaker)

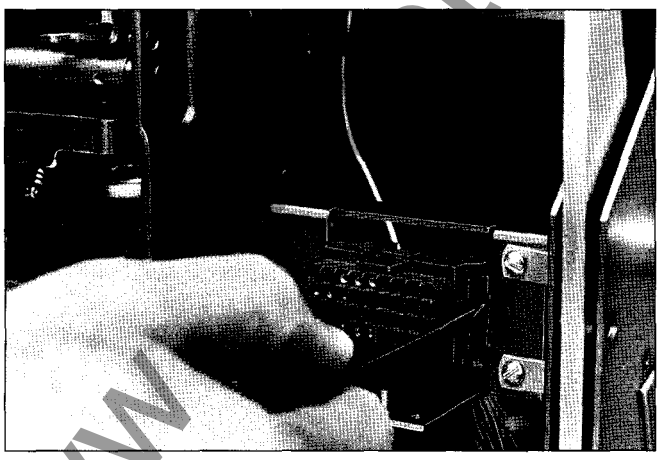
Remote Indicator Panel



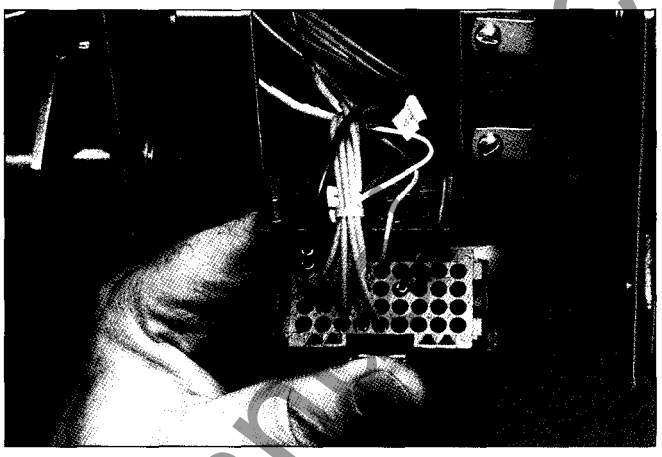
CAUTION: Do not attempt to install an accessory with the breaker "Closed" or "Charged". Make certain breaker is "Open" and "Discharged" as shown above. Personal injury or mechanical damage may occur. Preliminary installation procedures are outlined on pages 36-37.



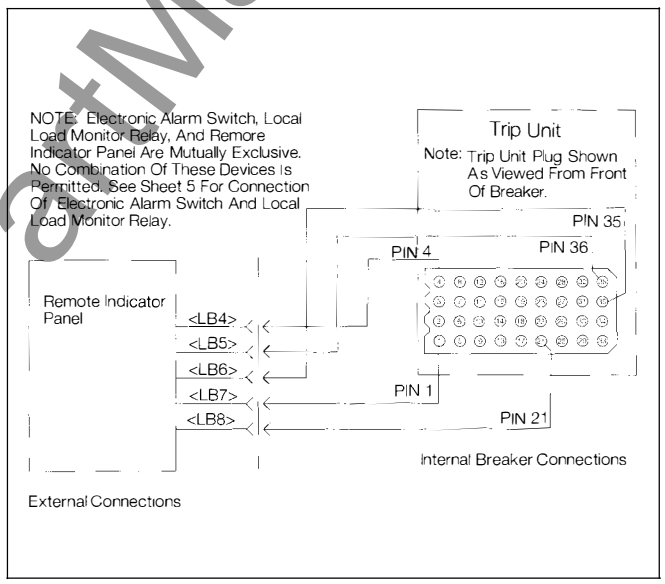
NOTE: To properly use the Siemens Remote Indicator Panel, the SB Circuit Breaker Trip Unit must be removed (See Instructions Pages 36-37) if previously installed.

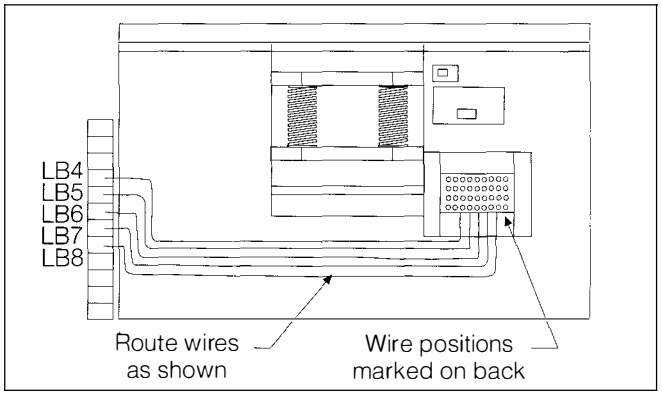


1.) With a small screwdriver, press in tab on right side of 36-pin trip unit connector and release from mounting bracket.



2.) Connect the wires provided between the trip unit 36 pin connector and the External Termial Block.



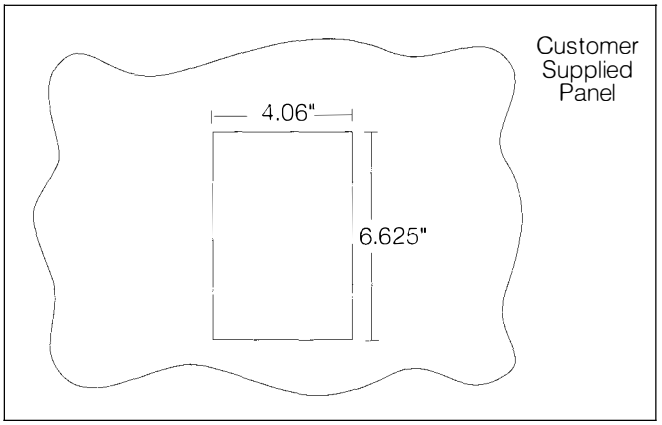


Remote Indicator Panel

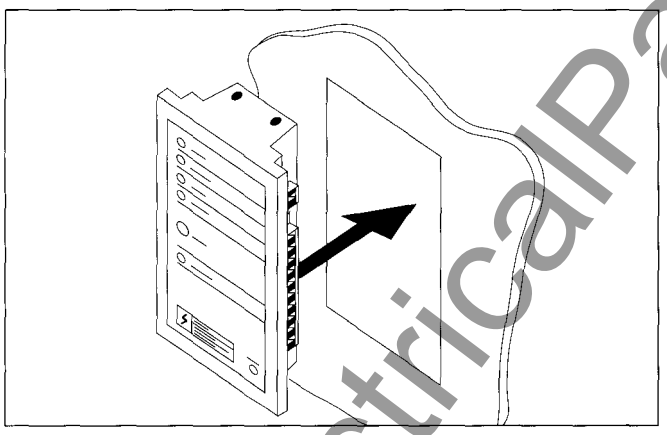
The Remote Indicator Panel can be either panel mounted or wall mounted. The intent is mounting versatility yet keeping all electrical connections within the switch board or panel.

Note: The maximum distance between the breaker and remote indicator panel allowed is 10 feet.

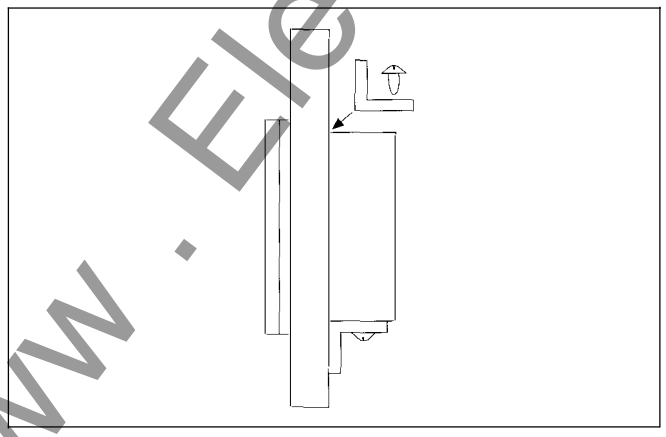
Panel Mounting



1. Cut opening in Panel 4.06" wide and 6.625" high.



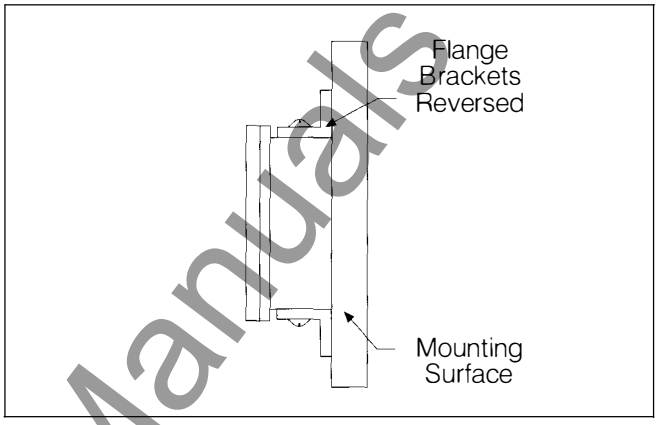
2. Remove both Flange Brackets and insert Remote Indicator Panel into the opening.



3. Replace Flange Brackets positioned as shown - slide bracket against panel and tighten screws.

Panel Mounting

This style mounting is intended for surface use inside of the switchboard or panel.



1. Reverse Flange Brackets as illustrated. Set unit on flat surface and tighten screws. Hold unit in location desired. Mark and drill 4 holes for #6 screws. Mount Remote Indicator Panel with (4) #6 Screws (Not Supplied).

Wiring

Note that these terminal blocks are removable for ease of wiring. Pull them straight out to unplug, insert wires and tighten screws then plug them back into circuit board.

Wire Remote Indicator Panel to circuit breaker using terminals on left side marked LB4-LB8. Connect them to the corresponding terminal block positions located on left bottom side of SB breaker. These wires must be 18AWG with a maximum length of 10 feet.

The 5 Relay outputs located on the bottom right terminal block may be wired to your system using 18AWG wire. The contact ratings of these relays are 60VA-1.25A-150VDC/200VAC.

Connect supply power to top right terminal block as marked. Use the correct voltage as marked on the name-plate. Make sure the housing is grounded using the #8-32 screw provided.

Remote Indicator Panel

Relay Functions
The relay outputs on this device can be used for wiring to remote indicators.

In a trip condition only one of the four relays marked G.F. (Ground Fault), S.T. (Short Time), O.L. (Over Load) or S.C. (Short Circuit) will latch up and stay latched until the Reset button on front of Remote Indicator Panel is pushed. Which relay latches is dependent on the trip condition of the breaker.

The other relay marked M.A. (Module Alarm) does not latch but pulls in and drops out dependent on the switch setting of the Module located in the Trip Unit. This could be either a Display Module or a Ground Fault Monitor Module. When the current exceeds the switch setting, relay "M.A." pulls in, and it drops out when the current goes below the switch setting.

Ground Fault Sensing and Relaying System
When used with a Ground Fault Monitor Module (Cat. No. SBGFM) the Remote Indicator Panel may be used as a Ground Fault Sensing and Relaying system. For more information see the Ground Fault Monitor Module installation instructions.
Note: If the Module is removed while the circuit breaker is powered up the Module Alarm line will be set to its "ON" state.

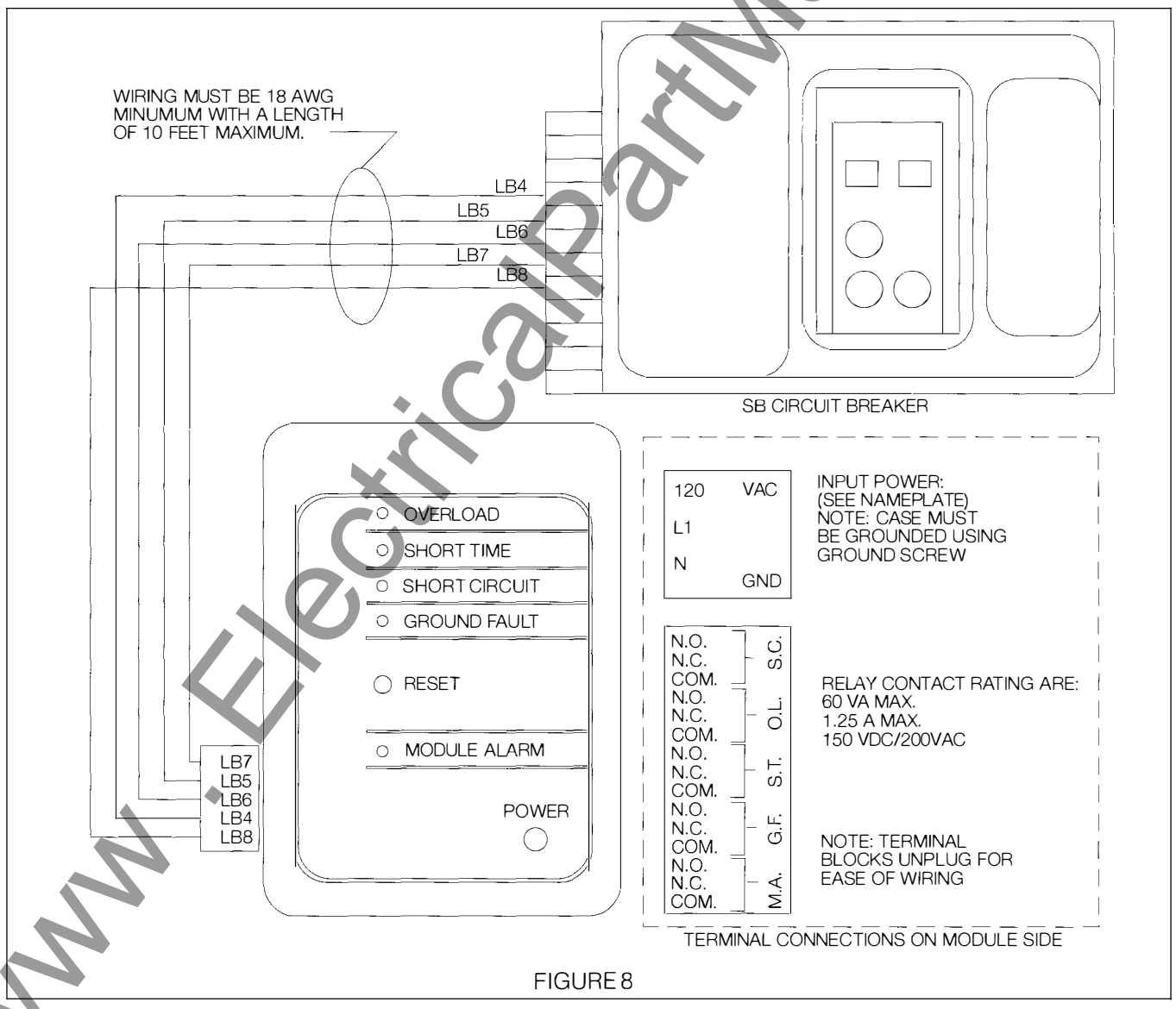


FIGURE 8

Ground Fault Monitor and Display Module

Display Module and Ground Fault Monitor

The Ground Fault Monitor (GFM) is an optional module that allows the user to locally monitor the ground fault current and can be used in trip units with or without the integral ground fault protection function. Trip units with the integral ground fault protection function are identified by a "G" in the catalog number and the presence of ground fault adjustments on the face of the trip unit. If the trip unit is equipped with ground fault protection, the Ground Fault Monitor utilizes the same ground fault sensing method as the electronic trip unit. If the trip unit is not equipped with ground fault protection, then the GFM uses a residual ground fault sensing method. The Ground Fault Monitor works independently from the trip unit's ground fault protection.

Ground Fault Monitor Settings

There are three ground fault pickup levels offered on the Ground Fault Monitor:

"LO" equals 20 percent of the frame rating.

"HI" equals either the frame rating or 1200 amps, whichever is less.

"MED" equals the average of the "LO" and "HI" pickup levels.

The ground fault delays are divided into three fixed time delay bands: 0.1, 0.3, and 0.5 seconds. The "MAX" setting is defined as a 1200 amp pickup and 0.5 second delay.

Display

The Ground Fault Monitor displays the ground fault current in amps. Then the ground fault current reaches a level 12 percent below the selected pickup setting, the amps display will start to flash. Then the ground setting, the display will flask "-OL-" for overload and the alarm line will be set to its' "ON" state.

Remote Interface

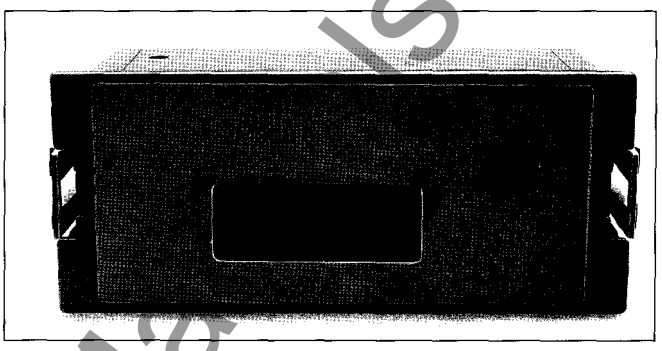
The Ground Fault Monitor can be utilized with a Display Module Relay (mounted inside the breaker) or a Remote Indicator Panel (externally mounted) to provide a set of relay contacts for ground fault alarm. When used in conjunction with either of these devices and a Shunt Trip, the Ground Fault Monitor can be used as Ground Fault Sensing and Relaying Equipment per U.L. 1053. For more information see the Installation Instructions for the Ground Fault Sensing and Relaying System.

Also, note that if the Ground Fault Monitor is removed while the circuit breaker is powered up the alarm line will be set to its' "ON" state

NOTE: Option for Ground Fault Detection and Alarm without tripping in accordance with NEC Article 700 Section 700-26 is available. Consult Siemens Sales Office for further information.

Display Module

The Display Module provides features for allowing the user to locally monitor the phase currents. The switch to set and select the display is accessible to the user through a hole in the transparent cover of the trip unit.



Display Module

Maximum Current Demand

This feature provides a display of the maximum current demand since the unit was last reset. The unit is reset by depressing both the phase and ground fault test pushbuttons simultaneously. Phase and ground fault pushbuttons are located on the SB Electronic Trip Unit in the integral testing section.

Present Current Demand

This feature provides a display of the present current demands. The present current demands are calculated averages over thirty (30) minute intervals. The user may display the most recent stored values by setting the switch to the present demand position for the 30-minute interval.

Local Monitor Relay

This feature provides a local alarm display and an output signal for an external alarm when the average of the phase currents exceeds the alarm set point. The display automatically resets itself when the alarm condition ceases. The output alarm signal is a 5-volt DC level. The signal may be used to display an alarm on a remote indication panel or by using an internal Systems Breaker Modular Relay (SBDMR). The alarm set point may be set to 60, 70, 80, 90, or 100 percent of the continuous current setting.

Load Current Meter

This feature provides a local display of the present 3-phase currents. The user may display the current value by setting the switch to the I_A, I_B, or I_C positions.

Before installing the display module, the breaker should be placed in the open position.

The display module is a plug-in unit. To install the module:

1. Remove the trip unit's transparent cover.
2. Remove cover from the display module receptacle.
3. Insert the module into the receptacle.
4. Replace and seal the transparent cover.

