



**Installation Instructions for Cutler-Hammer Series C 800 Amp MDL, HMDL, MDLB, and HMDLB, CMDL and CHMDL Circuit Breakers, Circuit Breaker Frames and Molded Case Switches**

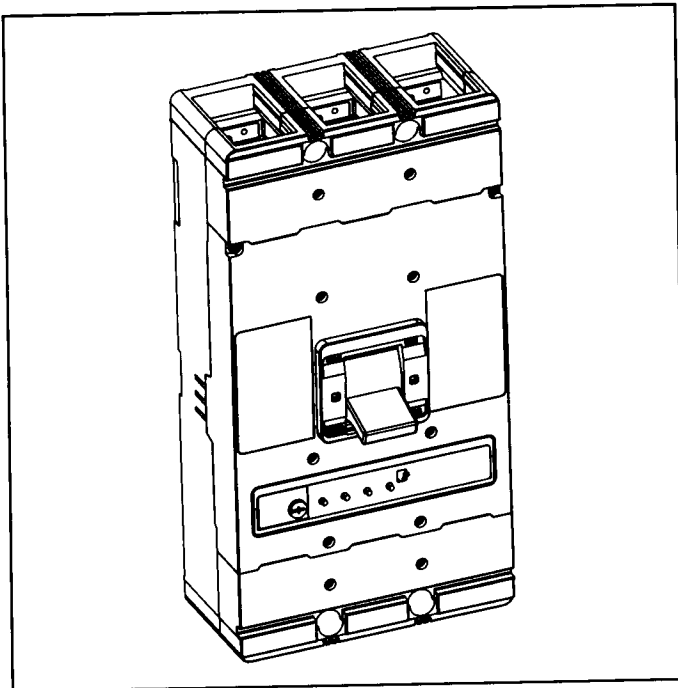


**WARNING**

**CONTACT WITH ENERGIZED EQUIPMENT CAN RESULT IN DEATH, SEVERE PERSONAL INJURY, OR SUBSTANTIAL PROPERTY DAMAGE. DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. ALWAYS VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING WITH THE TASK, AND ALWAYS FOLLOW GENERALLY ACCEPTED SAFETY PROCEDURES.**

**CUTLER-HAMMER IS NOT LIABLE FOR THE MISAPPLICATION OR MISINSTALLATION OF ITS PRODUCTS.**

The user is cautioned to observe all recommendations, warnings and cautions relating to the safety of personal and equipment, as well as all general and local health and safety laws, codes and procedures.



*Fig. 1-1 MDL-Frame Series C Circuit Breaker Frame with LES Trip Unit Installed*

The recommendations and information contained herein are based on Cutler-Hammer experience and judgment, but should not be considered to be all-inclusive or covering every application or circumstance which may arise. Contact Cutler-Hammer for further information or instructions.

**1. INTRODUCTION AND GENERAL INFORMATION**

The Series C circuit breaker (Fig. 1-1) types MDL and HMDL are 600 Vac maximum rated devices with interchangeable thermal-magnetic or electronic DIGITRIP RMS trip units rated up to 800 amps continuous current. Electronic trip units are for use on alternating current applications only. Refer to Table 1-1 for all available trip unit ratings. These circuit breakers are listed in accordance with Underwriters Laboratories, Inc. For more information, see Selection Data 29-120L.



**CAUTION**

**ELECTRONIC TRIP UNITS MAY BE APPLIED ON ALTERNATING CURRENT CIRCUITS ONLY; THEY DO NOT FUNCTION ON DIRECT CURRENT CIRCUITS.**

Types MDLB and HMDLB circuit breakers are factory sealed breakers with non-interchangeable trip units. Factory sealed breakers may be installed with reverse feed.

**100 Percent Rated MDL-Frame Circuit Breakers**

CMDL, CHMDL, CMDLB and CHMDLB circuit breakers are suitable for continuous operation at 100 percent of the frame rating when connected with 90° C rated cable and AL9CU terminals in an enclosure which measures at least 42" high x 18" wide x 7.5" deep. The minimum required enclosure ventilation is 40 sq. in. top front and 40 sq. in. bottom front. The circuit breaker must be used with an electronic MES trip unit.

