

## Instructions for Installation of 120 and 240 Vac Electrical (Solenoid) Operator on J-Frame and K-Frame Series C Circuit Breakers and Molded Case Switches



### 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 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.

### 1-0 INTRODUCTION

#### General Information

The electrical operator (Figure 1-1) is a dual-solenoid mechanism for local and remote circuit breaker ON and OFF (reset) switching. The electrical operator is mounted on the cover of the circuit breaker and provides high speed switching with operating times of less than 5 cycles (80 ms), making it suitable for small generator synchronizing operations. The electrical operator has a terminal block for control connections. Catalog numbers and electrical rating data are shown in Table 1.1. The electrical operator is Underwriters Laboratories, Inc. listed as a circuit breaker accessory suitable for field installation under UL File E64983.

The electrical operator is suitable for application with 3 and 4-pole Series C circuit breaker types J-Frame and K-Frame.

① UL listing pending.

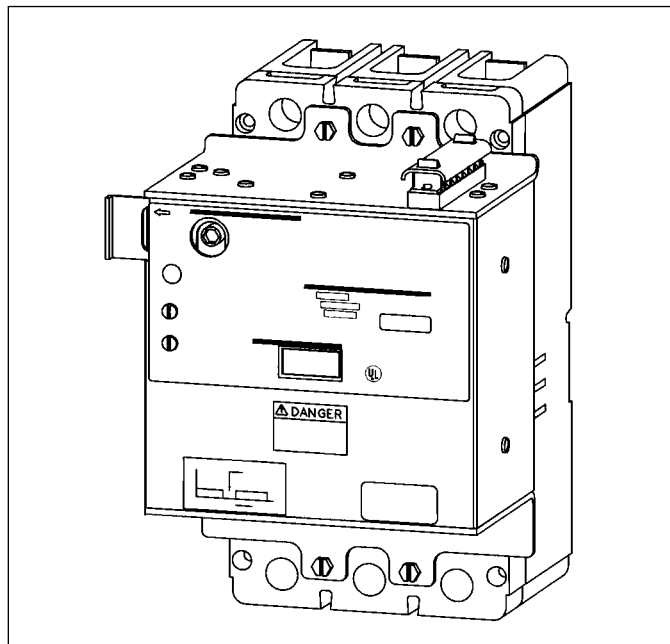


Figure 1-1 Electrical (Solenoid) Operator Installed on K-Frame Circuit Breaker

Table 1.1 Electrical (Solenoid) Operator Catalog Numbers Electrical Rating Data①②③④⑤⑥ (See Figure 1-4 for Additional Data)

Catalog Numbers	AC Voltage (V) <i>f</i>	Inrush Current (A)	Fuse (A)
J-Frame			
EOP2T07	120	30	6
EOP2T11	240	16	4
K-Frame			
EOP3MT07	120	30	6
EOP3MT11	240	16	4

- ① The electrical operator designed has been endurance tested for 5,000 electrical operations.
- ② Maximum operating rate: one operation per minute.
- ③ Frequency: 50/60 Hz.
- ④ Maximum operating time: 5 cycles (80 ms) at nominal voltage.
- ⑤ Tolerance:  $\pm 10\%$  of nominal voltage at operator terminal block.
- ⑥ Power supply to be one KVA minimum.

### Mechanical Operation

The electrical operator, using solenoids, has a bistable latching mechanism to switch the circuit breaker CLOSE and OPEN. A manual operation shaft designed for use with a hexagonal wrench or socket permits the electrical operator and circuit breaker to be switched locally without electric power. The bistable latching mechanism consists of dual intermittently rated solenoids, magnets, armature drive plates, and the bistable latch. The drive plates slide on bearing surfaces and move the circuit breaker handle from one position to another. Each solenoid consists of an armature, a coil, and a magnet. Both solenoids operate at the same time and move the drive plates when the coil is energized. The bistable latch determines in which direction the solenoid components and drive plates move.

A molded trigger fits over the circuit breaker handle to transfer the drive plate force to the circuit breaker handle.