Ground Fault Sensing and Relaying

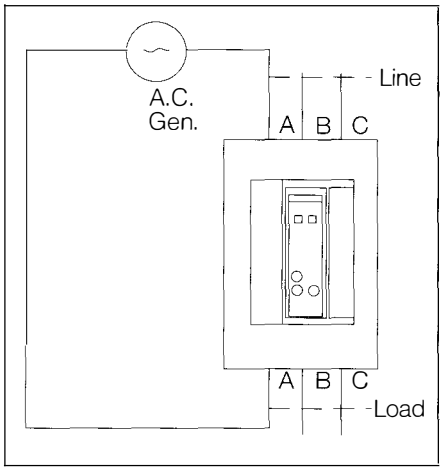


Figure 2

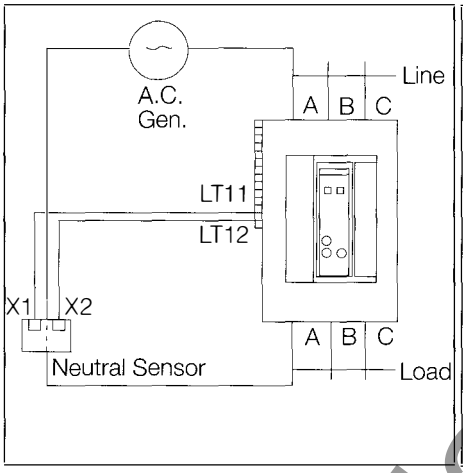


Figure 3

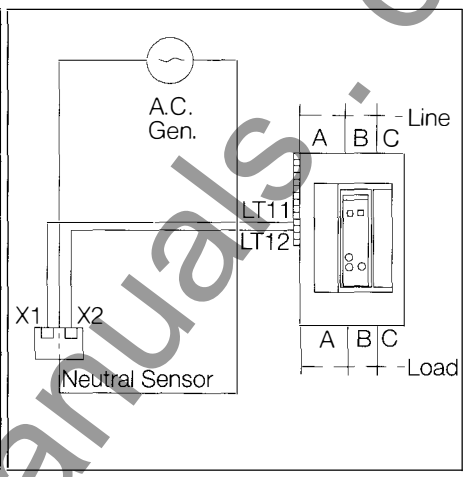


Figure 4

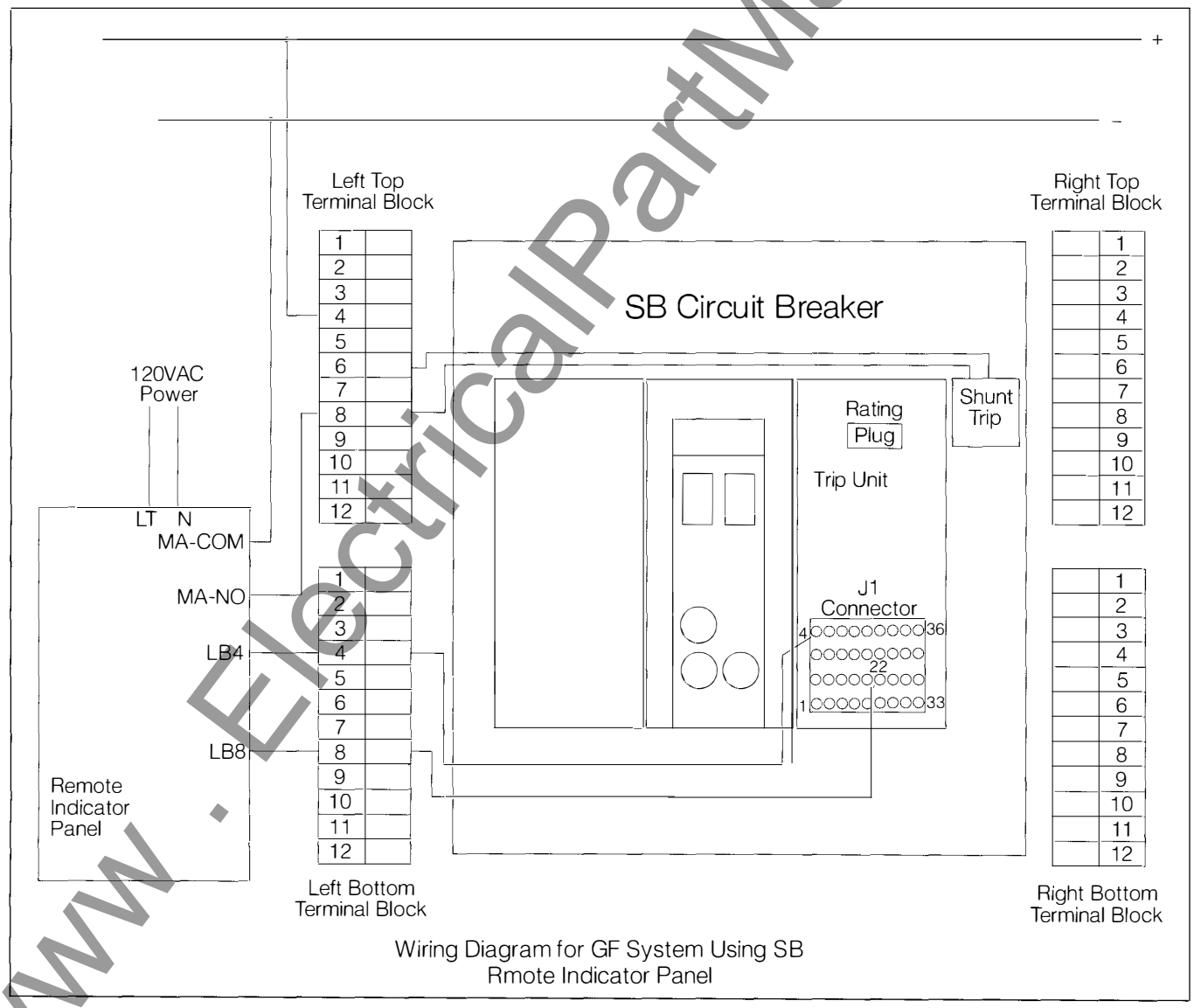


Figure 5.

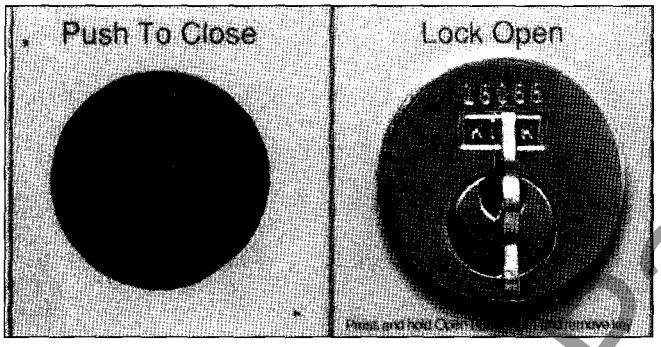
Key Interlock and SB Breaker Padlock Device

Key Interlock on SB Breaker

Key interlocks are often used to control local sequencing of breakers when multiple power sources are available for a common load. When the key is removed, the key interlock holds the open pushbutton switch in the trip position, preventing the breaker from being closed. Therefore, if the same key is required by each breaker in a multiple power source system, no two breakers in the system can be closed at the same time.

To remove the key from the key interlock, press and hold the "open" pushbutton; turn and remove key.

The breaker key interlock is not field installable. It is installed at the factory in the central escutcheon of the front panel, directly above the push-to-open pushbutton switch.

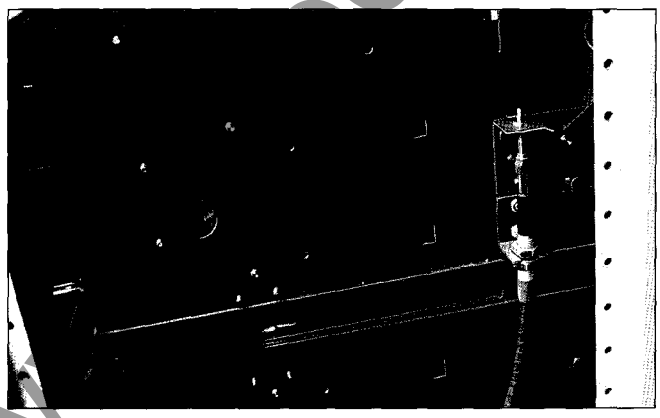


Key is installed in the central escutcheon.

Mechanical Interlock

The mechanical interlock device provides the capability to prevent simultaneous closing of two SB breakers. The first breaker to close will keep the other breaker in the open/tripped position. The interlock device is available for fixed mounted breakers installed side-by-side or in the same vertical section. On drawout configured breakers, the interlock device is available for breakers installed in adjacent cubicles, either vertically or horizontally.

The mechanical interlock device is **not** field installable.



Mechanical Interlock

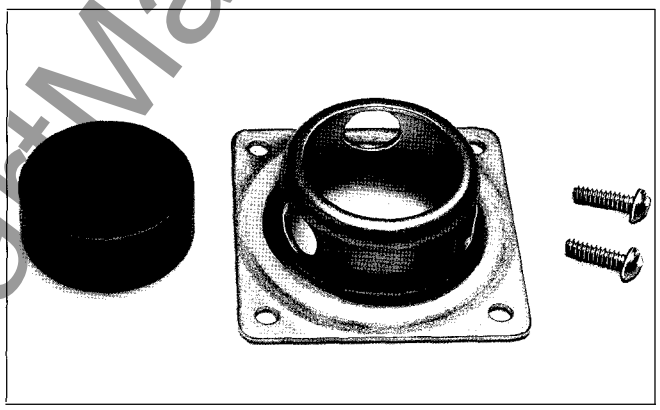
Padlock Device on Breaker

A padlock device on the breaker allows the breaker to be padlocked in the open position, preventing the breaker from being closed. It will accommodate three padlocks.

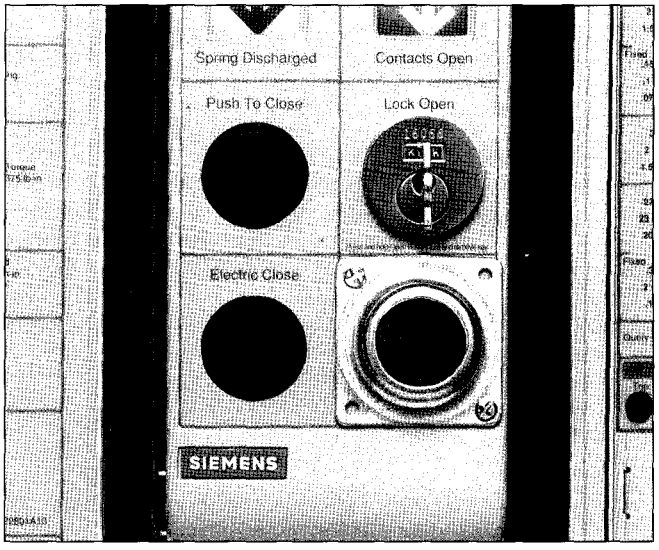
The accessory kit consists of a padlock device and one-way self-tapping screws to prevent its removal. The device is installed over the open pushbutton switch. Blind holes for the self-tapping screws are located above and to the left, and below and to the right of the open pushbutton switch.

Before starting the installation, the breaker should be in the open position, and the stored energy mechanism should be discharged.

To install the device, secure it in place with the screws as provided.



SB Breaker Padlock Device Kit



The padlock device is installed over the open pushbutton.

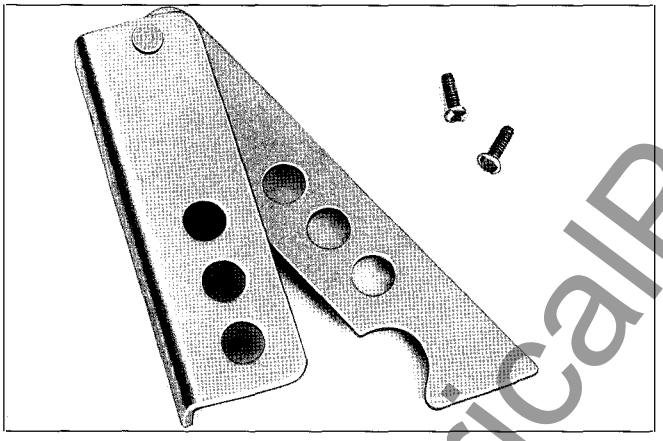
Drawout Padlock and Close Blocking Devices

Padlock Device on Drawout Mechanism
A padlock device on the drawout mechanism provides the means to padlock the moveable drawout element in the connected, test, or unlocked position. The padlock device can also lock the interlock lever in the interlock disengaged position to prevent the breaker from being closed. This is an important feature. When padlocked in the unlocked position, the moveable element can be pulled to the fully withdrawn position. The device will accommodate three padlocks.

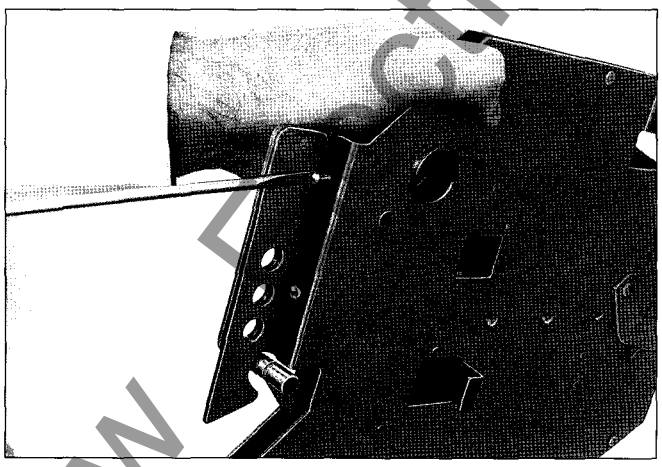
The accessory kit consists of a padlock device and one-way self-tapping screws to prevent its removal. It is installed on the left side of the moveable drawout element, just above the interlock lever.

Before starting the installation, the breaker should be in the open position and the stored energy mechanism should be discharged.

To install the device, secure it in place with the one-way screws as provided.



Drawout padlock device kit



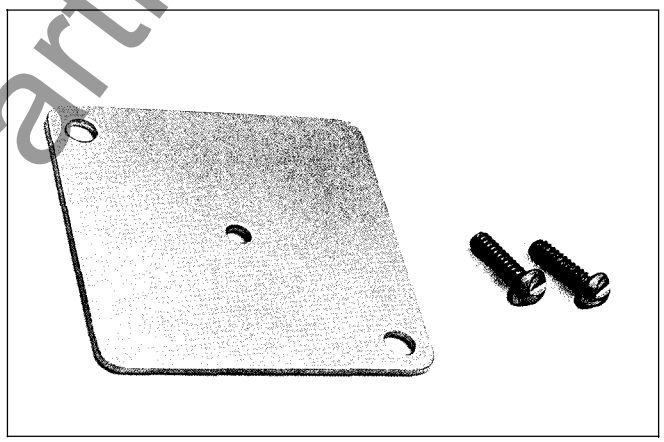
Padlock device is installed above the interlock lever

Closing Blocking Device on SB Breaker
A closing blocking device is used to prevent local closing of the breaker under normal operating conditions. The device is a cover that mounts over the push-to-close pushbutton, blocking normal access to this switch. A small hole in the center of the cover provides a means to defeat the blocking device in case of an emergency or for test purposes. A small screw driver or similar object may be inserted through the hole to depress the close pushbutton.

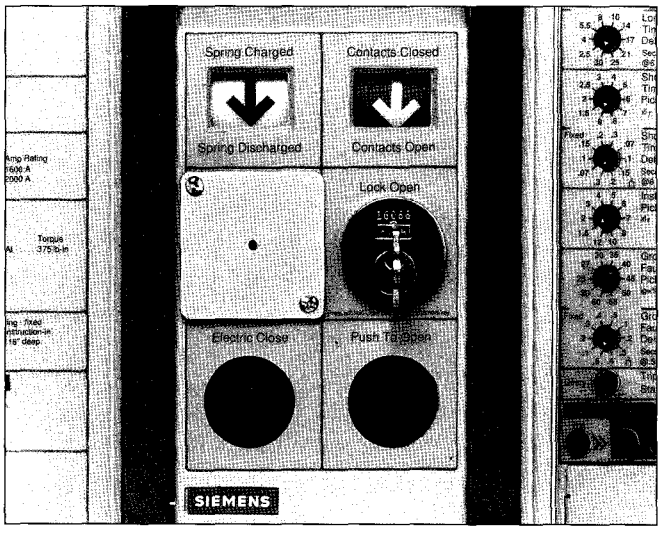
The accessory kit consists of a blocking device and one-way self-tapping screws to prevent its removal. Blind holes for the self-tapping screws are located above and to the left and below and to the right of the close pushbutton switch.

Before starting the installation, the breaker should be in the open position and the stored energy mechanism should be discharged.

To install the device, secure it in place with the screws provided.



Closing Blocking Device Kit



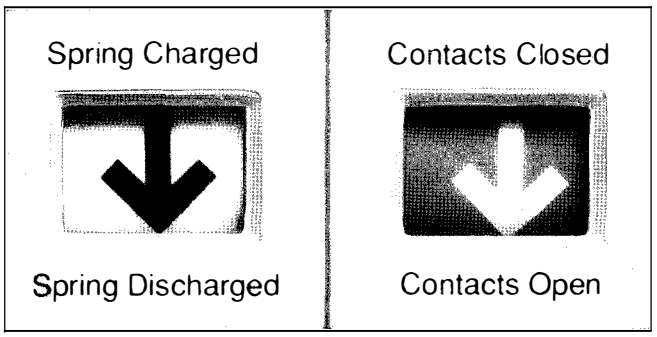
Closing Blocking Device is installed over the close pushbutton switch.

Cell Switches

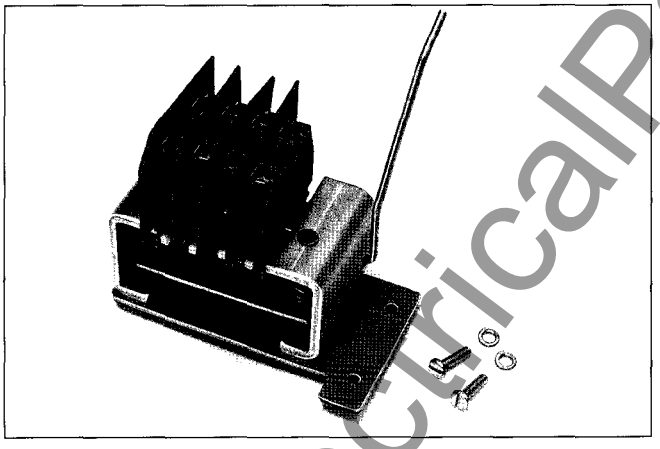
⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Do not attempt to install Cell Switch accessory into Stationary Drawout Element with voltage present.



CAUTION: Do not attempt to install an accessory with the breaker "Closed" or "Charged". Make certain breaker is "Open" and "Discharged" as shown above. Personal injury or mechanical damage may occur.



Cell Switch Accessory Kit

Cell Switches on Drawout Mechanism

Cell switches are used on drawout SB breakers as signal contacts to indicate when the moveable drawout element is in a position other than the connected position. The position of the moveable drawout element is indicated by the open/closed status of the cell switches as follows:

"A" or "NO" contacts - Open when the moveable drawout element is in the test, unlocked, or withdrawn position.
Closed when the moveable drawout element is in the connected position.

"B" or "NC" contacts - Closed when the moveable drawout element is in the test, unlocked, or withdrawn position.
Open when the moveable draw out element is in the connected position.

A maximum of four "A" and "B" cell switches may be installed in a breaker. The switch contact ratings are given in the following table.

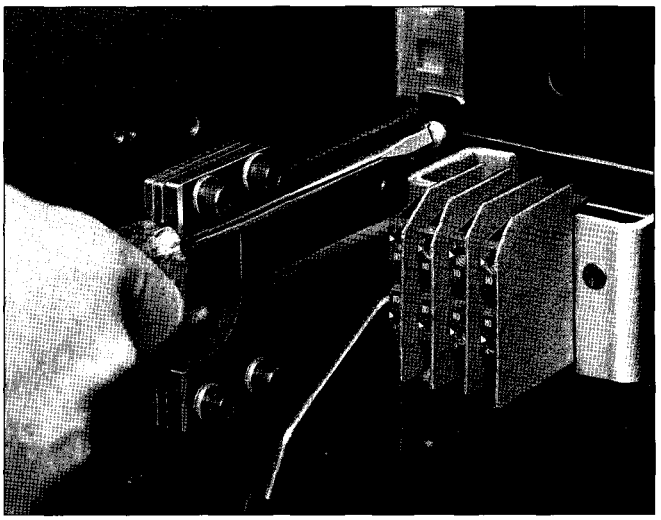
Switch Contact Ratings

Supply Voltage	Ampere Rating
120 VAC	10 Amps
240 VAC	10 Amps
480 VAC	6 Amps
24 VDC	3 Amps
125 VDC	0.5 Amps

The cell switches are installed on the left-rear flange of the stationary drawout element, between the bus supports.

The cell switch assembly should be installed prior to the moveable drawout element being installed in the switchboard. If the drawout elements have already been installed, the moveable drawout element will have to be placed in the fully withdrawn position or removed from the switchboard to allow access to the installation location.

To install the cell switch assembly, attach assembly to the left-rear flange with two (2) 8/32" panhead screws with lock washers in the threaded holes on the flange.



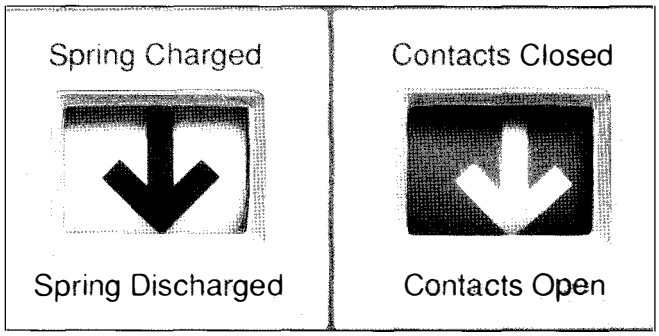
Cell Switches are installed on the left-rear flange of the cradle assembly or drawout element.

Drawout Safety Shutters

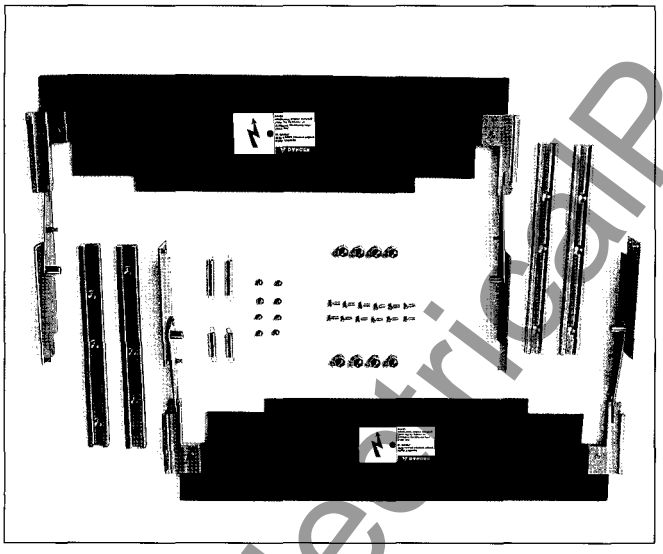
⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Do not attempt to install Shutters with voltage present.



CAUTION: Siemens recommends Shutter installation prior to placing Stationary Drawout Element into a switchboard or panelboard.



Drawout Safety Shutters Accessory Kit

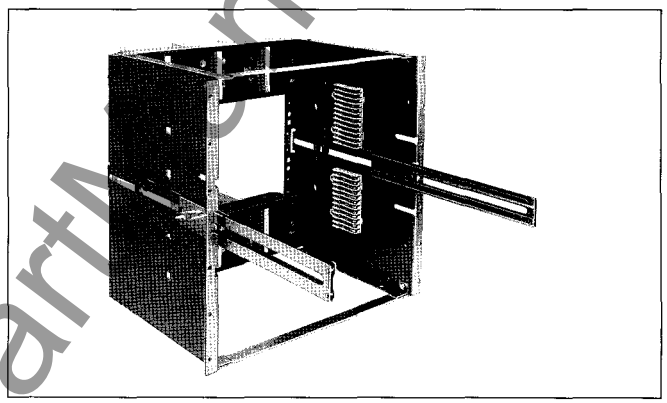
Drawout Safety Shutters

Drawout safety shutters prevent inadvertent contact with the primary stabs. As the moveable drawout element is moved from the unlocked to the withdrawn position, the shutters automatically cover the primary stabs. The shutters automatically retract to expose the stabs, as the moveable drawout element is moved from the withdrawn to the unlocked position.