This instruction leaflet (IL) gives procedures for installation and field testing of L-frame Series C circuit breakers. For this publication, the term circuit breaker shall also include the molded case switch.

Internal accessories are available which are field-installable in non-factory sealed breakers. They are factory-

installed in sealed breakers. The Instruction Leaflets for each accessory follow:

- Alarm (Signal) Lockout (ASL) Switch .....I.L. 29C183
- Auxiliary Switch .....I.L. 29C123
- Shunt Trip .....I.L. 29C146
- Low Energy Shunt Trip .....I.L. 29C147
- Undervoltage Release Mechanism .....I.L. 29C170

## 2. INSTALLATION

The installation procedure consists of inspecting the circuit breaker and, as applicable, installing the trip unit and rating plug, accessories, and terminals; mounting the circuit breaker; connecting the line and load conductors; torquing terminals; and attaching terminal shields. Circuit breaker frames, trip units, rating plugs, accessories, mounting hardware and unmounted terminals may be supplied in separate packages. To install the circuit breaker, perform the following steps.

**Note: MDLB and HMDLB circuit breakers are factory sealed for reverse feed applications under U.L. 489. U.L. requires that internal accessories be installed at the factory in these types of breakers.**

**Internal accessory installation in any type of circuit breaker should be done before the circuit breaker is mounted and connected. Refer to individual accessory instruction leaflets for specific installation instruction on field installable accessories.**

- 2-1. Compare nameplate data with existing equipment ratings and system requirements to make sure that the circuit breaker is suitable for the intended installation. Prior to mounting, confirm that the circuit breaker has not been damaged during transit or initial handling.
- 2-2. To install trip unit and any internal accessories, remove installed cover screws and cover.

**Note: The circuit breaker handle must be in the tripped or OFF position to remove the cover. Instructions for installing the trip unit and accessories are supplied with the devices.**

- 2-3. If not already installed, mount the trip unit and accessories (if required) in circuit breaker frame.

See Fig. 2-1. Rating plug must be installed in electronic trip units.

**Note: When required to be removed or replaced, stationary interphase barriers can only be installed or removed with the circuit breaker in the tripped or open position.**

- 2-4. After the trip unit and any internal accessories are installed, and with the circuit breaker in the tripped position, make sure that stationary interphase barriers are properly installed in the base. Install main cover and secure with supplied pan head screws. Eight screws are provided for the main cover. Torque to 20-22 lb.-in (2.26-2.49 N.m).
- 2-5. If not already installed, mount wire connecting terminals as shown in Fig. 2-2. Secure the terminals to the circuit breaker using the provided 1/2 in. bolts and lock washers. Torque to 30 to 35 lb.-ft. (40.68 to 47.46 N.m). With the circuit breaker mounted and before the conductors are installed and conductor clamping screws inserted, the terminal mounting screws may be checked for the correct torque.



## WARNING

**THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE DEATH OR SEVERE PERSONAL INJURY. BEFORE MOUNTING THE CIRCUIT BREAKER IN AN ELECTRICAL SYSTEM, MAKE SURE THERE IS NO VOLTAGE PRESENT WHERE WORK IS TO BE PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT.**

**Note: Depending on the equipment configuration, the circuit breaker can be mounted using different styles of hardware. The following steps describe how to mount the circuit breaker using standard hardware. When special hardware is needed (for example, with the motor operator), the instruction leaflet describing the accessory also describes the special mounting arrangements.**

- 2-6. To mount the circuit breaker, perform the following steps:

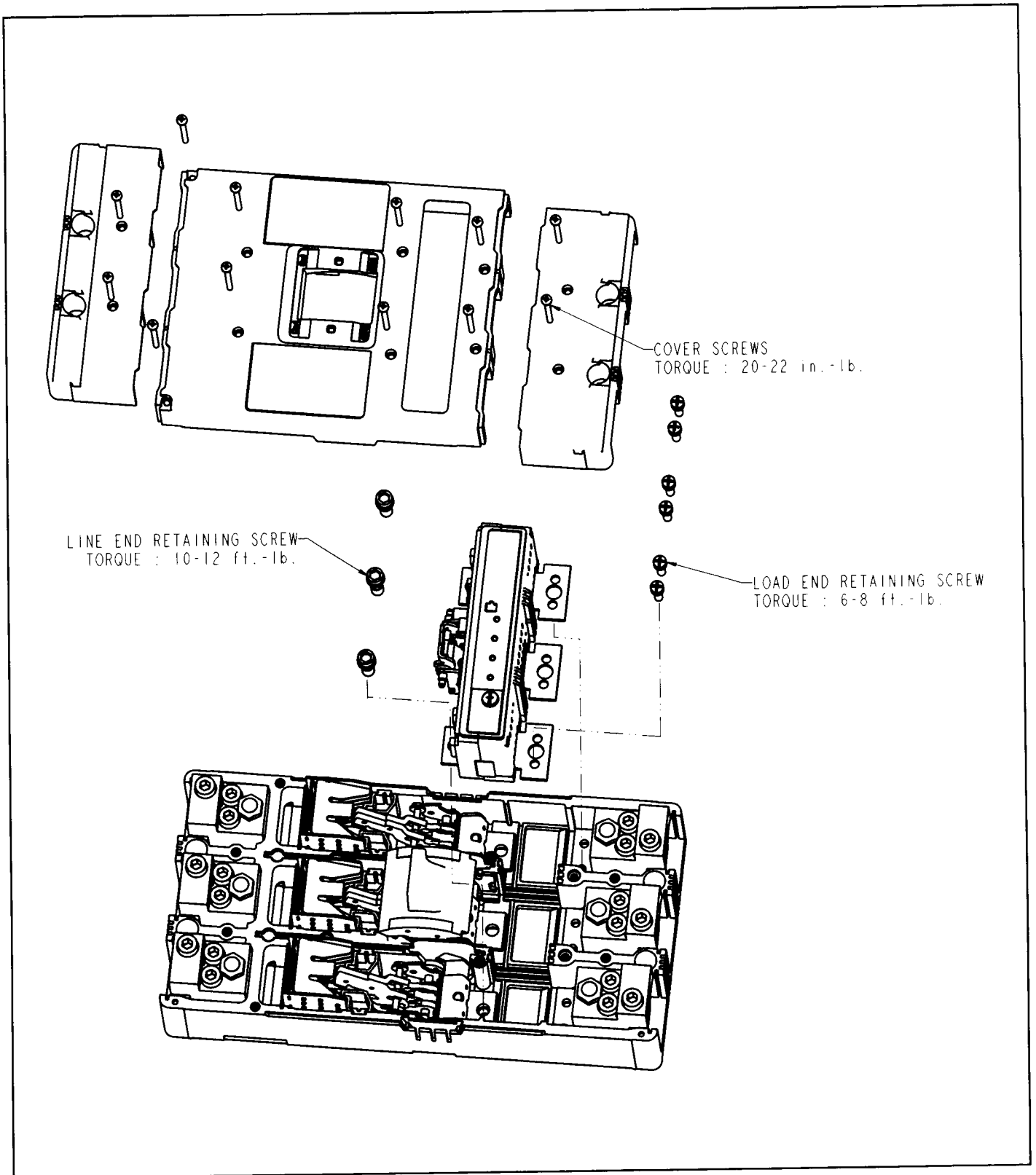


Fig. 2-1 Trip Unit and Covers Installation

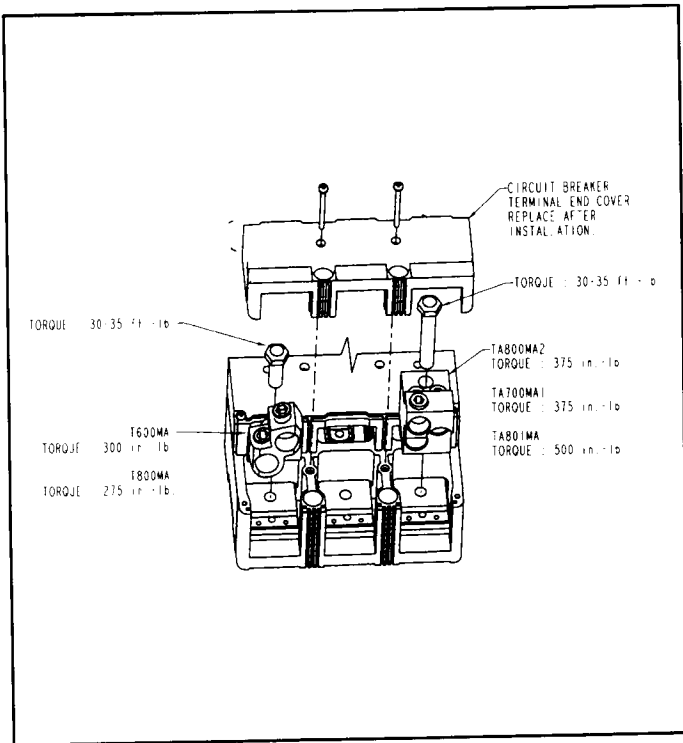


Fig. 2-2 Terminal Installation

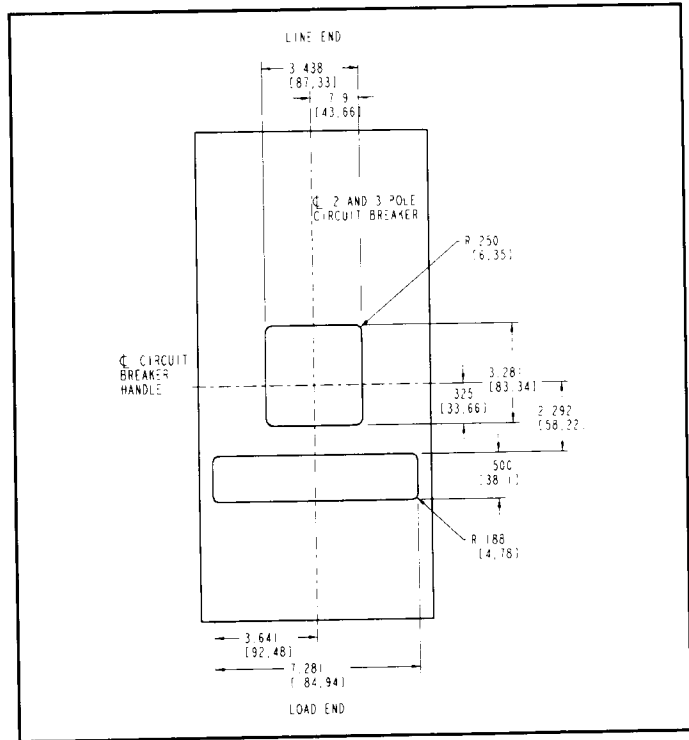


Fig. 2-4 2 & 3 Pole Cutout Dimensions

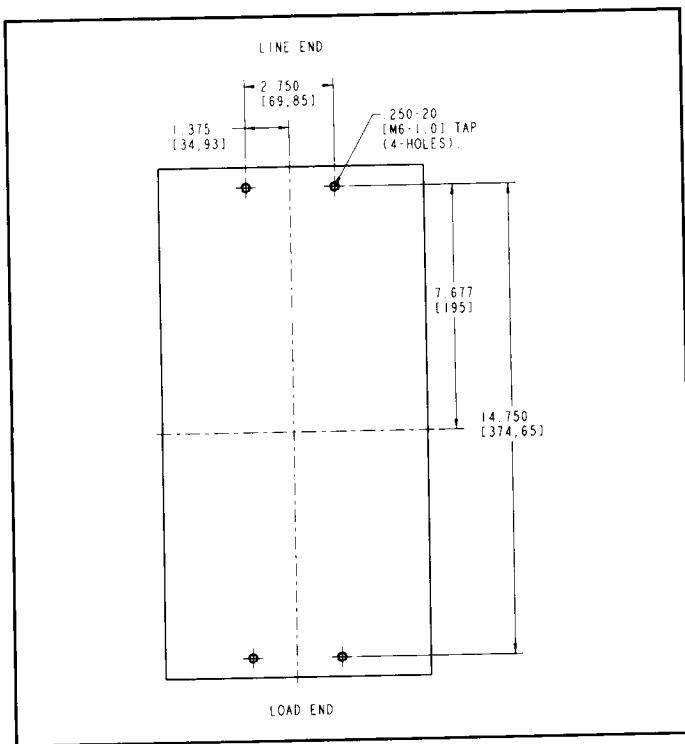


Fig. 2-3 2 & 3 Pole Mounting Bolt Drilling Plan

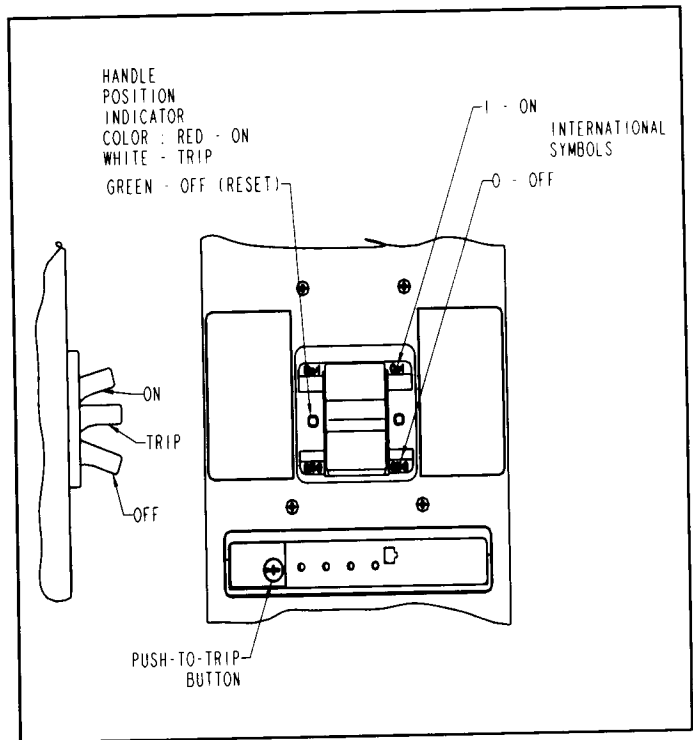


Fig. 4-1 Circuit Breaker Manual Controls

- a. For individual surface mounting, drill the mounting panel using the drilling plan shown in Fig. 2-3. For panelboard mounting, only load end support mounting holes are required. For Deadfront cover applications, cut out cover to correct escutcheon dimensions, see Fig. 2-4.
- b. If the circuit breaker includes factory or field installed internal accessories, make sure accessory wire is accessible when the circuit breaker is mounted.

**Note: Labels with accessory connection schematic diagrams are provided on the side of the circuit breaker.**

- c. Position the circuit breaker on the mounting surface.
- d. Install circuit breaker mounting screws and washers. Tighten screws firmly, but do not exceed 28 lb.-in. (3 N.m).



## CAUTION

**WHEN ALUMINUM CONDUCTORS ARE USED, THE APPLICATION OF A SUITABLE JOINT COMPOUND IS RECOMMENDED TO REDUCE THE POSSIBILITY OF TERMINAL OVERHEATING. OVERHEATING CAN CAUSE NUISANCE TRIPPING AND DAMAGE TO THE CIRCUIT BREAKER.**

- 2-7. Connect line and load conductors and accessory leads.
- 2-8. After the circuit breaker is installed, check all mounting hardware and terminal connecting hardware for correct torque loading. Torque values for line/load terminals are given in Table 2-1 and on the circuit breaker nameplate.
- 2-9. Install both the line and load terminal covers on the circuit breaker cover with mounting screws provided. Torque to 20-22 lb.-in. (2.26-2.49 N.m).