When the circuit breaker handle is in the OPEN position (Figure 1-2), the bistable latch blocks the magnets and allows the armatures to move when the coils are energized. When the coils are energized, the armatures are drawn to the magnets and pull the armature drive plate, moving the circuit breaker handle to the CLOSE position. As the circuit breaker handle moves, it toggles a cutoff switch (handle position/cutoff) to disconnect power to the solenoids. The circuit breaker handle movement also toggles the bistable latch so that the latch blocks the armatures the next time the solenoids are energized.

When the circuit breaker handle is in the CLOSE or trip position (Figure 1-3), the bistable latch blocks the armatures. When the solenoids are energized, the magnets are drawn to the armatures and pull the magnet drive plate, moving the circuit breaker handle to the OPEN (reset) position. As the circuit breaker handle moves, the cutoff switch disconnects power to the solenoids, and the bistable latch toggles so that the latch blocks the magnets the next time the solenoids are energized.

The manual operation shaft, which is located in the top lefthand corner of the electrical operator and below the level of the cover, will accept a 5/16-inch (8 mm) hexagonal wrench or a 1/2-inch (13 mm) socket. The shaft is connected by linkages to the molded trigger which operates the circuit breaker handle. A sliding door with a padlock bracket can be moved over the manual operation shaft to prevent electrical and manual operation of the electrical operator. The padlock bracket will accept one padlock shackle up to 1/4 inch (6 mm) in diameter.

The circuit breaker status is shown through a centrally located window in the electrical operator cover: CLOSE (1 ) Red, Trip (+), or OPEN (O) Green.

### Electrical Operation

The electrical operator includes the dual-solenoid, a full-wave bridge rectifier, and interlock and control switches. An externally mounted terminal block is provided for control connections. The following paragraphs describe the electrical sequence of operation. Figure 1-4 shows the connection and schematic diagram for the electrical operator.

Customer installed connections provide power to the rectifier. The solenoids are connected to the rectifier output. The interlock and control switches include a SPDT handle position/cutoff switch (S1) and normally closed cover interlock/REMOTE OPERATION switch (S2).

The handle position/cutoff switch (S1) disconnects power to the solenoids each time the circuit breaker handle is moved to the opposite position.

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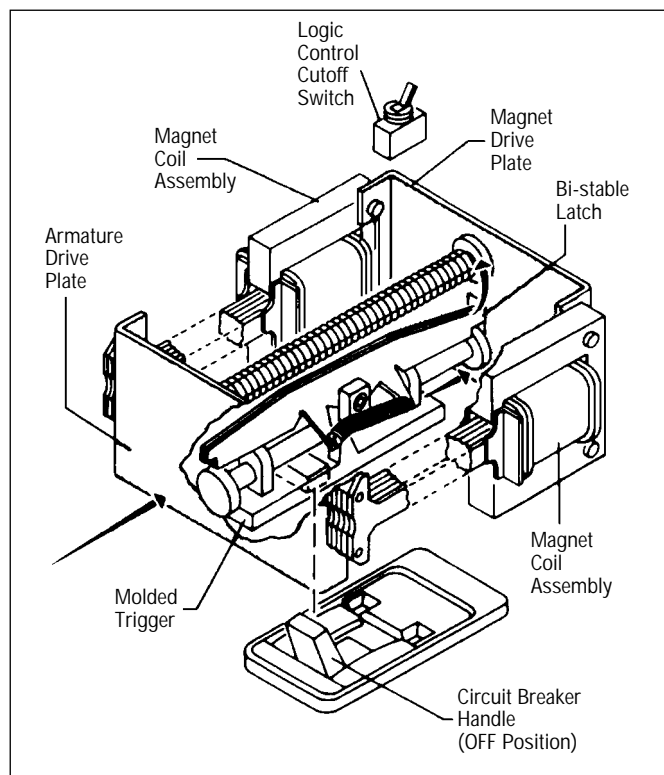