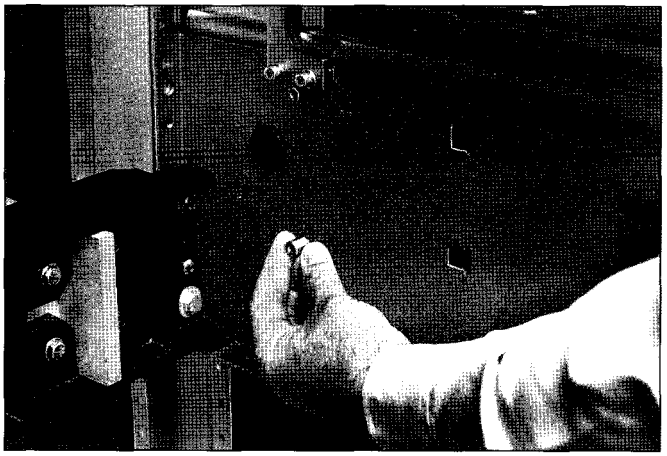
The drawout safety shutters kit consists of two shutter assemblies and mounting hardware. The shutters are symmetrical so that either shutter can be used to cover the line or load stabs. The shutters are installed on the sides of the stationary drawout.

If practical, the drawout safety shutters should be installed prior to the stationary drawout element being installed in the switchboard. If the drawout elements have already been installed, the moveable drawout element will have to be removed from the switchboard to allow access to the installation location.

To install the safety shutters:

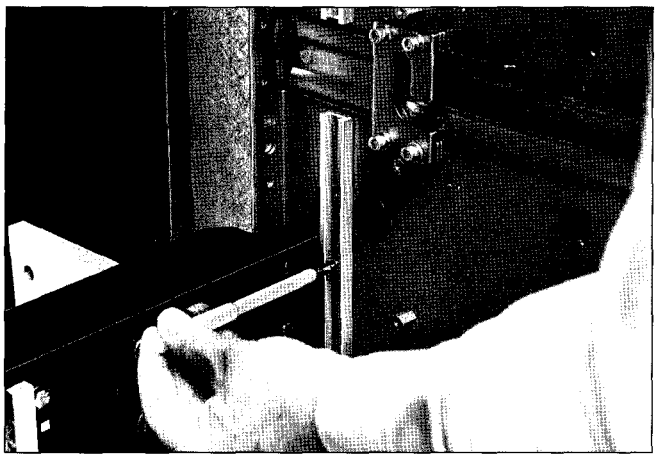


1.) Pull out two (2) stationary drawout rails.

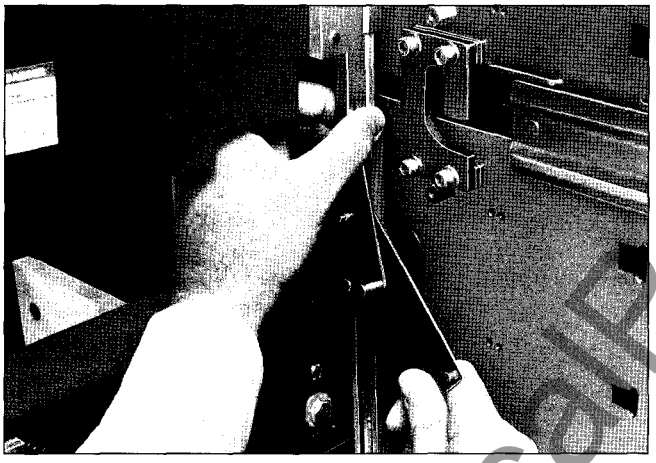


2.) Install eight (8) Shutter Plate pins (4 per side).

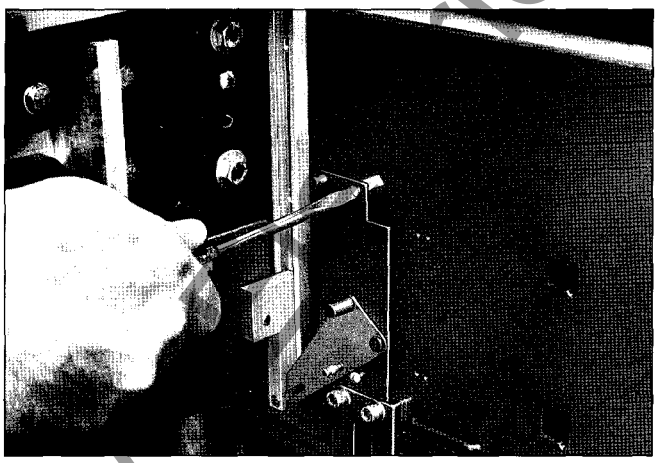
Drawout Safety Shutters



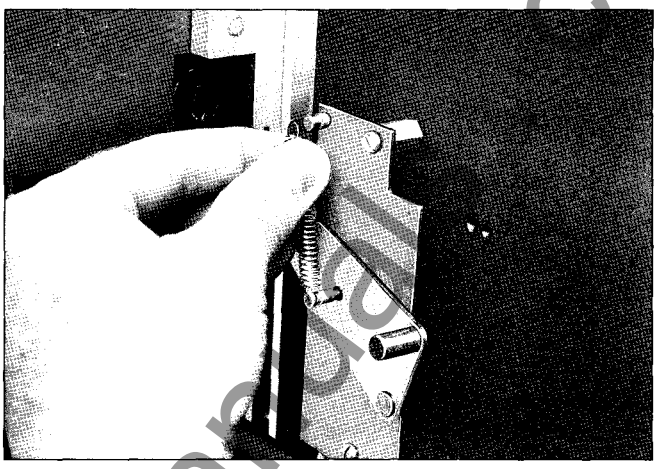
3.) Install four (4) Shutter Rails (2 per each side).



4.) Slide top of shutter slide block into bottom of grooved top shutter rail.

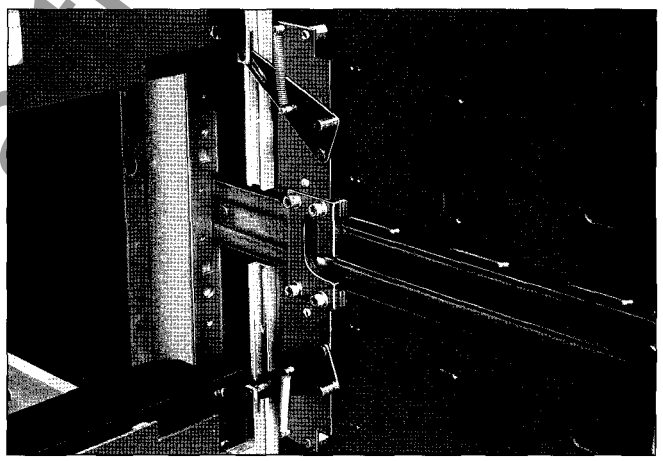


5.) Install top shutter section with #6-32 x 1/4" screws and lock washers, to the sides of the stationary drawout element.

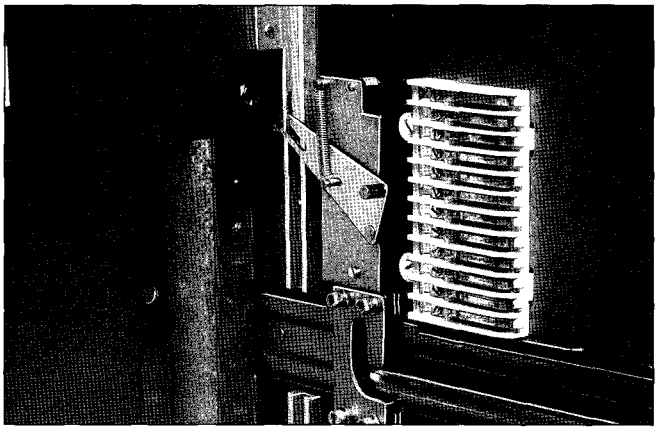


6.) Install shutter springs (zinc silver spring is used for the top shutter, white springs are used for the bottom shutter). Installation of the bottom shutter is similar to the top.

7.) Push down on the top shutter and pull up on the bottom shutter to ensure that they will move freely in the tracks.

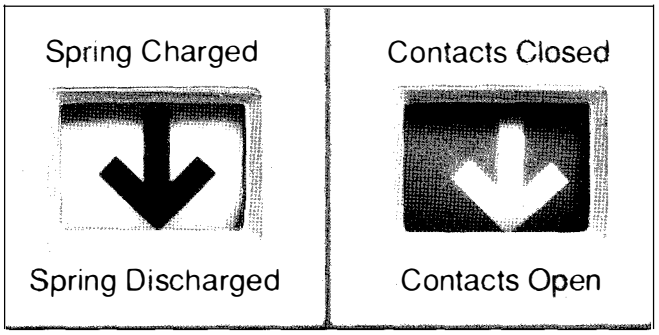


8.) Drawout Safety Shutters shown installed.



9.) Install terminal blocks (see page 57).

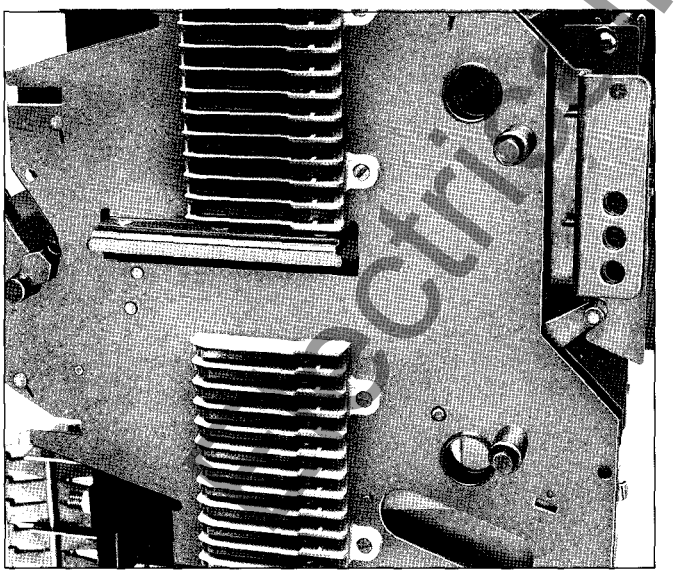
Secondary Disconnects and Control Terminal Blocks



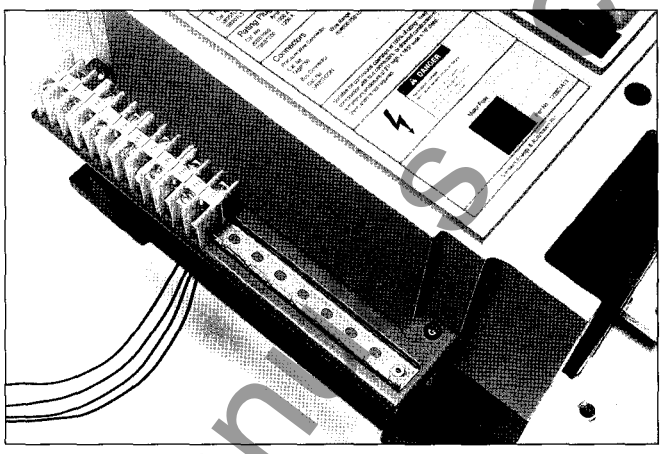
CAUTION: Do not attempt to install an accessory with the breaker "Closed" or "Charged". Make certain breaker is "Open" and "Discharged" as shown above. Personal injury or mechanical damage may occur.

Secondary Disconnects

Secondary wiring connections to remote locations are made to "secondary disconnects" on drawout breakers and to "control terminal blocks" on fixed-mounted breakers. The secondary disconnects and terminal blocks are located along the sides of the breakers, as many as two on each side. They are referenced as left top (LT), left bottom (LB), right top (RT), and right bottom (RB). Left and right are with respect to the user facing the breaker. The terminal points of factory installed internal accessories are identified on page 62. The same terminal point locations should be used when an accessory is installed in the field.



Secondary Disconnects terminal points



Control Terminal Block mounted on fixed-mounted breaker.

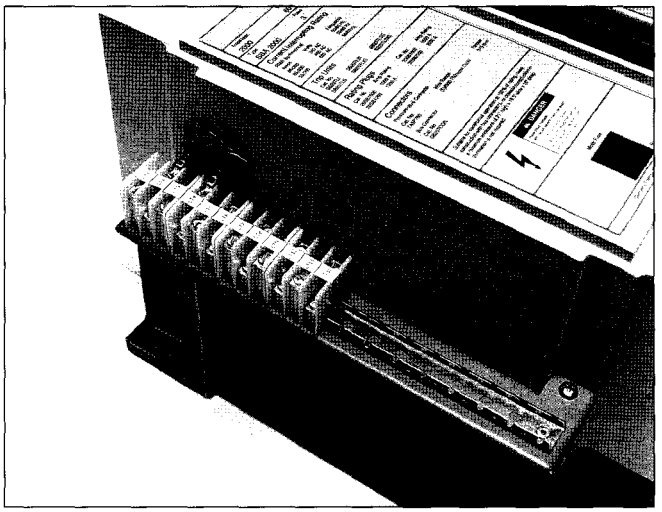
Control Terminal Blocks

Control terminal blocks provide electrical access to the internal accessories and trip unit of a fixed-mounted breaker. A breaker can be equipped with up to four control terminal blocks, each with 12 terminal points. The terminal blocks accept #12 AWG user wiring. They are rated for 600 volts application.

The terminal blocks are designed to be installed along the sides of the breaker. They must be installed with a terminal block mount. To install the terminal block assembly(s), attach them with screws to the breaker as illustrated.

The control terminal blocks are referenced as left-top (LT), left-bottom (LB), right-top (RT), and right-bottom (RB). Left and right are with respect to the user facing the breaker. The recommended terminal points for accessories added in the field are illustrated below.

NOTE: The addition of terminal blocks to a fixed mounted circuit breaker adds 1.5 inches to each side or 3 inches overall.



Wires mounted on terminal block.

Sliding Secondary Disconnects

⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Do not attempt to install Sliding Disconnects with voltage present.

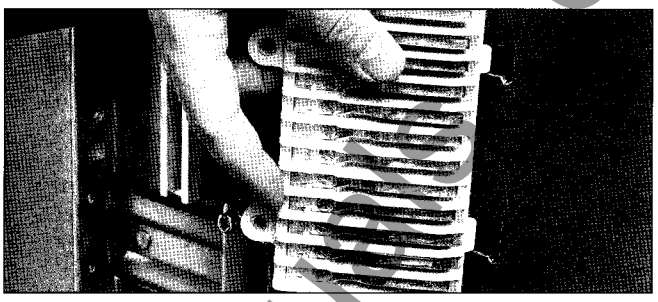
Sliding Secondary Disconnects

Sliding secondary disconnects provide electrical access to the internal accessories and trip unit of a drawout constructed SB breaker. They are installed along the sides of the drawout elements such that the electrical connections are made as the moveable drawout element is moved/racked into the stationary drawout element.

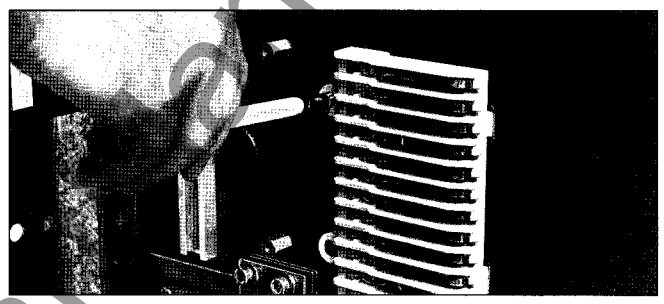
A breaker can be equipped with up to four secondary disconnects, each with 12 terminal points. Each secondary disconnect consists of an A and a B block. On the right side of the stationary drawout element the A block is at the top and the B block is at the bottom. They are reversed on the left side: B at the top, A at the bottom. On the right side of the moveable drawout element, the B block is at the top and the A block is at the bottom. These are also reversed on the left side: A at the top, B at the bottom. The blocks and drawout elements are keyed to prevent improper installation.

Disconnects should be affixed to stationary and moveable drawout elements prior to racking-in the moveable element. The secondary disconnects are attached with screws to the stationary and moveable drawout elements.

To install the secondary disconnects:



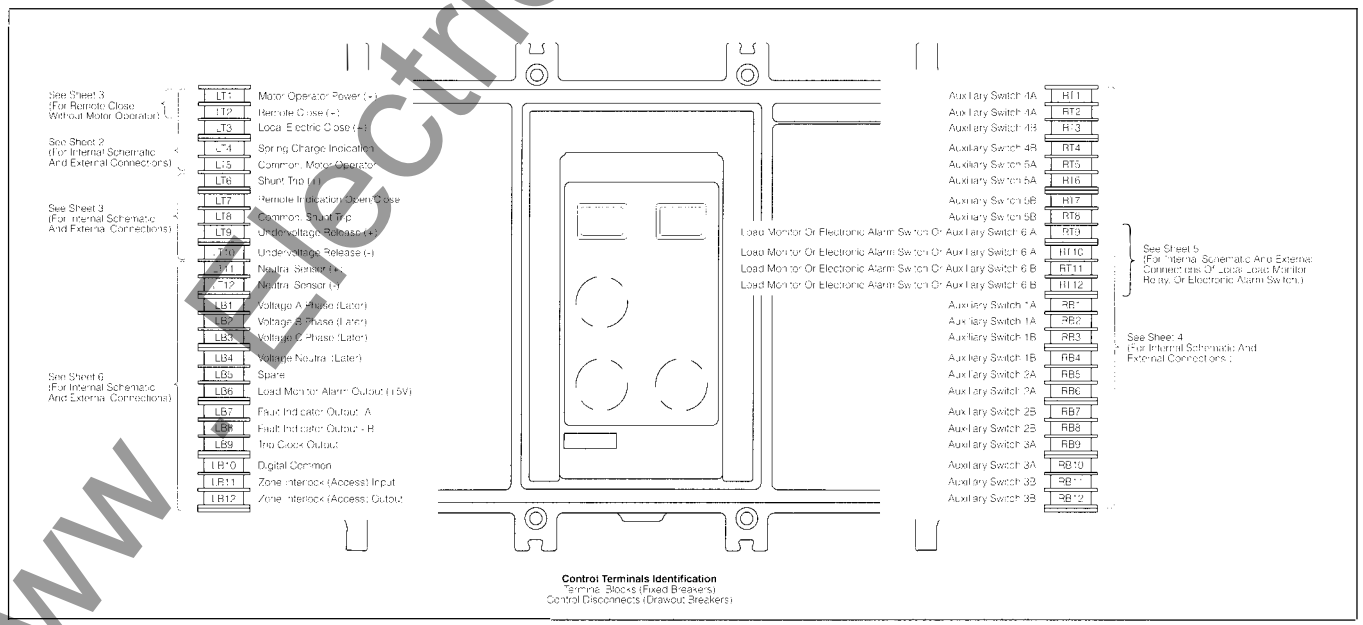
1.) Engage Secondary Disconnect molded tabs into factory formed slots as indicated.



2.) Prior to final installation of the secondary disconnect, it is recommended that a drop of LocTite #271 be put on the 8-32 x 5/16-inch long counter-sunk screws.

The secondary disconnects are referenced as left-top (LT), left-bottom (LB), right-top (RT), and right-bottom (RB). Left and right are with respect to the user facing the breaker. The recommended terminal points for accessories added in the field are illustrated below.

Secondary Disconnects and Terminal Block Terminal Points



Control Terminals Identification
Terminal Blocks (Fixed Breakers)
Control Disconnects (Drawout Breakers)

Pressure Wire Connectors "T" Connectors

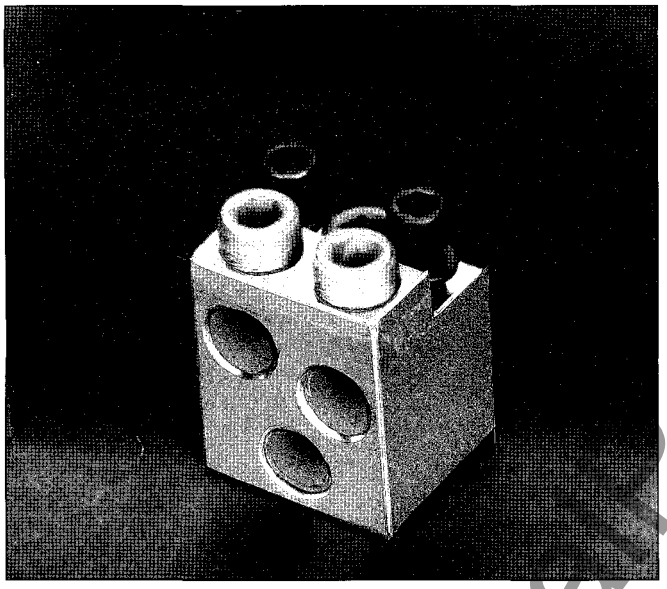
⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Do not attempt to install accessories with voltage present.

Pressure Wire Connectors

Pressure wire connectors are used to connect power cables to the SB breaker.



TA3K500SB Pressure Wire Connector

Pressure Wire Connectors

Frame Size	Amp Rating	Cables per Connector	Connector Wire Range	Catalog Number
800	800	1-3	1/0-500 kcmil Cu/Al	TA3K500SB
1200	1200	1-4	250-500 kcmil Cu/Al	TA4N8500SB
2000	1200	1-4	250-500 kcmil Cu/Al	TA4P8500SB
2000	1600	1-5	300-600 kImil Cu/Al	TA5P600SB
2000	2000	1-5	250-600 kcmil Cu	TA6R600SB

To install the pressure wire connectors:

1.) Attach the power cables to the connectors and tighten the set screws. Use the recommended torque supplied with the terminal connector.
2.) Mount the connectors to the terminal pads with the mounting bolts. Use torque value supplied with the terminal connector.

