

Installation/Maintenance Instructions

MB Low-Voltage Power Circuit Breakers

*Frame Sizes 800
Through 2500 Amperes*

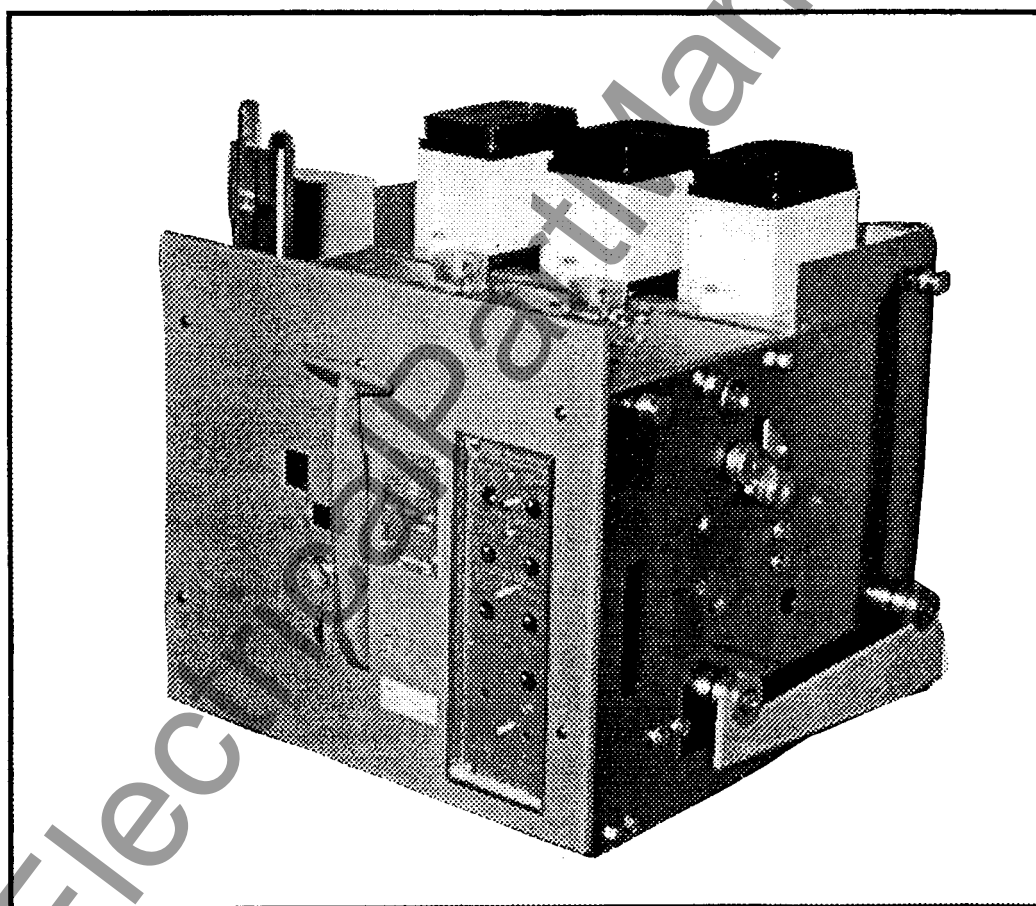


ABB Power Distribution, Inc.
Circuit Breaker Division

ABB
ASEA BROWN BOVERI

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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 purchaser's purposes the matter should be referred to the nearest District Office.

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**INSTRUCTIONS FOR TYPE MB LOW VOLTAGE POWER
CIRCUIT BREAKERS -- 800 THROUGH 2500 AMPERES****INTRODUCTION**

The type MB circuit breaker is a low voltage AC power circuit breaker featuring drawout construction and the MICRO Power-Shield microprocessor-based trip system. These circuit breakers can be furnished with either electrically operated or manually operated mechanisms. On electrically operated models, various AC and DC control power combinations are available. Numerous optional features are also available.

These instructions apply to MB 800, MBE 800, MB 1600, MBE 1600, MB 2000 and MB 2500 circuit breakers. Refer to the Quick Reference section below for general instructions on circuit breaker uncrating, inspection, and installation. Complete details on MB features, operation, and adjustments follow the Quick Reference section.

The circuit breaker continuous current rating is given by the number which follows the type designation MB 800, MB 2000, etc. These breakers, in some cases, can be fitted with lower ampere current sensors and trip systems, which would 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 MICRO Power-Shield 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.

**QUICK REFERENCE FOR MB UNCRATING,
INSPECTION, AND INSTALLATION**

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. ASEA Brown Boveri 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. Pull up on the foam packing to gain access to the circuit breaker. Remove the breaker from the carton, 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 a 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 with the closing handle. Springs must be charged on electrically operated models, using the proper control power applied to secondary disconnect points (1) and (2) or by using maintenance handle 703848-K01. Manual close and trip operators on the front escutcheon can be used to operate the breaker. Please note that when the contacts are properly adjusted, there is a gap between the moving and stationary arcing contacts when the circuit breaker is closed.

5. Rack the circuit breaker to the fully DISCONNECTED position. This will position the racking cams properly to engage cubicle.

6. Match circuit breaker to switchgear cubicle. MB 800 through 2500 ampere circuit breakers are the same size although their current carrying parts differ. Interference blocking is provided to prevent inserting breakers of differing current ratings or short circuit capabilities into cubicles for which they are not intended. Do not tamper with the interference blocking; equipment damage and/or injury to operating personnel can occur when these blocks are removed.

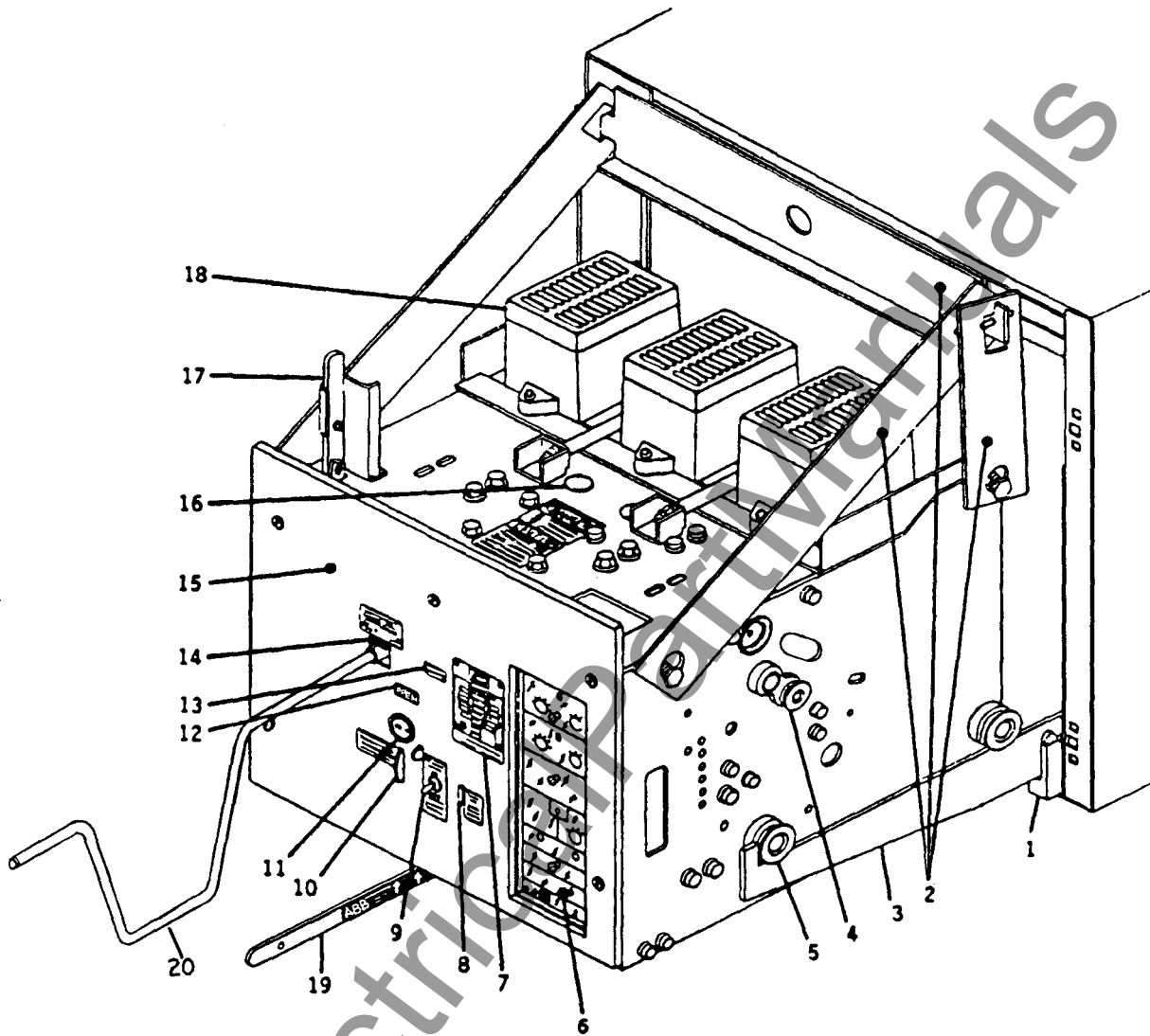
7. Lift the circuit breaker securely. Use either the lifting yoke assembly 713984-T03 or other sturdy lifting device to position the circuit breaker on the cubicle rails.

