

# Installation Instructions for R-Frame Circuit Breakers and Molded Case Switches

Table of Contents	Page
1.0 Introduction .....	1
1.1 General Information .....	1
1.2 100 Percent Rated R-Frame Circuit Breaker .	4
1.3 2500 Amp R-Frame Circuit Breakers .....	4
2.0 Installation.....	4
3.0 Manual Operation .....	5
3.1 Circuit Breaker Reset .....	5
3.2 Push-To-Trip Button .....	5
3.3 Interchangeable Trip Units .....	5
4.0 Inspection and Field Testing .....	6
Inspection .....	6
Field Testing .....	6



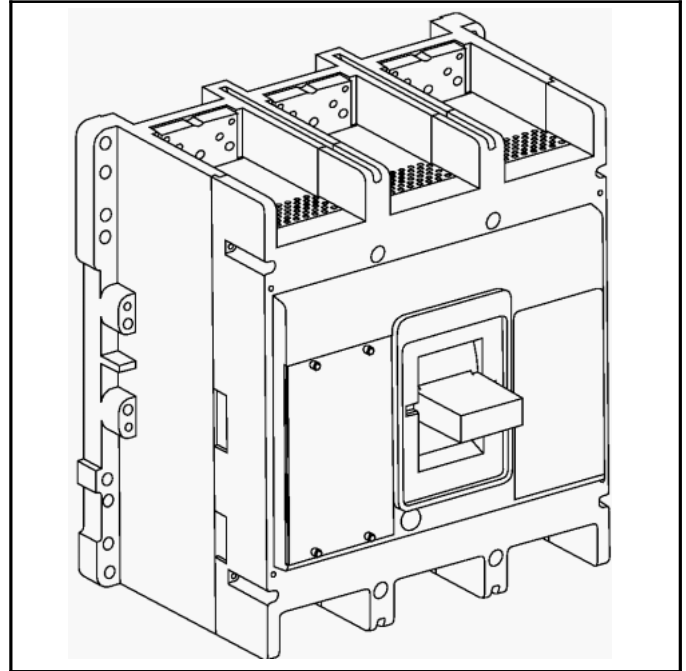
## WARNING

**WARNING DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. DEATH, SEVERE PERSONAL INJURY, OR SUBSTANTIAL PROPERTY DAMAGE CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. 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 personnel and equipment as well as all general and local health and safety laws, codes, and procedures.

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. If any questions arise, contact Cutler-Hammer for further information or instructions.



*Fig. 1-1 R-Frame Circuit Breaker  
Frame with Digitrip RMS Trip Unit Installed*

## 1. INTRODUCTION

### 1.1 General Information

The R-Frame circuit breakers (Fig. 1-1) have interchangeable electronic trip units rated 2500A maximum. Refer to Table 2-2 for all available trip unit rating plug ratings. R-Frame breakers and molded case switches are listed in accordance with Underwriters Laboratories, Inc. Standard UL489 and satisfy the requirements of the International Electrotechnical Commission Recommendations No. IEC 60947-2. For more information, see Selection Data 29-120R.

