IB 6.2.11.1-1C

Installation/Maintenance Instructions
Low Voltage Power Circuit Breaker

K-Line Plus®

Type KP-8 thru KP-20

ABB

CONTENTS

NOTE: This Instruction Book is provided solely for the convenience of the purchaser, and does 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 nearest Sales Representative.

INTRODUCTION

The KP-8 through KP-20 circuit breakers are low voltage AC power circuit breakers featuring draw-out construction and the MPSC-2000 microprocessor-based trip system with RMS sensing. These circuit breakers can be furnished with either electrically operated (EO) or manually operated (MO) mechanisms. On EO models, various control power combinations are available, and numerous options are available for both mechanism styles.

These instructions apply to the non-fused, ANSI-rated “KP” series (KP-8, KP-16, KP-20), the non-fused extended-rated “KPE” series(KPE-8, KPE-16, KPE-20), and the fused “KDP” series(KDP-8 and KDP-16). Refer to the Quick Reference section below for general instructions on circuit breaker uncrating, inspection, and installation.

Complete details on K-Line Plus features, operation, and adjustments follow the Quick Reference section.

The circuit breaker continuous current rating (in hundreds of amps) is given by the number which follows the type designation (e.g., KP-8 = 800A). Some of these breakers can be fitted with lower ampere current sensors and trip systems, which provide tripping below the actual continuous current rating of the frame size.

Exceeding the continuous current rating of the circuit breaker for extended periods may raise the temperature of the circuit breaker beyond the limits set forth in ANSI C37.13 thus affecting the life of the circuit breaker insulating materials. The MPSC-2000 trip system has a tolerance band on long time of minus zero, plus ten percent (-0, +10%) which will allow the circuit breaker to carry its rated continuous current but will provide tripping above that value. Additionally, root mean square (RMS) current calculation on the long time trip element can provide tripping based on the true heating value of the current passing through the circuit breaker.

QUICK REFERENCE FOR UNCRATING, INSPECTION, AND INSTALLATION

The following Quick Reference is provided to serve as a checklist for uncrating, inspecting, and installing K-Line Plus low voltage power circuit breakers. It is not intended to provide all of the information necessary to describe the features of the circuit breaker. That information can be found in the later sections of this instruction bulletin.

1. Inspect the circuit breakers immediately upon receipt. Examine shipping cartons to determine if any damage or loss was sustained during transit. When such damage is evident, file a damage claim with the carrier and notify your ABB sales office. ABB is not responsible for damage of goods after delivery to the carrier, but will assist when notified of claims. The period of time after shipment that claims can be filed is short so act immediately.

2. Uncrate carefully. Remove and retain these instructions and other shipping papers. Remove shipping brackets and remove the breaker from the pallet, supporting as needed, to prevent dropping. Check the contents of each carton against the packing list before discarding the packing material. Should there be discrepancies, notify your ABB sales office furnishing purchase order and carton number information.

3. Install circuit breakers in their permanent location as soon as possible. If the circuit breakers are not to be placed in service for some time, it is necessary that adequate means of protection be provided. This may be done by keeping the circuit breaker in its original shipping carton in an upright position and storing indoors in warm (approximately 15°C), dry (50% max. humidity) and uncontaminated atmosphere. Standard domestic packaging is not suitable for outdoor storage. If the circuit breaker cannot be stored properly due to abnormal circumstances, it must be thoroughly inspected and repaired as necessary before placing in service to insure that it is without damage and uncontaminated. Failure to properly store the circuit breaker may void the warranty and lead to extensive refurbishing.

4. Inspect and/or check calibration after uncrating when site procedures require. It will be necessary to rack the circuit breaker to the TEST or CONNECTED position before the breaker can be closed. Springs must be charged on EO models using the proper control power applied to secondary disconnect points (A1) and (A7) or by using maintenance handle 716648-A00. Manual close and trip operators on the front escutcheon can be used to operate the breaker.

5. Rack the circuit breaker using crank 711706-K03 to the fully DISCONNECTED position (fully counter-clockwise). This will position the racking cams properly to engage cubicle.

6. Match the circuit breaker to its switchgear cubicle. Interference blocking is provided to prevent inserting breakers of differing current ratings or short circuit capabilities into cubicles for which they are not intended.

<u>Do not tamper with the interference blocking</u>; equipment damage and/or injury to operating personnel can occur when these blocks are removed.

7. Lift the circuit breaker securely. Use either the lifting yoke assembly 709770-T05 or other sturdy lifting device to position the circuit breaker on the cubicle rails.

8. Pull out the cradle rails, then lower the circuit breaker so that the positioning pins (two on each side of the circuit breaker) rest in the cut-out sections of each track.

9. Remove the lifting yoke and push the circuit breaker toward the compartment. The circuit breaker will slide in the cut-out sections of the tracks until the positioning pins reach the end of the cut-outs. Push down on the two track latches (one on each side of the breaker), while simultaneously pushing the breaker into the compartment until the racking cams stop against their guides on the cradles. The circuit breaker should remain in the disconnected position until system checkouts have been completed.

10. Set the thresholds and time delays of the MPSC-2000 solid state trip system. Using the circuit breaker coordination information, adjust the settings of the MPSC-2000 to the desired threshold (pick-up) and time delay settings (instructions for setting the trip device are contained in IB 6.1.2.8-1A). This must be done before the circuit breaker is put into service. ABB does not provide coordination information unless contracted to do so by the purchase order.

11. On electrically operated (EO) models, position the motor disconnect switch in the OFF position. This is solely to prevent spring charging as the secondary disconnects mate during racking.

12. To rack the circuit breaker to the test position for evaluation, close the switchgear door, then lift the shutter covering the racking shaft. Insert the racking crank and turn the crank in a clockwise direction to begin racking. Racking position indicators between the front escutcheon and the dust plate will indicate relative circuit breaker position. It may be necessary to move the crank either clockwise or counterclockwise in the test position until the proper position is reached to allow the shutter to drop. Spring charging and/or breaker closing is not possible with the racking shutter door open.

13. With tests complete, the circuit breaker can be racked to the connected position using a procedure similar to (12) above.

CIRCUIT BREAKER ESCUTCHEON FEATURES

The K-Line Plus low voltage power circuit has a number of standard features and can be equipped with numerous other optional features. Refer to Figure 1 as the features are discussed below.

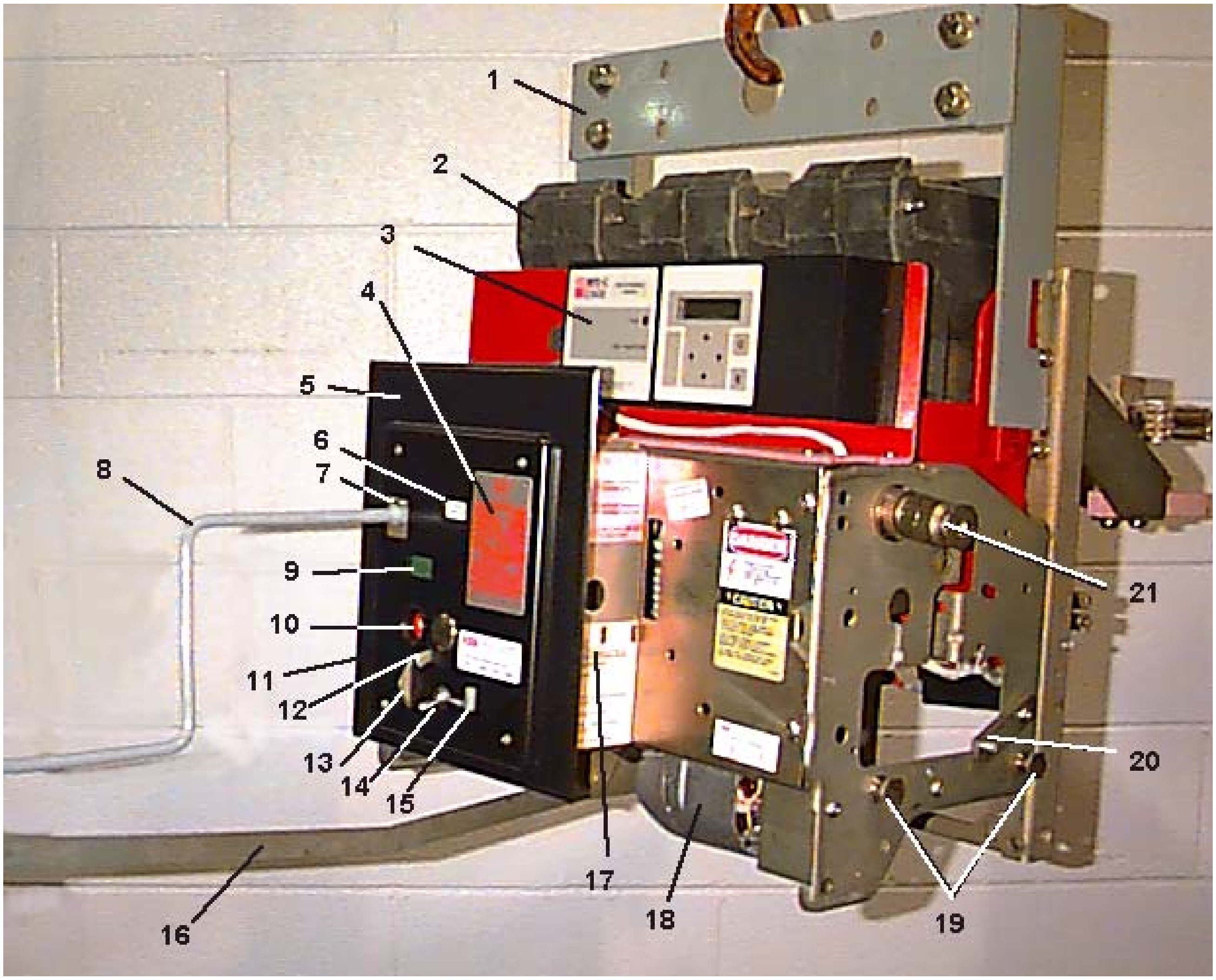
Circuit Breaker Nameplates - There are two nameplates on the circuit breaker. The brief nameplate on the escutcheon provides information regarding the manufacturer’s name and address, type of circuit breaker design, frame size, serial number of the circuit breaker, and date of manufacture. The main breaker nameplate is located on the breaker frame, and provides additional information including the breaker operating voltages and currents, interruption ratings, and nominal control voltages. When contacting ABB with questions on the circuit breaker, always refer to the serial number found on these plates.