8. Push the circuit breaker into the switchgear cubicle. If interference is encountered before the racking cams reach their mating cubicle parts, recheck the switchgear plans to make sure the circuit breaker is intended for that cubicle. Heed the warnings above relating to interference blocking.

9. Lift the cubicle rails into their parked position and close the cubicle door. The circuit breaker should remain in this disconnected position until system checkouts have been completed.

10. Set the thresholds and time delays of the solid state trip system. Using the circuit breaker coordination information, set the dials of the MICRO Power-Shield to the desired threshold (pick-up) and time delay settings. This must be done before the

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- | | |
|-----------------------------|--------------------------------------|
| 1. CRADLE | 11. MANUAL TRIP BUTTON |
| 2. LIFTING YOKE ASSEMBLY | 12. "OPEN" OR "CLOSED" INDICATOR |
| 3. TRACK | 13. CLOSING SPRINGS CHARGE INDICATOR |
| 4. RACKING CAM ASSEMBLY | 14. RACKING SHUTTER |
| 5. WHEELS | 15. ESCUTCHEON ASSEMBLY |
| 6. MICRO Power-Shield | 16. ACCESS HOLE CAP |
| 7. NAMEPLATE | 17. MOC OPERATOR |
| 8. AUTOMATIC TRIP INDICATOR | 18. ARC CHUTE |
| 9. MOTOR DISCONNECT SWITCH | 19. REMOVABLE MAINTENANCE HANDLE |
| 10. LOCKING HASP | 20. RACKING CRANK |

Figure1 -Typical Electrically Operated, Drawout Type
MB 800 thru MB 2500 Circuit Breaker

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circuit breaker is put into service. ASEA Brown Boveri does not provide coordination information unless contracted to do so by the purchase order.

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

12. Rack the circuit breaker to the CONNECTED position. When the breaker is to be put into service, rack the circuit breaker to the CONNECTED position following instructions on front of breaker. Racking crank 711706-K03 is required for closed door racking.

The above quick reference is provided to serve as a checklist for uncrating, inspecting, and installing MB circuit breakers. It is not intended to provide all of the information necessary to describe the features of the MB low voltage power circuit breaker. That information can be found in the pages of this instruction bulletin.

CIRCUIT BREAKER ESCUTCHEON FEATURES

The MB 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 Nameplate - The circuit breaker nameplate provides information regarding the manufacturer's name and address, type of circuit breaker design, serial number of the circuit breaker and date of manufacture. This plate also provides application information including the continuous current rating of the frame size, rating of the solid state trip system at rated voltages, applicable voltage frequency, and the circuit breaker short time rating. When contacting ASEA Brown Boveri with questions on the circuit breaker, always refer to the serial number found on this plate.

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

MICRO Power-Shield Trip System - The MICRO Power-Shield (MPS) trip system consists of the microprocessor-based trip box, a current sensor for each phase of the circuit breaker, a magnetic latch assembly, and an interconnecting harness. This direct-acting trip device can be equipped with any combination of long time delay, short time delay, instantaneous, and ground delay tripping. A self-monitor light on the front escutcheon 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 MPS elsewhere in this bulletin.

Automatic Trip Indicator - The automatic trip indicator is a standard feature of MB circuit breakers providing visual indication that an automatic trip due to overcurrent has occurred. Additional

visual indication of overcurrent trip appears on the MICRO Power-Shield 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 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.

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. (**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 circuit breakers, a double pole-single throw 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 circuit breaker.

Padlocking Device - All MB 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 cannot be racked to any other position.

Manual Closing Lever - On electrically operated models, a manual closing lever is provided for times when control power for the close circuit is not available or when its simply more convenient to manually close the breaker. Lift up on the close lever to close the circuit breaker.

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

Open/Closed Indicator - All MB 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 MB circuit breakers allows access to the racking shaft when lifted. The circuit breaker must be manually tripped before the shutter can be lifted. This prevents racking the circuit breaker with the main contacts closed.

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The padlock hasp holds the racking shutter closed when the hasp is activated. Instructions appear on the front escutcheon of the circuit breaker for racking the MB 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 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.

The circuit breaker is normally provided with spring charging after any trip operation. As an option, the circuit breaker can be provided with charge after close. Automatic spring charging occurs only when the Motor Disconnect Switch is ON.

Local Electric Close and Trip Push buttons - (not shown). The local electric close and trip push buttons on the front escutcheon allow the electrical energization of the close or trip circuits when the circuit breaker is in the TEST and/or CONNECTED position. These buttons are to the right of the manual trip push button.

Operation Counter (not shown) - The non-resettable operation counter advances one count each time the circuit breaker is closed. It is typical that the counter on new circuit breakers will show counts of greater than 9950 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.

CIRCUIT BREAKER INTERNAL COMPONENTS

For electrically operated 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.

Closing Control Devices

The closing control devices furnished on electrically operated circuit breakers are the closing spring charging motor, the "X" close coil, and the "Y" relay. The "X" close coil, when energized, releases the stored energy of the closing springs causing the circuit breaker to close. The "Y" relay coil prevents additional operation of the "X" closing coil while the close button is depressed should the breaker automatically trip upon closing. A second close operation can not occur until the close push button is released, deenergizing the "Y" relay coil. The close push button can then again be depressed.

The "X" close coil and the "Y" anti-pump relay are enclosed in the black control box in the lower front left hand corner of the circuit breaker mechanism. The base of the device provides a terminal block for circuit breaker wiring.

Shunt Trip

The shunt trip, when energized, releases the stored energy of the opening springs causing the circuit breaker to open.

Closing Spring Charging Motor - The closing spring charging motor is energized automatically by internal limit switches to charge the closing springs electrically.

Figure 2
ELECTRICAL CHARACTERISTICS OF CONTROL DEVICES
CLOSING AND TRIPPING CURRENTS, VOLTAGES AND RANGES

Type Breaker	Nominal Control Voltage	Average Closing Motor Current Amperes	Shunt Trip Current Amperes	Closing Relay Current Amperes		Closing Circuit Voltage Range	Shunt Trip Circuit Voltage Range	Recommended Control Fuse Size
				Anti-Pump	Release			
MB 800	120 V ac 60 cycle	10.0	6.5	0.15	0.15	104-127	50-127	10A
	240 V ac 60 cycle	5.0	1.15	0.075	0.75	208-254	208-254	10A
Through	48 V dc	25.0	3.14	0.15	1.33	38-56	28-56	15A
MB 2500	125 V dc	10.0	1.3	0.06	0.7	100-140	70-140	10A
	250 V dc	5.0	0.65	0.03	0.3	200-280	140-280	10A

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Integral Auxiliary Switch

The integral circuit breaker mounted auxiliary switch contains the one "a" and three "b" contacts. It is mechanically interconnected with the circuit breaker mechanism such that, with the circuit breaker closed, the "a" contact is closed and the "b" contacts are open. With the circuit breaker open, the "a" and "b" contacts reverse positions. This integral auxiliary switch is for circuit breaker control only and is not available for other use. Manual circuit breakers with shunt trip will also feature an auxiliary switch.

Electrical Characteristics of Control Devices

For closing and tripping currents at the various available control voltages, see the table on page 6. Current values are average steady state values at nominal voltage. Momentary in-rush currents for the charging motors and AC coils are approximately 6-8 times these values.

MB CIRCUIT BREAKER CUBICLE FEATURES

All MB 800 through 2500 ampere circuit breakers use a mating cubicle which provides support and guidance to the breaker so that primary and secondary connection are made properly. This cubicle incorporates the stationary primary and secondary disconnects, grounding connection, interference blocks, and racking guides. Optional equipment includes the mechanism operated cell switch (M.O.C.), the truck operated cell switch (T.O.C.), current transformers, mechanical interlocks, KIRK[®] Key interlock, 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 on the circuit breaker.

Stationary Secondary Disconnects - The stationary secondary disconnects interface with the moving secondary disconnects mounted on the bottom of the circuit breaker to provide the control and indicating connections to and from the circuit breaker. Connecting points of each function are dedicated positions to provide for interchangeability of circuit breakers.

The standard contacts function in both the CONNECTED and TEST positions. However, optional operating position only (O.P.) and test position only (T.P.) contacts are available. The "O.P." contacts function only in the CONNECTED position and the "T.P." contacts function only in the TEST position.