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

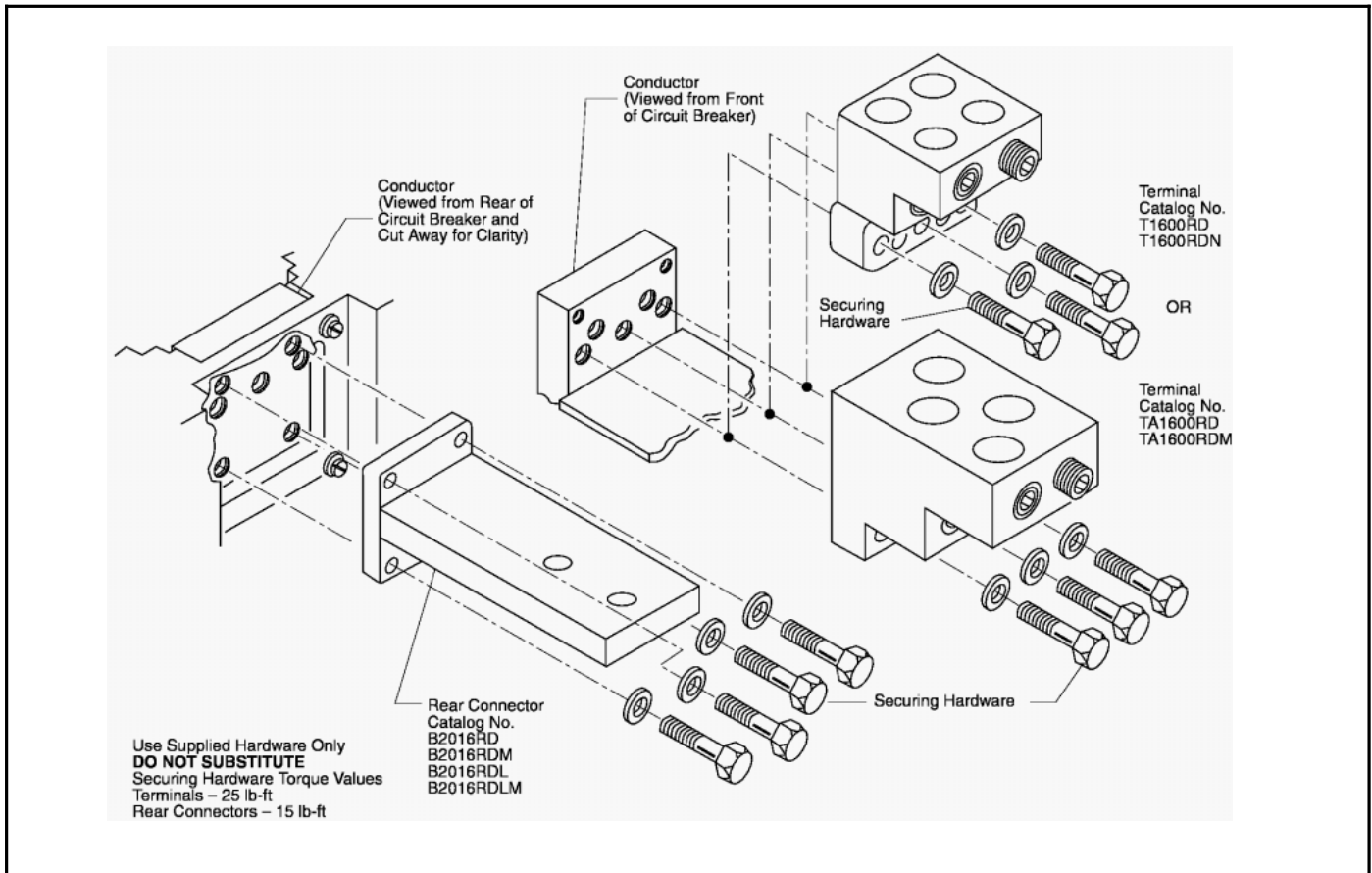


Fig.2-1 Terminal Installation

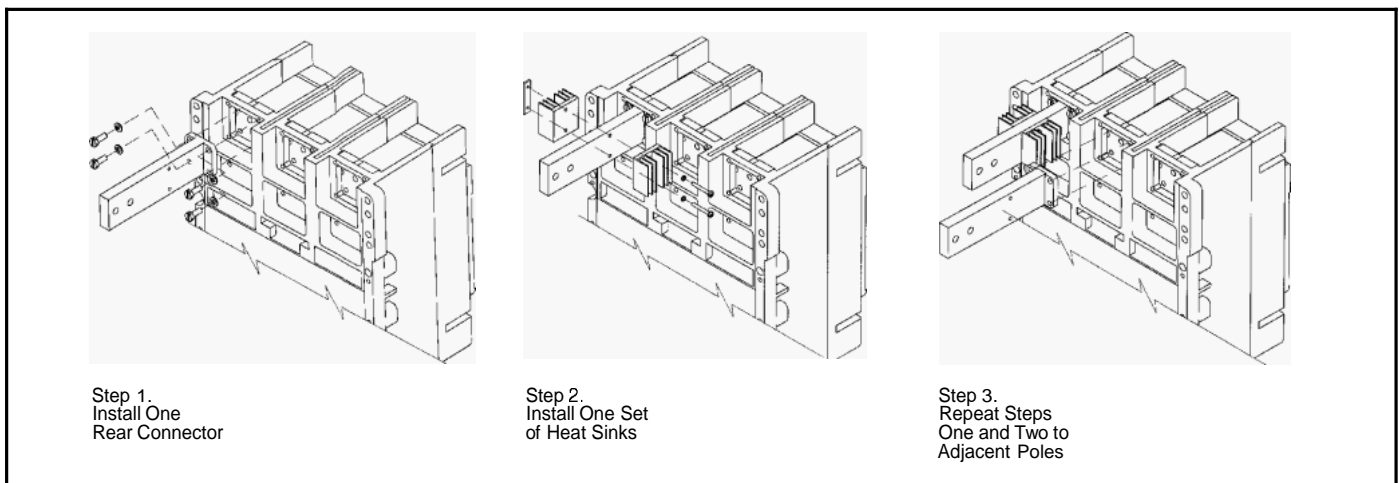


Fig.2-2 2500A Rear Connector Instructions

Table 2-1. Terminal Types

	Catalog Number	Maximum Breaker Amps	Terminal Body Material	Hardware	AWG/MCM Wire Range/No. Conductors	Metric Wire Range mm <sup>2</sup>	Wire Type	Torque Valves	
								Lb-in (N.m)	Mtg. Hardware
Wire Terminals	TA1600RD	1600	Aluminum	English	500-1000(4)	300-500	Cu/Al	550 (62)	300 (34)
	T1600RD	1600	Copper	English	1-600 (4)	50-300	Cu	375 (42)	300 (34)
	TA1600RDM	1600	Aluminum	Metric	500-1000(4)	300-500	Cu/Al	550 (62)	300 (34)
	T1600RDM	1600	Copper	Metric	1-600 (4)	50-300	Cu	375 (42)	300 (34)
Rear Connectors	B2016RD	2000	Copper	English					180 (20)
	B2016RDM	2000	Copper	Metric					180 (20)
Rear Connectors	B2016RDL①	2000	Copper	English					180 (20)
	B2016RDLM①	2000	Copper	Metric					180- (20)
Rear Connectors	B2500RD②	2500	Copper	English					180 (20)
	B2500RDM②	2500	Copper	Metric					180 (20)

Required and shipped with 100% rated frames ①

Required and shipped with 2500 Amp frames. ②

Table 2-2. Available Trip Unit Rating Plug Ratings and Trip Unit Settings

Digitrip RMS310 Trip Units							
Trip Unit Maximum Rating Amperes	Fixed Rating Plug Amperes	Adjustable Rating Plug Amperes①	Adjustable Pick-up Setting Range①	Adjustable Short Time Delay			