Manual Closing Handle - (not shown) On manually operated (MO) circuit breakers, this T-shaped handle is used to simultaneously charge the close springs then close the circuit breaker main contacts in one continuous downward stroke.

MPSC-2000 Trip System - The MPSC-2000 trip system consists of the microprocessor-based trip device, a current sensor for each phase of the circuit breaker, a magnetic latch assembly, and an interconnecting harness. This direct-acting trip device comes complete with long time delay, short time delay, instantaneous, and ground delay tripping capabilities. A self-monitor light on the front of the trip system flashes approximately once per second, when the circuit breaker is closed with current flowing, to signal that the trip system is functioning satisfactorily. Refer to the complete description of the features and operation of the MPSC-2000 in bulletin IB 6.1.2.8-1A.

Automatic Trip Indicator - The automatic trip indicator is a standard feature of K-Line Plus circuit breakers providing visual indication that an automatic trip due to overcurrent has occurred. Additional visual indication of overcurrent trip appears on the MPSC-2000 trip system discussed above.

When an overcurrent trip has occurred, this white indicator will extend from the front escutcheon approximately one-half inch. The action of this indicator actuates two optional accessories, the R/S (bell) alarms and the Trip Lockout. When so equipped, the R/S contacts change state when the automatic trip indicator "pops" out. The R/S (bell) alarms are available with one normally open (N.O.) and one



1. Lifting Rig
2. Arc Chute
3. MPSC-2000 Trip Device
4. Nameplate
5. Self-Aligning Dust Cover
6. Spring Charge Indicator
7. Racking Shutter
8. Racking Handle
9. “OPEN” or “CLOSED” Indicator
10. Manual Trip Button
11. Escutcheon Assembly
12. Manual Close Lever
13. Padlock Hasp
14. Motor Disconnect Switch
15. Automatic Trip Indicator
16. Removable Maintenance Handle
17. Position Indicator
18. Spring Charging Motor
19. Positioning Pins
20. Side Latches
21. Racking Cam Assembly

Figure 1 - Typical Electrically Operated K-Line Plus Circuit Breaker

normally closed (N.C.), with either common or isolated return circuits. The Trip Lockout prevents circuit breaker reclosure when the automatic trip indicator is in the extended position. To reset the automatic trip indicator, and when so equipped the R/S switch and/or Trip Lockout, simply push the white indicator in toward the front escutcheon; it will relatch automatically (except for breakers with Undervoltage Trip Device - see discussion later in this bulletin).

It is very important that the operator investigate the cause of the overcurrent trip prior to resetting the automatic trip indicator and reclosing the circuit breaker.

The indicator will also extend when the circuit breaker is tripped by the optional Under-Voltage Device, or by the Open Fuse Trip device on fused breakers.

(Note: The circuit breaker can be reclosed without resetting the automatic trip indicator when the circuit breaker is not equipped with the optional Trip Lockout.)

Motor Disconnect Switch - On electrically operated (EO) circuit breakers, a switch is provided when the operator wants to prevent recharging of the closing springs, as when the circuit breaker is racked in or out. It can also be used to disconnect the motor from the control wiring when performing control wiring dielectric tests.

Maintenance Handle - This accessory must be installed underneath the circuit breaker to manually charge the springs of an electrically operated (EO) circuit breaker.

Padlocking Device - All K-Line Plus circuit breakers are provided with a padlock hasp to lock the circuit breaker in a trip-free condition which prevents circuit breaker closing. To engage this device, simply push in the manual trip push button then pull straight out on the padlock hasp. This hasp can accommodate up to three padlocks. When padlocking is engaged the circuit breaker cannot be racked to any other position.

Manual Trip Button - All K-Line Plus models feature a manual trip push button for tripping the circuit breaker.

Open/Close Indicator - All K-Line Plus circuit breakers have a visual indicator showing the status of the circuit breaker contacts. OPEN appears in silver with a green background, CLOSED appears in silver with a red background.

Racking Shutter and Racking Mechanism - The racking shutter of all K-Line Plus circuit breakers allows access to the racking shaft when lifted. The circuit breaker must be tripped before the shutter can be lifted This prevents racking the circuit breaker with the main contacts closed.

The padlock hasp holds the racking shutter closed when the hasp is activated. Instructions appear on the side of the front escutcheon of the circuit breaker for racking the breaker into and out of its cubicle. Circuit breaker racking is possible with the cubicle door open or closed. Indicators on the cubicle indicate the position of the circuit breaker during racking.

Closing Spring Charge Indicator - On electrically operated (EO) models, the closing spring charge indicator shows through a window in the front escutcheon. A yellow indicator with black lettering indicates SPRINGS CHARGED; one with white background and black lettering indicates SPRINGS DISCHARGED. When the Motor Disconnect Switch is ON and control power is available, the springs will automatically charge after any breaker trip operation.

Operation Counter (not shown) - The non-resetable operation counter advances one count each time the circuit breaker is closed. The counter on new circuit breakers may show counts of 9950 or greater so that the counter will advance to 0000 during check-out prior to energization. Circuit breaker operation record keeping can thus begin from the 0000 point.

Self-aligning Dust Plate - The dust plate immediately behind the escutcheon face plate is used to exclude dust from the circuit breaker compartment. The escutcheon face will protrude through the front door of the compartment when the circuit breaker is in the "TEST" and "DISCONNECTED" positions. In these positions, the dust plate still functions to exclude dust.

Local Electrical Close and Trip Push Buttons (optional) - On electrically operated (EO) models these push buttons may be ordered as an option. These switches energize the circuit breaker close/trip coils when the circuit breaker is in the "TEST and/or "CONNECTED" position. On manually operated (MO) breakers with a shunt trip, only the trip push button is provided when this option is ordered.

CIRCUIT BREAKER INTERNAL COMPONENTS

For electrically operated (EO) circuit breakers, the schematic diagram of the control circuit in the Operating Sequence section illustrates the function of the following devices. Electrical characteristics can be found in Figure 2.

Solid State Control Device (SSCD) - The SSCD is

Figure 2 - Electrical Characteristics of Control Devices

Nominal Control Voltage	Average Charging Motor Current*	Shunt Trip or Close Coil Current	Closing Circuit Voltage Range	Shunt Trip Circuit Voltage Range	Recommended Control Fuse Size
120VAC (60 Hz)	10A	6.5A	104-127	104-127	10A
240VAC (60 Hz)	5A	1.2A	208-254	208-254	10A
48VDC	25A	3.1A	38-56	28-56	15A
125VDC	10A	1.3A	100-140	70-140	10A
250VDC	5A	0.7A	200-280	140-280	10A

* Approximate steady state values; momentary in-rush currents are approximately 6-8 times these values

located in the lower-rear portion of EO circuit breakers, and controls the electrical closing functions of the breaker. The "anti-pump" feature of the SSCD prevents a second electrical closing until the first closing signal is released. For example, if the breaker is closed electrically and the signal is maintained, the SSCD will not permit the breaker to be closed electrically again after a trip until the electrical close signal is released.

Shunt Trip - The shunt trip is standard on EO breakers and optional on MO breakers. When energized, it releases the stored energy of the opening springs causing the circuit breaker to open.

Closing Spring Charging Motor - When the motor disconnect switch is ON, the charging motor is energized automatically by internal limit switches to charge the closing springs electrically.

Closing Spring Check Switch (CSCS) - The CSCS automatically disconnects the power to the charging motor when the closing springs are fully charged.

Integral Auxiliary Switch - The integral circuit breaker mounted auxiliary switch is standard on EO breakers and MO breakers with shunt trip, and optional on MO breakers without shunt trip. The standard configuration contains the four "a" and four "b" contacts (with three "a" and two "b" contacts available for customer use via the secondary disconnects). The switch is mechanically interconnected with the circuit breaker mechanism such that, with the circuit breaker closed, the "a" contacts are closed and the "b" contacts are open. With the circuit breaker open, the "a" and "b" contacts reverse positions. This switch is located in the lower left portion of the circuit breaker.