Figure 1-2 Circuit Breaker Handle in OPEN Position

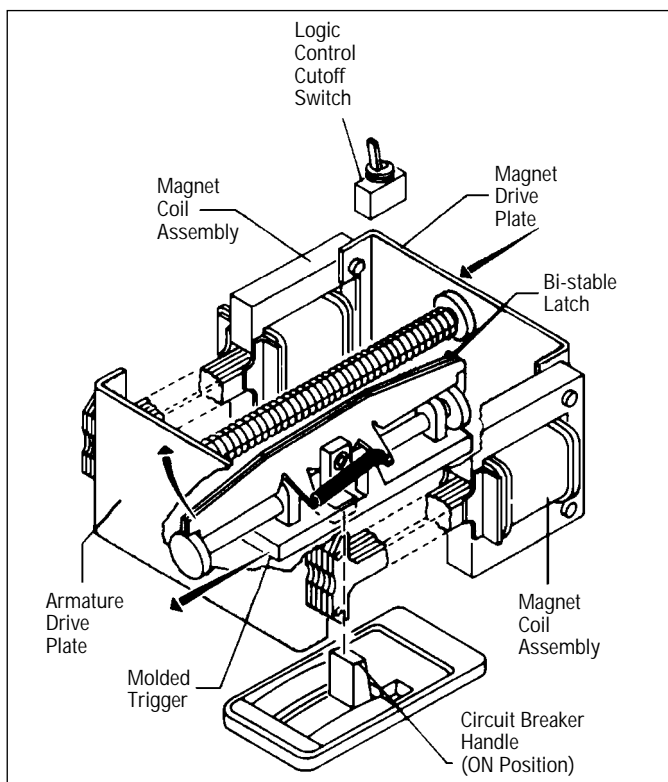


Figure 1-3 Circuit Breaker Handle in CLOSED Position

The cover interlock/REMOTE OPERATION switch (S2) disconnects power to the solenoids when the cover is removed or when the REMOTE OPERATION slide switch, actuated by the padlock bracket on the cover, is in the OPEN position. The switch is held closed when the cover is in place and the padlock bracket is in the non-padlockable position.

## 2-0 INSTALLATION

The electrical operator is normally supplied as a separate item for mounting on an uninstalled circuit breaker. If an electrical operator is to be mounted on an installed circuit breaker, all power must be removed from the circuit breaker before proceeding to mount the electrical operator.

The installation procedure consists of inspecting and mounting the electrical operator and connecting control wiring. To install the electrical operator, perform the following steps:

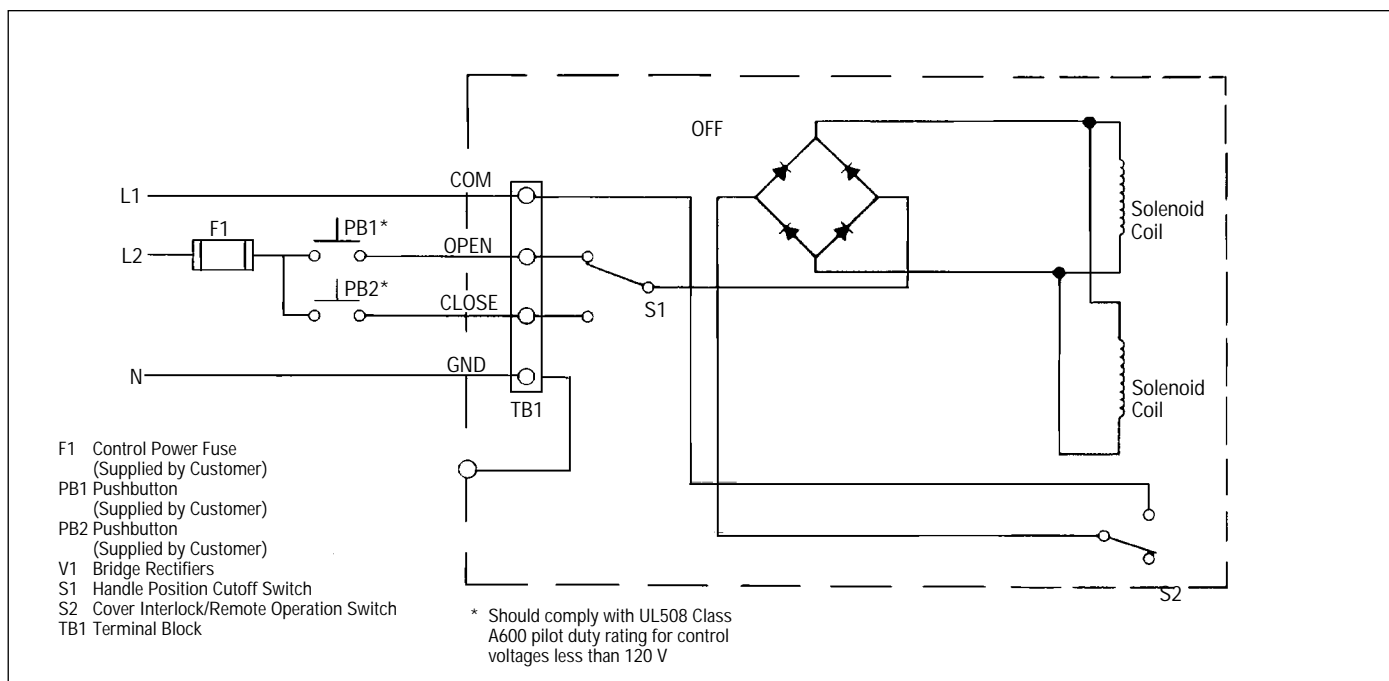


Figure 1-4 Electrical Operator Connection and Schematic Diagram



## WARNING

**BEFORE MOUNTING AN ELECTRICAL OPERATOR ON A CIRCUIT BREAKER INSTALLED 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. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.**

- 2-1. Remove electrical operator from packing. Inspect it for completeness and damage. Check the electrical operator nameplate to make sure that the rating agrees with the installation requirements; and make sure that mounting hardware is included.

## NOTICE

Where the circuit breaker is installed, existing hardware must be replaced.

If a 4-pole circuit breaker has been installed using the four outer mounting positions, new holes must be drilled and tapped in the panel center top and bottom mounting positions. Refer to I.L. 29C103 (J-Frame) or I.L. 29C104 (K-Frame) for drilling plans.

- 2-2. If the circuit breaker is mounted, remove all existing mounting screws one at a time and replace with special stacking screws supplied with the electrical operator (Figure 2-2). Tighten screws firmly, but do not exceed 28 pound-inches (3 N.m)
- 2-3. Install a new circuit breaker using special stacking screws provided with the electrical operator (Figure 2-1). Tighten screws firmly, but do not exceed 28 pound-inches (3 N.m)

## NOTICE

When the electrical operator is mounted on the circuit breaker, the circuit breaker nameplate is not visible. Before mounting the electrical operator, make sure the circuit breaker nameplate information is recorded for future reference. A blank nameplate is supplied for this purpose. The nameplate should be placed on the side of the electrical operator, or a per-