				Time Delay		Independently Adjustable Setting Time (Optional)	
				I <sup>2</sup> t Ramp (Standard)			
1600	800 1000 1200 1250 1400 1600	800/1000/1200/1600 800/1000/1250/1600	2 to 8	X		I (No Intentional Delay) 100/200/300 M.Sec.	
2000	1000 1200 1250 1400 1600 2000	1000/1200/1600/2000 1000/1250/1600/2000	2 to 8	X		I (No Intentional Delay) 100/200/300 M.Sec.	
2500	1200 1250 1600 2000 2500	1200/1600/2000/2500 1250/1600/2000/2500	2 to 6	X		I (No Intentional Delay) 100/200/300 M.Sec.	
Digitrip RMS 510, 610, 810, 10,750 and 1050 Trip Units②							
Maximum Rating Amperes	Rating Plug Amperes④	Adjustable Long Delay (Standard)		Adjustable Short Time Delay		Adjustable Instantaneous (Optional)	
		Pick-up(I <sub>r</sub> ) Setting Range③	Time Delay Setting Range (Sec.)	Pick-up Setting Range⑤	Time Delay Setting (Sec.)		Pick-up Setting Range⑤
					Using I <sup>2</sup> t Ramp	Using Flat Response	
1600	800 1000 1200 1250 1600	.5-1.0	2 to 24 @ 6 X I <sub>r</sub> Rating	2 to 8	0.1 to 0.5	0.1 to 0.5	2 to 10
2000	1000 1200 1250 1600 2000	.5-1.0	2 to 24 @ 6 X I <sub>r</sub> Rating	2 to 8	0.1 to 0.5	0.1 to 0.5	2 to 10
2500	1600 2000 2500	.5-1.0	2 to 24 @ 6 X I <sub>r</sub> Rating	2 to 8 2 to 8 2 to 7	0.1 to 0.5	0.1 to 0.5	2 to 9 2 to 10 2 to 8 2 to 7