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 cubicle side sheet 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.

Mechanism Operated Cell (M.O.C.) Switch (Optional) - The MOC auxiliary switch mounts in the upper left-hand corner of the cubicle and is driven by a verticle operator connected via linkages directly to the jackshaft of the circuit breaker. Four or eight contacts in any arrangement of normally open "a" and normally closed "b" can be provided for remote indication of circuit breaker primary contact status. When unspecified, half of the contacts are "a" while the other half are "b".

Two arrangements are available. In the standard arrangement, the M.O.C. works when the circuit breaker is in the CONNECTED or TEST position. In the second arrangement, the MOC work only in the CONNECTED position.

Truck Operated Cell (T.O.C.) Switch (Optional)

The T.O.C. auxiliary switch is operated as the circuit breaker is racked into the cubicle. Mounted on the left lower side of the cubicle, 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 (Optional)

Provisions for mounting one current transformer per phase are incorporated into all cubicles. Current transformers are mounted on the lower primary cubicle leads for the MB 800 through 2500 ampere circuit breakers.

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 solid state trip system includes the sensors, the MICRO Power-Shield (MPS) solid state 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 that is directly proportional to the current flowing in the primary. When the value of current flowing in the primary exceeds the trip unit settings for a given time, a signal is sent to the magnetic latch causing the circuit breaker to trip. On a three phase, four wire, wye systems, provisions are made for input from a separately mounted sensor to obtain a residual connection of all four (4) sensors for sensitivity to ground currents.

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MICRO Power-Shield (MPS) Trip Unit

The MPS trip unit (figure 3) is visible on the front of the circuit breaker on the right hand side. It is completely selfpowered, taking the tripping energy from the primary current flowing through the circuit breaker without the need for any additional power supply.

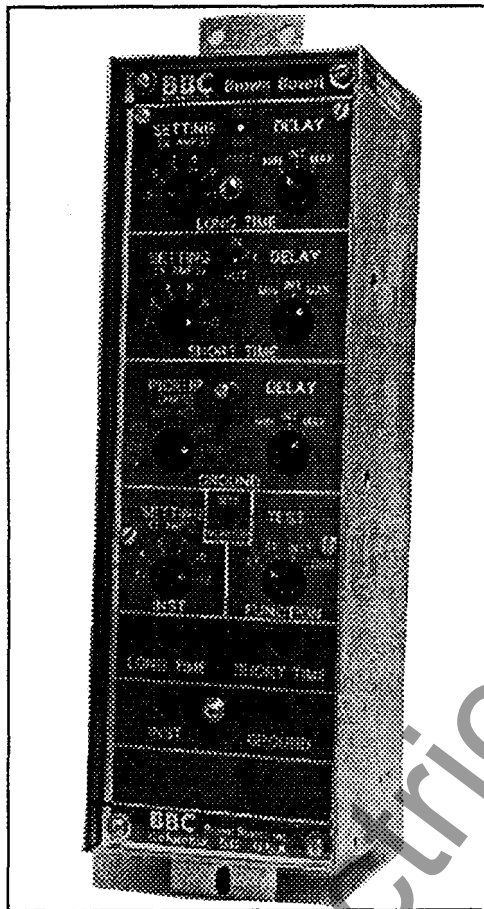


Figure 3 - MICRO Power-Shield (MPS-5G)

Protective Elements

Four basic trip elements within the MPS trip unit perform the protective functions: (1) long-time, (2) short-time, (3) instantaneous, and (4) ground. MPS types with various combinations of these protective elements are shown in figure 4. Selection of type is dependent upon the protection and coordination requirements for the specific power circuit. The MPS 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 and without an I^2t characteristic; instantaneous setting; and ground setting and delay bands.

The MPS trip unit must be properly set, as required by the individual circuit, in order to provide the necessary protection. With the transparent cover removed, the rotary switches on the unit faceplate enable independent selection of the long-time, short-time, instantaneous, and ground characteristics as applicable. In addition, as part of the short-time function, an I^2t characteristic response has been included. A two-position switch gives the user the choice of selecting this option.

The MPS trip unit protective elements, with the exception of ground, will cause the circuit breaker to trip at a value equal to the ampere range selector position times the pick-up (threshold) setting of the various protective elements. The ground trip settings are marked on the faceplate in primary amperes.

Ampere Range Selector

The ampere range selector switch provides two settings: fifty percent and one hundred percent of phase sensor rating. In the upper position, the setting is one hundred percent of phase sensor rating. In the lower position the setting is fifty percent of the phase sensor rating. This exclusive feature effectively expands all trip elements settings, except ground, by a factor of two.

Targets

Operation indicators (targets) are provided as standard on all types of MPS trip units. One indicator is provided for each of the protective trip elements included (long-time, short-time, instantaneous, and ground). Therefore, a maximum of four targets will be supplied based on the total number of trip elements in the particular trip unit. When a trip occurs, the target for the trip element which was responsible for tripping the circuit breaker will display the color orange. The target will retain its position despite shock or vibration as long as the breaker remains open. The target will reset automatically within two seconds after the circuit breaker is closed and the sensors detect current flow through the circuit breaker. Upon closing, if there is a trip condition, the target will reset instantly and a new target will display corresponding to the trip element which caused the condition.

Available Settings

Ampere Range Selector Switch

The ampere range selector switch has two positions. The maximum setting corresponds to the rating of the phase sensor. The minimum setting corresponds to fifty percent of the phase sensor rating. See figure 5.

Long-time

The long-time setting may be 0.5, 0.6, 0.7, 0.8, 0.9, or 1.0 times the ampere range selector setting. Three long-time delay bands are provided. The three bands are labeled MAX (maximum), INT (intermediate), and MIN (minimum).

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Short-time

The short-time setting may be 2, 3, 4, 6, 8 or 10 times the ampere range selector setting. Three short-time delay bands are provided: MAX (maximum), INT (intermediate), and MIN (minimum).

A two-position switch is provided to select an I²t type of response. The switch when placed in the OUT position selects the normal current characteristic curve. By placing the I²t switch in the IN position, the I²t current characteristic curve is selected.

Instantaneous

The instantaneous setting may be 3, 4, 5, 7, 10, or 12 times the ampere range selector setting.

Ground

The available ground settings vary with the phase sensor rating. Settings are listed in Figure 5. These settings are marked on the faceplate in primary amperes. Three ground fault display bands are provided: MAX (maximum), INT (intermediate), and MIN (minimum). The time current delay bands of the ground elements include an I²t characteristic that is a permanently programmed feature. Unique circuitry of the MPS trip unit responds to low level arcing faults by summing the erratic currents associated with arcing, then providing a trip when that sum is above the trip threshold for a preprogrammed period of time.

Figure 4 - AVAILABLE MICRO Power-Shield TRIP UNIT

ADJUSTABLE PROTECTIVE TRIP ELEMENTS										
TYPE	LONG-TIME SETTING DELAY		SHORT-TIME SETTING DELAY		INSTANTANEOUS SETTING	GROUND SETTING DELAY		TIME-CURRENT CHARACTERISTIC CURVES		
								OVCT.	I ² t	GROUND
MPS-3	X	X	---	---	X	---	---	TD9601	---	---
MPS-3G	X	X	---	---	X	X	X	TD9601	---	TD9603
MPS-4	X	X	X	X	---	---	---	TD9602	TD9604	---
MPS-4G	X	X	X	X	---	X	X	TD9602	TD9604	TD9603
MPS-5	X	X	X	X	X	---	---	TD9602	TD9604	---
MPS-5G	X	X	X	X	X	X	X	TD9602	TD9604	TD9603

Figure 5 - CURRENT SENSORS AND CIRCUIT BREAKER RATINGS

SENSOR RATING	AMPERE RANGE SELECTOR SETTING	GROUND PRIMARY AMPERES SETTING	AVAILABLE ON CIRCUIT BREAKER TYPES
200	100, 200	100, 200, 300, 600, 900, 1200	MB, MBE 8
800	400, 800	100, 200, 300, 600, 900, 1200	MB 8, MBE 8, MB 16
1600	800, 1600	300, 400, 600, 800, 1000, 1200	MB 16, MBE 16, MB 20
2000	100, 2000	300, 400, 600, 800, 1000, 1200	MB 20
2500	1250, 2500	300, 400, 600, 800, 1000, 1200	MB 25

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Self Monitoring

A continuous monitoring of the microprocessor function is provided consisting of a red Light Emitting Diode (LED) mounted in the faceplate. When primary current is approximately six percent of the sensor rating, the LED will blink approximately one time per second. The LED does not blink at current levels below 6%. Servicing is required if the LED remains lit but does not blink, or does not illuminate at all at current levels above 6%.