"T" Connectors

"T" connectors are used to connect power buses to the SB breakers. The connectors are rotatable to allow for vertical or horizontal bus connections.

"T" connectors with mounting hardware (1 connector and appropriate hardware shipped with each kit).

To install the "T" connectors:

1. Mount the "T" connectors to the terminal pads with the mounting bolts. Use torque value supplied with the "T" connector kit.

Neutral Sensing Transformer

⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn off and lock out all power before installing this device.

Replace all covers and shields before power supplying this device is restored.

⚠ CAUTION

Incorrect neutral sensor transformer could cause nuisance tripping or improper operation of the ground fault function.

Use only the above series of neutral sensors.

The Ampere Rating of the neutral sensor must match the Maximum Frame rating of the Circuit Breaker.

1.) Turn off power feeding this device before starting the installation.
2.) Also turn off any line power within the immediate vicinity to prevent the incidental or accidental contact of tools by the installer.

Use transformers with the following breaker frame ratings only.

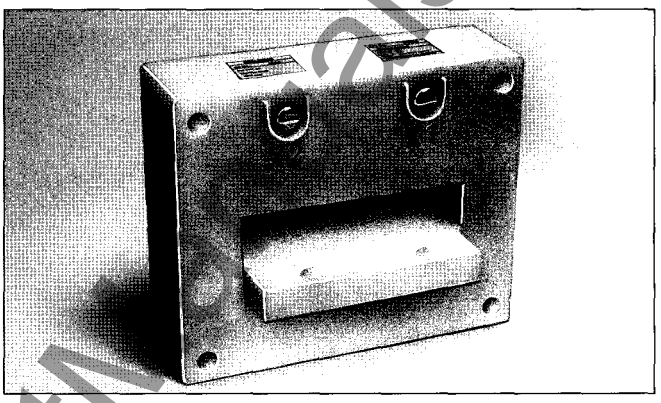
NO4SB	NO8SB	N12SB	N16SB	N20SB
SBA0400	SBA0800	SBA1200	SBA1600	SBA2000
SBS0400	SBS0800	SBS1200	SBS1600	SBS2000
SBH0400	SBH0800	SBH1200	SBH1600	SBH2000

Introduction

This neutral sensing transformer is designed to be mounted on a bus bar with maximum dimensions of 3.00" x .75".

Neutral Sensing Transformer

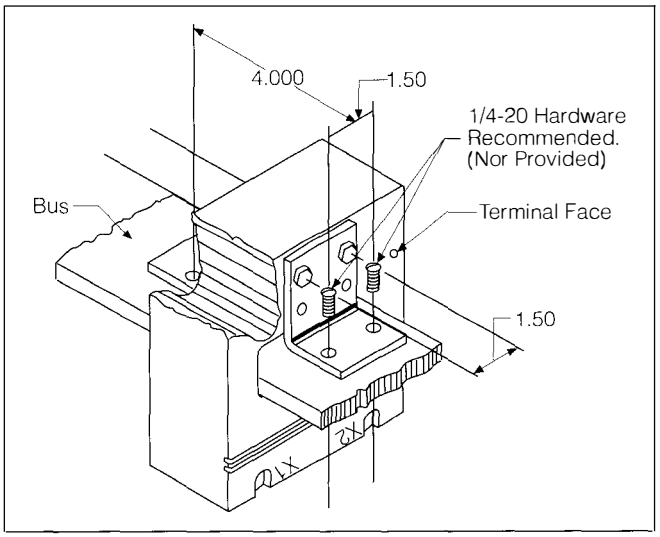
Neutral sensing transformers are used with 4-wire residual ground fault protection and ground source schemes.



Neutral Sensing Transformer

Mounting

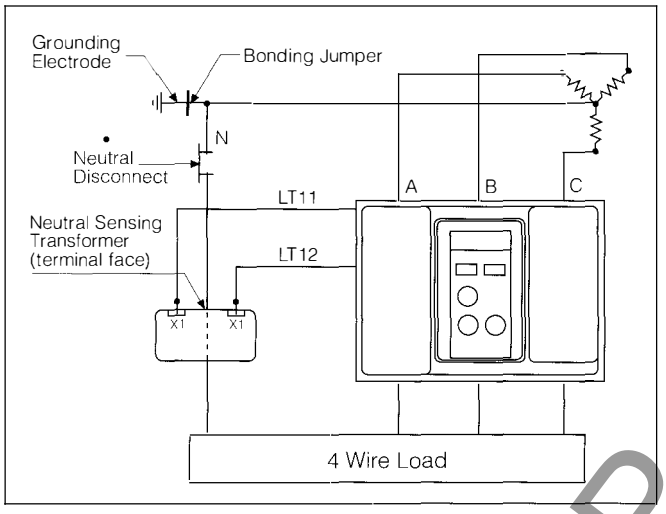
Position the neutral sensor as close as possible to the associated circuit breaker and fabricate two .312 diameter holes 1.75 inches apart in bus, as shown below. Mount the neutral sensor to the bus as shown with 1/4-20 hardware (not provided). Torque mounting bolts to 50 in. lbs. **maximum**.



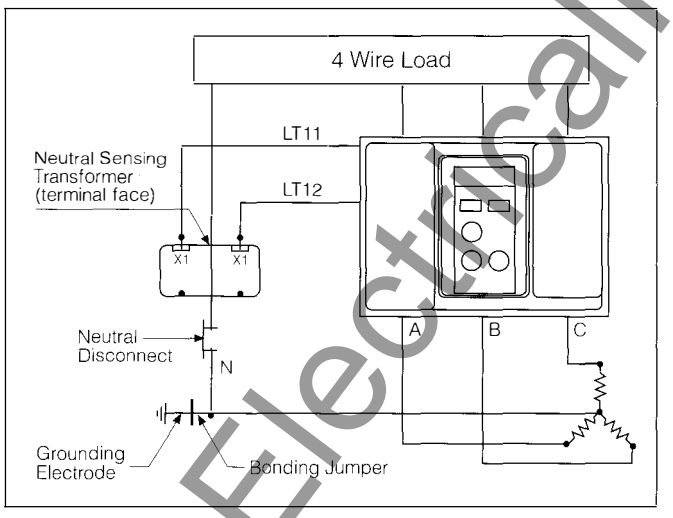
Bus Mounting

Neutral Sensing Transformer

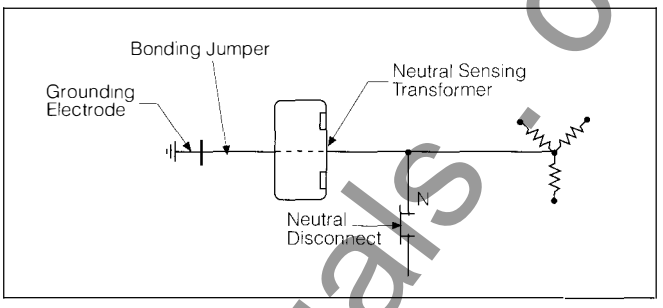
Important
The SB series of electronic trip circuit breakers equipped with ground fault protection may be used in the Residual or Ground Return modes. When used in the Residual mode the orientation of the neutral sensing transformer is important for proper operation. See illustrations below for proper orientation of the neutral sensor for Residual mode Ground Fault. Orientation of the neutral sensor is not required when used in the Ground Return mode of Ground Fault.



Standard Connection



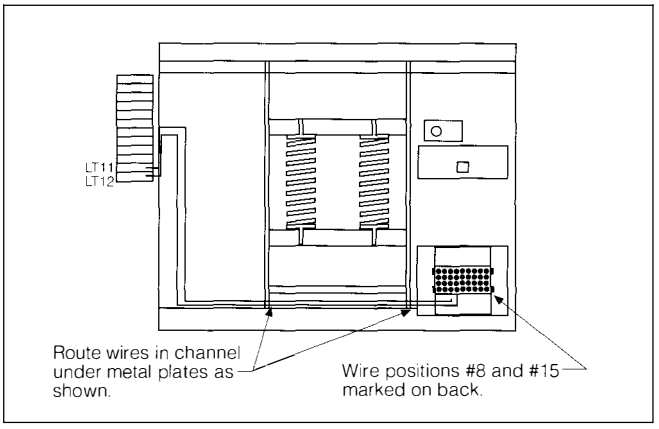
Reverse Connection



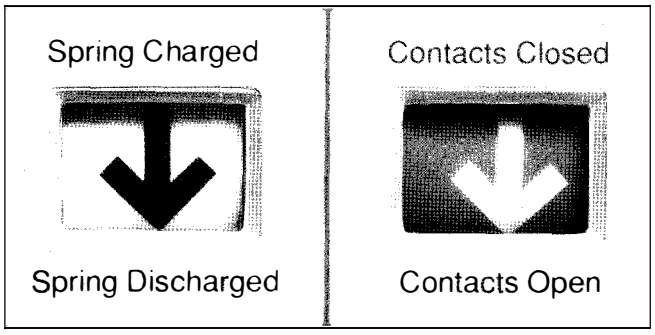
Installation of neutral transformer

Terminal Connections
After properly orienting and mounting the neutral sensing transformer, maintain the correct polarity by connecting terminal LT11 on the circuit breaker to terminal X1 on the neutral sensor, and terminal LT12 on circuit breaker to terminal X2 on the neutral sensor.

Trip Unit Connections
Check to see if there are wires routed from terminal block positions LT11 and LT12 to the inside of circuit breaker. If there are, discard the 2 connection wires supplied with the transformer. If not, these wires will need to be installed. Remove breaker front cover and trip unit (see pages 36-37 of guide). Follow steps 2 and 3 on page 54. With a small screwdriver, press in tab on right side of 36 pin trip unit connector and release it from mounting bracket. Connect the wire marked LT11 from trip unit connector position #8 to terminal block position LT11. Connect wire marked LT12 from connector position #15 to terminal block position LT12. Make sure these connectors are fully seated and locked into connector. Route wires as shown below. Use number 18-gauge copper wire (to be supplied by customer) for lead wires. Replace trip unit and front cover taking care not to pinch any wires.



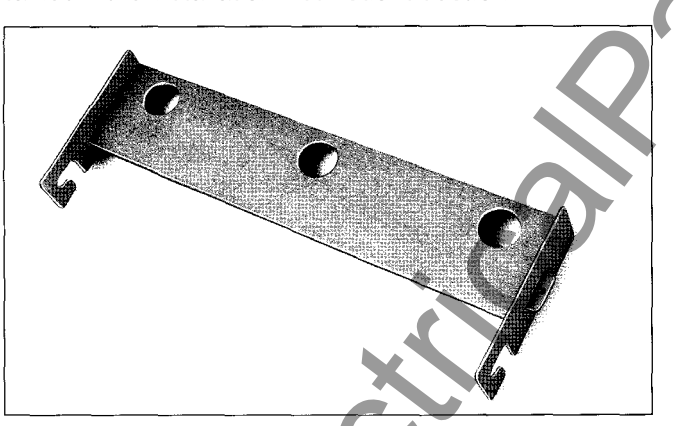
Lifting Device Bracket



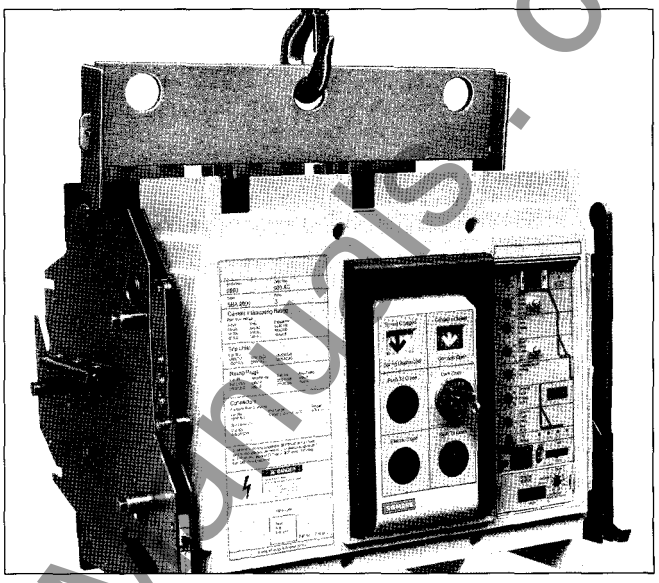
CAUTION: SB breakers and Stationary Drawout Elements are heavy. Personal injury or mechanical damage may occur if care is not used in lifting these pieces of equipment.

Lifting Device Bracket
A lifting device is used in conjunction with a hoist or crane to lift a moveable drawout element. Provisions are provided on the drawout elements to attach a lifting device. The attachment location allows the elements to be balanced as they are being lifted and installed.

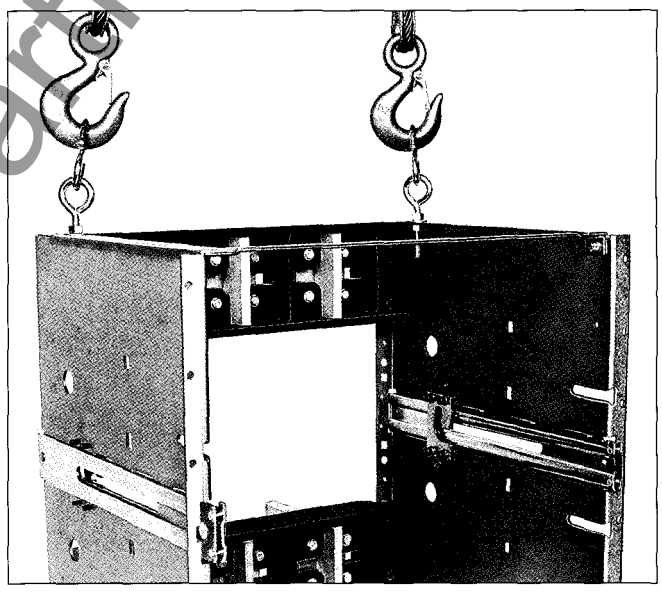
The instructions for attaching the lifting devices are contained in the Installation Instructions section.



Lifting Device Bracket



Connecting point of the lifting device.



Lifting the Moveable Drawout Element
(Use only two rear lift holes).

Auxiliary Power Supply

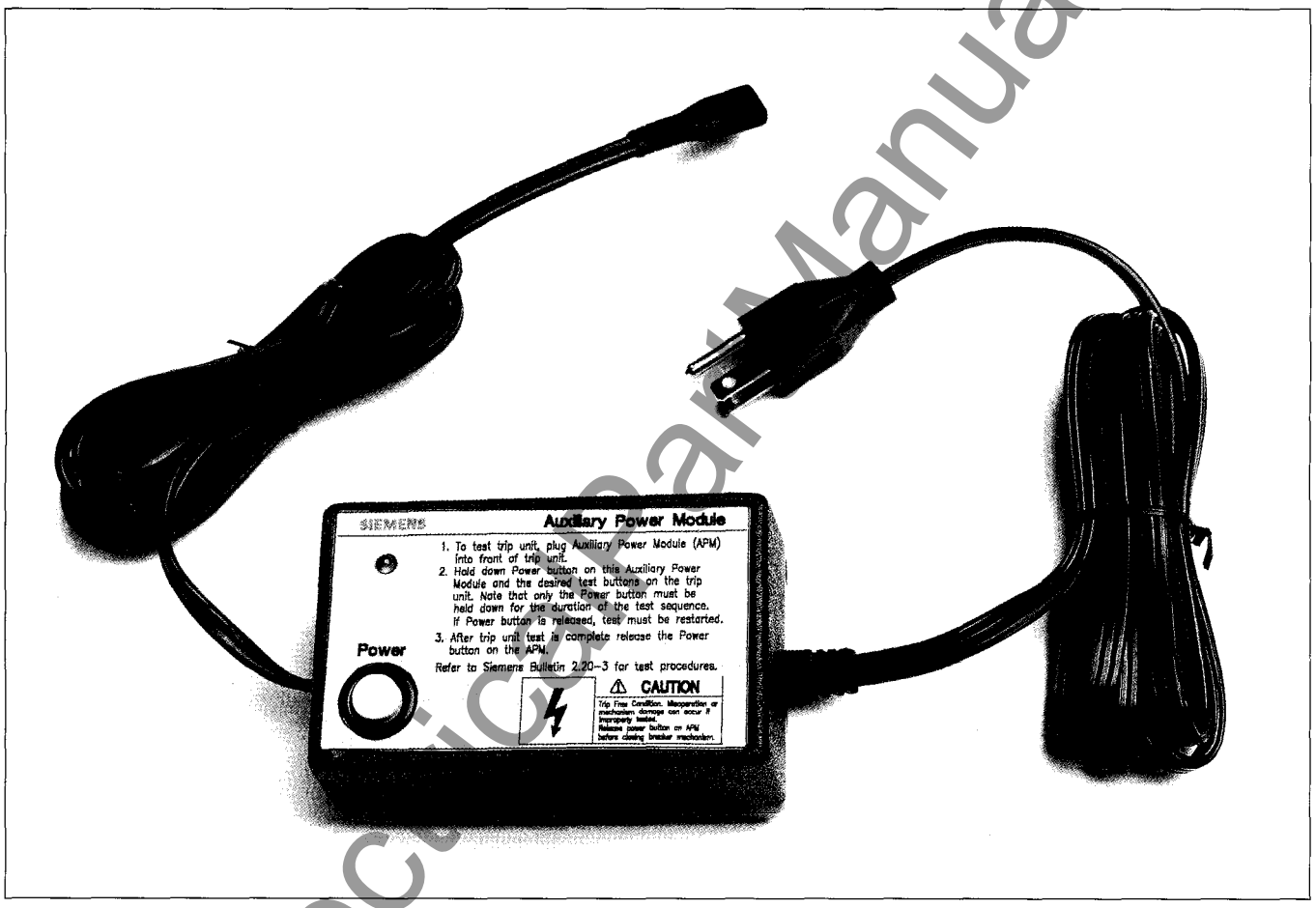
⚠ CAUTION

Trip Free Condition. Misoperation or mechanism damage can occur if improperly tested.

Release power button on APM before closing breaker mechanism.

Auxiliary Power Supply

The auxiliary power supply is a plug-in supply for bench testing the Electronic Trip Unit. The supply may also be used to power the trip unit during the execution of a "go/no-go" type test before bringing the SB breaker on-line (see Monitoring the Trip Unit in the Operating Instructions section). The auxiliary power supply operates from 120V ac source power.



Auxiliary Power Supply

Test Procedures

1. To test trip unit, plug Auxiliary Power Module (APM) into front of trip unit.

2. Hold down Power button on this Auxiliary Power Module and the desired test buttons on the trip unit. Note that only the Power button must be held down for the duration of the test sequence. If Power button is released, test must be restarted.

3. After trip unit test is complete release the Power button on the APM.

Universal Test Kit (TS-31)

General Information
(detailed instructions supplied with kit)

⚠ DANGER

Hazardous Voltage.
Will cause severe injury or death.

Turn power off and lock out all power supplying breaker to be tested before removing cover(s) and during testing.

Replace all covers and shields before power supplying breaker is turned on.

⚠ Safety Instructions

TS-31 Procedures

Operating Instructions

A. Remove electrical loads from circuit breaker.

B. Plug the TS-31 test set into a grounded 120 VAC receptacle and turn it on. You will be greeted by the identifying turn-on message:

Siemens Energy & Automation, Inc. TS-31 Test Set. Press any key to continue.

C. Select the appropriate ribbon cable assembly and connect it between the TS-31 and the circuit breaker, making sure of alignment and polarity. After pressing ENTER, the TS-31 will prompt:

Enter catalog number:

D. Type in the catalog of the circuit breaker if a JD, LD, MD, ND, PD FRAME. If the unit being tested is a SB ENCASED BREAKER, type in the catalog number of the trip unit (currently on the side of the trip unit proper and the side of the circuit breaker if the unit was factory installed.)

After entering the catalog number information, press the ENTER key. The TS-31 will respond with:

Searching Catalog . . . Searching Family/Series . . .

If an invalid catalog number has been entered, the TS-31 will respond with:

XXX...NOT found. Press any key to continue.

and you will be asked to enter another catalog number.

E. If valid catalog number has been entered, the TS-31 will prompt for the breaker settings. The TS-31 will respond with:

Enter Continuous Current Setting in %:

If the unit being tested is a SB ENCASED BREAKER trip unit set the continuous setting to 100% (this equals the value of the rating plug which is referred to as I_r.)

Enter Long Time Delay in Seconds:
Enter Instantaneous Pickup Setting:

For breakers with short time functions you may be asked one of the following:

Enter Short Time Pickup:
Select Short Time Delay 1-Fixed 2-I^2t:
Enter Short Time Delay in Seconds:

For breakers with ground fault you will be asked:

Select Ground Fault Type: 1 - Residual 2 - Gnd. Return 3 - Unsure:
Enter Ground Fault Pickup Setting in %:
Enter Ground Fault Delay: 1-Fixed 2-I^2t:
Enter Ground Fault Delay in Seconds

In each case, enter your breaker's switch settings. For example if your breaker is set for 70%, type 70 and then press ENTER. Entry of erroneous data in the above steps will result in false tests and results.

F. After entering the breaker switch settings, you must select the test you wish to have performed:

Enter test: L - Long S - Short I - Inst. G - Gnd. Fault C - CT Cont.?

"L" – Long time or overload test.
"S" – Short time test.
"I" – Instantaneous test.
"G" – Ground fault test.
"C" – Current transformer continuity test.