Optionally, EO breakers and MO breakers with shunt trip can be fitted with a 16-pole switch, which offers an additional four each "a" and "b" contacts for customer use.

Undervoltage Trip Device (Optional) - The electrically reset undervoltage trip device (UVD) is a single-phase device which automatically trips the circuit breaker when the line voltage decreases to 30 to 60 percent of the rated voltage. This device is presently only available for instantaneous trip operation. The undervoltage trip device is an integral unit which may be added to the circuit breaker either at the factory or in the field.

When the breaker is tripped by the UVD, the Automatic Trip Indicator will extend through the front plate of the breaker escutcheon. The indicator cannot be reset until the UVD is electrically reset by the control power.

See Figure 3 for electrical characteristics of the UVD.

Figure 3 - Undervoltage Trip Device Operating Data

Service Voltage	Current at Rated Voltage	Maximum Pickup Voltage	Dropout Voltage Range
120VAC (60 Hz)	0.5A	102	36-72
240VAC (60 Hz)	0.2A	204	72-144
480VAC (60 Hz)	0.1A	408	144-288
48VDC	0.3A	41	15-29
125VDC	0.2A	106	38-75
250VDC	0.1A	212	75-150

K-LINE PLUS CIRCUIT BREAKER CRADLE FEATURES

All K-Line Plus breakers use a mating cradle which provides support and guidance to the circuit breaker so that primary and secondary connections are made properly. This cradle incorporates the stationary primary and secondary disconnects, grounding connection, interference blocking, and racking guides and rails. Optional equipment includes: truck-operated cell (TOC) switches, current transformers (CT's), mechanical interlocks, KIRK® Key interlocks and door interlock.

Stationary Primary Disconnects - The stationary primary disconnects interface with the moving primary disconnects mounted on the circuit breaker to provide the LINE and LOAD connection.

Secondary Disconnect - The cell-mounted secondary disconnects interface with the secondary disconnects mounted on the bottom rear of the circuit breaker to provide the control and indicating connections to and from the circuit breaker. The contacts are connected when the breaker is in both the CONNECTED and TEST positions.

Grounding Connection - A copper connection is provided which engages the circuit breaker in the TEST and CONNECTED positions. Positive grounding is provided to the cubicle frame.

Interference Blocks - Interference blocks are mounted on the side of the cradle to interface with those mounted on the circuit breaker to reject the interchanging of different circuit breaker frame sizes, short circuit ratings, and fused versus non-fused versions.

Truck Operated Cell (TOC) Switch (Optional) - The TOC auxiliary switch is operated as the circuit breaker is racked into the cubicle. Mounted at the upper rear of the cradle, the switch is available with four or eight contacts. Two separate arrangements are available to allow remote indication of the circuit breaker's drawout position. In the standard arrangement, the cell switch contacts change state between the CONNECTED and TEST racking positions. A special arrangement is available that allows operation between TEST and DISCONNECTED racking positions.

Current Transformers (CT's) (Optional) - Provisions for mounting at least one CT per phase are incorporated into all cubicles, depending on the CT's rating and physical size.

Mechanical Interlock (Optional) - Interconnected cradle-mounted linkage permits only one of two horizontally or vertically adjacent circuit breakers to be closed at any time, when in the CONNECTED position.

KIRK® Key Interlock (Optional) - Positions for mounting a KIRK® Key interlock are available with accessibility through the closed compartment door. The Kirk Key is released only when the linkage on the cradle locks the circuit breaker open when in the CONNECTED position.

SOLID STATE TRIP SYSTEM

The MPSC-2000 electronic, microprocessor-based trip system includes the sensors, the MPSC-2000 electronic trip device, the magnetic latch, and the interconnecting wiring. A current sensor is integrally mounted on each phase of the circuit breaker to supply a value of current flowing in the trip unit which is directly proportional to the current passing through the primary circuit. When the value of current in the primaries exceeds the trip unit threshold setting for a given time in long time, short time, and/or ground, then tripping occurs by sending a signal to the magnetic latch. Instantaneous tripping occurs in the same manner, but without the time delay. On three phase, four wire, wye systems, provisions are made for input from a separately mounted sensor to obtain a residual connection of all four sensors for sensitivity to ground currents.

The MPSC-2000 trip unit (Item 3 of Figure 1) is visible on the front of the circuit breaker. It is completely self-powered, taking the tripping energy from the primary current passing through the circuit breaker without the need for any additional power supply. An external 9V battery is supplied to permit the user to access the MPSC-2000's menus. The battery is not required for correct operation of the trip device. The battery will last only about 1-2 hours of actual use, so the switch to this battery should be left in the "off" position except when needed.

To cope with modern power systems where harmonics in the system can cause cable and busway overheating, the MPSC-2000 long time trip element samples the current in a unique algorithm, then calculates the root mean square (RMS) value of the system current, providing tripping when the RMS current is above the trip threshold. Overheating in cable and busway is thus avoided with the MPSC-2000 trip system. Short time and instantaneous tripping remains based on peak sensing methods, avoiding unnecessary delay in tripping caused by the RMS calculation.

The MPSC-2000 trip system also includes all the connection ports and software for performing communication duties when connected to the PRICOM or PRICOM-PLUS communication systems. Although a breaker might not be connected to a communication system when it is installed, it will not require any modification to be connected to the Network Interface Module (NIM) in the PRICOM system at some future time. This unique feature allows for future expansion without incurring additional up-front expenses. The NIM cable is connected to the nine-pin connector adjacent to the 25-pin connector on the end of the MPSC-2000 trip device. If the device is configured with a Voltage Interface Module (VIM), a four pin connector will also be adjacent to the previously mentioned connectors. See bulletin 3.1.3-2A for additional details about the PRICOM communication system.

Four basic elements within the MPSC-2000 trip unit perform the protective functions: (1) long time, (2) short time, (3) instantaneous, and (4) ground. Each of these may be disabled or adjusted independently, except for a few conditions which are required to ensure the correct functionality of the breaker. For example, it is not possible to disable both the instantaneous and short time elements simultaneously. Also, it is not possible to disable the Long Time element.

The MPSC-2000 trip unit is completely tested prior to shipment. Since there are no mechanical devices which may have lost adjustment during shipment, no readjustments, other than making the required settings, need be made prior to placement in service. The following trip characteristics are available: long time setting and delay bands; short time setting and delay bands with switchable I^2t characteristic, instantaneous setting, and ground setting and delay bands with switchable I^2t characteristic. Other settings are available for devices with a VIM installed - see IB 6.1.2.8-1A for details.

The MPSC-2000 trip unit must be properly set, as required by the individual circuit based on a coordination study performed for the system, in order to provide the necessary protection. The MPSC-2000 trip device is shipped with standard shipping settings; THE SHIPPING SETTINGS DO NOT CORRESPOND TO THE REQUIREMENTS OF THE SYSTEM IN WHICH THE BREAKER IS INSTALLED. DETERMINE WHAT THE CORRECT SETTINGS SHOULD BE FOR THE ELECTRICAL SYSTEM IN WHICH THE BREAKER IS INSTALLED PRIOR TO CLOSING THE CIRCUIT BREAKER INTO THAT SYSTEM. Nuisance tripping or inadequate protection may result from failure to properly adjust the circuit breaker trip device. To adjust the settings of the MPSC-2000 trip device, see the instructions in IB 6.1.2.8-1A.

A trip operation indicator, or target, is provided on the face of the MPSC-2000 unit. When the MPSC-2000 determines that a trip is necessary, it will both signal the magnetic latch and display the trip target with an orange "day-glo" color. Since the target is a mechanical device, it does not require power to retain its indication. This indication is resistant to shock and vibration, and will remain as long as the breaker is open. The target is automatically reset by the microprocessor within about two seconds after breaker closure (as long as at least 6% of sensor current is flowing through the circuit breaker phases). In situations where a circuit breaker is closed into a circuit where a trip condition still exists, the target will be reset instantaneously, and then displayed again when the breaker re-trips. New circuit breakers unpacked from the factory may have the target displayed as a result of the factory testing performed on the breaker prior to shipping. This target will reset when the circuit breaker is closed and primary current is flowing.

Continuous monitoring of the microprocessor function is programmed into the MPSC-2000. "Watchdog" circuits guard against the possibility of microprocessor disfunction due to "endless loops". A red light emitting diode (LED) mounted on the face of the MPSC-2000 indicates the condition of the microprocessor. Normal operation is shown by a blink rate of one flash per second when a minimum of approximately six percent of the sensor current rating is flowing through the primaries. The LED may not blink, or may blink intermittently at current levels below 6%. Servicing is required if the LED remains lit but does not blink, or does not illuminate at all when current levels are above 6%. When a trip element "picks up", indication is provided by a fast blink rate of the self monitor LED. When this is observed, the MPSC trip unit is in the timing mode and breaker tripping is imminent.

Selecting Trip Settings - The settings of current threshold and delay bands must be determined by an analysis of the protection and coordination requirements of the power system. Settings are made using the menus on the LCD screen as explained in IB 6.1.2.8-1A. Unlike previous electronic trip devices, the MPSC-2000 settings are selected in amperes (e.g., 2400A, 480A, etc.) instead of multipliers (e.g., 3X, .6X, etc.), thereby eliminating intermediate calculations.