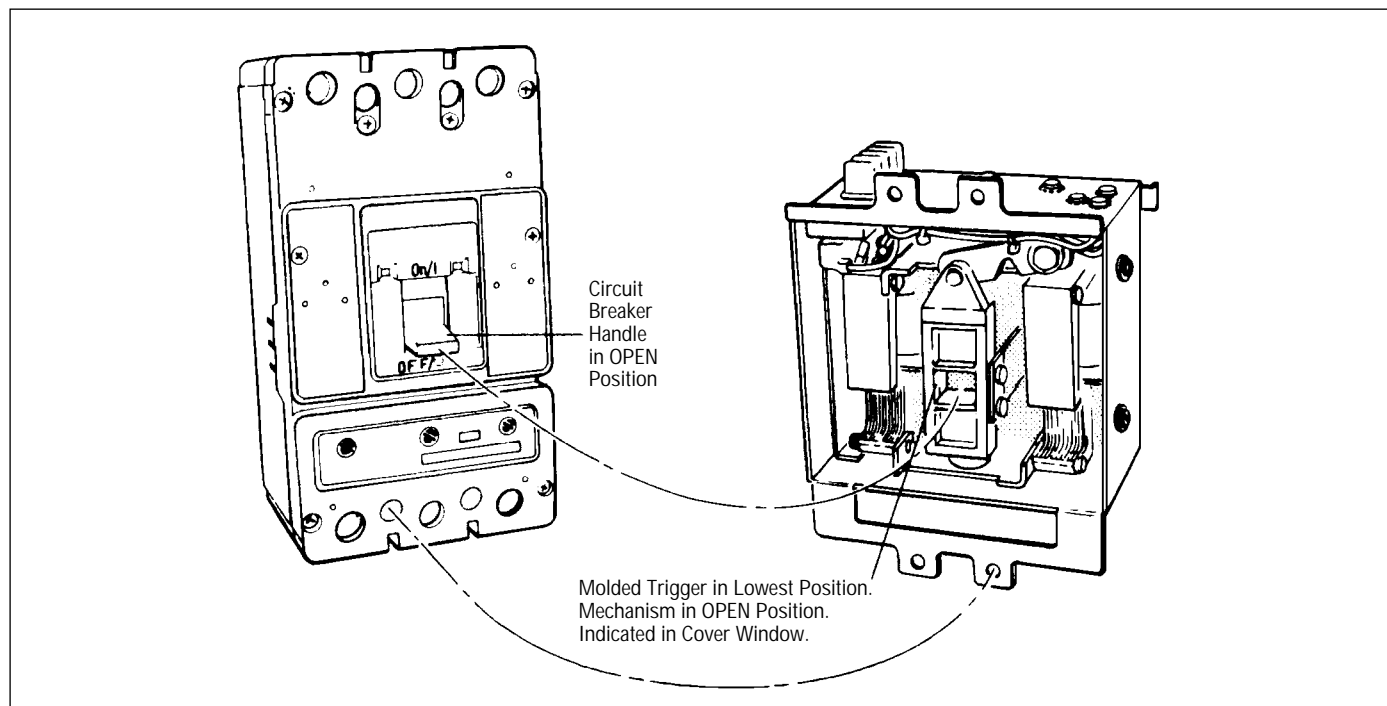


Figure 2-1 Position for Mounting Electrical Operator to Circuit Breaker (K-Frame Shown)