G. If you press ENTER, you will be prompted for the phase to be tested: The TS-31 will display:

Enter Phase to Test:

Universal Test Kit (TS-31)

Enter one of the following letters:
"A"—Phase A or Left Pole
"B"—Phase B or Center Pole
"C"—Phase C or Right Pole

H. The TS-31 will report the type of test you selected and give you a chance to abort the test. For example, if "I" was pressed above. The TS-31 will display:

Instantaneous Test Press ENTER to Continue or A to Abort.

If you pressed the letter "A" to abort, you will be asked to enter again.

Change: 1 - Test 2 - Catalog 3 - Settings:

I. Press Enter again to start the test. Press any other key to STOP the test. Once a test has been started, the TS-31 will respond with:

Trip test. Press Any Key to Abort. Time Remaining: xx.xxx Sec.

Be careful at this time. Any key press will abort the test.

J. The test may take anywhere from a fraction of a sec ond to minutes to complete, depending on which procedure was run. If the test passes, the display will show the following, depending on whether the breaker tripped or not.

Test Passed. xxx.xx seconds Press any key to continue.

If the breaker tripped during the test, RESET the circuit breaker before continuing.

K. The TS-31 will prompt for the next instructions. The display will show:

Change: 1 - Test 2 - Catalog 3 - Settings

Enter one of the following numbers:
"1" – select a new test
"2" – enter a new catalog number
"3" – enter a new switch setting

If you enter "1" you will be sent to step F. Choosing a "2" will send the program back to step E. Entering "3" which sends you back to step E, will be slightly different the second time through. On the second line after the prompt for the setting, a number or text in brackets will appear. This will indicate the last setting you entered. If you DON'T wish to change a setting, just press ENTER. If you DO wish to change a setting, type in the new setting and press ENTER.

L. If you pressed "C" when asked.
You will first be prompted by:

Current Transformer Test Press ENTER to Continue or A to abort.

and then for the phase to test. A message will then appear stating the test results. For example:

CT Resistance Test. Phase X PASSED. Press any key to continue.

M. There are additional ERROR messages which may appear on the display during this operation which were not covered previously:

Test Not Running — Check Test Cable. Press enter to continue.

The test set has sensed that current is not flowing properly in the breaker under test and that there is either an open or short circuit between the TS-31 and the breaker trip unit.

Ground Fault is NOT available on a SJD69300. Press any key to continue.

You will get this error message if you enter a choice that is not available, such as entering "G" in step F for ground fault test on a catalog number that does have ground fault.

Inconclusive Test, Check Settings. Press any key to continue or A to abort.

Note: This warning will appear if you attempt to run a short time test with the instantaneous pickup set equal to or below the short time pickup. It would also appear if you tried to run a long time test with short time pickup set to 2. This is only a warning: the test can still be run. However, passing or failing the test may not be conclusive.

XX is NOT a Valid Setting. Press any key to continue.

Note: This message will appear if you enter a setting value that does not exist. For example a SMD69700ANGT has continuous current settings of 20, 30, 40, 50, 60, 70, 80, 90, 100 percent. If you were to enter any other value than those listed, the above message will appear.

Test Exceeds Capability of TS-31. Press any key to continue.

Note: This message is not likely to occur. If it does, it means that a test requires more current to run than the TS-31 can produce.

Unit Too Hot, Please Wait.

Note: Running many successive high-current long time tests may over-heat the test set. It will protect itself from damage by preventing further tests until it has had a chance to cool down. The display will indicate when testing can resume.

Dead Front Shield

Note: Accessory installation should be completed before the breaker is racked into the "Connected" position. If the breaker is in the "Connected" position, rack the breaker out to the "Unlocked" position. Turn off and lock out all power supplying the switchboard before installing any accessories.

1. Tighten rubber inserts until they are flush against spacer and the spacer is flush against the dead front shield (See Figure 1).

2. Place the dead front shield on the front of the breaker while guiding the rubber inserts into the holes located in the breaker cover (See Figure 1).

3. Secure the dead front shield by tightening the two (2) screws provided.

Note: Approximately ten (10) complete rotations of the screws will secure the dead front shield.

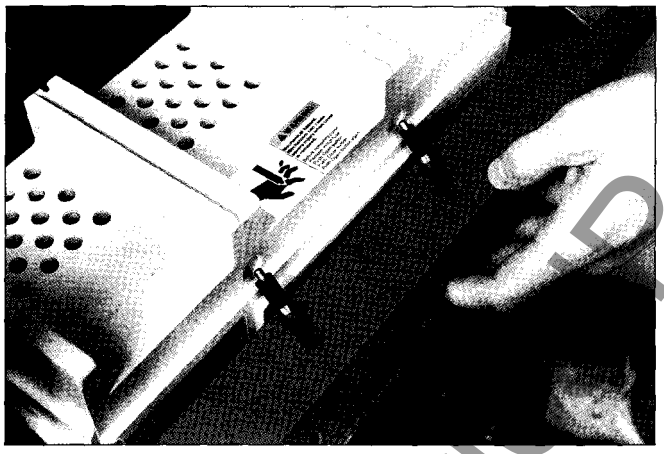
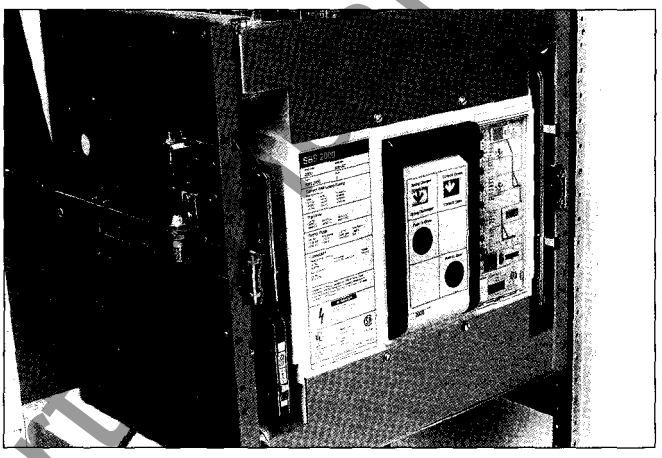


Figure 1.

4. Check the dead front shield to insure that it is properly secured. Tighten screws more if the dead front shield feels loose.

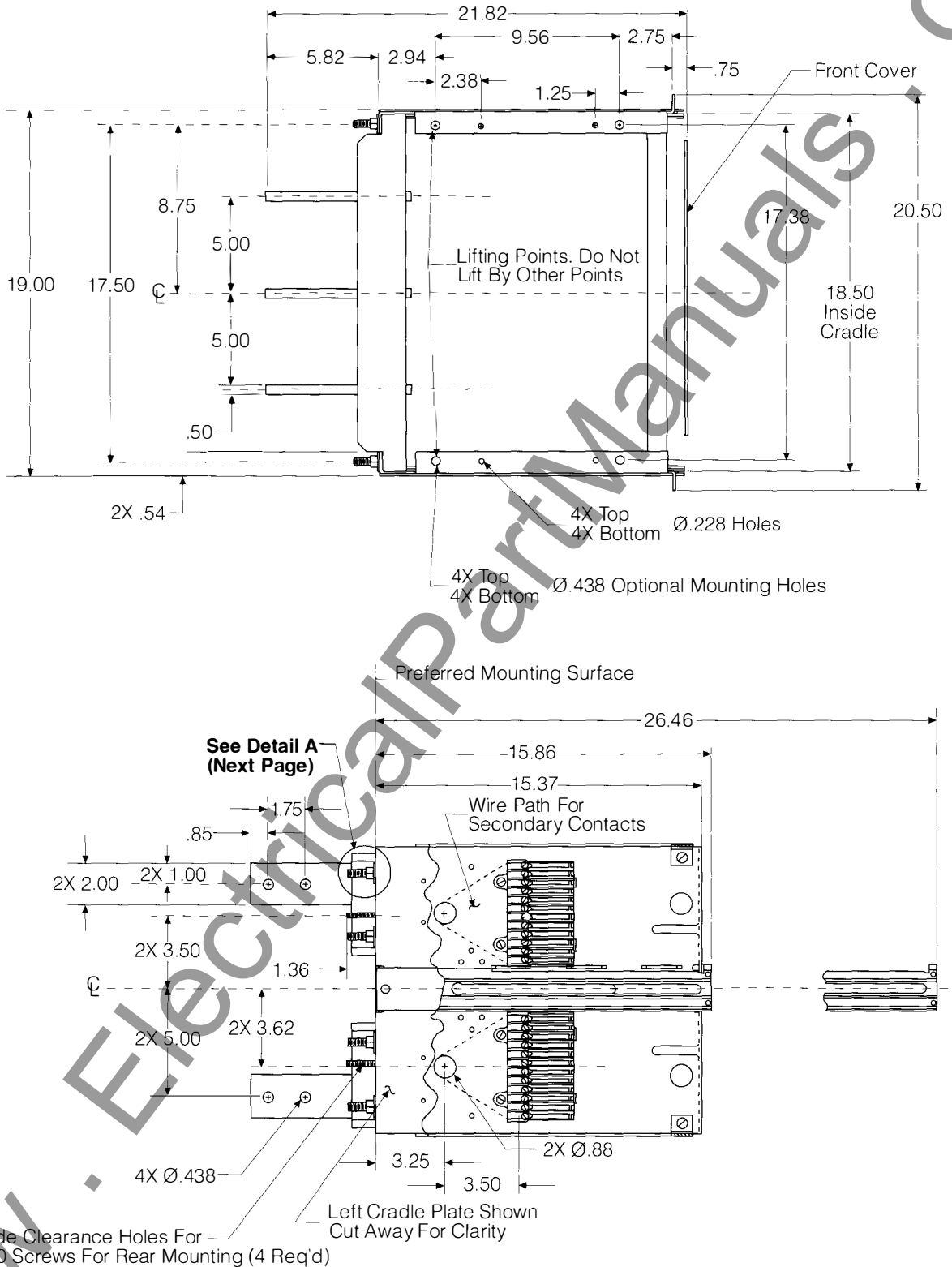
5. The dead front shield assembly consists of two (2) identical shields, one for the top of the breaker and one for the bottom. Repeat steps 1 through 4 for installation of the second shield.



Dead Front Shields Installed

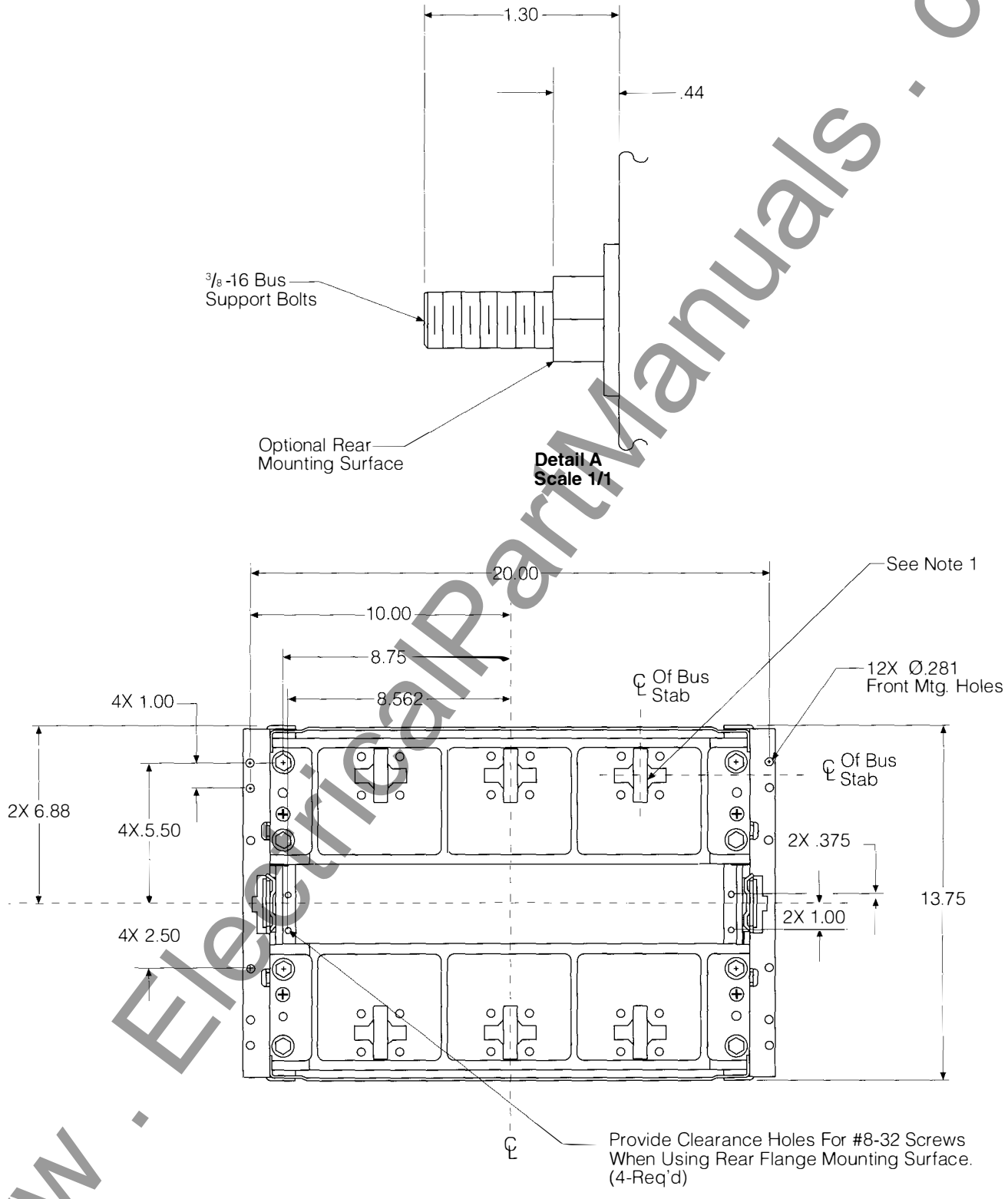
Outline Dimension Drawing

800A Stationary Drawout Element
1200A Stationary Drawout Element



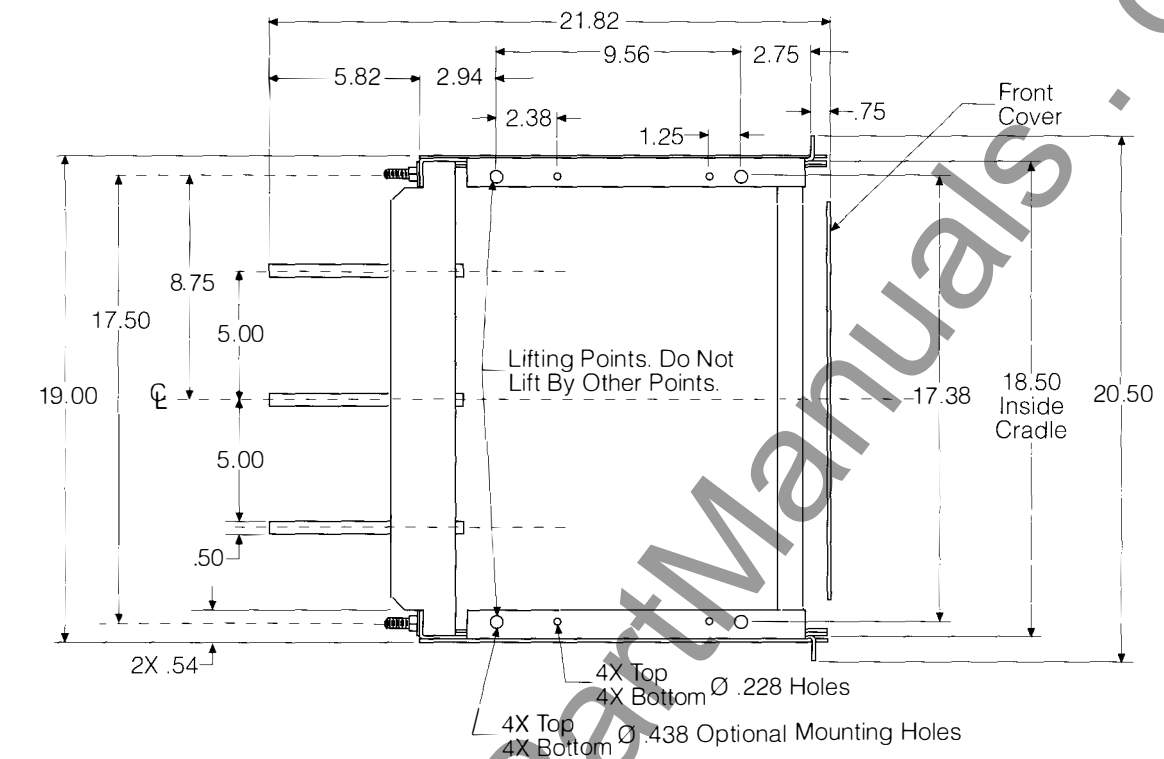
Outline Dimension Drawing

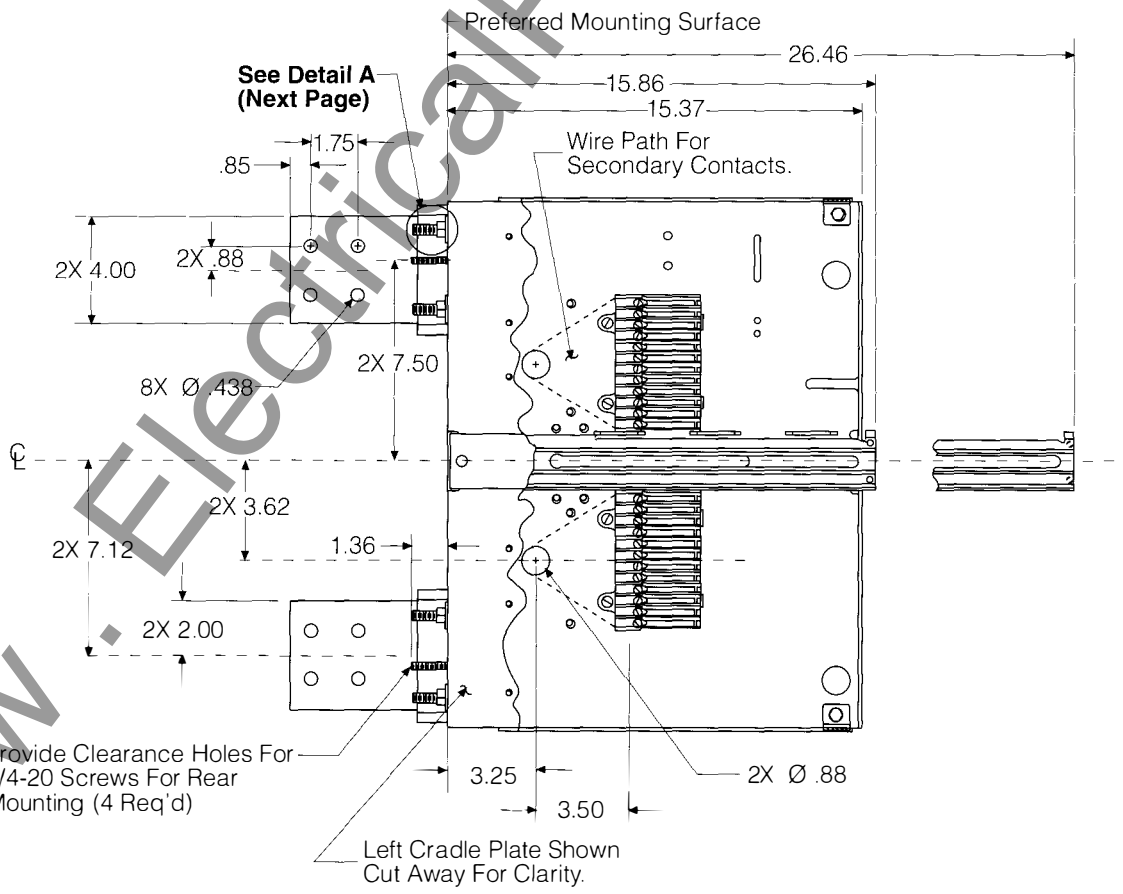
800A Stationary Drawout Element
1200A Stationary Drawout Element