OPERATING SEQUENCE FOR ELECTRICALLY OPERATED (EO) CIRCUIT BREAKERS

With the circuit breaker racked to the TEST or CONNECTED position, the closing springs discharged, and the control power source energized, the following occurs when the motor disconnect switch is placed in the ON position (Refer to the schematic on page 11):

1. The "b" contact (closed when the breaker is open) and the CSCS contact (closed when the closing springs are discharged), allow the spring charging motor to be energized. When the closing springs reach the fully charged condition, the CSCS opens to deenergize the motor.

2. Operation of the remote close control switch or optional electrical close push button energizes the close coil through the Solid State Control Device (SSCD) and the breaker auxiliary switch "b" contact. The close coil releases the close latch, the springs discharge, and the breaker contacts close.

3. When the springs discharge, the CSCS contacts close.

4. When the circuit breaker contacts close, all auxiliary switch “a" contacts close and all “b" contacts open.

5. With the local or remote close signal still applied, the anti-pump feature of the SSCD “locks out” the close coil. In doing so, the circuit breaker mechanism will not pump should it close into a faulted circuit.

6. The circuit breaker can be tripped electrically by operation of remote trip control or by operating the optional local electric trip push button. When tripped in this manner, the trip coil is energized through the SSCD and the auxiliary switch "a" contact.

7. Tripping the circuit breaker opens the “a" contacts and closes the “b” contacts. At that point, the motor circuit is once again complete and the motor will charge the closing springs.

CLOSING SPRING OPERATION (MO)

In one continuous downward pull of the handle the two closing springs are charged, and near the end of the stroke are discharged to fast close the circuit breaker. During closing, the two opening springs are charged. If so equipped, the breaker may be opened electrically by energizing the optional shunt trip.

INSTALLATION, INITIAL TESTING, AND REMOVAL

For Safety: When installing or removing the circuit breaker for the first time, the primary and control circuits should be deenergized. All tests of the circuit breaker should be done with the circuit breaker in the TEST position.

Installation

To insert the circuit breaker into its mating cubicle, proceed as described below:

1. The circuit breaker contacts must be OPEN, and the racking crank turned in the counterclockwise direction fully against its stop. On electrically operated circuit breakers, the motor disconnect switch should be in the OFF position.

2. Open the compartment door and pull out the right and left hand tracks to the full extended position (until they snap into place with the retaining latches).

3. Using a lifting yoke, position the yoke so that it captures the K-Line Plus circuit breaker as shown in Figure 1. Using an overhead lifting device, raise and install the circuit breaker by lowering it such that the studs on either side of the circuit breaker rest in the cutouts in the extended cradle rails. If the switchgear does not have the overhead lifting device, an external lifting device with capabilities for handling the circuit breaker weight, and compartment height requirements, is needed. In addition, this equipment must be compatible with the lifting yoke. Use a hoist type of lift. Do not attempt to raise the circuit breaker by any other means, as damage to the circuit breaker can occur rendering it unsatisfactory for service. **DO NOT USE THE PRIMARY DISCONNECTS AS A LIFTING POINT.**

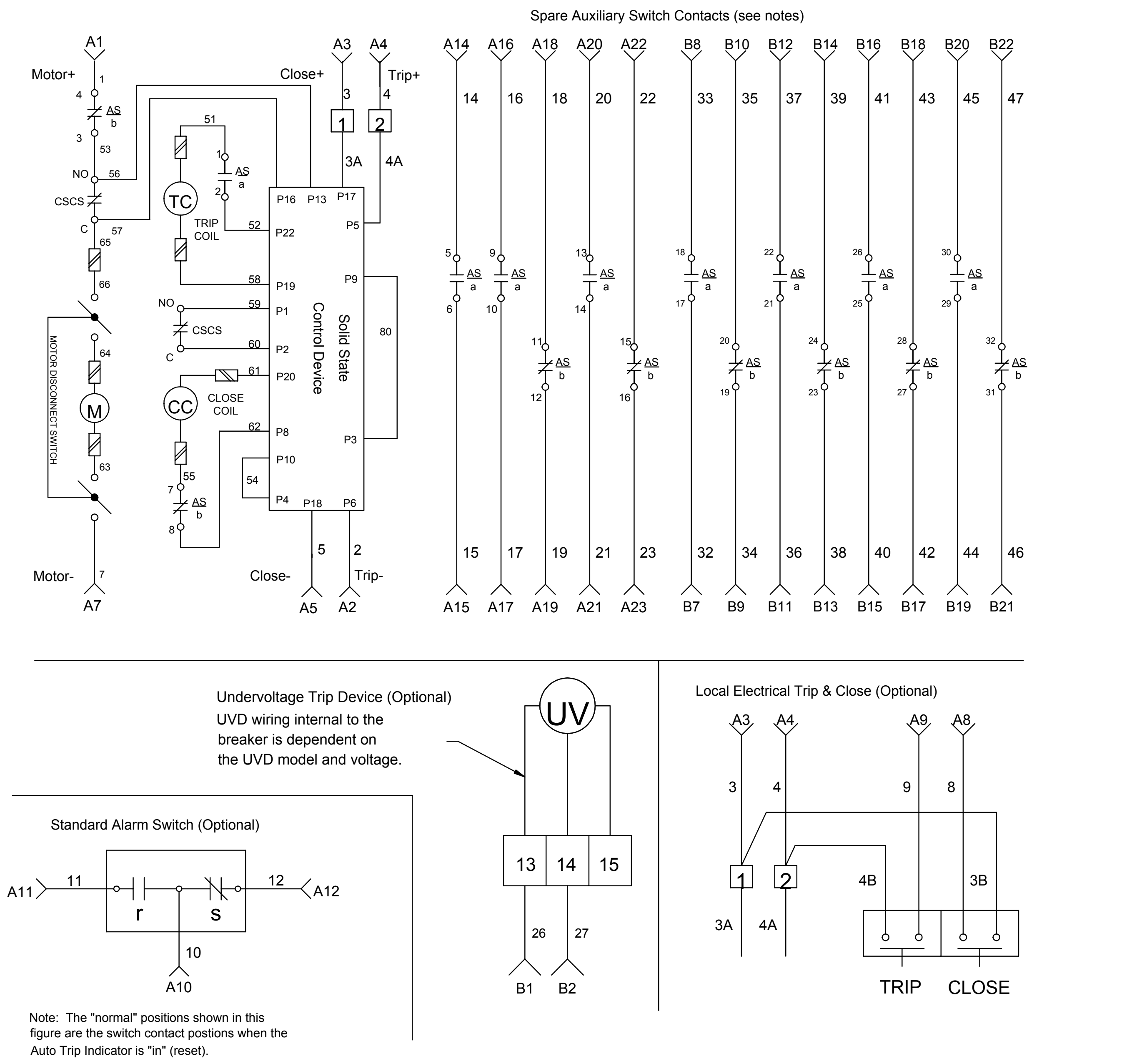
4. Remove the lifting yoke and push the circuit breaker toward the compartment. The circuit breaker will slide in the cut-out sections of the tracks until positioning pins reach the end of the cutouts. Push down on the side levers to release the two latches; this allows the circuit breaker to move toward the compartment until the racking cams stop against their guides in the cradle. If mechanical interference occurs before the circuit breaker reaches this point, recheck the cradle and the ampere rating of the breaker to make sure they match.

5. Lift the shutter covering the racking opening, insert the racking crank, and turn the crank clockwise. Pass through the DISCONNECTED position, until the position indicator on the cradle (left side) shows TEST position. Remove racking crank, and ensure that the racking shutter closes completely.

Initial Testing

(Continued on page 13)

K-Line Plus Typical Composite Schematic (Electrically Operated)



NOTES:

1. This wiring diagram includes some optional features not found on all K-Line Plus breakers, including an alarm switch, undervoltage trip device, LET/LEC, and spare auxiliary switch contacts.

2. Secondary disconnect numbers begin with a letter which indicates in which plug the disconnect resides. The “A” plug is the right-hand plug when viewed from the rear of the breaker.

3. The spare auxiliary switch contacts which are routed through secondary disconnect “A” are standard on EO breakers. Those routed through plug “B” are optional.