Making 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. The ampere range selector and the short-time I^2t switch are two position switches on the MPS trip unit. All other settings are made by means of six position rotary switches. The long-time, short-time, and instantaneous trip element thresholds are multiples of the ampere range selector setting. The ground trip element functions independently of all other protective elements and the ampere range selector setting. The ground trip value in primary amperes is selected directly by its rotary switch setting. An example of settings:

800 Amp circuit breaker with 800A sensor

Long-time setting required: 480 amperes

Instantaneous setting required: 8000 amperes

Ground setting required 200 amperes

1. Set AMPERE RANGE SELECTOR at 800 amperes
2. Set LONG-TIME SWITCH at .6 setting ($.6 \times 800 = 480$)
3. Set INSTANTANEOUS SWITCH at 10 setting ($10 \times 800 = 8000$)
4. Set GROUND SWITCH at 200 setting.
5. Set DELAY BANDS required for coordination.

WARNING WARNING WARNING

Rotary switches must be positioned in the detent when making pickup and time delay settings. There are NO intermediate settings between detents. Failure to position the rotary switch in the detent will impair the tripping capability of the element so adjusted.

Testing

A test set designated type 606 and designed specifically for use with the MPS trip system is available. A type 606 test set instruction bulletin detailing step-by-step procedures for testing the MPS trip system is furnished with each type 606 test set. Refer to IB 6.1.1.7-4. Primary current injection is also covered in this document.

A test function switch in the faceplate is provided for testing only with the type 606 test set.

WARNING WARNING WARNING WARNING

WHEN USING PRIMARY CURRENT TO TEST THE MICRO Power-Shield TRIP SYSTEMS EQUIPPED WITH THE GROUND TRIP FUNCTION, THIS FUNCTION MUST BE DEFEATED IN ORDER TO TEST THE OTHER TRIP ELEMENTS. A SPECIAL GROUND DEFEAT TEST CABLE (PART 712918-T09) MUST BE USED. THE CABLE IS INSERTED TEMPORARILY IN THE CIRCUIT CONNECTING THE TRIP UNIT AND THE CIRCUIT BREAKER. FAILURE TO USE THE GROUND DEFEAT TEST CABLE CAN RESULT IN DAMAGE TO THE MICRO Power-Shield TRIPPING SYSTEM. CALL THE NEAREST ASEA BROWN BOVERI DISTRICT OFFICE TO ORDER EITHER THE GROUND DEFEAT TEST CABLE (PART 713918-T09) OR THE D.E.S.P. TEST CABLE (PART 713918-T10).

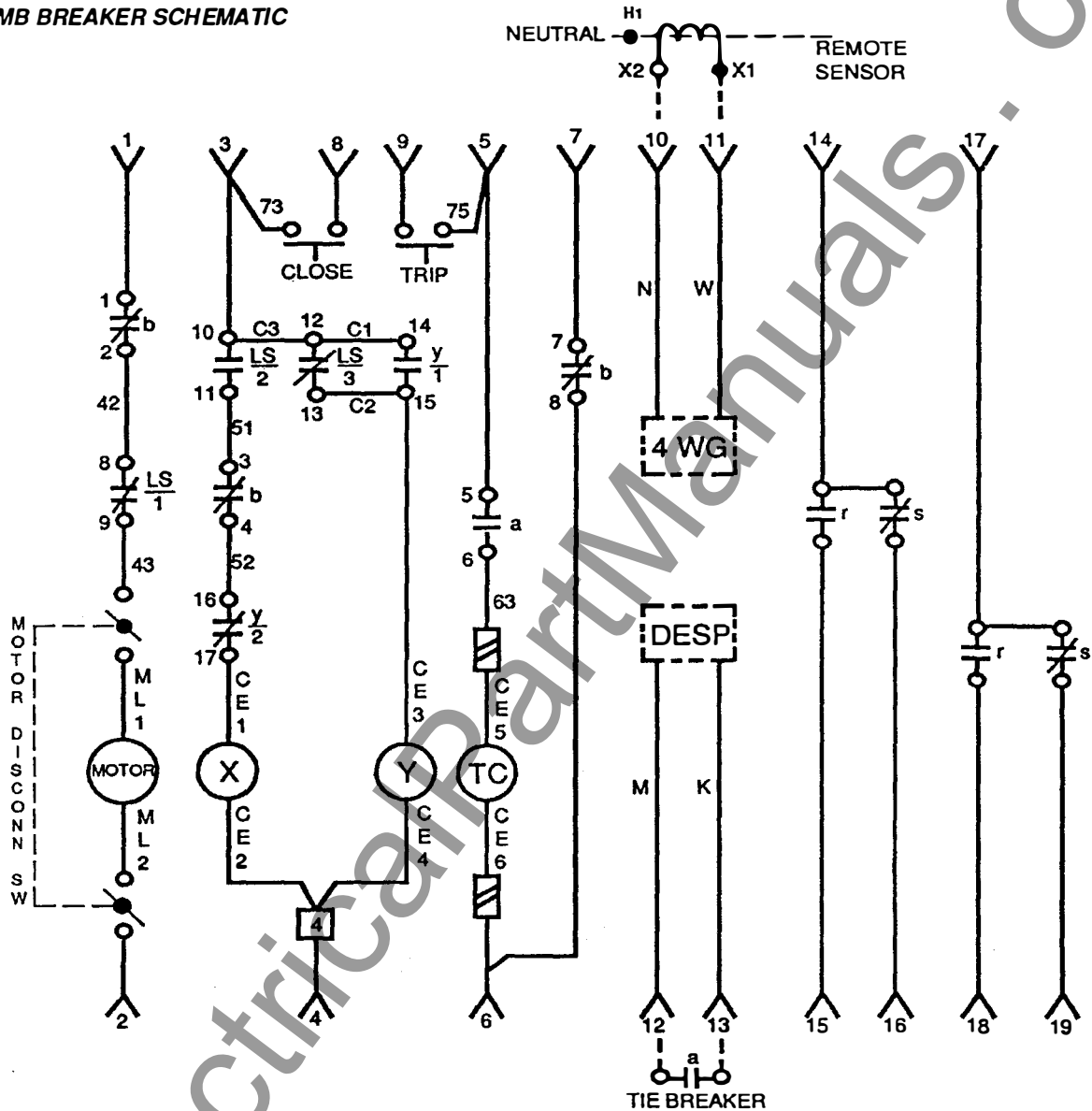
OPERATING SEQUENCE FOR ELECTRICALLY OPERATED MB CIRCUIT BREAKERS

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 Figure 6):

1. The "b" contact which is closed when the breaker is open and the LS/1 which is closed when the closing springs are discharged, allow the spring charging motor to be energized. When the closing springs reach the fully charged condition, LS/1 opens to deenergize the motor. LS/3 also opens in the "Y" relay (anti-pump) circuit. The contacts of LS/2 close when the springs are fully charged.
2. Operation of the remote close control switch or optional electrical close push button energizes the close latch release coil (X) through the circuit breaker LS/2 limit switch, the breaker auxiliary switch "b" contact and the "Y" relay Y/2 contact. The close latch release coil "X" releases the close latch, the springs discharge and the breaker contacts close.
3. When the springs discharge, limit switch contacts "LS/1" and "LS/3" close and limit switch contact "LS/2" opens.
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 "Y" relay coil is energized when LS/3 is closed. Energization of the "Y" coil opens lockout contact Y/2 which deenergizes the close coil "X." Lockout contact Y/1 closes which seals in the lockout relay coil "Y" as long as the local or remote close signal is maintained. In doing so, the circuit breaker mechanism will not pump should it close into a faulted circuit.

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Figure 6 - MB BREAKER SCHEMATIC