Outline Dimension Drawing

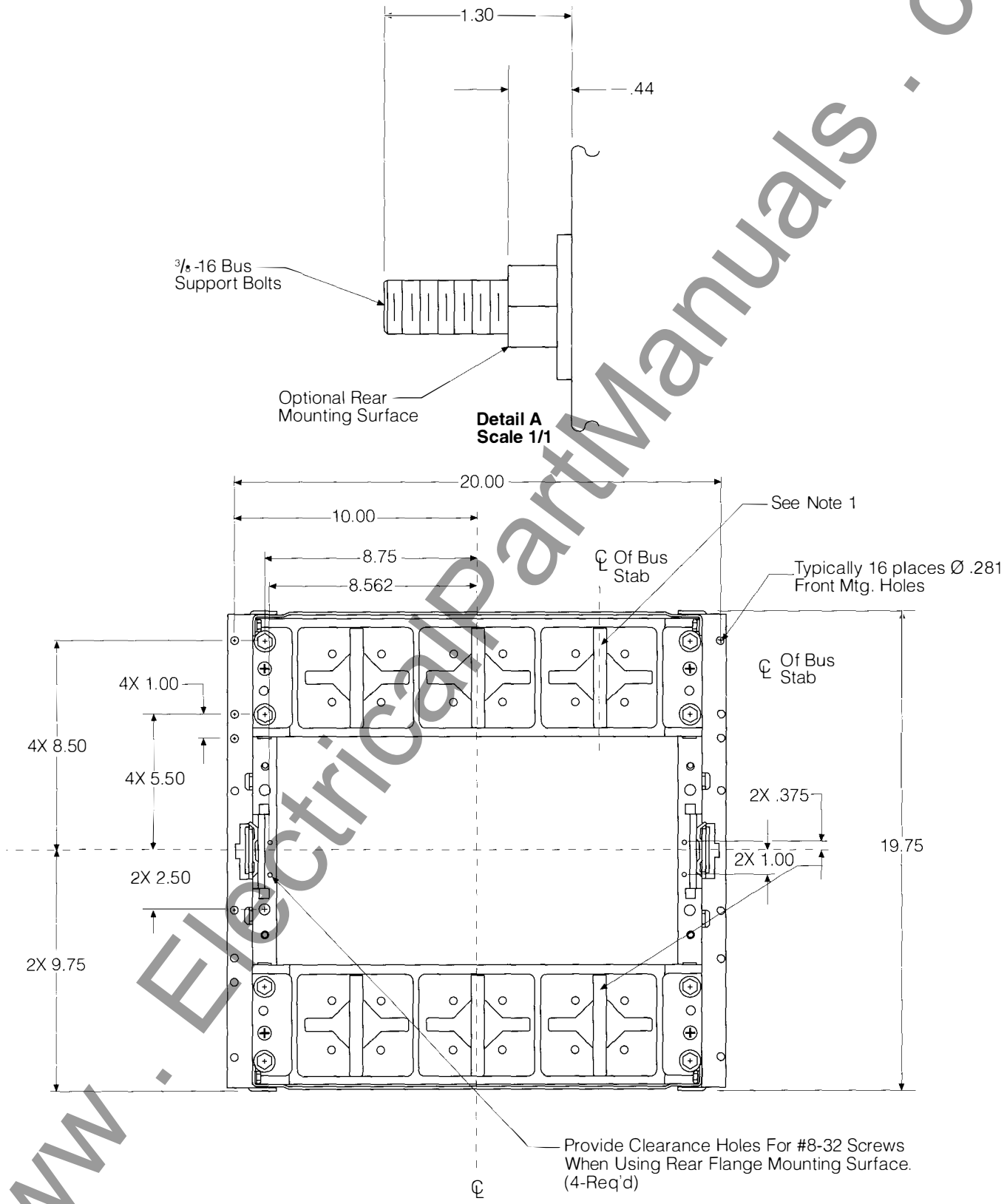
2000A Stationary Drawout Element





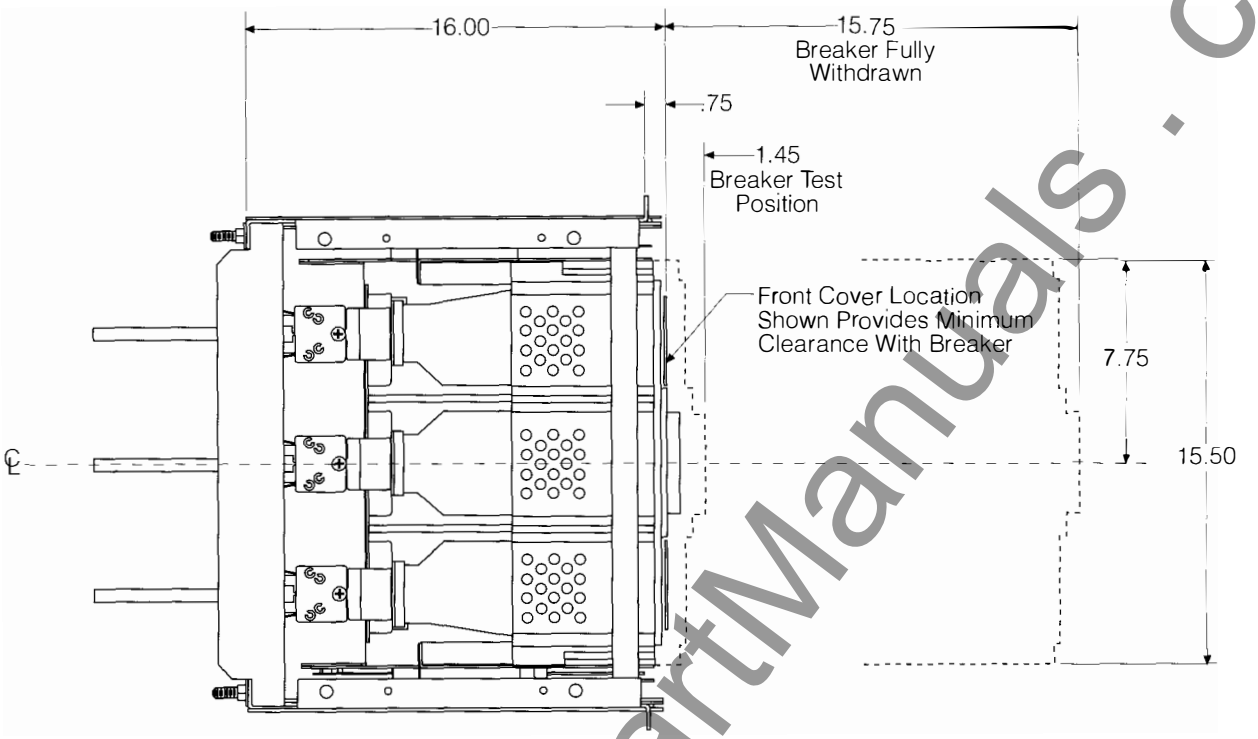
Outline Dimension Drawing

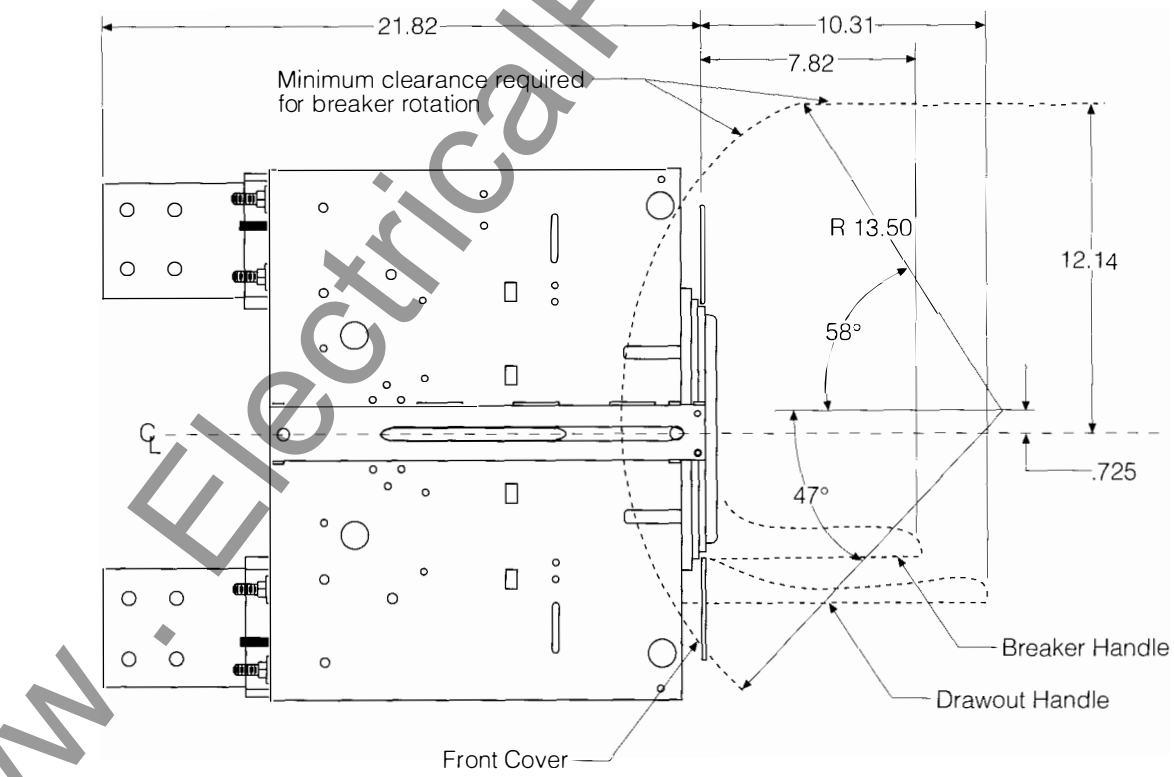
2000A Stationary Drawout Element



Outline Dimension Drawing

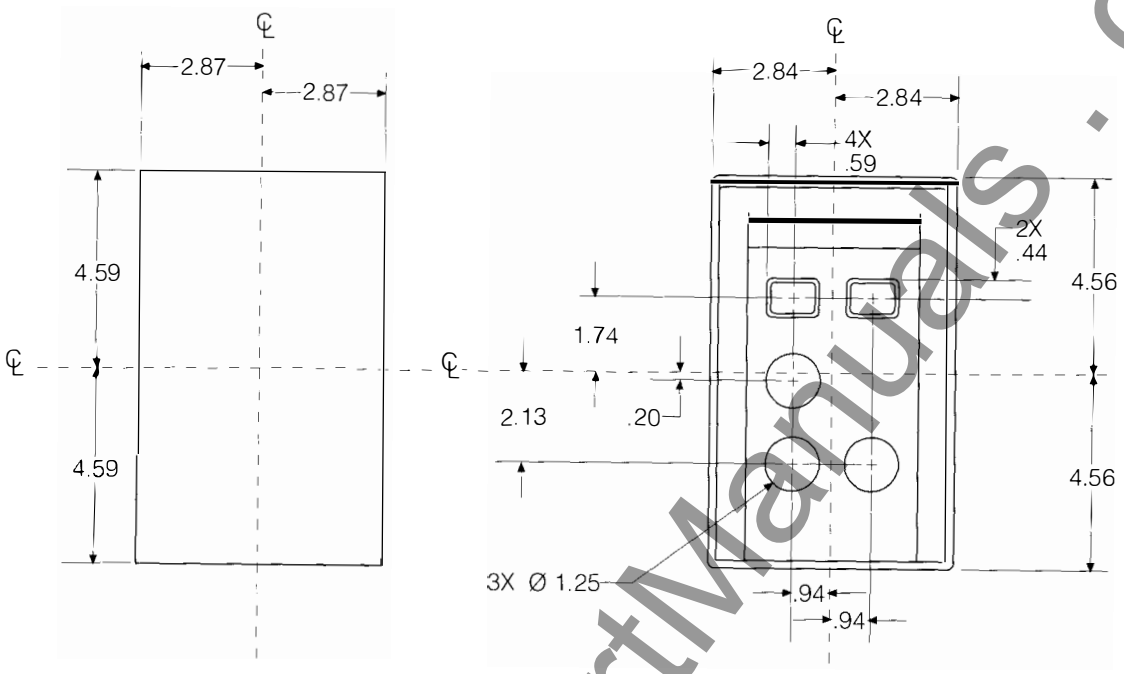
2000A Moveable Drawout Element

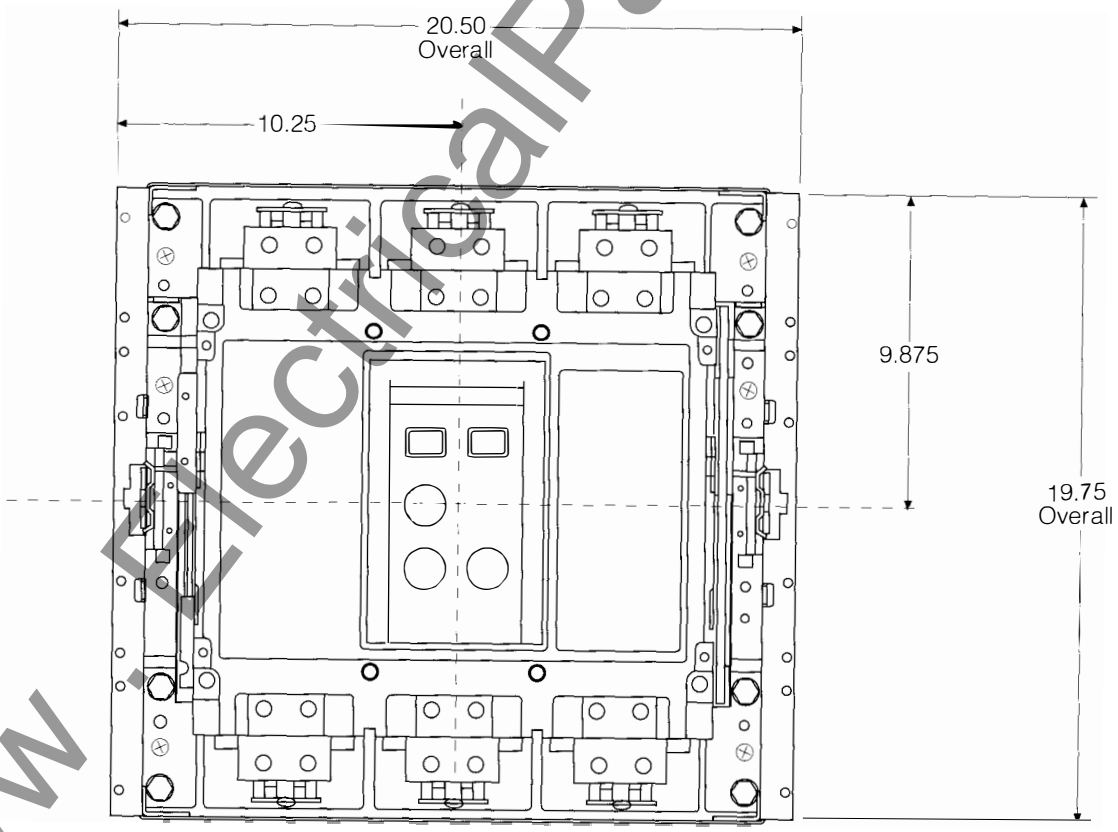




Outline Dimension Drawing

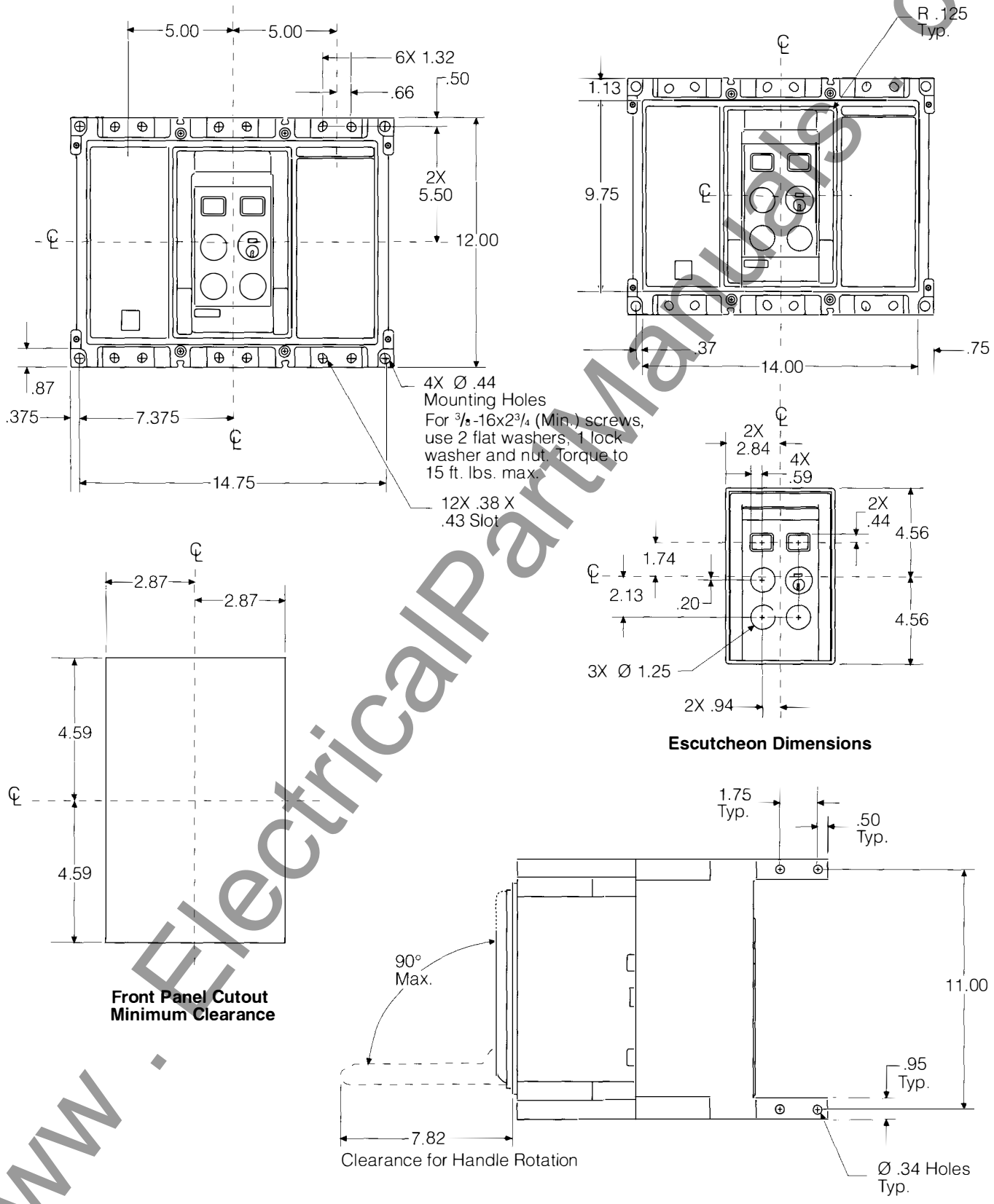
2000A Moveable Drawout Element





Outline Dimension Drawing

800A Fixed Mounted
1200A Fixed Mounted

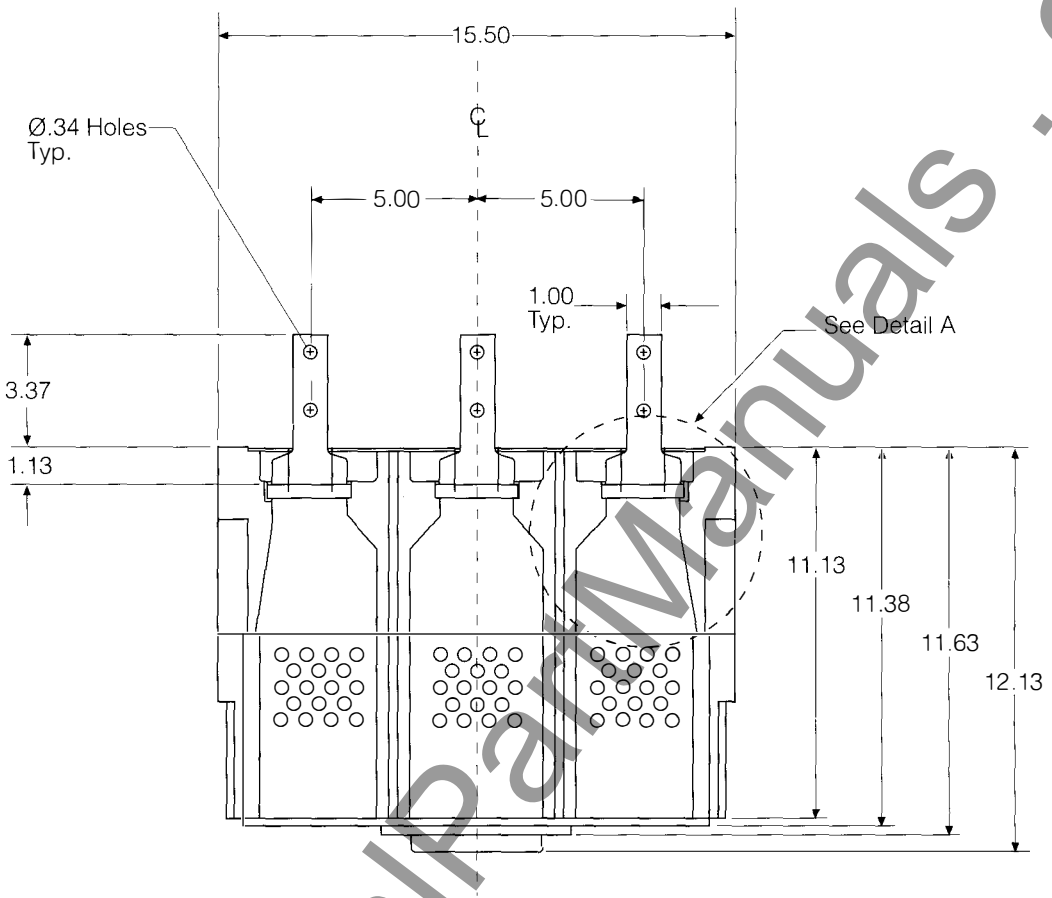


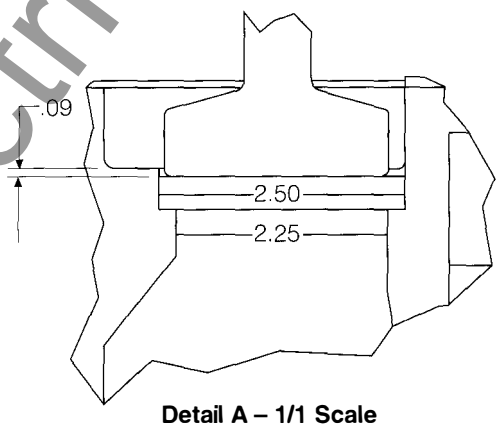
Escutcheon Dimensions

Front Panel Cutout
Minimum Clearance

Outline Dimension Drawing

800A Fixed Mounted
1200A Fixed Mounted

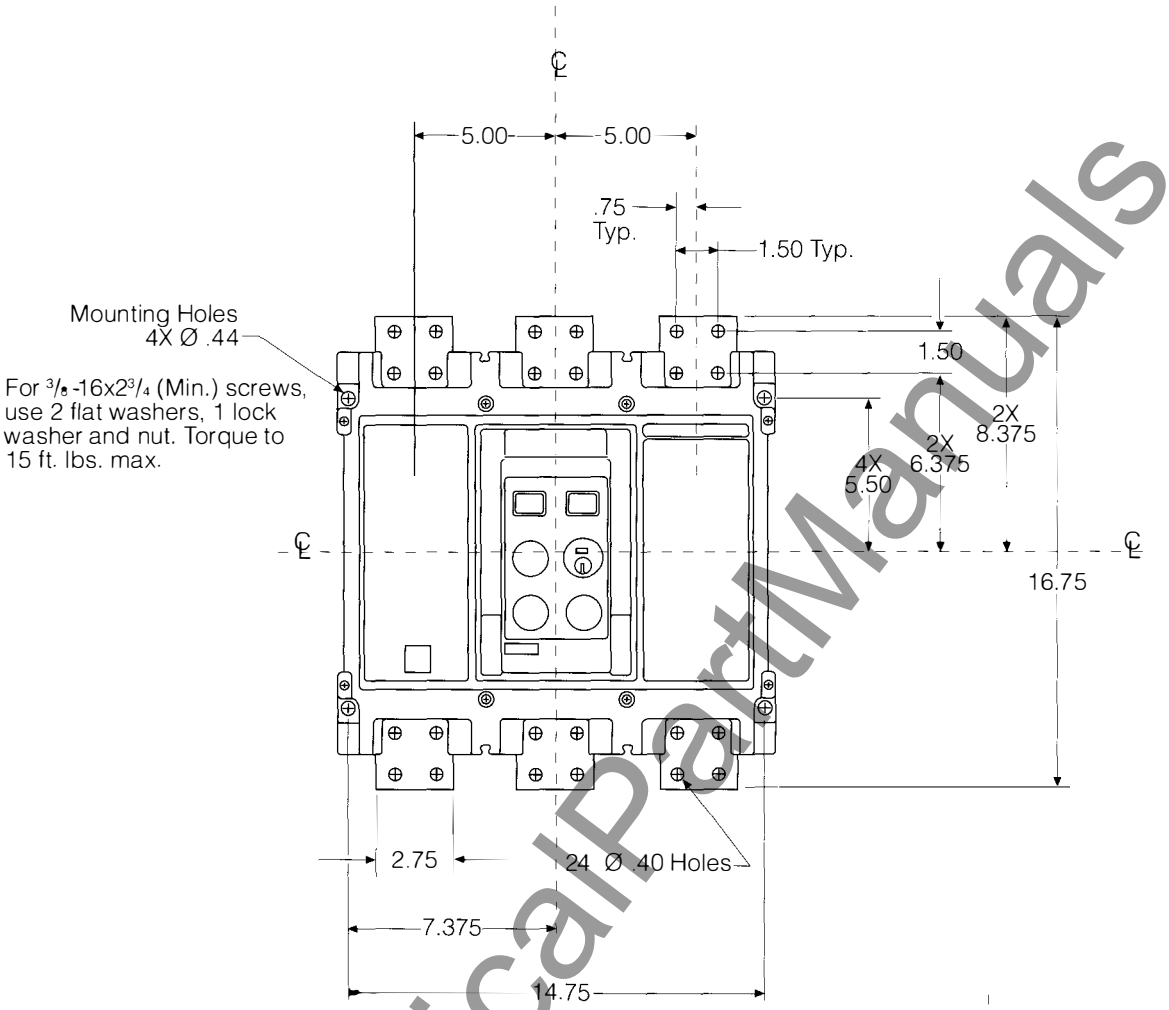


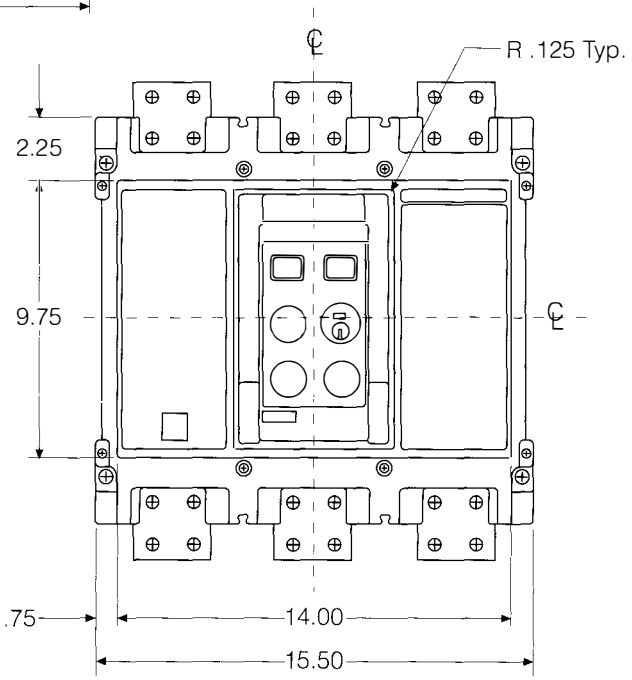


Detail A – 1/1 Scale

Outline Dimension Drawing

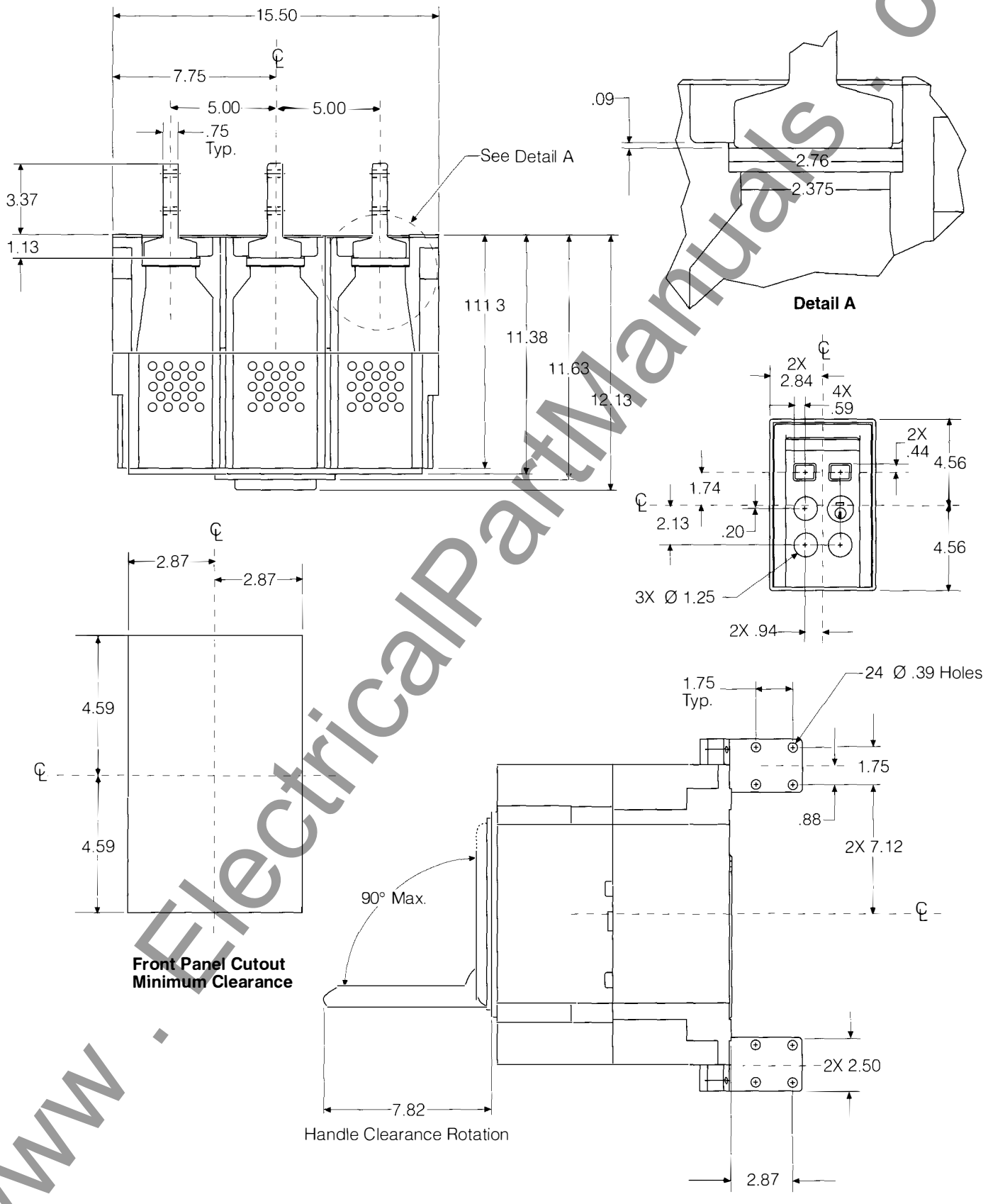
2000A Fixed Mounted





Outline Dimension Drawing

2000A Fixed Mounted



Encased Systems Circuit Breakers and Electronic Trip Units

Type SB Encased Systems Breaker Frames, Alternate Interrupting Rating (To 85 A.I.R. (kA))

Breaker Type		Fixed Mounted	Drawout Breaker with Moveable Mechanism		Stationary Drawout Mechanism	
Ampere Rating	Frame Size	Catalog Number	Vertical Bus Catalog Number	Horizontal Bus Catalog Number	Vertical Bus Catalog Number	Horizontal Bus Catalog Number
400	800	SBA0804F	SBA0804DV	SBA0804DH	SBA08DFV	SBA08DFH
800	800	SBA0808F	SBA0808DV	SBA0808DH	SBA08DFV	SBA08DFH
1200	1200	SBA1212F	SBA1212DV	SBA1212DH	SBA12DFV	SBA12DFH
1600	2000	SBA2016F	SBA2016DV	SBA2016DH	SBA20DFV	SBA20DFH
2000	2000	SBA2020F	SBA2020DV	SBA2020DH	SBA20DFV	SBA20DFH

Type SB Encased Systems Breaker Frames, Standard Interrupting Rating (To 100 A.I.R. (kA))

Breaker Type		Fixed Mounted	Drawout Breaker with Moveable Mechanism		Stationary Drawout Mechanism	
Ampere Rating	Frame Size	Catalog Number	Vertical Bus Catalog Number	Horizontal Bus Catalog Number	Vertical Bus Catalog Number	Horizontal Bus Catalog Number
400	800	SBS0804F	SBS0804DV	SBS0804DH	SBS08DFV	SBS08DFH
800	800	SBS0808F	SBS0808DV	SBS0808DH	SBS08DFV	SBS08DFH
1200	1200	SBS1212F	SBS1212DV	SBS1212DH	SBS12DFV	SBS12DFH
1600	2000	SBS2016F	SBS2016DV	SBS2016DH	SBS20DFV	SBS20DFH
2000	2000	SBS2020F	SBS2020DV	SBS2020DH	SBS20DFV	SBS20DFH

Type SB Encased Systems Breaker Frames, High Interrupting Rating (To 200 A.I.R. (kA))

Breaker Type		Fixed Mounted	Drawout Breaker with Moveable Mechanism		Stationary Drawout Mechanism	
Ampere Rating	Frame Size	Catalog Number	Vertical Bus Catalog Number	Horizontal Bus Catalog Number	Vertical Bus Catalog Number	Horizontal Bus Catalog Number
400	800	SBH0804F	SBH0804DV	SBH0804DH	SBH08DFV	SBH08DFH
800	800	SBH0808F	SBH0808DV	SBH0808DH	SBH08DFV	SBH08DFH
1200	1200	SBH1212F	SBH1212DV	SBH1212DH	SBH12DFV	SBH12DFH
1600	2000	SBH2016F	SBH2016DV	SBH2016DH	SBH20DFV	SBH20DFH
2000	2000	SBH2020F	SBH2020DV	SBH2020DH	SBH20DFV	SBH20DFH

Electronic Trip Unit, 800A Frame

Catalog Number	Frame Ampere Rating	Continuous Current Setting	Long Time Delay	Instantaneous Pickup	Short Time Pickup/Delay	Ground Fault Pickup/Delay
SB04TLI	400	x	x	x		
SB04TLS	400	x	x		x	
SB04TLSI	400	x	x	x	x	
SB04TLIG	400	x	x	x		x
SB04TLSG	400	x	x		x	x
SB04TLSIG	400	x	x	x	x	x
SB04TMLI	400			x		
SB08TLI	800	x	x	x		
SB08TLS	800	x	x		x	
SB08TLSI	800	x	x	x	x	
SB08TLIG	800	x	x	x		x
SB08TLSG	800	x	x		x	x
SB08TLSIG	800	x	x	x	x	x
SB08TMLI	800			x		

Electronic Trip Unit, 1200A Frame

Catalog Number	Frame Ampere Rating	Continuous Current Setting	Long Time Delay	Instantaneous Pickup	Short Time Pickup/Delay	Ground Fault Pickup/Delay
SB12TLI	1200	x	x	x		
SB12TLS	1200	x	x		x	
SB12TLSI	1200	x	x	x	x	
SB12TLIG	1200	x	x	x		x
SB12TLSG	1200	x	x		x	x
SB12TLSIG	1200	x	x	x	x	x
SB12TMLI	1200			x		

Encased Systems Circuit Breakers and Electronic Trip Units (Continued)

Electronic Trip Unit, 2000A Frame

Catalog Number	Frame Ampere Rating	Continuous Current Setting	Long Time Delay	Instantaneous Pickup	Short Time Pickup/Delay	Ground Fault Pickup/Delay
SB16TLI	1600	x	x	x		
SB16TLS	1600	x	x		x	
SB16TLSI	1600	x	x	x	x	
SB16TLIG	1600	x	x	x		x
SB16TLSG	1600	x	x		x	x
SB16TLSIG	1600	x	x	x	x	x
SB16TMLI	1600			x		
SB20TLI	2000	x	x	x		
SB20TLS	2000	x	x		x	
SB20TLSI	2000	x	x	x	x	
SB20TLIG	2000	x	x	x		x
SB20TLSG	2000	x	x		x	x
SB20TLSIG	2000	x	x	x	x	x
SB20TMLI	2000			x		

Rating Plugs

Rating Plugs, 400 Ampere Frame Rating