① The current pick-up setting is a multiple of the fixed rating plug value or setting of the adjustable rating plug.

② Adjustable Rating Plugs are not available for Digitrip RMS510, 610, 810, 910, 750 and 1050 Trip Units.

③ The adjustable long time pick-up adjustment permits a pick-up range of 50 to 100% of the rating plug value. This defines the I<sub>r</sub> rating which is both the long delay and short delay protection. A 1600A circuit breaker can provide 400A circuit protection when equipped with a Digitrip RMS 510,610, 810,910,750 or 1050 Trip Unit with the adjustable long time pick-up adjustment set to .5 with an 800A rating plug. A 2000A circuit breaker can likewise provide 500A circuit protection.

④ Rating plugs for the Digitrip RMS 510, 610,810,910, 750 or 1050 Trip Unit are marked 50 Hz/60 Hz.

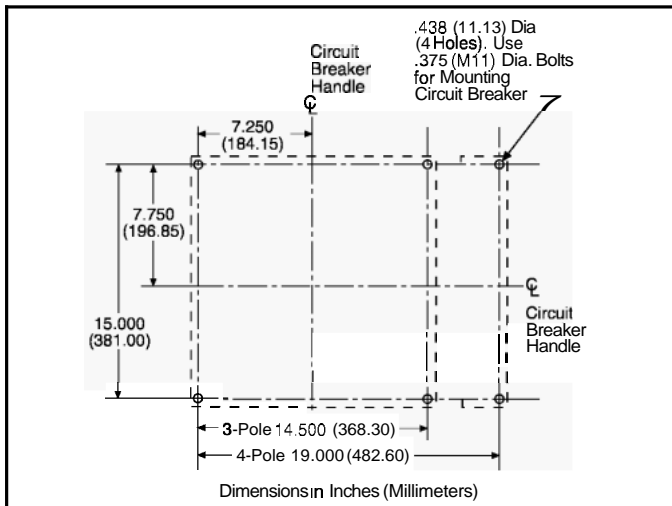
⑤ In multiples of the I<sub>r</sub> rating.

**1.2 100 Percent Rated R-Frame Circuit Breakers**

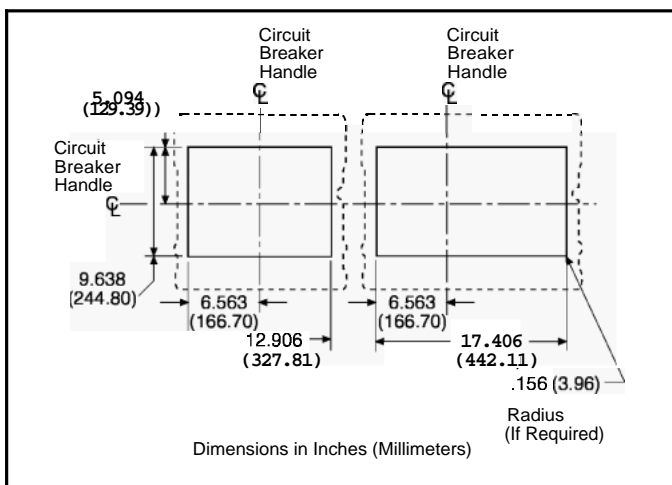
CRD and CRDC circuit breakers are suitable for continuous operation at 100 percent of the frame rating if used with the supplied rear connectors B2016RDL and in an enclosure which measures at least 21.5 in. high x 18 in. wide x 13 in. deep. Ventilation is not required in an enclosure having these minimum dimensions. If cable connections are made to these rear connectors, use only 90°C wire with ampacity based on 75°C conductors and copper only or AL9CU terminals.