SYM.	DESCRIPTION
a	AUXILIARY SWITCH CONTACT, OPEN WHEN BREAKER IS OPEN.
b	AUXILIARY SWITCH CONTACT, CLOSED WHEN BREAKER IS OPEN.
LS	LIMIT SWITCH CONTACT.
2	CONTACT OPEN WHEN CLOSING SPRINGS ARE DISCHARGED AND IS LATCHED OPEN WHEN "Y" COIL IS ENERGIZED.
3	CONTACT UNLATCHED CLOSED WHEN "Y" COIL IS DE-ENERGIZED.
CLOSE	LOCAL ELECTRICAL CLOSE PUSH BUTTON.
TRIP	LOCAL ELECTRICAL TRIP PUSH BUTTON.
LS	LIMIT SWITCH CONTACT.
1	CLOSED WHEN SPRINGS ARE DISCHARGED.
	OPEN WHEN SPRINGS ARE CHARGED.
LS	LIMIT SWITCH CONTACT.
3	OPEN WHEN SPRINGS ARE DISCHARGED.
	CLOSED WHEN SPRINGS ARE CHARGED.
M	MOTOR, CLOSING SPRING CHARGING.
MDS	MOTOR DISCONNECT SWITCH.
	ALARM CONTACT CLOSING ON OVERCURRENT (AND/OR GROUND) TRIP, MANUALLY RESET.
r(UV)	UNDERVOLTAGE ALARM SWITCH CONTACT, CLOSING ON UV TRIP.
	OPEN WHEN UV PICKS UP.
s	ALARM CONTACT OPENS ON OVERCURRENT (AND/OR GROUND) TRIP, MANUALLY RESET.
TC	SHUNT TRIP COIL.
UV	UNDERVOLTAGE DEVICE (TRIP OR LOCK OPEN).
SS ALARM	SOLID STATE ALARM SWITCH (GROUND TRIP ALARM OR HIGH LOAD ALARM FUNCTION).
AR	ALARM RELAY COIL (GROUND TRIP ALARM OR HIGH LOAD ALARM FUNCTION).
X	CLOSE COIL, CLOSING LATCH RELEASE.
Y	"Y" RELAY COIL (PREVENTS PUMPING).
□	TERMINAL BLOCK.
▨	WIRE DISCONNECTS.
⌘	MOVABLE SECONDARY DISCONNECTS CONTACTS.
H1	PRIMARY SIDE OF NEUTRAL SENSORS.
X1 & X2	SECONDARY SIDE OF NEUTRAL SENSORS.
●	POLARITY (H1) TOWARD SOURCE IF BREAKER UPPER
○	TERMINALS ARE SOURCE TERMINALS. REVERSE IF BREAKER UPPER TERMINALS ARE LOAD TERMINALS.
4WG	4 WIRE GROUND TRIP FUNCTION.
DESP	DOUBLE ENDED SUB - PROTECTION 4 WIRE GROUND FUNCTION.

NOTE: a AND b CONTACTS FOR CUSTOMER USE ARE MOUNTED ON CRADLE AND WIRED DIRECTLY.

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

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, 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 down the right and left hand tracks to the full extended position.

3. Using a lifting yoke, position the yoke so that it captures the MB circuit breaker as shown in Figure 1. Using an overhead lifting device, raise and install the circuit breaker by lowering it such that the wheels on either side of the circuit breaker rest on the extended cubicle 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, and 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. Using both hands positioned at each top corner, push the circuit breaker in until the racking cams stop against their guides on the cradle. If mechanical interference occurs before the circuit breaker reaches this point, recheck the cubicle and the ampere rating of the breaker to make sure they match.

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.

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

Initial Testing

Electrically Operated Models:

1. Manually reset automatic trip indicator if it protrudes approximately 1/2". Push to reset.

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

3. Close the circuit breaker by the manual close lever, then trip with the manual trip push button. The closing springs should automatically recharge after trip (or optionally after close). 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.

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. To manually charge the closing springs, first remove the front escutcheon. Position the maintenance handle hooked section in the long slot on the pawl carrier (Refer to Figure 7). 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 Models:

1. Manually reset automatic trip indicator if it protrudes approximately 1/2". Push in 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.

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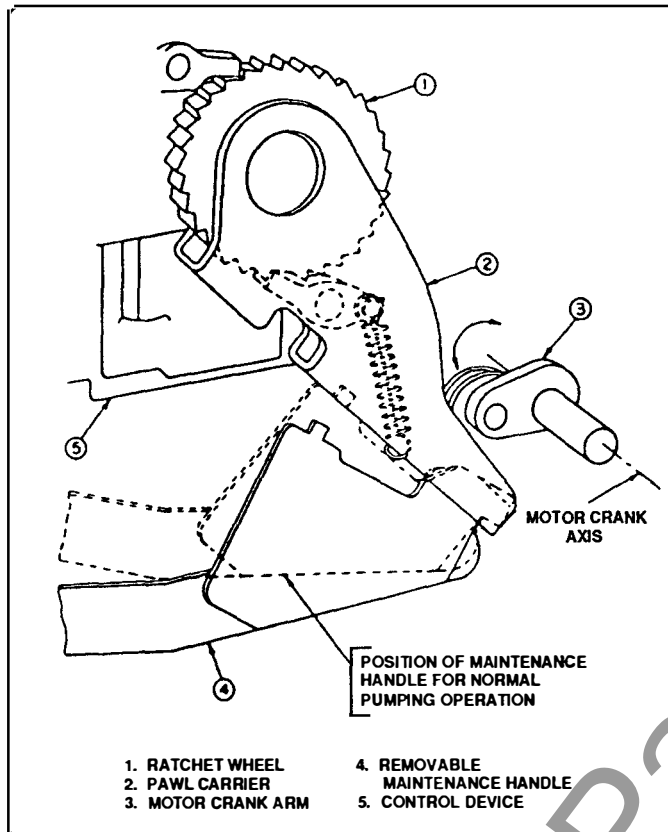


Figure 7 - MANUAL CHARGING OF ELECTRICALLY OPERATED CIRCUIT BREAKERS

Circuit Breaker Removal

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

1. With the compartment door closed, trip the circuit breaker by means of the remote mounted control switch or manual TRIP button on the escutcheon. On electrically operated models, when it is desirable to rack the circuit breaker with the springs discharged, turn the motor disconnect switch off prior to tripping the circuit breaker.
2. Lift the racking shutter, insert the racking crank and turn counterclockwise until the TEST position is indicated. Any tests that are necessary can be done on the circuit breaker in this position.
3. Continue turning the racking crank counterclockwise until the position indicator on the right-hand side of the door slider shows DISCONNECTED position.
4. The circuit breaker may be racked out with the closing springs charged. At a point between the DISCONNECTED and OUT position, the closing springs will automatically discharge.

5. 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.

6. Lower the cubicle rails. Place fingers in the cutouts on either side of the circuit breaker and pull the circuit breaker forward onto the rails. Pull out until the circuit breaker wheels contact the rail stops.

DO NOT USE THE MECHANISM OPERATED CELL SWITCH OPERATOR AS A HANDLE FOR PULLING OUT THE BREAKER.

7. Using a lifting yoke, lift the circuit breaker with an overhead lifting device.

8. Place the circuit breaker on the floor, sturdy work table, or a surface suitable for transporting the device.

9. Pivot the cradle rails up to their parked position then close the 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 close 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:

MB, MBE 800	- After 1,750 operations
MB, MBE 1600	- After 500 operations
MB 2000	- After 500 operations
MB 2500	- 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.

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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. American National Standard C37.16, tables 5 and 6 can provide additional information on this subject.

Where unusual service conditions exist, it must be assumed that these conditions were considered at the time of order; that the equipment supplied was designed 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 ANSI'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, "Y" relay and insulation structure should be inspected as described below.

Arc Chutes

Removal

1. Loosen and remove the retaining screw.
2. Lift the front end of the arc chute and pivot rearward to disengage tab on arc chute from breaker arc chute support.

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.

Re-Installation

1. Properly position the arc chute in the arc chute support.
2. Insert and tighten the retaining screws.

Contacts

Special Note: When the contacts are properly adjusted, there is a gap between the moving and stationary arcing contacts. A rocking action in the moving contact design allows the contacts to touch then transfer the arc during contact parting.

Inspection

1. Soot and discoloration are normal on the arcing contacts. Following fault interruption, signs of burning will also be evident on the arcing contacts. This is not considered detrimental unless it interferes with proper contact pressure adjustment.
2. The main contacts will have some signs of burning and some pitting. It may be necessary to remove the plastic shield to inspect the main contacts.

Cleaning

Warning : Do not use solvent type contact cleaners which can damage non-metallic parts. Do not use Dichlorodifluoromethane degreaser.

1. Remove dust or grease on arcing contacts with a clean, lint-free cloth.
2. Scotch Brite or other non-metallic scrubbing media can be used to clean both the arcing and main contacts. Blow any debris away with clean, dry, compressed air. Take care to prevent debris from dropping into the mechanism.
3. Replace badly pitted or eroded contacts that will not allow contact adjustment. They can be individually removed and replaced by removing their retaining bolts and hardware.
4. When contacts have been replaced or filed it is necessary to readjust the contact pressure.

Electrical Components (Electrically Operated Only)

Inspection

1. Rack the circuit breaker to the TEST position. Make sure the closing springs are charged.
2. Operate the local or remote electrical close push button as applicable to close the circuit breaker. This will confirm operation of the close coil.

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3. While maintaining the close signal, trip the circuit breaker with the shunt trip. The "Y" relay should prevent the reclosing of the circuit breaker until the close signal is removed and then re-applied. Control box replacement is required if the "Y" relay does not perform as required.
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 Structure

Inspection

1. Insulated parts should be checked for damage. Dust and dirt should be removed by cleaning with a lint-free cloth. To remove persistent contamination, apply a mild detergent and wipe with a moist cloth, then dry. If environmental conditions are too severe, action should be taken to prevent additional contamination.

Adjustments

The adjustments detailed below should only be performed when the periodic maintenance inspection verifies that the close coil, "Y" relay, shunt trip, or tripper latch require them. Because these devices 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 it is 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.

Trip Latch Engagement (Refer to Fig. 8)

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 through the right access hole after the plug is removed.