Catalog Number	Plug Rating
04SB200	200
04SB225	225
04SB250	250
04SB300	300
04SB350	350
04SB400	400

Rating Plugs, 800 Ampere Frame Rating

Catalog Number	Plug Rating
08SB400	400
08SB450	450
08SB500	500
08SB600	600
08SB700	700
08SB800	800

Rating Plugs, 1200 Ampere Frame Rating

Catalog Number	Plug Rating
12SB600	600
12SB700	700
12SB800	800
12SB1000	1000
12SB1200	1200

Rating Plugs, 1600 Ampere Frame Rating

Catalog Number	Plug Rating
16SB800	800
16SB1000	1000
16SB1200	1200
16SB1600	1600

Rating Plugs, 2000 Ampere Frame Rating

Catalog Number	Plug Rating
20SB1000	1000
20SB1200	1200
20SB1600	1600
20SB2000	2000

Internal Accessories/External Accessories

Electric Motor Operator

Accessory	Catalog Number
120 VAC	SBEO120
24 VDC	SBEO24
48 VDC	SBEO48
125 VDC For Fix Mount Only	SBEO125
125 VDC For Drawout Only	SBEO125D

Electric Operator With Close Coil Interlock

Accessory	Catalog Number
120 VAC	SBEO120CCX
24 VDC	SBEO24CCX
48 VDC	SBEO48CCX

Dead Front Shield

Frame Size	Accessory
800A, 1200A	SB08DF
2000A	SB20DF

Remote Closing Solenoid

Accessory	Catalog Number
120 VAC	SBRCS120
24 VDC	SBRCS24
48 VDC	SBRCS48
125 VDC	SBRCS125

Shunt Trip

Accessory	Catalog Number
120 VAC	SBST120
240 VAC	SBST240
480 VAC	SBST480
12 VDC	SBST12
24 VDC	SBST24
48 VDC	SBST48
125 VDC	SBST125

Undervoltage Release

Accessory	Catalog Number
120 VAC	SBUV120
240 VAC	SBUV240
480 VAC	SBUV480
12 VDC	SBUV12
24 VDC	SBUV24
48 VDC	SBUV48
125 VDC	SBUV125

Auxiliary Switches

Accessory	Catalog Number
1A & 1B	SBAS2
2A & 2B	SBAS4
3A & 3B	SBAS6
4A & 4B	SBAS8
5A & 5B	SBAS10
6A & 6B	SBAS12

Electronic Bell Alarm

Accessory	Catalog Number	Voltage
Bell Alarm	SBBA24	24V dc
	SBBA48	48V dc
	SBBA125	125V dc
	SBBA120	120V dc

Display Module Relay

Accessory	Catalog Number	Voltage
Display Module Relay	SBDMR24	24V dc
	SBDMR48	48V dc
	SBDMR125	125V dc
	SBDMR120	120V ac

Time Delay Undervoltage

Accessory	Catalog Number
Time Delay Undervoltage	CONSULT SIEMENS

Drawout Safety Shutters

Accessory	Catalog Number
800A Envelope 1200A Envelope	SBSS08
2000A Envelope	SBSS20

Sliding Secondary Disconnects ②

Accessory	Catalog Number
Sliding Secondary Disconnects	SBSDLT, SBSDLB, SBSDRT, SBSDRB

● The catalog number for the secondary disconnects include one each 12-point A and B block.

Control Terminal Blocks ③

Accessory	Catalog Number
Control Terminal Blocks	SBTBLT, SBTBLB, SBTBRT, SBTBRB
Terminal Block Mount	SBTBM

③ The catalog numbers for the control terminal block consists of one 12-point fixed terminal strip.

Pressure Wire Connectors

Accessory	Catalog Number
800A Envelope – 800 Amp	TA3K500SB
1200A Envelope – 1200 Amp	TA4N8500SB
2000A Envelope – 1200 Amp	TA4P8500SB
2000A Envelope – 1600 Amp	TA5P600SB
2000A Envelope – 2000 Amp	TA6R600SB

"T" Connectors

Accessory	Catalog Number
800A Envelope 1200A Envelope	SB12TCON
2000A Envelope	SB20TCON

Lifting Device Bracket

Accessory	Catalog Number
Drawout Circuit Breaker	SBLD

Neutral Current Transformers

Accessory	Catalog Number
400 Amps Frame Rating	N04SB
800 Amps Frame Rating	N08SB
1200 Amps Frame Rating	N12SB
1600 Amps Frame Rating	N16SB
2000 Amps Frame Rating	N20SB

External Accessories

Key Interlocks

Accessory	Catalog Number
Installed on Breaker	KISB, SISB
Provision Only	
Circuit Breaker	KIPOF
Drawout	8KIPOD, 20KIPOD

Padlock Devices

Accessory	Catalog Number
Installed on Breaker	SBPLB
Installed on Drawout	SBPLD

Breaker Closing Blocking Device

Accessory	Catalog Number
Breaker Closing Blocking Device	SBBD

Capacitor Trip

Accessory	Catalog Number
Capacitor Trip	CONSULT SIEMENS

Cell Switches

Accessory	Catalog Number
1A & 1B	CEL1
2A & 2B	CEL2
3A & 3B	CEL3
4A & 4B	CEL4

Mechanical Interlock

Accessory	Catalog Number
800A, 1200A Envelope	
Fixed Circuit Breaker	SBMIF08
Drawout Circuit Breaker	SBMID08
2000A Envelope	
Fixed Circuit Breaker	SBMIF20
Drawout Circuit Breaker	SBMID20

Remote Indication Panel

Accessory	Catalog Number
Remote Indication Relay Panel	SBRIP

Display Module

Accessory	Catalog Number
Display Module	SBDM

Ground Fault Display Module

Accessory	Catalog Number
Ground Fault Display Module	SBGFM

Auxiliary Power Source For Electronic Trip Unit

Accessory	Catalog Number
Auxiliary Power Source	SBAPM

Universal Trip Unit Test Kit

Accessory	Catalog Number
Test Kit	TS31

UL Listings and File Numbers

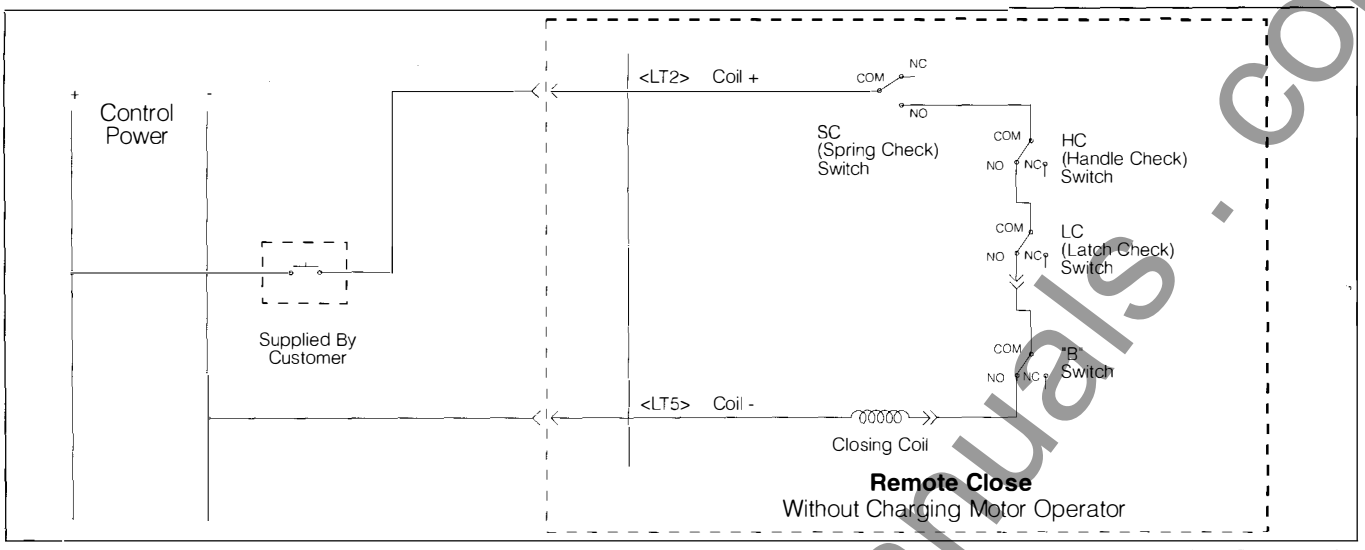
UL Listing	File Number
Trip Unit	E9896
Breaker	E9896
Drawout Assembly	E135453
Accessories	E57501
CSA Guide	LR57039