K-Line Plus Secondary Disconnect Assignments

Pin	Description	Pin	Description
A1	Charge Motor +	B1	Undervoltage Trip Device +
A2	Shunt Trip -	B2	Undervoltage Trip Device -
A3	Close Coil +	B3	(MPSC-2000 4WG or DESP) [6]
A4	Shunt Trip +	B4	(MPSC-2000 4WG or DESP) [6]
A5	Close Coil -	B5	(MPSC-2000 4WG or DESP) [6]
A6	MPSC-2000 VIM	B6	(MPSC-2000 4WG or DESP) [6]
A7	Charge Motor -	B7	Aux. Sw. "a" +
A8	Local Elec. Close +	B8	Aux. Sw. "a" -
A9	Local Elec. Trip +	B9	Aux. Sw. "b" +
A10	Alarm Switch [4]	B10	Aux. Sw. "b" -
A11	Alarm Switch [4]	B11	Aux. Sw. "a" +
A12	Alarm Switch [4]	B12	Aux. Sw. "a" -
A13	Alarm Switch [4]	B13	Aux. Sw. "b" +
A14	Aux. Sw. "a" +	B14	Aux. Sw. "b" -
A15	Aux. Sw. "a" -	B15	Aux. Sw. "a" +
A16	Aux. Sw. "a" +	B16	Aux. Sw. "a" -
A17	Aux. Sw. "a" -	B17	Aux. Sw. "b" +
A18	Aux. Sw. "b" +	B18	Aux. Sw. "b" -
A19	Aux. Sw. "b" -	B19	Aux. Sw. "a" +
A20	Aux. Sw. "a" +	B20	Aux. Sw. "a" -
A21	Aux. Sw. "a" -	B21	Aux. Sw. "b" +
A22	Aux. Sw. "b" +	B22	Aux. Sw. "b" -
A23	Aux. Sw. "b" -	B23	(Spare) [5]
A24	(Spare) [5]	B24	(Spare) [5]
A25	(Not Used)	B25	(Not Used)

Notes:

(1) These assignments are provided for reference only, and may be changed due to special requirements. Some pins or plugs may not be present on all breaker configurations. See the breaker schematic wiring diagram(s) for details.

(2) Note the polarity of control devices: “+” is the send and “-” is the return.

(3) The two terminals of each Auxiliary Switch contact are connected to adjacent Secondary Disconnect pins. For example, pins A14 and A15 are connected to a single “a” contact. Also, the polarity signs are provided on these pins for consistency only; the Auxiliary Switch contacts are not polarity sensitive.

(4) The Alarm Switches can be wired in two different ways. See the schematic supplied with the breaker for details on the pin-outs.

(5) The pins marked “(Spare)” may be used in some breakers for special customer wiring requirements. Refer to the schematic wiring diagram supplied with the breaker for pin-out assignments.

(6) The assignments for pins B3 - B6 will differ depending on whether the DESP option has been supplied. See the MPSC-2000 schematic supplied with the breaker.

(Continued from page 10)

Electrically Operated (EO) Models:

1. Manually reset the Automatic Trip Indicator if it protrudes approximately 1/2”. Push to reset. (Note: on breakers with an Undervoltage Trip Device (UVD) installed, control power must be present to reset the Trip Indicator.)

WARNING WARNING WARNING WARNING

DO NOT REMOVE THE INTERFERENCE BLOCKING IN AN EFFORT TO ALLOW CIRCUIT BREAKER RACKING. RISK TO PERSONNEL AND SERIOUS DAMAGE TO THE CIRCUIT BREAKER AND CUBICLE CAN RESULT.

2. Turn the motor disconnect switch to the ON position and the closing springs will automatically charge, if control power is available.

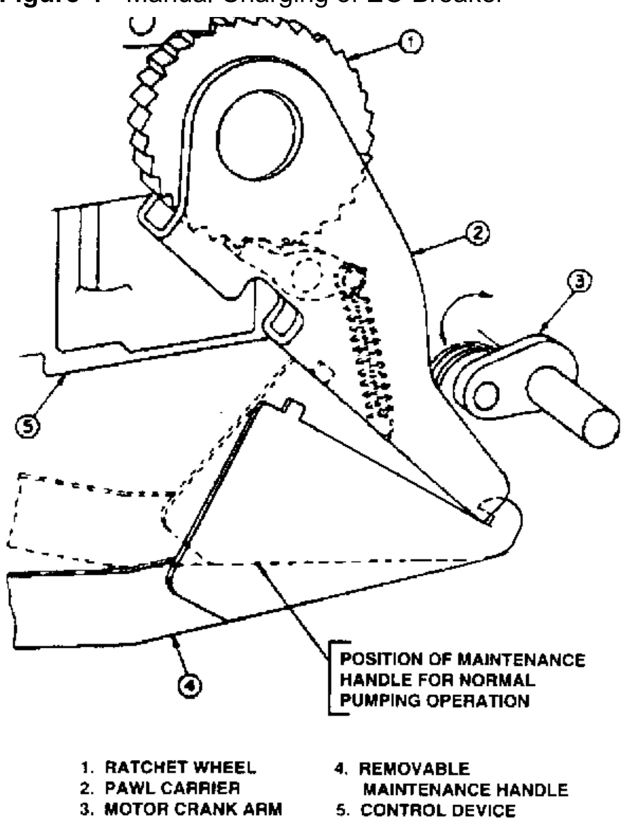
3. Close the circuit breaker by lifting the manual close lever, then trip with the manual trip push button. The closing springs should automatically recharge after trip. On models with local electric close and trip, these push buttons may be used to operate the circuit breaker. NOTE: Some switchgear schemes allow the local electrical close and trip push buttons to operate only in the CONNECTED positions.

4. Close and trip circuit breaker by means of remote control switch.

5. Check each auxiliary device for proper operation.

6. Close the circuit breaker and check that the shutter cannot be lifted to allow insertion of the racking crank. This demonstrates that the circuit breaker could not be racked out while closed.

Figure 4 - Manual Charging of EO Breaker



Manual Operation of Electrically Operated Models:

Electrically operated circuit breakers may be charged manually by a removable maintenance handle for bench tests or emergency operation. Position the maintenance handle hooked section in the long slot on the pawl carrier (Refer to Figure 4). The small tab on the maintenance handle will fit the small hole of the pawl carrier. Using a pumping motion, rotate the pawl carrier until the ratchet wheel no longer rotates. At this point, the spring charged indicator will indicate SPRINGS CHARGED. The circuit breaker can be closed manually with the manual close lever. (Note: Occasionally the motor crank arm will stop in a position that will not allow manual spring charging. When this happens, the motor crank arm must be rotated manually by using a screw driver to rotate the crank arm sufficiently so that the springs may then be manually charged with the maintenance handle.)

Manually Operated (MO) Models:

1. Manually reset the Automatic Trip Indicator if it protrudes approximately 1/2". Push to reset.

2. Close the circuit breaker by pulling down on the T handle.

3. Trip by manual TRIP button.

4. Check each auxiliary device for proper operation.

5. Close the circuit breaker and check that the shutter cannot be lifted to allow insertion of the racking crank. This demonstrates that the circuit breaker could not be racked out while closed.

After initial testing, the circuit breaker can be racked to the CONNECTED position to be put into service.

Circuit Breaker Removal

To move the circuit breaker to the TEST position or to remove it from the compartment, proceed as follows:

1. On electrically operated (EO) models, turn the motor disconnect switch to the OFF position.

2. With the compartment door closed, trip the circuit breaker by means of the remote mounted control switch or manual TRIP button on the escutcheon.

3. Lift the racking shutter, insert the racking crank and turn counterclockwise until the position indicator on the right-hand side of the escutcheon shows TEST position. (NOTE: The circuit breaker may be tested in this position; the primary contacts are disconnected and the control contacts are connected.)

4. Continue turning the racking crank counterclockwise until the position indicator on the right-hand side of the escutcheon shows DISCONNECTED position.

5. The circuit breaker may not be racked out with the closing springs charged. At a point between the DISCONNECTED and OUT positions, the closing springs will automatically discharge.

6. Rack the circuit breaker through the DISCONNECT position to the OUT position. Rack the circuit breaker as far as the stops will allow but DO NOT FORCE. Open the cubicle door.

7. Pull circuit breaker forward until tracks are in the fully extended and latched position.

8. Using a lifting yoke, just pick up the circuit breaker weight.

9. Lift the pivoting latches on the sides of the breaker, and pull the breaker forward to release the positioning pins from the cut-out sections of the tracks.

10. Lift the circuit breaker free from the tracks.

11. Release latch on each track, push tracks into the compartment, and close compartment door.

MAINTENANCE AND INSPECTION

Safety Notes

De-energize both primary circuits and secondary control circuits before making any inspections, adjustments or parts replacements. Check the OPEN/CLOSED indicator for contact status and closing spring charge indicator for closing spring status.

When it is necessary to charge the closing springs and/or operate the circuit breaker during maintenance, keep hands and tools away from operating parts.

Circuit breakers should be withdrawn to the TEST position for checking the breaker operation. For further inspection, adjustments, cleaning, or parts replacement, the circuit breaker should be withdrawn and moved to a suitable work area.

Periodic Maintenance Inspection

The safety and successful functioning of downstream devices depends upon the proper operation of their feeder circuit breaker. Therefore, a maintenance program should be established that will provide for periodic inspection of the circuit breaker as follows:

KP-8, KPE-8, or KDP-8 - After 1,750 Operations
KPH-8, KP-16, KPE-16, KDP-16 or KP-20 - After 500 Operations

Note: An operation counter is available as an option.

The above inspection periods apply for no load or load current switching. At the end of the first year of service the circuit breaker should be inspected regardless of the number of operations on it.

If the total number of operations in service is very low, maintenance schedules should be based on time rather than operations; yearly inspections are advised. When operations are low, moreover, mechanism exercising is important.

The circuit breaker should always be inspected after short circuit or severe overload interruption, regardless of the time elapsed or number of operations since the last maintenance interval. When the circuit breaker is used as a contactor, where it may be operated by automatic switching devices, the operations on it will accumulate more quickly necessitating more frequent inspection. ANSI Standard C37.16 can provide additional information on this subject.