To adjust the trip latch engagement, proceed as follows:

1. Back off adjusting screw to assure generous latch engagement.
2. Charge the closing springs, then close the circuit breaker.
3. Turn adjusting screw down slowly until the latch just releases, tripping the circuit breaker.
4. Back off the adjusting screw two (2) turns.

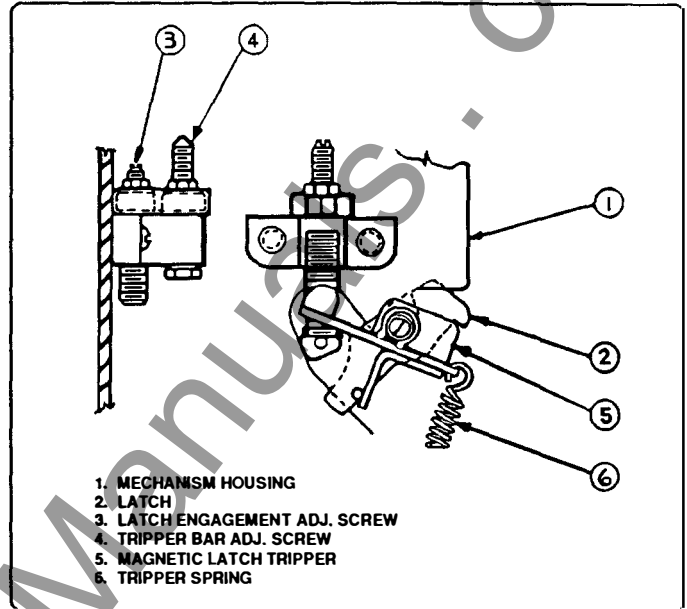


Figure 8 - TRIP LATCH AND MAGNETIC LATCH TRIPPER ENGAGEMENT

Magnetic Latch Tripper Engagement (Refer to Fig. 8)

The magnetic latch tripper engagement adjusting screw (4) is located adjacent to the latch engagement adjusting screw (3), through the right access hole.

To adjust the tripper engagement, proceed as follows:

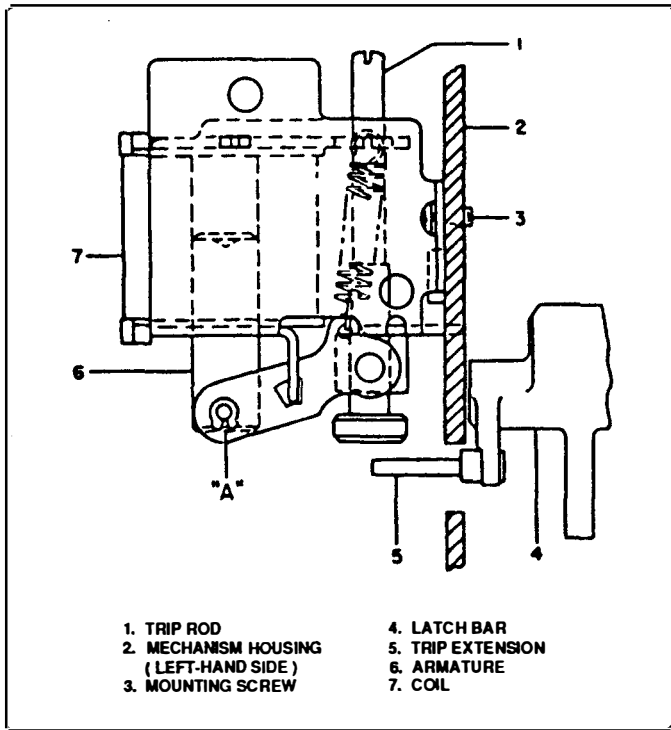
1. Back off adjusting screw (4) to assure excessive tripper travel.
2. Charge the closing springs and close the circuit breaker.
3. Turn adjusting screw down slowly until the latch just releases, tripping the circuit breaker.
4. Back off the adjusting screw three and one half (3 1/2) turns.

Shunt Trip Device Trip Adjustment

Remove the plug in the left access hole, refer to Fig. 9, then adjust as follows:

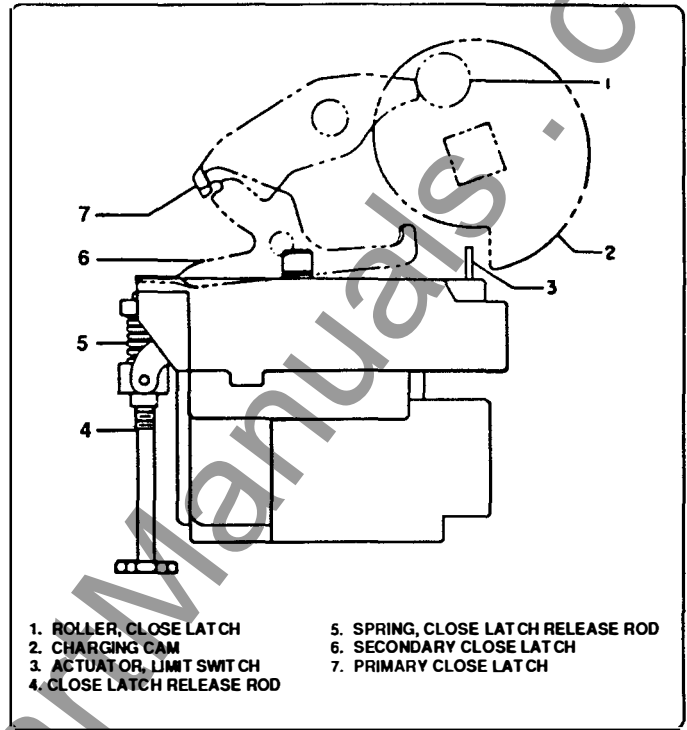
1. Back off trip rod (1) until it will not trip the circuit breaker with the armature (6) pushed up as far as the travel will allow.
2. Charge the closing springs, then close the circuit breaker.
3. Push up on the armature at "A" as far as the armature travel will allow.

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1. TRIP ROD
 2. MECHANISM HOUSING (LEFT-HAND SIDE)
 3. MOUNTING SCREW
 4. LATCH BAR
 5. TRIP EXTENSION
 6. ARMATURE
 7. COIL

Figure 9 - SHUNT TRIP DEVICE TRIP ADJUSTMENT



1. ROLLER, CLOSE LATCH
 2. CHARGING CAM
 3. ACTUATOR, LIMIT SWITCH
 4. CLOSE LATCH RELEASE ROD
 5. SPRING, CLOSE LATCH RELEASE ROD
 6. SECONDARY CLOSE LATCH
 7. PRIMARY CLOSE LATCH

Figure 10 - CLOSE LATCH RELEASE ROD OVERTRAVEL

4. Hold the armature as positioned in step 3 and turn trip rod (1) down until the circuit breaker just trips.
5. Turn trip rod (1) down an additional three (3) turns.

Control Device Close Release Rod Adjustment
 (Refer to Fig. 10)

The control device is adjusted before leaving the factory. It is recommended that no attempt be made to adjust the internal relays and contacts of this device in the field. If replacement of the control device is required, the close latch release rod (5) overtravel may be adjusted as described below.

1. Back off on close latch release rod and check that the circuit breaker will not close by attempting to close it electrically or manually pushing up on close latch release rod to the full extent of its travel.
2. Charge the closing springs. Push up on close latch release rod to the full extent of its travel. While holding the close latch release rod in this position, turn up on close latch release rod until the circuit breaker closes. Turn close latch release rod up an additional 1 1/2 turns.

Magnetic Latch

This device is located just right of center behind the auxiliary switch (on E.O. models). There are no adjustments required or recommended.

Main Contact Adjustment

Slow Close Procedure

Arcing contact gap inspection and adjustment should be performed only after the circuit breaker contacts have been slow closed using the procedure described below. The slow close procedure allows evaluation of the contact gap as well as simultaneous make of the arcing and main contacts.

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

Note: The circuit breaker should be clamped down or braced during the slow close procedure to keep it from tilting or moving. Do not perform this procedure on extended cradle rails.

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Manually Operated MB Circuit Breaker
 (Refer to Figure 11)

1. Remove the circuit breaker front cover, taking care to retrieve the local electric trip push button if so equipped. The cover must be pulled out then turned sideways to clear the manual closing handle.
2. Insert a screwdriver or rod through the rectangular opening in the right-hand side mechanism frame.
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 manual closing handle downward to slowly close the circuit breaker contacts. Perform inspections or adjustments with contacts in this position.
4. It is necessary to hold down on the manual close lever while making the contact gap and simultaneous make evaluation. Pushing the handle downward to the limit of its downward travel will latch the contacts in the closed position.