**1.3 2500 Amp R-Frame Circuit Breakers**

When placed in an enclosure with minimum size of 26 in. x 18 in. x 10 in., the enclosure cover must be insulated with a barrier on the line end having minimum dimensions of 18 in. x 8 in. x 1/32 in.



**Fig. 2-3 Circuit Breaker Mounting Bolt Drilling Plans**



**Fig. 2-4 Circuit Breaker Escutcheon Dimensions for 3 and 4-Pole Circuit Breakers**

When installing the R-Frame 2500 amp breaker at 80% of the full rating and inside an enclosure, it is necessary to use coated or painted buswork.

**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; and torquing terminals. Circuit breakers, rating plugs, accessories, mounting hardware, and unmounted terminals may be supplied in separate packages. To install the circuit breaker, perform the following steps.

Note: If required, 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.

2-1. Make sure that the circuit breaker is suitable for the intended installation by comparing nameplate data with existing equipment ratings and system requirements. Inspect the circuit breaker for completeness, and check for damage before mounting.

2-2. Remove cover screws and cover.

Note: The breaker is equipped with a Cover Interlock feature, so that when the cover is removed, the breaker will trip and cannot be reset or operated until the cover is replaced and screwed down securely.

Note: Instructions for installing the trip unit rating plug and accessories in the R-Frame circuit breaker are supplied with each item.

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

2-4. Re-install cover and secure with pan-head screws provided. Torque cover screws to 24 in-lbs.

If not already installed, mount terminals as shown in Fig. 2-1 or 2-2. If warning label is supplied with the terminal, place on upper portion of circuit breaker cover.



**WARNING**

**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 ENSURE NO VOLTAGE IS PRESENT.**

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

- a. For individual surface mounting, drill mounting panel using the drilling plan shown in Fig. 2-3. For dead-front cover applications, cut out cover to correct escutcheon dimensions, see Fig. 2-4.
- b. If circuit breaker includes factory or field installed internal accessories, make sure accessory wiring is accessible when the circuit breaker is mounted.

Note: Labels with accessory connection schematic diagrams are provided on the side of the circuit breaker. A note should be made of the diagrams if the labels cannot be seen when the circuit breaker is mounted.

- c. Position circuit breaker on mounting surface.
- d. Install circuit breaker (mounting hardware not supplied).

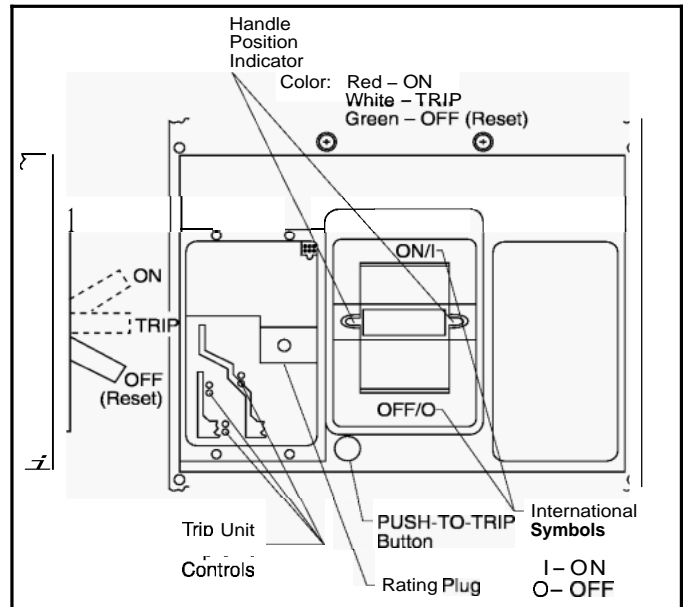


Fig. 3-1 Circuit Breaker Manual Controls

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. 3-1.)