## WARNING

**HAZARDOUS VOLTAGE CONDITIONS CAN CAUSE DEATH OR SEVERE PERSONAL INJURY. MAINTAIN ORIGINAL ELECTRICAL CLEARANCE AND CREEP-AGE SPACINGS AT TERMINATIONS.**

### 3. REPLACEMENT OF EXISTING CUTLER-HAMMER / WESTINGHOUSE CIRCUIT BREAKER TYPES MA, HMA, MDS, MD, MC AND HMC

Although the physical size of the MDL frame Series C circuit breakers is the same as existing MA, MD, HMA, MC and HMC types, there are certain differences including those mentioned below that must be considered when making replacements.

- Panel Escutcheon Cutout Sizes  
Existing cutouts must be modified to agree with requirements shown in Fig. 2-4.
- Handle Throw Positions  
Existing handle mechanisms may be modified or replaced. Consult Cutler-Hammer for additional information.
- Internal Accessories  
Only MDL and LD frame Series C accessories may be used.
- External Accessories  
Motor operators must be replaced.  
Key interlock mounting brackets must be replaced.  
Consult Cutler-Hammer for replacement styles.



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**Note: When replacing an existing circuit breaker of the types listed above, make sure the voltage, continuous current and interrupting rating of the new circuit breaker are suitable.**

#### 4. MANUAL OPERATION AND THERMAL-MAGNETIC TRIP UNIT ADJUSTMENT

##### Manual Operation

The circuit breaker handle and the Push-To-Trip button in the trip unit control manual operation of the circuit breaker. The circuit breaker handle has three positions, two of which are shown on the cover with raised lettering to indicate ON and OFF. On the handle, ON, OFF and Trip are also shown by a color-coded strip for each circuit breaker handle position: red for ON, white for Tripped and green for OFF (see Fig. 4-1).

##### Circuit Breaker Reset

After a trip operation, moving the circuit breaker handle to the Reset (extreme OFF) position resets the circuit breaker.

**Note:** In the event of a thermal (overload) trip the circuit breaker cannot be reset immediately. In a breaker with a thermal-magnetic type trip unit the thermal element needs to cool (up to approximately five minutes) before it can be reset. A circuit breaker with a DIGITRIP RMS trip unit simulates the thermal element with an electronic "thermal memory" that also requires up to five minutes to "cool" before it can be reenergied.

No circuit breaker should be reclosed until the cause of trip is known and the situation rectified.

##### PUSH-TO-TRIP Button

The PUSH-TO-TRIP button operates the circuit breaker tripping function and may be periodically used to exercise the operating mechanism. In thermal magnetic trip units, the button is designed to be operated by a small screwdriver. The rating plug in DIGITRIP RMS trip units contains the PUSH-TO-TRIP button, which is operated by finger pressure. There is no PUSH-TO-TRIP button in the molded case switch.

##### Thermal-Magnetic Trip Unit Adjustment

The magnetic element of each pole of the trip unit is adjusted by rotating the adjustment buttons on the front of the trip unit with a screwdriver. The buttons have several settings as indicated on the nameplate with values in multiples of the trip unit ampere rating ( $I_n$ ). To adjust the setting, rotate each button clockwise until arrow on button points to desired setting. The molded case switch is set at the factory (at 8X) and is not field adjustable.

##### Interchangeable Trip Units

For additional information on thermal-magnetic trip units, refer to I.L. 29C607 (3-pole). For electronic DIGITRIP RMS trip units, refer to I.L. 29C615.

#### 5. INSPECTION AND FIELD TESTING

Series C molded case circuit breakers are designed to provide years of almost maintenance-free operation. The following procedure describes how to do a limited amount of field inspection and testing of a circuit breaker.

##### Inspection

Circuit breakers in service should be inspected periodically. The inspection should include the following checks: 5-1 through 5-8.