Electrically Operated Circuit Breakers
 (Refer to Figure 12)

1. Remove the circuit breaker front cover, taking care to retrieve push buttons for local electric close and trip if so equipped.
2. Manually charge the closing springs.
3. Locate the slow close block and its lever pin. Push downward on that lever while simultaneously lifting the manual close lever. The circuit breaker will attempt to close making a loud "thunk" sound.
4. Insert the maintenance handle in the ratchet carrier and pump the handle slowly. The contacts will slowly move toward the closed position with each pump of the handle. (See Fig. 7 and Manual Operation of Electrically Operated Models for instructions on use of maintenance handle). Any inspections and adjustments should be done with the contacts in this position.

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

5. With the maintenance handle still in place, continue the spring charging operation until the indicator shows SPRINGS CHARGED. The contacts will have closed early in the pumping action; the pumping action will become very light after that point. Just before the springs are fully charged, the effort will become moderate to heavy for two to three strokes, until the springs are fully charged. The slow close block will automatically release at this point.
6. Push the manual trip button to open the contacts.

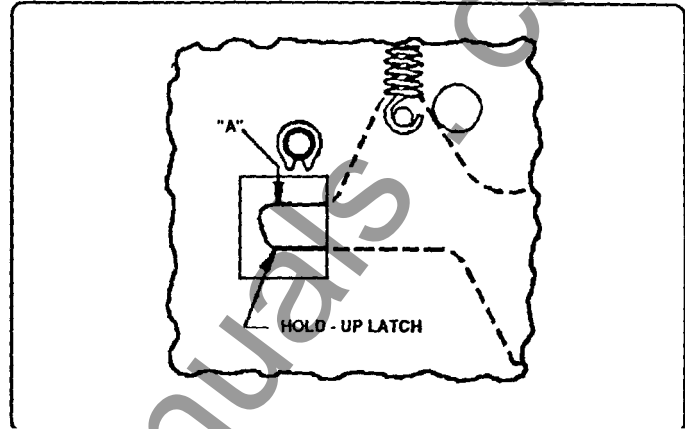


Figure 11- PARTIAL VIEW OF ESCUTCHEON ASSEMBLY (RIGHT-HAND SIDE) SHOWING SLOW CLOSE LEVER FOR MANUALLY OPERATED CIRCUIT BREAKERS

7. Repeat steps 2, 3 and 4 above to repeat the slow close operation.

To reset the charging cranks for normal electrical operation:

8. Repeat steps 5 and 6 above.
9. Lift the manual close lever to close the contacts (and discharge the closing springs).
10. Push the manual TRIP push button to open the contacts.

The circuit breaker is now open with its closing springs discharged. Rack the circuit breaker racking cranks to the full OUT position. The circuit breaker is now ready for normal service operation.

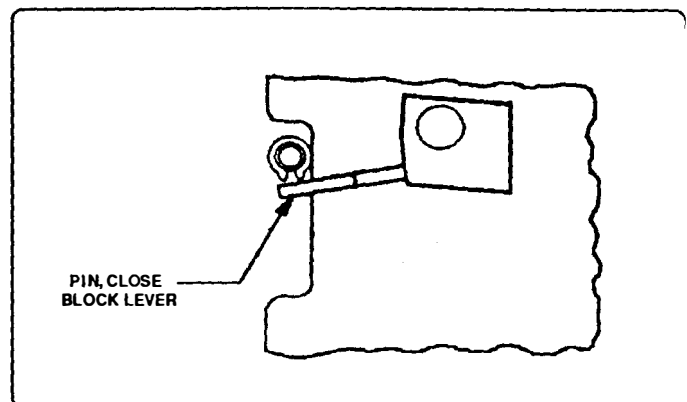


Figure 12 - PARTIAL VIEW OF ESCUTCHEON ASSEMBLY (RIGHT-HAND SIDE) SHOWING SLOW CLOSE LEVER FOR ELECTRICALLY OPERATED CIRCUIT BREAKERS

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Contact Gap Adjustments

1. Remove the arc chutes to observe the motion of the main and arcing contacts.

2. Prior to measuring the contact gap, remove the contact insulator. On MB 800, MBE 800 and MB 1600, the insulator is attached to the arc horn with two Phillips type countersunk screws. On MBE 1600, MB 200 and MB 2500, the insulator is screwed to the base molding with screws into captive units.

3. During the slow close procedure, observe the simultaneous make of the contacts. The arcing contacts touch first, leaving a gap between the mains. As the slow close procedure continues, the arcing contacts will compress then allow the mains to touch. Further slow close action compresses the mains to the point that the arcing contacts open. When no further parting of the arcing contacts is evident, the breaker contacts can be considered fully closed. Arcing contact gap can now be measured.

4. The gap between the stationary and moving arcing contacts should be between 1.0 and 1.5 millimeters. (Refer to figure 13.) If no metric shim is available, a one-sixteenth shim can be used. It should not fit loosely in the gap; a one-sixteenth shim is larger than 1.5 millimeters.

5. If the contact gap is too narrow, first loosen the stationary arcing contact retainer bolts, with the contact checking tool in place. Shift the stationary contact rearward, if possible. With the gap checking tool still in place, retighten the stationary arcing contact hardware. If the gap remains too narrow, proceed to the adjustments described below.

6. Slow close the circuit breaker.

7. Bend back the adjustment locking plates adjacent to the adjusting nuts on both sides of push rod bracket.

NOTE: MB 800, MBE 800 and MB 1600 use one nut on each side of bracket. MBE 1600 through MB 2500 use two on each side of bracket.

8. Loosen the nut(s) on the contact side of the push rod bracket.

9. Use the nut(s) on the push rod side to regulate the position of the fixed arcing contact to obtain a gap of 1.0 to 1.5 millimeters (or approximately one sixteenth of an inch). Where two nuts are employed, adjust them so that each is loaded equally. (Note: In the evaluation, if it is noted that one or two of the faces of the arcing contact fingers are not flush with the others on that given pole, they may be gently bent to the proper position to yield proper alignment. It is more desirable to ease arc contacts into alignment by bending away from the stationary arcing contact.)

10. When the correct gap is achieved, remove tools then operate the circuit breaker for five regular close/open operations. Re-check the contact gap to verify that the gap has not changed due to mechanical settling. Repeat the adjustment if it has changed radically.

11. Lock the nut(s) by bending the locking plates down on one of the flats of each nut.

12. Remove all adjustment tools from the breaker prior to replacing the arc chutes and returning to service.

CAUTION CAUTION CAUTION

Contact spring loading - adjustments are factory sealed and should not be readjusted. The tightness of the locking nuts (See Figure 13) can be rechecked during maintenance intervals but **ADJUSTMENTS WHICH REQUIRE AN ALLEN WRENCH SHOULD NOT BE DISTURBED.**

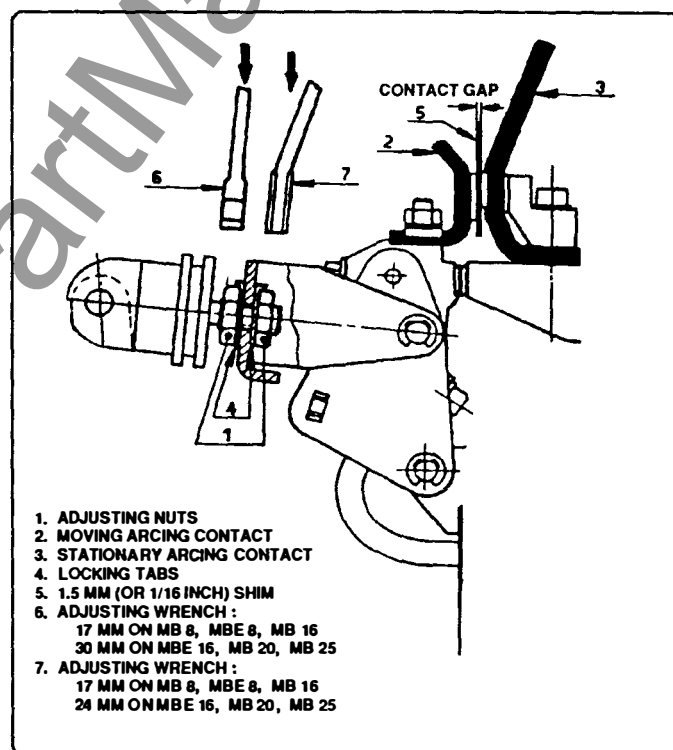


Figure 13 - MB CONTACT GAP ADJUSTMENT

PROCEDURE FOR FIELD TESTS ON MB CIRCUIT BREAKERS

MPS Solid State Trip System testing

There are two ways to evaluate the MICRO Power-Shield solid state trip system. A secondary current injection test set, the type 606 MPS tester, has been designed specifically for use with the MPS box. This tester simulates the current from the current

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sensor and allows evaluation of the MPS solid state box and magnetic latch. Used in conjunction with the TEST FUNCTION selector switch on the MPS box, the type 606 tester can be used to evaluate long time, short time, instantaneous, and ground with or without the maglatch. The full range of circuit breaker frame sizes can be evaluated with the 606 tester. To obtain a tester, call the nearest ASEA Brown Boveri sales office and ask for part 714516-T01. Refer to bulletin 6.1.1.7-4, which was written for the 606 test set.