Where unusual service conditions exist, it must be assumed that the conditions were considered at the time of order; that the equipment supplied was designated for the special application; and that an appropriate supplemental maintenance program has been developed. Maintenance records containing the date of last inspection and the condition of the circuit breaker, as well as any adjustments or replacements made, should be filed as a guide for any special attention. These maintenance instructions only cover circuit breakers used under the ANSI standard's usual service conditions. Unusual conditions are covered in ANSI Standard C37.13. The inspection of all circuit breakers should include opening and closing the circuit breaker electrically and manually. The unit should be visually inspected for loose or damaged parts. Arc chutes, contacts, and insulation structure should be inspected as described below.

MPSC-2000 Trip Device Removal and Installation

1. Remove the two nylon screws which retain the trip system harness plug to the MPSC-2000 device. Retain for re-use. If the breaker has the Voltage Interface Module (VIM) option, disconnect the four-pin plug from the trip unit.

2. Remove the six self-tapping screws holding the breaker top shelf and remove the shelf with the MPSC-2000 unit attached.

3. To reinstall, reverse the above procedure.

Metallic screws must not be used to retain the trip system harness. Should a metallic screw fall into the trip system, serious damage can result.

Arc Chute Removal

1. Remove the MPSC-2000 trip device according to the instructions above.

2. Loosen the two arc chute retaining screws and remove the screws and retainers.

3. Pull the arc chute forward slightly then lift to remove.

Arc Chute Examination

1. Discoloration or slight eroding of the metal parts can be expected. Soot on the inside and outside of the arc chute is usual, especially after fault interruption.

2. Metal plates or moldings that are severely burned, cracked, or broken require arc chute replacement.

3. If the arc chute can be reused, wipe excess soot from the arc chute and blow any excess away with clean, dry compressed air.

WARNING WARNING WARNING WARNING

RISK TO PERSONNEL AND FIRE CAN RESULT IF THE CIRCUIT BREAKER IS OPERATED WITHOUT THE HARNESS PLUG AND SCREWS IN PLACE.

Arc Chute Replacement

1. Properly position the arc chute in the upper molding.

2. Position retainer and insert and tighten screw.

3. Replace the MPSC-2000 trip device observing all recommendations and warnings above.

Contact Inspection

1. Discoloration, signs of burning, and pitting on the arcing contacts is normal unless it interferes with proper contact adjustment.

2. Some discoloration and pitting may be observed on the main contacts. Again, it is detrimental only when contact pressure adjustments are affected, or if the available contact area has eroded significantly.

Contact Cleaning

Warning: do not use solvent-type contact cleaners which can damage non-metallic parts. The use of alcohol or dichlorodifluoromethane is also prohibited.

1. Remove dust, grease, and soot on main and arcing contacts with a clean, lint-free cloth.

2. Use non-metallic scrubbing pads like 3M Company's "Scotch Brite" to clean more persistent burn marks and pits on the main and arcing contacts. Take care to prevent debris from dropping into the lower contact structures or mechanism. Remove the debris with a vacuum cleaner or blow away with clean, dry, compressed air.

3. Small burrs on the arcing contacts to be removed by filing along contour of the contact. Do not let filings fall into the mechanism.

4. Replace badly burned and pitted contacts that do not meet correct adjustment requirements.

5. If contacts are replaced or filed, then it is necessary to check the contact adjustment.

NOTE: Several operations at two week intervals will remove the effects of oxidation.

Electrical Components (EO Breakers Only)

1. Rack the circuit breaker to the TEST position. Make sure the closing springs are charged.

2. Operate the local (if installed) or remote electrical close push button as applicable to close the circuit breaker. This will confirm operation of the close coil.

3. While maintaining the close signal, trip the circuit breaker with the shunt trip. The Solid State Control Device (SSCD) should prevent the reclosing of the circuit breaker until the close signal is removed and then re-applied. SSCD replacement may be required if it does not perform as indicated.

4. During the previous test, electrical operation of the shunt trip and the spring charging motor is confirmed. Malfunction of either requires repair or replacement.

Insulation Structures

Polyester glass insulation and base molding assemblies should be checked for breakage, cracking, or burn marks from normal operation and especially following fault interruption. Dust, soot and dirt should be removed by wiping with a lint-free cloth. Even though some greasy dirt may be present, **THE USE OF ANY TYPE OF SOLVENT CLEANER IS STRICTLY FORBIDDEN.**

To remove persistent contamination, apply a mild detergent and wipe with a water-moistened cloth, then dry thoroughly.

If environmental conditions fall in the severe category as defined by ANSI C37.13, Paragraph 10.6, additional measures may be necessary to avoid breaker misoperation and further contamination.

ADJUSTMENTS

The adjustments detailed below should only be performed when the periodic maintenance inspection verifies that the close coil, SSCD, shunt trip, or tripper latch require them. Because these devices may incorporate locking hardware intended to hold the factory adjustments, malfunction of one of the items listed above should be the only reason for making any adjustment; the locking hardware will become ineffective when adjustments are made at each maintenance period regardless of whether they are needed or not.

Operating experience indicates that the contact gap adjustment is the only one normally required during the periodic maintenance interval. When contacts are replaced or abraded during cleaning, contact gap adjustment is mandatory.

FOR SAFETY: See SAFETY NOTES in MAINTENANCE section.

NOTE: The operating mechanism must be operated slowly, as described in section SLOW CLOSE PROCEDURE, when performing any adjustment requiring contact movement.

In order to close the circuit breaker, the racking mechanism must be turned to a position such that the racking shutter is closed when the racking crank is removed.

SLOW CLOSE PROCEDURE

NOTE: The circuit breaker should be clamped down during the slow close procedure to keep it from tilting or moving.

Manually Operated Circuit Breakers

Refer to Figure 5 unless otherwise noted.

1. Loosely install 1/4 inch diameter pins or machine screws in each of the two spring guards located under the breaker (See Fig. 6).

2. Insert a screwdriver or rod through the hole in the escutcheon box and mechanism housing assembly (right-hand side when facing the front of the circuit breaker).

3. Using the top of the hole as the fulcrum and the screwdriver or rod as the lever, depress the hold-up latch at "A" and, at the same time, pull the operating handle downward to slowly close the circuit breaker contacts.

4. Remove the two 1/4 inch diameter pins or machine screws installed in Step 1 after the slow close operation is complete.

Electrically Operated Circuit Breakers

NOTE: The charging cranks must be reset (see steps 8, 9, and 10 below) after the last slow close operation, or future electrical operation will be impossible.

Refer to Figure 7 unless otherwise noted.

1. The closing springs must be charged; see spring charge indicator.

2. Insert a screwdriver or rod through the hole in the

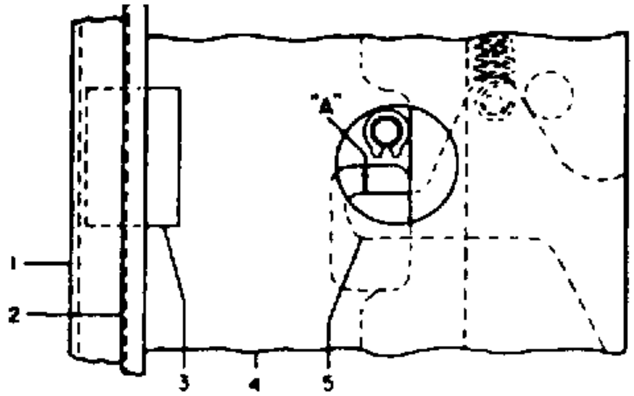


Figure 5 - Partial View of Escutcheon Assembly (Right-Hand Side) Showing Slow Close Lever for Manually Operated Circuit Breakers

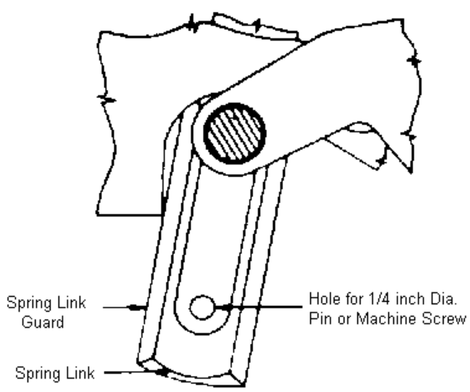


Figure 6 - Location of Hole in Spring Guard

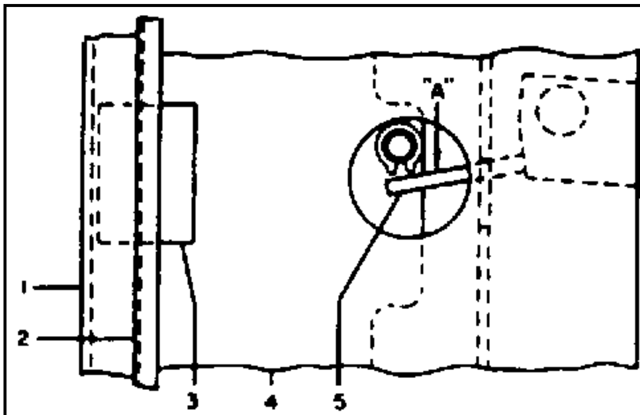


Figure 7 - Partial View of Escutcheon Assembly (Right-Hand Side) Showing Slow Close Lever for Electrically Operated Circuit Breakers

escutcheon box (right-hand side when facing the front of the circuit breaker) and depress the close block lever pin (5) at "A".