**3.1 Circuit Breaker Reset**

After an automatic or accessory initiated trip, or a manual PUSH-TO-TRIP operation, the circuit breaker is reset by moving the circuit breaker handle to the extreme OFF position.

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

**3.2 PUSH-TO-TRIP Button**

The PUSH-TO-TRIP button checks the circuit breaker tripping function and may be used to periodically exercise the operating mechanism. The button is designed to be operated by finger pressure.

**3.3 Interchangeable Trip Units**

Information for the Digitrip RMS trip units is shown in Table 2-2.

For additional information on interchangeable trip units, refer to the following instruction leaflets:

Digitrip RMS 310 .....	I.L. 29C883
Digitrip RMS 510 .....	I.L. 29-885
Digitrip RMS 610 .....	I.L. 29-886
Digitrip RMS 810 .....	I.L. 29-888
Digitrip RMS 910 .....	I.L. 29-889
Digitrip OPTIM 750 or 1050 .....	I.L. 29C891



**CAUTION**

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

2-7. Connect line and load conductors and accessory leads.

Note: The circuit breaker is suitable for reverse feed application. Observe warning label on cover before attempting to remove cover.

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 nameplates.

**3. MANUAL OPERATION**

Note: The trip unit and rating plug must be installed before attempting to close the circuit breaker.

Manual operation of the circuit breaker is controlled by the circuit breaker handle and the PUSH-TO-TRIP button. 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

#### 4. INSPECTION AND FIELD TESTING

R-Frame molded case circuit breakers are designed to provide years of almost maintenance-free operation. The following procedure describes how to inspect and test a circuit breaker in service.

##### Inspection

Circuit breakers should be inspected periodically. This inspection can best be done during normal equipment maintenance periods when no voltage to the equipment is available. The inspection should include the following checks 4-1 through 4-9.



### WARNING

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**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 BEING PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT.**

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### 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.**

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- 4-1. 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.
- 4-2. Switch circuit breaker to ON and OFF several times to be sure that the mechanical linkages are free and do not bind. If mechanical linkages are not free, replace circuit breaker.
- 4-3. With the circuit breaker in the ON position, press the PUSH-TO-TRIP button to mechanically trip the circuit breaker. Trip, reset, and switch circuit breaker ON several times. If mechanism does not reset each time the circuit breaker is tripped, replace the circuit breaker.
- 4-4. Check base, cover, and operating handle for cracks, chipping, and discoloration. Circuit breakers should be replaced if cracks or severe discoloration is found.
- 4-5. Check terminals and 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 condition when originally installed.
- 4-6. Check circuit breaker mounting hardware, and tighten if necessary.
- 4-7. Check area where circuit breaker is installed for any safety hazards, including personal safety and fire hazards. Exposure to certain types of chemicals can cause deterioration of electrical connections.
- 4-8. The operation of circuit breakers with Digitrip RMS 310 trip units can be field tested using the Seltronic test kit, Catalog Number SKT2. (See Selection Data 29-120R.)
- 4-9. The operation of circuit breakers with Digitrip RMS 510, 610, 810, and 910 trip units can be field tested on a bench using the Auxiliary Power Module, Catalog Number PRTAAPM. The Digitrip OPTIM 750, and 1050 trip units also require a Digitrip OPTIMIZER for bench testing.

##### Field Testing

Any field testing should be done in accordance with NEMA Standards Publication AB4-1990.

NOTES

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Printed USA/TQC  
Publication No. 6645C84H13  
Effective June 2008