The other method of evaluating the MPS solid state trip system is by primary current injection using a primary current injection test set. This method allows evaluation of the sensors, MPS solid state box, magnetic latch and the interconnecting harness. Below is a procedure for performing this field testing.

Primary Current Testing - MICRO Power-Shield Type MPS

Notes:

- a. Refer to time current curves TD-9601, TD-9602, TD-9603, TD-9604.
- b. When checking calibration, set functions not being tested at their highest threshold value.
- c. On MPS trip units equipped with ground, the ground trip must be defeated by using a special cable assembly, part number 713918-T09. This assembly is installed between the solid state box and the breaker wiring harness. Failure to use this harness will prevent primary current testing of the long-time delay function.
- d. The TEST FUNCTION selector switch on front of the MPS solid state box operates only with the optional Type 606 secondary current injection test set. The position of this switch has no influence during primary current injection tests.
- e. The closing springs must be charged and the circuit breaker closed before each test below.

Instantaneous Threshold Test

- a. Position other trip element selectors at their highest threshold value.
- b. Position trip system Range Selector in the desired position, either full or one-half breaker sensor rating.
- c. Put instantaneous selector switch in the four times (4X) setting.
- d. Test for the actual threshold by increasing test set current until the breaker trips.
- e. The threshold tolerance is +/- 10% on all selector switch settings.

- f. Instantaneous times cannot be accurately measured with primary current test sets. Such times can only be measured with oscillographic equipment. Percent error in the timer and meter of primary current test sets can make it appear that the instantaneous does not fall inside its band.

Long Time-Delay Test

- a. Position other trip element selectors at their highest threshold value.
- b. Position Range Selector in desired position.
- c. Put long time selector in the one times (1X) setting.
- d. Set test set current so that current through the breaker is three (3X) trip system Range Selector setting. Times should be as follows:

MPS 3,	MIN.	8 - 13 SEC.
MPS 4,	INT.	20 - 33 SEC.
& MPS 5	MAX.	61 - 100 SEC.

Short-Time Delay Test

- a. Position other trip element selectors at their highest threshold value.
- b. Position trip system Range Selector in the desired position. To prevent stress on solid state components, however, the "lower" position is recommended.
- c. Put I²t switch in the OUT position.
- d. Put short time selector in the two times (2X) setting.
- e. Set test set current so that current through breaker is four times (4X) trip system Range Selector setting. Times should be as follows:

MPS 4 & MPS 5 Without I ² t	MIN .	0.080 - 0.170 SEC.
	INT.	0.200 - 0.320 SEC.
	MAX.	0.350 - 0.500 SEC.

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- f. Put I²t switch in the IN position.
- g. Set test set current so that current through breaker is 1.5 times the two times (2X) trip system Range Selector setting. Times should be as follows:

MPS 4 &	MIN.	0.160 - 0.250 SEC.
MPS 5	INT.	0.520 - 0.780 SEC.
With I ² t	MAX.	0.910 - 1.350 SEC.

Ground Trip Delay Tests

- a. Position other trip element selectors at their highest threshold value.
- b. Remove the ground defeat cable assembly. Connect the breaker harness directly to the MPS box.
- c. The Range Selector has no influence on ground settings.
- d. Put the ground trip selector in the minimum available ground setting (100A on 200 and 800 sensors, 300A on 1600 through 2500 sensors, and 500A on 3000 through 4200A sensors). Device nameplate has actual current values on ground trip available.
- e. Set test set current so that current through breaker is three times (3X) the minimum setting selected in (d) above. Times should be as follows:

- f. On breakers with 4-wire ground and 4-wire ground on double-ended substations, the remote neutral sensor can be simulated with the breaker-mounted left pole sensor. On the back of the breaker temporarily reverse wires marked **W** and **N**. These wires appear on secondary disconnect points 10 and 11. Connect the circuit breaker so that current flows through the left pole only, and check the ground system as in (e) above. Following the test, return wires **W** & **N** to their proper location.

Note that wire **N** is on terminal 11 of secondary disconnect and **W** is on terminal 10 for 4W ground boxes. On double-ended sub, 4 wire ground **W** is on 11 and **N** is on 10.

- g. As an alternative to (f) above, a separate neutral sensor can be used to operate the MPS trip system. Optional test cable assembly 713918-T10 provides leads-out which may be connected to a neutral sensor. The type used is at the discretion of the tester. It is recommended that it be of type planned for the final installation. Connect the primary current injection machine to pass current through the neutral sensor.

DIELECTRIC WITHSTAND TESTS ON POWER AND CONTROL CIRCUITS

1. Dielectric withstand tests on circuit breakers shall be made to determine the ability of the insulation to withstand overvoltages.
2. A 60-cps alternating sinusoidal voltage (rms) value is 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.
3. Duration Of Test - The dielectric test voltage shall be applied for a period of 60 seconds. The duration of the test may be one second if a voltage 30% greater than that specified is applied.

	DELAY SETTING	SENSORS		
		200 - 800A	1600 - 2500	3000 - 4200
ALL	MIN.	0.68 - 1.3 SEC.	0.07 - 0.18 SEC.	0.05 - 0.17 SEC.
MPS	INT.	2.1 - 4.2 SEC.	0.24 - 0.47 SEC.	0.20 - 0.32 SEC.
TYPES	MAX.	5.2 - 9.5 SEC.	0.59 - 1.2 SEC.	0.35 - 0.50 SEC.

NOTE THAT I²t FUNCTION IS A PERMANENT FEATURE OF MPS GROUND TRIP CHARACTERISTIC CURVES.

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4. Condition Of Circuit Breaker To Be Tested - Dielectric tests shall be made on a new, completely assembled circuit breaker and not on individual parts. When a circuit breaker is tested in the field or after storage, the test voltage shall be 75 percent of the value listed in C37.50-3.5.2. (Values shown below.)

5. Temperature At Which Tests Are To Be Made - Dielectric tests shall be made at any temperatures between 10 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 2,200 volts (1,000 volts plus twice 600 volts on new breakers, .75 x 2200 = 1650V on breakers that have been in service):
 - a. Between live parts, including both line and load terminals, and metal parts that are normally grounded.
 - b. Between line terminals and load terminals.
2. With circuit breaker in the closed position, apply 2,200 volts (1,000 volts plus twice 600 volts on new breakers, .75 x 2200 = 1650V on breakers that have been in service):
 - a. Between live parts and metal parts that are normally grounded.
 - b. Between terminals of different phases.
3. With circuit breaker in either open or closed positions, apply 1,500 volts (1125V on breakers taken out of service):

Note : Pull plug on solid state trip unit, as a precaution.

- a. Between control circuit and metal parts that are normally grounded. If the circuit breaker control circuit includes a motor, the motor **MUST** be disconnected during the dielectric test on the control circuit.

4. Apply 1,000V to:

- a. Between leads of new motors.

5. SPECIAL NOTES:

- a. Apply 60% of the values given in (1) through (5) above on breakers that interrupted a short circuit.
- b. 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.
- c. Do not perform dielectric testing on the MPS solid state trip system. If such tests are performed, internal surge protection will falsely indicate dielectric failure on the MPS solid state box.

LUBRICATION

Only two lubricants are approved for use in the MB circuit breaker. Lubricated during final assembly, the MB 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 performed as follows:

1. Apply NO-OX-ID special Grade "A" grease from Dearborn Chemical Company to all mating surfaces of moving current carrying joints. **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 ASEA Brown Boveri in one pint cans, number 713222-A.
2. Apply Anderol 757 synthetic grease manufactured by Huls America, Inc. to mechanism parts, bearings and pins. **DO NOT APPLY GREASE TO LATCH OR ROLLER SURFACES.** Anderol 757 is available from Asea Brown Boveri in four-ounce tubes, part number 712994-A.
3. **DO NOT** apply light machine oil, or thin spray lubricants to lubricate any mechanism part.
4. **DO NOT** attempt to relubricate the spring charging motor gearbox. It is sealed and should not require repacking.
5. **DO NOT** lubricate magnetic latch device or otherwise clean or spray with any substance.
6. **DO NOT** use Dichlorodifluoromethane on any part of the mechanism.

RENEWAL PARTS

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

Refer to renewal parts bulletin RP 6.1.3.8-1 for complete ordering information and parts list.

The minimum quantities of assemblies recommended in the Renewal Parts Bulletin are based on ABB's own tests and statistical information on customer operating experience. The replacement of total assemblies is recommended in the field so that the circuit breaker can be returned to service as quickly as possible. The faulty assemblies can then be returned to ABB for reconditioning when that is possible.

The ABB service organization and factory personnel can be reached by calling:

Service 215-699-8887
Factory 803-665-4144

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