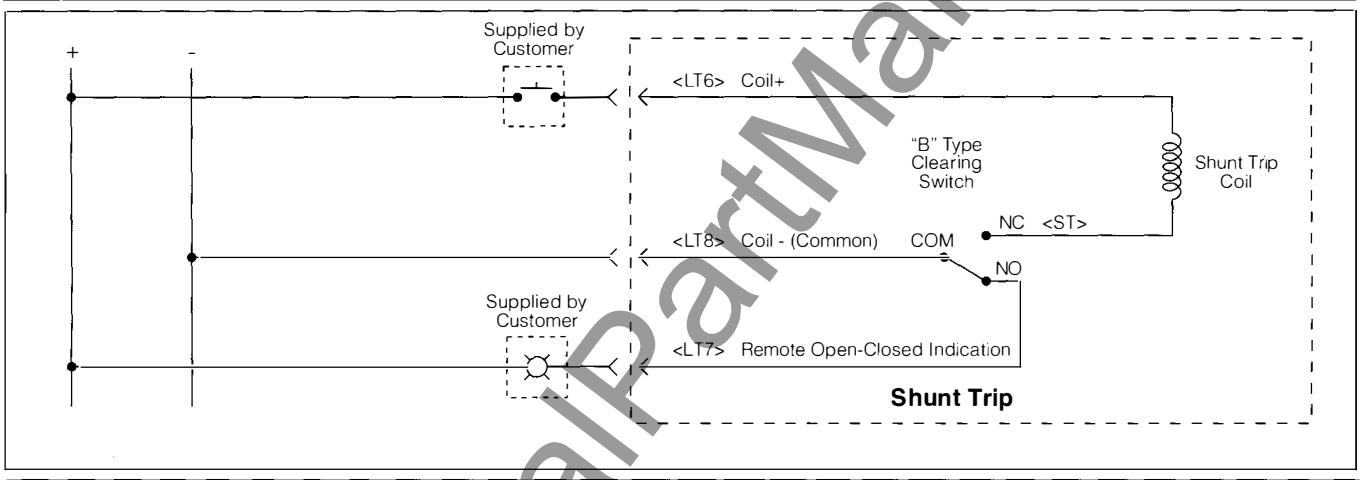
Time Current Curves

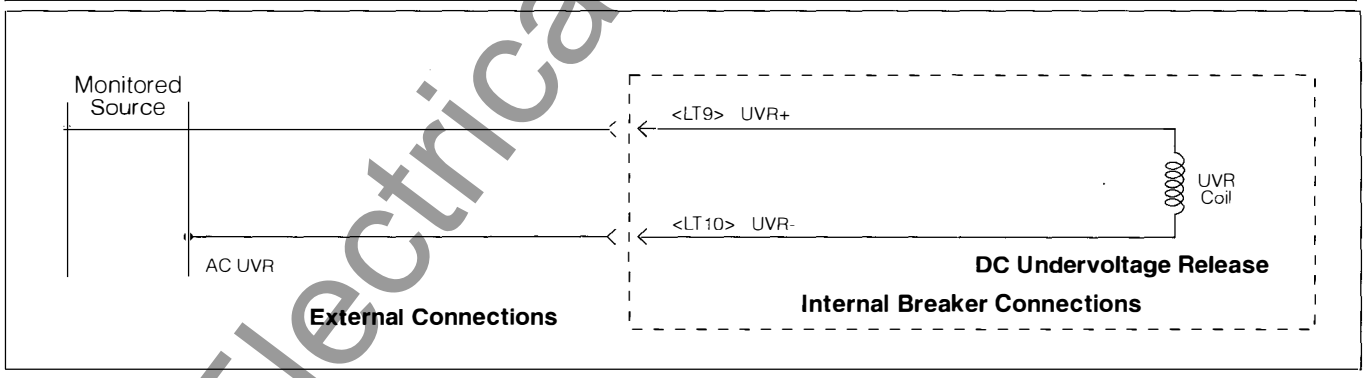
Description	Catalog Number
Time Current Curves	TD7210

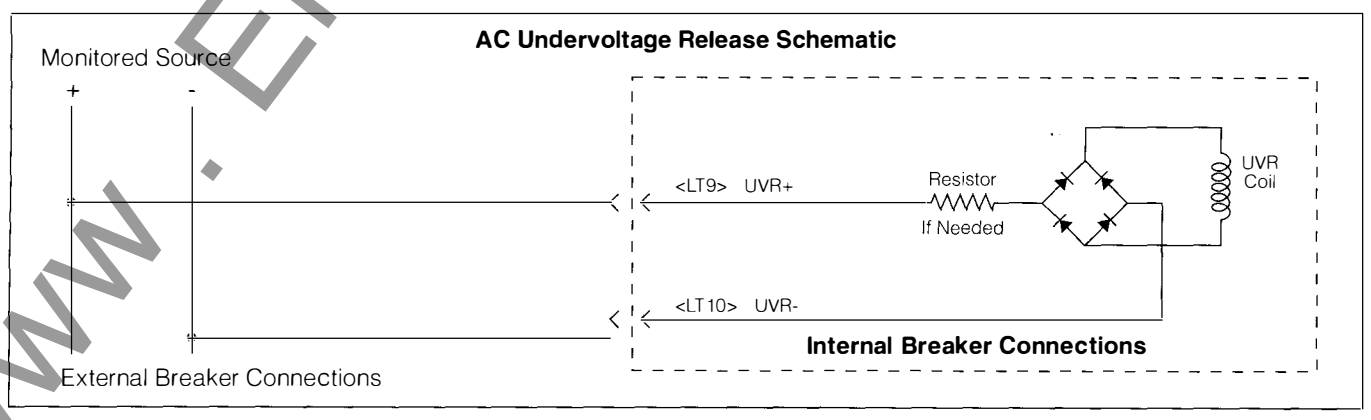
Electric Operator Troubleshooting Guide

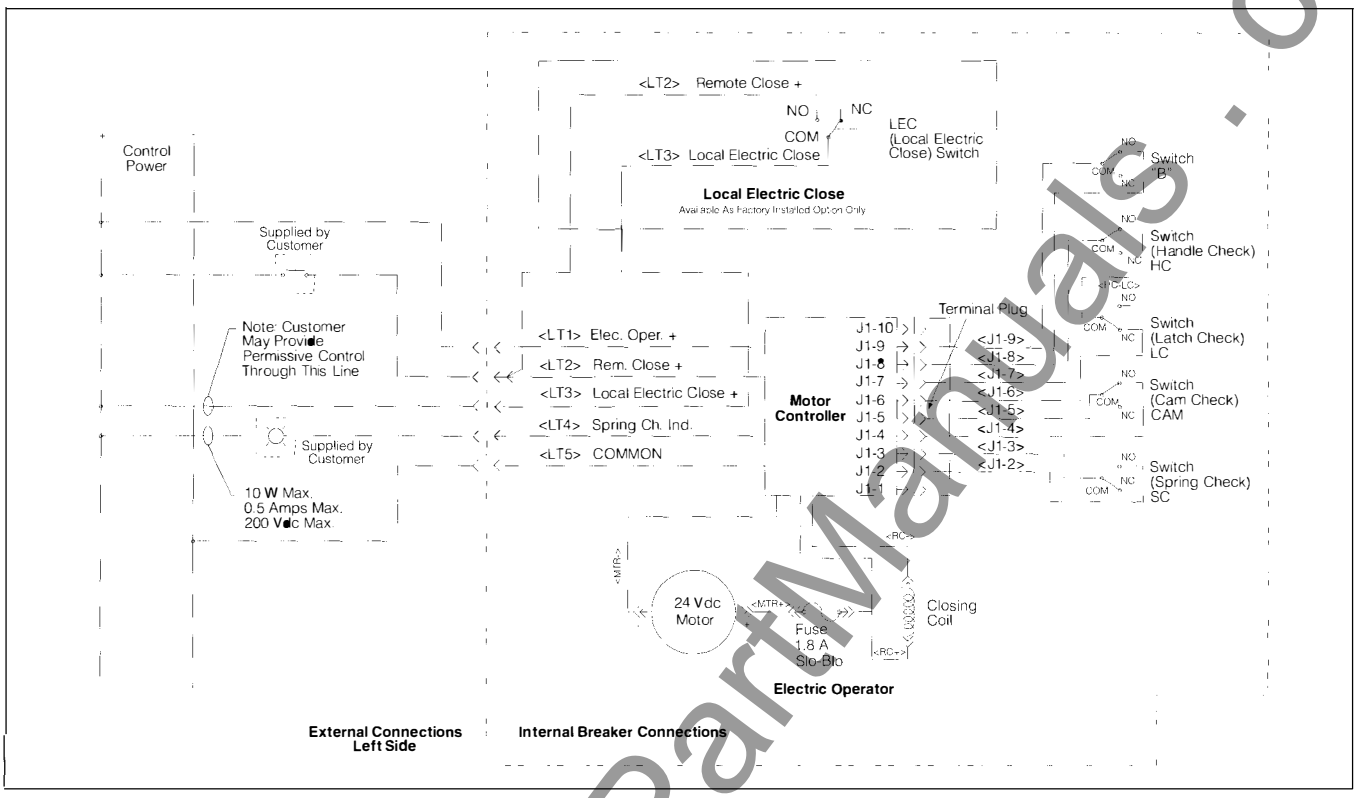
Symptom	Solutions
Motor does not run	1. Check for springs already charged by checking spring charge indicator. 2. Check for rated voltage at LT1 and LT5. 3. Check motor fuse – requires 1.8A Slo-Blo fuse. 4. Check all wiring connections. 5. If the lamp connected to LT4 is blinking slowly (one second on, two seconds off) remove power from LT1 and LT5 then re-apply power
Motor runs for 20 seconds does not charge springs, lamp on LT4 blinks slowly (one seconds on, two seconds off)	1 Remove power from LT1 and LT5, manually charge breaker. Reapply power to LT1 and LT5 motor should run for less than 10 seconds and shut off. Lamp on LT4 should remain on.
Breaker will not close electrically.	1. Check to see if springs are charged by checking charged indicator flag. 2. Check for power on LT1 and LT5. 3 Check for power on LT2. If power is on LT2, remove and reapply. 4. Check to see if breaker is locked in open position by either padlocking device, kirk key, or drawout interlock. 5. Check to see if breaker handle is fully seated in cover. 6. Check all wiring connections.
Lamp on LT4 blinks slowly (one second on, two seconds off).	1 Remove power from LT1 and LT5. Manually charge breaker springs. Reapply power to LT1 and LT5. Lamp on LT4 should remain on.



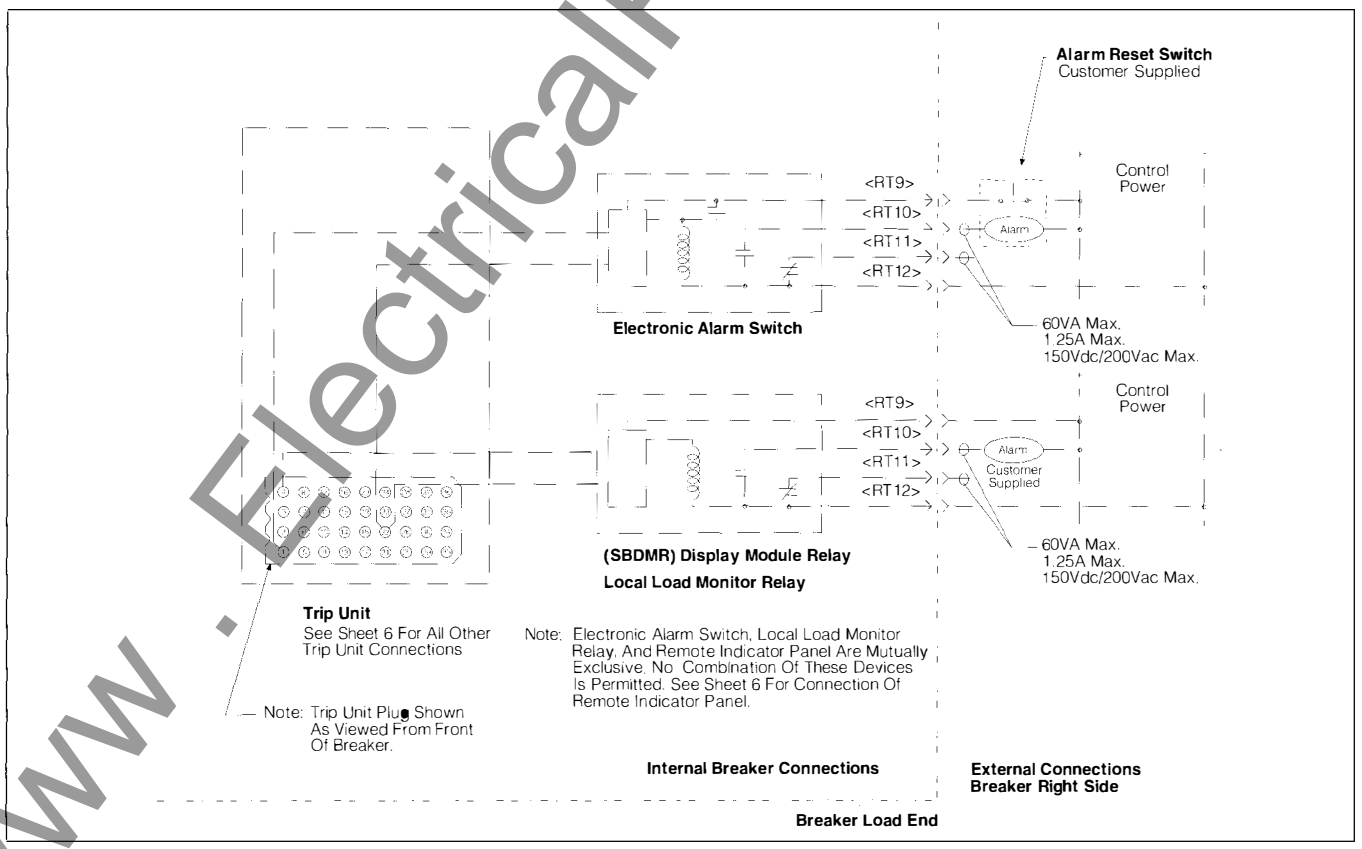




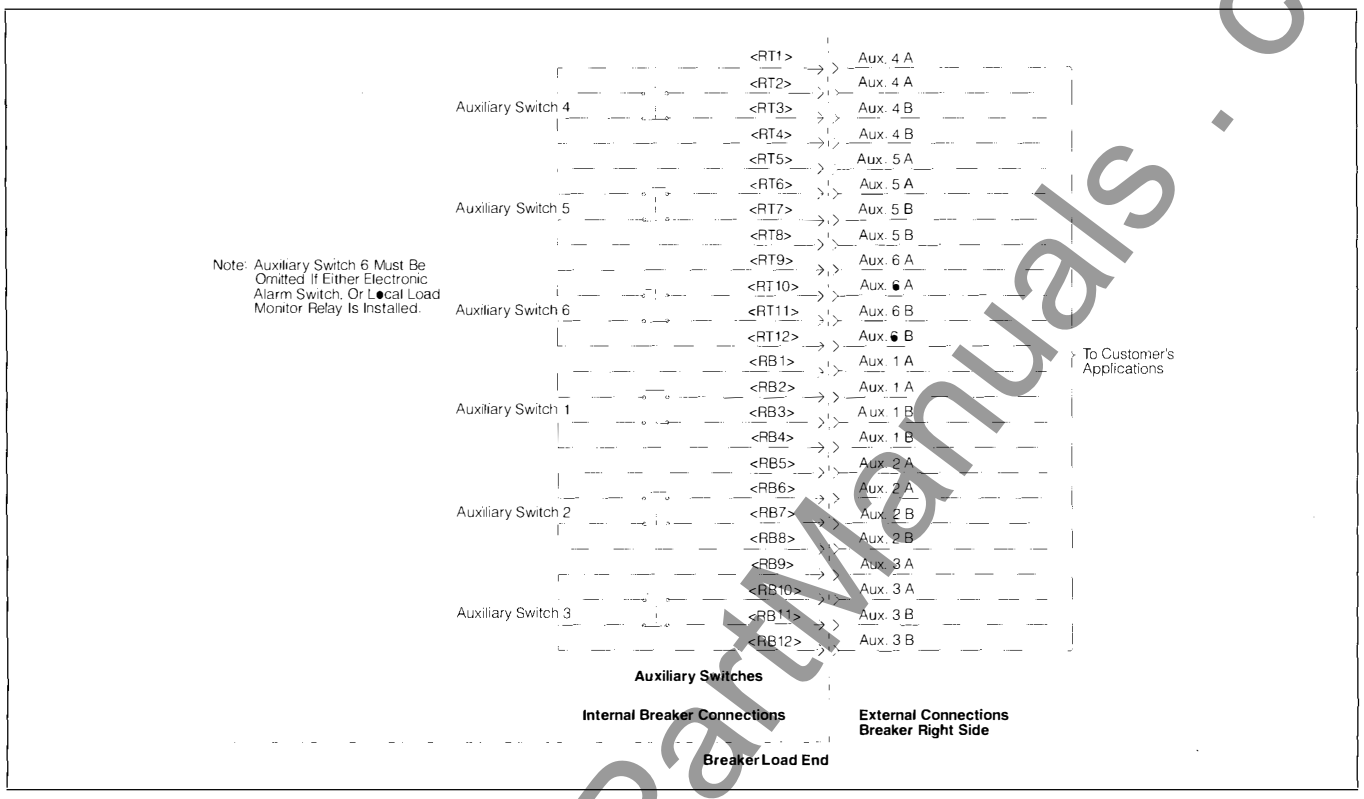




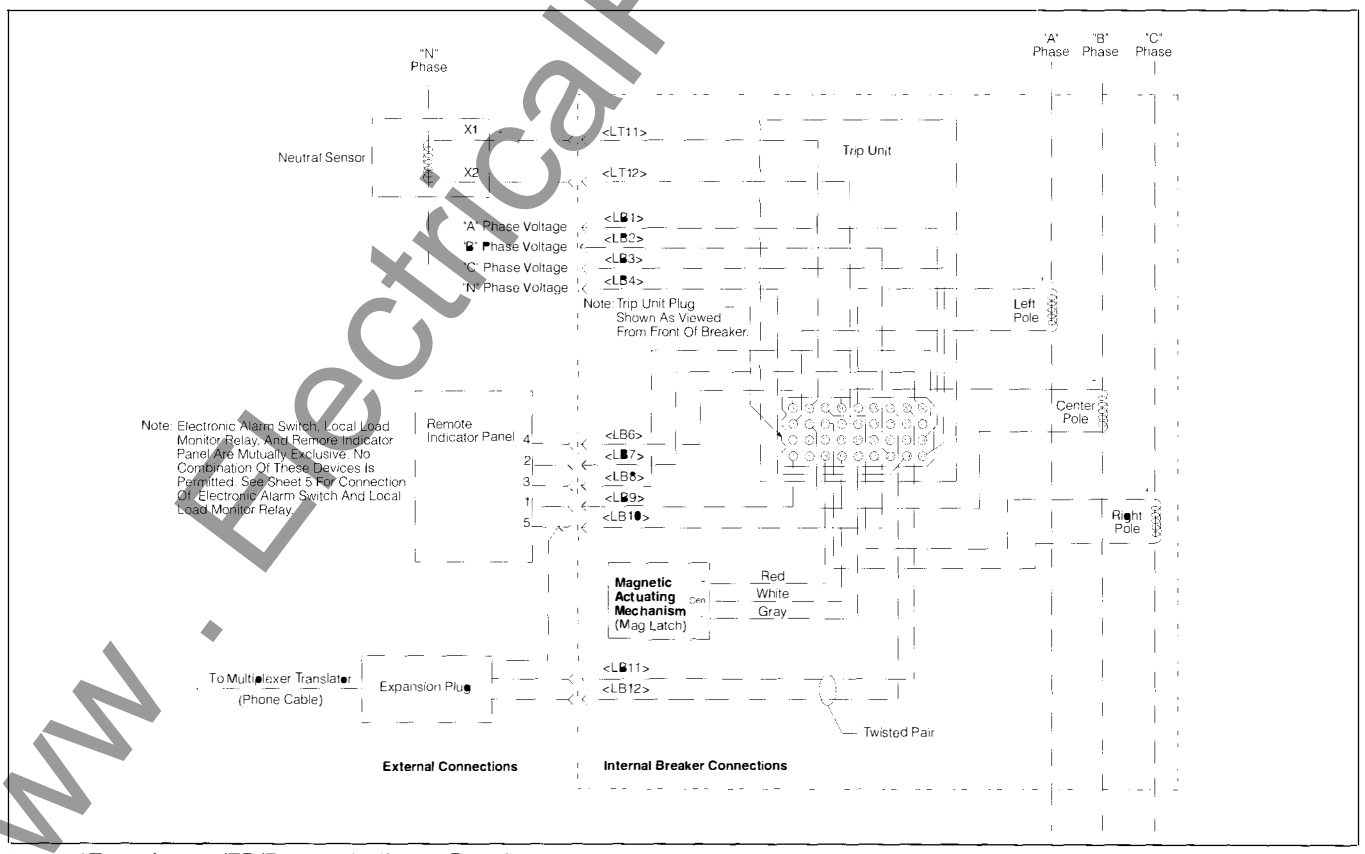
Motor Operator Wiring Diagram



Bell Alarm/Display Module Relay



Auxiliary Switch



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