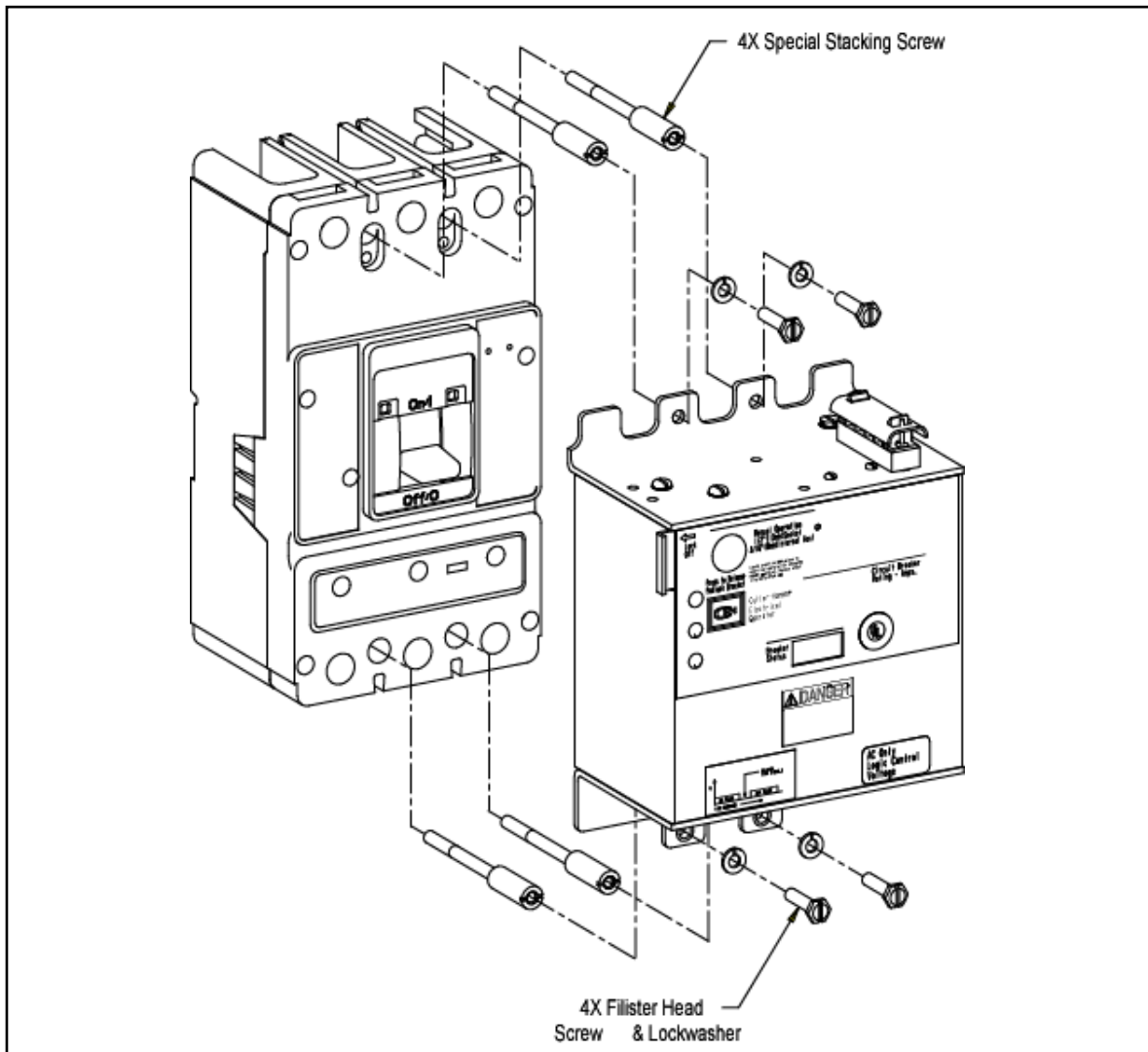


Figure 2-2A Electrical Operator Mounting hardware (see Table 2.1) K-Frame

mounting surface adjacent to the circuit breaker when installed. The circuit breaker ampere rating should be marked in the space provided on the electrical operator nameplate.

Table 2.1 Electrical Operator Mounting Hardware

<b>Imperial</b>	
1. Screw, stacking, special, Imperial male thread	
2. .250-20 x 1.00 Filister Head Screw and Lockwasher	
<b>Metric</b>	
1. Screw, stacking, special Metric male thread	
2. M6-0.7 x 25.4 Filister Head Screw and Lockwasher	

2-4. Check that circuit breaker handle is in the OPEN position

2-5. Aligning the circuit breaker handle with the molded trigger as shown in Figure 2-1, place the solenoid operator on the face of the breaker assuring that the locating spacers, which are attached to the back of the line end of the solenoid operator, are positioned correctly in the line end cover mounting holes.

