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

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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.

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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 Eaton 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 Eaton for further information or instructions.

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

Step 1. Install One Rear Connector
Step 2. Install One Set of Heat Sinks
Step 3. Repeat Steps One and Two to Adjacent Poles

Fig. 2-2  2500A Rear Connector Instructions
Table 2-2. Available Trip Unit Rating Plug Ratings and Trip Unit Settings

<table>
<thead>
<tr>
<th>Trip Unit Rating Plug Amperes</th>
<th>Adjustable Rating Plug Amperes</th>
<th>Short Time Delay</th>
<th>Adjusted Long Delay (Standard)</th>
<th>Adjustable Short Time Delay</th>
<th>Adjustable Instantaneous Time Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1600</td>
<td>800/1000/1200/1600</td>
<td>2 to 8</td>
<td>0.1 to 0.5</td>
<td>2 to 10</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>1000/1200/1600/2000</td>
<td>2 to 8</td>
<td>0.1 to 0.5</td>
<td>2 to 10</td>
<td></td>
</tr>
<tr>
<td>2500</td>
<td>1200/1600/2000/2500</td>
<td>2 to 6</td>
<td>0.1 to 0.5</td>
<td>2 to 9</td>
<td></td>
</tr>
</tbody>
</table>

The current pick-up setting is a multiple of the fixed rating plug value or setting of the adjustable rating plug. Adjusted Rating Plugs are not available for Digitrip RMS 510, 610, 810, 910, 750, and 1050 Trip Units. 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, 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 an adjustable long time pick-up adjustment set to 0.5 with an 800A rating plug. A 2000A circuit breaker can likewise provide 500A circuit protection.

Rating plugs for the Digitrip RMS 510, 610, 810, 910, 750, or 1050 Trip Unit are marked 50 Hz/60 Hz.
### Table 2-3. Series G RMS 310+ Trip Units - Available Ratings & Trip Unit Settings

<table>
<thead>
<tr>
<th>Trip Unit Maximum Rating Amperes</th>
<th>I&lt;sub&gt;r&lt;/sub&gt; Settings</th>
<th>Adjustable Long Delay (Standard)</th>
<th>Adjustable Short Time Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I&lt;sub&gt;r&lt;/sub&gt;</td>
<td>Time Delay Setting Range (Sec.)</td>
<td>Pick-Up Setting Range&lt;sup&gt;①&lt;/sup&gt;</td>
</tr>
<tr>
<td>1600</td>
<td>A-H</td>
<td>800A/900A/1000A/1100A/1200A/1400A/1500A/1600A = I&lt;sub&gt;n&lt;/sub&gt;</td>
<td>2 to 24 @ 6 X I&lt;sub&gt;r&lt;/sub&gt;, Rating</td>
</tr>
<tr>
<td>2000</td>
<td>A-H</td>
<td>1000A/1200A/1400A/1600A/1700A/1800A/1900A/2000A = I&lt;sub&gt;n&lt;/sub&gt;</td>
<td>2 to 24 @ 6 X I&lt;sub&gt;r&lt;/sub&gt;, Rating</td>
</tr>
<tr>
<td>2500</td>
<td>A-H</td>
<td>1600A/1700A/1800A/2000A/2100A/2200A/2400A/2500A = I&lt;sub&gt;n&lt;/sub&gt;</td>
<td>2 to 24 @ 6 X I&lt;sub&gt;r&lt;/sub&gt;, Rating</td>
</tr>
</tbody>
</table>

<sup>①</sup>The current pick-up setting is a multiple of the I<sub>r</sub> setting.
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 B2016EDL 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 Based on 75°C conductors and copper only or 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.

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.

2-5. 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).

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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.

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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

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:

- Series G RMS 310+ ........................................... IL0121003E
- 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
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

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.

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.

4-10. The operation of circuit breakers with Series G RMS 310+ trip units can be field tested using the G Series test kit general assembly number: 70C1056G54.

Field Testing

Any field testing should be done in accordance with NEMA Standards Publication AB4-1990.
NOTES:
The instructions for installation, testing, maintenance, or repair herein are provided for the use of the product in general commercial applications and may not be appropriate for use in nuclear applications. Additional instructions may be available upon specific request to replace, amend, or supplement these instructions to qualify them for use with the product in safety-related applications in a nuclear facility.

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