### WARNING

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**THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. BEFORE INSPECTING THE CIRCUIT BREAKER IN AN ELECTRICAL SYSTEM, MAKE SURE THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THAT THERE IS NO VOLTAGE PRESENT WHERE WORK IS TO BE PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT.**



### CAUTION

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**SOME COMMERCIAL CLEANING AGENTS WILL DAMAGE THE NAMEPLATES OR MOLDED PARTS. MAKE SURE THAT CLEANING AGENTS OR SOLVENTS USED TO CLEAN THE CIRCUIT BREAKER ARE SUITABLE FOR THE JOB.**

- 5-1. Remove dust, dirt, soot, grease or moisture from the surface of the circuit breaker using a lint-free dry cloth, brush or vacuum cleaner. Do not blow debris into circuit breaker. If contamination is found, look for the source and eliminate the problem.
- 5-2. Switch the circuit breaker to ON and OFF several times to be sure that the mechanical linkages operate freely and do not bind. If mechanical linkages do not operate freely, replace circuit breaker.

- 5-3. With the circuit breaker in the ON position, press the PUSH-TO-TRIP button to mechanically trip the circuit breaker. Trip, reset and switch the circuit breaker ON several times. If the mechanism does not reset each time the circuit breaker is tripped, replace the circuit breaker.
- 5-4. Check base, cover, operating handle and the handle barrier for cracks, chipping and discoloration. Circuit breakers should be replaced if cracks or severe discoloration is found.
- 5-5. Check wire connecting terminals and other type bus bar connectors for looseness or signs of overheating. Overheating will show as discoloration, melting or blistering of conductor insulation, or as pitting or melting of conductor surfaces due to arcing. If there is no evidence of overheating or looseness do not disturb or tighten the connections. If there is evidence of overheating, terminations should be cleaned or replaced. Before re-energizing the circuit breaker, all terminations and cable should be refurbished to the original installed condition.
- 5-6. Check circuit breaker mounting hardware and tighten if necessary.
- 5-7. Exposure to certain types of chemicals can lead to deterioration of electrical connections. Check area where circuit breaker is installed for any safety hazards, including personal safety and fire hazards and take required precautionary actions.
- 5-8. The operation of circuit breakers with DIGITRIP RMS trip units can be field tested periodically using the Electronic test kit. (See Selection Data 29-120L.)

**Field Testing**

Any field-testing should be done in accordance with applicable NEMA Standard.

**Table 1-1. Available Trip Unit Ratings**

Circuit Breaker Types	Trip Unit Types					
	Thermal-Magnetic In (Amperes)		Digitrip RMS (Electronic)			
	Fixed Thermal	Magnetic Adjustable	LES3800LS, LSI, LSG, LSIG			
		Trip Unit Rating	Fixed Rating Plug	Adjustable Rating Plug	Adjustable ShortTime	
MDL, HMDL	300	5 to 10 x I <sub>n</sub>	800		400/500/ 600/800	2 to 8 x I <sub>n</sub>
	350					
	400			400		
	450			450		
	500			500		
	600			600		
	700	4 to 8 x I <sub>n</sub>		700		
	800			800		

**Table 2-1. Terminal Types** <sup>(1)</sup> <sup>(2)</sup>

Terminal Catalog No.	Terminal Body Material	Screw Head Type	Wire Cable Range	Wire Type	Torque Value (lb.-in)
TA700MA1	Aluminum	Socket	2 #1 - 500 MCM	Al/Cu	375
TA800MA2	Aluminum	Socket	3 3/0 - 400 MCM	Al/Cu	375
TA801MA1	Aluminum	Socket	2 500 - 750 MCM	Al/Cu	500
T600MA1	Copper	Socket	2 2/0 - 500 MCM	Cu ONLY	300
T800MA1	Copper	Socket	3 3/0 - 300 MCM	Cu ONLY	275

- (1) The maximum width non-standard wire connector (tang-type) or bus bar connector that can be used without reducing electrical clearance and creepage distances between phases is 1.690 inches.
- (2) No hardware or connector should be installed in a manner to reduce the electrical clearance between the underneath side of the phase termination (line or load) and ground without the addition of supplementary insulation.

**Cutler-Hammer**

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