3. With the close block lever pin (5) held in the down position, lift the manual close lever. The close block lever pin (5) will remain in the down position.

4. Insert the maintenance handle in the ratchet carrier and operate the handle to slowly close the contacts (See Figure 4).

To repeat the slow close operation, continue with the following steps:

5. Insert the maintenance handle and continue the charging operation until the indicator shows "SPRINGS CHARGED".

6. Push the manual "TRIP" button to open the contacts.

7. Repeat Steps 2, 3, and 4 above for the slow close operation.

To reset the charging cranks for normal electrical operation, proceed as follows:

8. Perform Steps 5 and 6 above.

9. Lift manual close lever to close the contacts.

10. Push the manual "TRIP" button to open the contacts.

The circuit breaker is now ready for normal service operation with the charging cranks reset and the closing springs discharged.

CONTACT PRESSURE (Refer to Figure 8)

The main contact adjustment is to be made with the breaker in the latched closed position. The self-locking adjusting stud (1) is to be turned to provide contact pressure such that a 0.750 inch shim will just fit the space “A” at the rear of the moving main contacts (2). On 800A models where this measurement is difficult to obtain, a dimension of 1.625 across space “B” may be used instead.

After making this adjustment in contact pressure, open the circuit breaker, then reclose the circuit breaker normally and recheck the gap. Readjust if necessary.

Open the circuit breaker and slow close the contacts until the arcing contact (3) of one pole just touches. The remaining poles should then be advanced by turning adjusting stud (1) so that these poles just touch

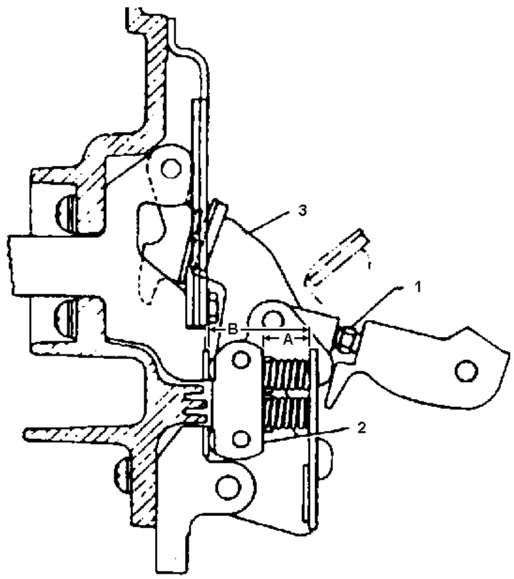


Figure 8 - Contact Adjustment

or are within 0.032 inch of each other.

The contacts should now be in correct adjustment and the breaker may be put in service. Note that if an adjustment is necessary for “simultaneous" make, the contact pressure will increase on those adjusted poles. Thus, a dimension of less than that specified above indicates more contact pressure, which is acceptable if achieved using the above procedure.

MECHANISM

The following adjustment values are approximate, and may have to be altered slightly to account for manufacturing tolerances, wear during use, etc.

Trip Latch Engagement (Bite) (Refer to Figure 9)

The latch engagement adjusting screw (3) is located to the right of the right-hand mechanism housing (1). It can be reached easily from the top of the circuit breaker. To adjust the latch (2) engagement, proceed as follows:

1. Back off adjusting screw (3) to assure excessive latch engagement.

2. Close the circuit breaker.

3. Turn adjusting screw (3) down slowly until the latch just releases, tripping the circuit breaker.

4. Back off the adjusting screw (3) approximately two full turns.

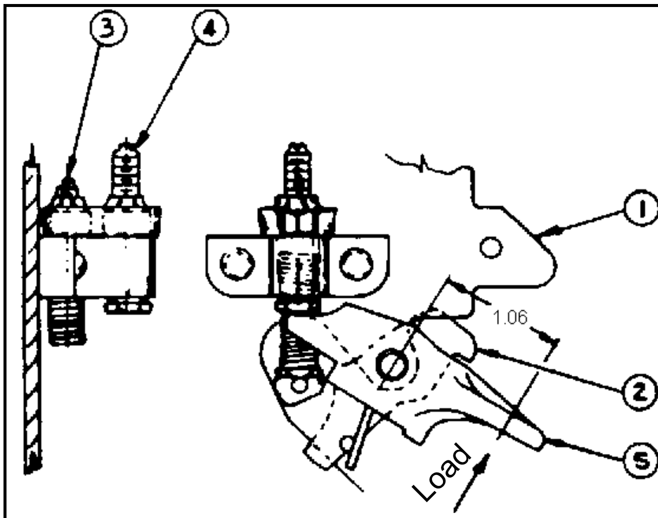


Figure 9 - Latch Engagement and Tripper Bar Latch Engagement Adjustments

Tripper Bar Latch Engagement (Refer to Figure 9)

The tripper bar latch engagement adjusting screw (4) is located adjacent to the latch engagement adjusting screw (3). To adjust the tripper bar latch engagement, proceed as follows:

1. Back off the adjusting screw (4) to assure excessive tripper bar travel.

2. Close the circuit breaker.

3. Turn the adjusting screw (4) down slowly until the latch just releases, tripping the circuit breaker.

4. Back off the adjusting screw (4) approximately 3½ turns.

Tripper Bar Load (Refer to Figure 9)

The tripper bar load is measured by the use of a spring scale positioned as shown. The tripper bar load should be no greater than 50 ounces.

Shunt Trip Adjustment (Refer to Figure 10)

Note: This procedure should only be performed when the shunt trip has malfunctioned or been replaced.

Caution: Perform this procedure only on an open circuit breaker with its closing springs discharged.

1. Locate the shunt trip adjusting screw (1). It can be accessed with a long screwdriver from the top of the breaker.

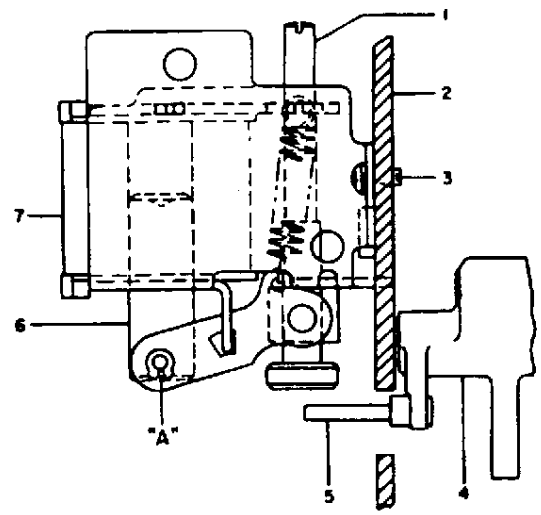


Figure 10 - Shunt Trip Adjustment

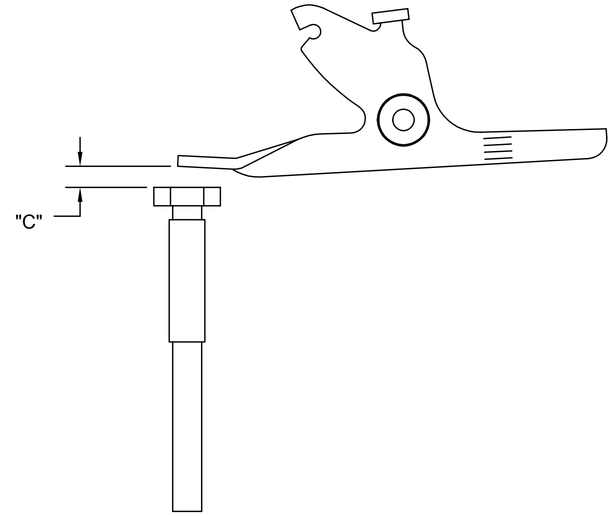


Figure 11 - Close Coil Adjustment

2. Rotate the adjusting screw counterclockwise until it is not possible to turn it further, DO NOT FORCE.

3. Rotate the screw clockwise approximately three (3) full turns.

4. Remove all tools from the breaker. Test the operation of the shunt trip device after charging and closing the breaker. Apply the required voltage to pins 4(+) and 2(-) of the circuit breaker secondary disconnect plug “A”.

Close Coil Adjustment (Refer to Figure 11)

Note: This procedure should only be performed when the close coil has malfunctioned or been replaced.

Caution: Perform this procedure only on an open circuit breaker with its closing springs discharged.

1. The circuit breaker must be lying on its back or on a cart which allows safe access to the close coil. Locate the close coil adjusting screw under the breaker.

2. Rotate the adjusting screw until gap “C” between the end of the plunger and the close latch is approximately 3/16” inches.

3. Remove all tools from the breaker and place the breaker in an upright position. Test the operation of the close coil device after charging the breaker. Apply the required voltage to terminals 3(+) and 5(-) of the circuit breaker secondary disconnects.

Magnetic Latch Device

The magnetic latch device in K-Line Plus breakers does not require adjustment.

PROCEDURE FOR FIELD TESTING THE MPSC-2000 SOLID STATE TRIP SYSTEM

There are two ways to evaluate the MPSC-2000 solid state trip system: primary current injection through the breaker main contacts; and secondary current injection directly into the trip device. Either method will test the trip device; primary injection has the advantage of testing the current sensors and magnetic latch also. The following is a procedure for performing this field testing.

Notes:

1. Refer to time current curves TD-9651, TD-9652, and TD-9653.

2. When checking calibration, disable the functions not being tested, or set them at their highest threshold and delay values. ***It is especially important to disable the Ground function when testing the other elements to prevent false tripping.***

3. The circuit breaker must be closed before each test below.

4. Following each test, check the MPSC-2000 event register to ensure that the correct element tripped the breaker, especially if test results appear to be incorrect.

5. Reference bulletin IB 6.1.2.8-1A for instructions on setting the MPSC-2000.

6. These procedures are written for primary injection. If the trip device is being tested by secondary current injection, use a special test cable available from ABB and follow the special instructions contained therewith.

7. The term “Range Selection” is used herein for consistency with previous MPS-type devices, and refers to the value of the “Rating” setting of the device. Like the previous MPS-type devices, the MPSC-2000 is capable of operating at two basic ratings: one equal to the maximum frame continuous current rating and one equal to one-half the frame rating. For example, on an 800A breaker, the MPSC-2000 rating can be set to 800A or 400A. When the rating is changed, other available settings are scaled accordingly; thus the term “Range Selection”.

Instantaneous or Short Time Threshold Test

1. Either disable the trip elements not being tested, or set them to their highest threshold value. Set the Long Time Delay to its maximum setting. Set the Short Time delay to its minimum setting for Short Time tests.

2. It is recommended that the Range Selection be set to its lowest value to minimize the current required for this test; however, it may be set to either available value.

3. Set the threshold and delay of the trip element being tested (again, it is recommended that a low value be used).

4. Test for the actual threshold by increasing test current until the breaker trips. It is important to increase the current fast enough so that the breaker will not be tripped by the Long Time element prior to completion of the test.

5. The threshold tolerance is +/- 10% on all selector switch settings.

Long-Time Threshold Test

1. Either disable the trip elements not being tested or set them to their highest threshold value.

2. It is recommended that the Range Selection be set to its lowest value to minimize the current required for this test; however, it may be set to either available value.

3. Set the Long Time threshold. Set the delay to its minimum value.

4. Test for the actual threshold by increasing test current until the Self Monitor light begins to blink quickly. The breaker should trip about 8-13 seconds later.

5. The threshold tolerance is +/- 10% on all selector switch settings.

Long-Time Delay Test

1. Position other trip element selectors at their highest threshold value.

2. It is recommended that the Range Selection be set to its lowest value to minimize the current required for this test; however, it may be set to either available value.

3. Set the Long Time threshold to its maximum setting.

4. Set test current so that it represents three times (3X) the trip system Range Selection setting. Delays should be as shown in Figure 12.

Short-Time Delay Test

1. Position other trip element selectors at their highest threshold value.

2. It is recommended that the Range Selection be set to its lowest value to minimize the current required for this test; however, it may be set to either available value.

Figure 12. Trip Element Delay Times

	Delay Times (sec.)		
Trip Element	**Min.**	**Int.**	**Max**
Long Time	**8-13**	**20-33**	**61-100**
Short Time (DEF)	**0.080-0.170**	**0.200-0.320**	**0.350-0.500**
Short Time (IIT)	**0.160-0.250**	**0.520-0.780**	**0.910-1.350**
Ground Trip (IIT) (200A-800A Sensors)	**0.68-1.3**	**2.1-4.2**	**5.2-9.5**
Ground Trip (IIT) (1600A-2000A Sensors)	**0.07-0.18**	**0.24-0.47**	**0.59-1.2**

3. Set the ST Curve to DEF.

4. Set the ST Pickup to its lowest setting.

5. Set test current so that it represents four times (4X) the ST Pickup setting. Delays should be as follows:

6. Set the ST Curve to IIT. (Note that the I^2t function of the MPSC-2000 Short Time element is operational only from twice to four times the Range Selection, and that the trip curve is fixed and does not vary with pickup settings.)

7. Set test current so that it represents 1.5 times the ST Pickup setting. Delays should be as shown in Figure 12.

Ground Trip Delay Tests

Ground Trip Delay tests are performed by injecting current through a single phase of the breaker, which appears to be a ground fault to the trip device. On breakers with 4-wire ground on double-ended substations, a remote neutral sensor must be used to perform this test.

1. Disable the other trip elements or set them at their highest threshold value.

2. The Range Selector has no influence on ground settings.

3. Set the GND PICKUP to the minimum available ground setting, and set the GND CURVE to “IIT”.

4. Set test current so that it represents three times (3X) the GND PICKUP setting. Delays should be as shown in Figure 12.

DIELECTRIC WITHSTAND TESTS ON POWER AND CONTROL CIRCUITS

Dielectric withstand tests on circuit breakers are made to determine the ability of the insulation to withstand overvoltages.

A 60 Hz alternating sinusoidal voltage (RMS) value equal to the specified voltage shall be used. All voltages used in the dielectric withstand tests shall be measured in accordance with ANSI Measurement of Voltage in Dielectric Tests, C68.1.

Duration of Test - The dielectric test voltage shall be applied for a period of 60 seconds.

Condition Of Circuit Breaker To Be Tested - Dielectric tests shall be made on a completely assembled circuit breaker and not on individual parts.

Temperature At Which Tests Are To Be Made - Dielectric tests shall be made at any temperature between 10°C and 55°C.

Magnitudes And Points of Application Of Test Voltage - The dielectric test shall be applied as follows:

1. With circuit breaker in the open position, apply 1,320 volts:
   a. Between live parts, including both line and load terminals, and metal parts that are normally grounded; and
   b. Between line terminals and load terminals.

2. With circuit breaker in the closed position, apply 1,320 volts:
   a. Between live parts and metal parts that are normally grounded; and
   b. Between terminals of different phases.

3. With circuit breaker in either open or closed position, apply 900 volts (Note: Pull plug on solid state trip unit, as a precaution) between all secondary disconnect pins (except for the motor pins - A1 and A7) and metal parts that are normally grounded.

4. Apply 600V between the motor leads and metal parts that are normally grounded (Note: if secondary disconnect pins A1 and A7 are used for this test, ensure that the motor disconnect switch is ON). Motors that have been in service may fail dielectric due to a normal accumulation of debris from the commutator. Cleaning the motor will restore dielectric integrity.

Do not perform dielectric testing on the MPSC-2000 solid state trip system. If such tests are performed, internal surge protection will falsely indicate dielectric failure on the MPSC-2000 solid state box.

Note: All circuit breakers are dielectrically tested before leaving the factory. The above voltages represent 60% of the originally tested values for testing circuit breakers that have been in service (ref. ANSI C37.50).

LUBRICATION

Only three lubricants are approved for use in the K-Line Plus circuit breaker. Lubricated during final assembly, the K-Line Plus circuit breaker should not require additional lubrication during its service life when applied in accordance with ANSI C37.13. If, however, the breaker is applied in unusual situations defined by ANSI C37.13, has lubricant contaminated with dirt and debris, or has parts replaced, relubrication should be

When mechanism cleaning and relubrication is required, do not spray solvents down through the mechanism to remove old lubricants, dust, and debris.

Do not use dichlorodifluoromethane on any part of the circuit breaker. These solvents tend to wash debris into the bearing areas of the breaker, while at the same time removing any existing lubricant. Breaker performance will be compromised when these cleaning techniques are employed.

Proper relubrication requires disassembly, thorough cleaning by wiping, then reassembly using a brush or other means for reapplying the lubricants listed.

1. Apply NO-OX-ID special grade "A" grease from Dearborn Chemical Company to all mating surfaces of moving current carrying joints, except as noted herein. Do not apply NO-OX-ID grease on any main or arcing contact surface. Primary disconnects should be maintained by reapplying NO-OX-ID during maintenance periods. NO-OX-ID is available from ABB in one pint cans, p/n 713222-A00

2. Apply Anderol 757 synthetic grease manufactured by HULS AMERICA, INC. to mechanism parts, bearings and pins, except as noted herein. DO NOT APPLY GREASE TO LATCH OR ROLLER SURFACES. Anderol 757 is available from ABB, p/n 712994-A00.

Anderol synthetic lubricant is also available as a spray, Anderol 732. Anderol 732 is useful as a solvent for removing old lubricant, dirt, and debris in the mechanism. However, it cannot be used as a substitute for Anderol 757.

4. Apply DAG-154 (Acheson Colloid, Inc.) to the following parts in accordance with ABB Specification 51626:

(a) The surface of the secondary close latch.
(b) The main shaft bearings.

Please observe the following lubrication warnings:

(a) DO NOT apply light machine oil, or thin spray lubricants to lubricate any mechanism part.

(b) DO NOT attempt to relubricate the spring charging motor.

(c) DO NOT lubricate the magnetic latch device or otherwise clean or spray with any substance.

(d) Use only the recommended lubricants. Use of other than approved lubricants can cause breaker misoperation.

RENEWAL PARTS

ABB recommends only those renewal parts be stocked that will be required to insure proper and timely maintenance of the breaker.

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