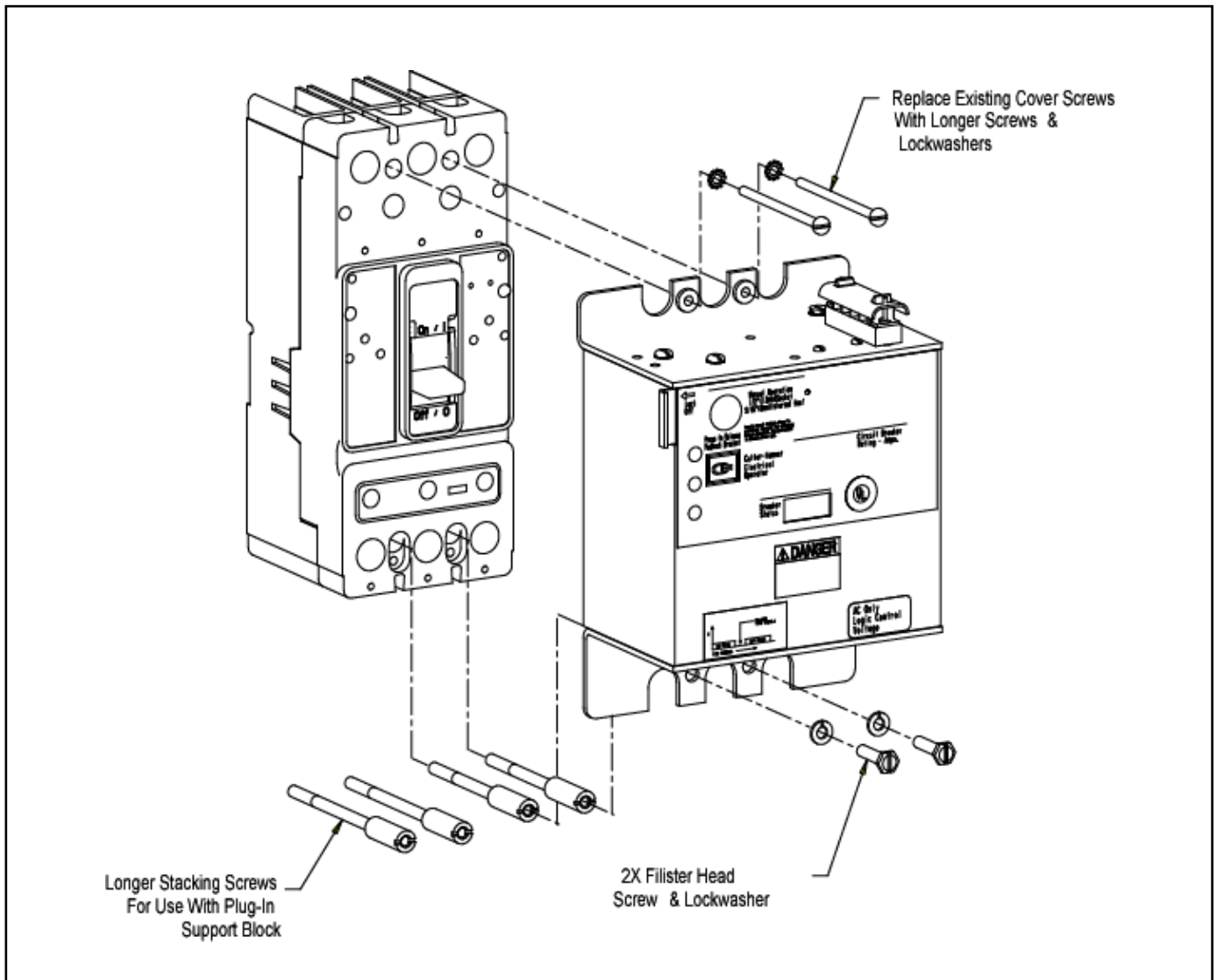


Figure 2-2B Electrical Operator Mounting hardware (see Table 2.1) J-Frame

- 2-6. Using the hardware provided with the solenoid operator, shown in Figure 2-2 and Table 2.1, loosely fasten the line end of the solenoid operator in place. **DO NOT TIGHTEN.**
- 2-7. Install the mounting hardware, shown in Figure 2-2 and Table 2.1, into the load end by lifting the solenoid operator up enough to start the screws in the top of the special threaded stacking screws.
- 2-8. After assuring that all four mounting screws are started correctly to avoid cross threading, tighten firmly but do not exceed 28 pound-inches (3 N.m).

- 2-9. Connect the control wires to the terminal block (TB1). See Figure 1-4.
- 2-10. Connect control wires to remote control devices. See Figure 1-4.

## NOTICE

When the assembly is mounted on an insulated surface, connect a ground conductor (green) as shown in Figure 1-4 to ground the electrical operator frame. The ground connection may be omitted where the circuit breaker is mounted on a grounded metal surface.

### 3-0 OPERATION

The following procedures describe the operation of the electrical operator and address electrical and manual CLOSE/OPEN operation.



#### CAUTION

**MAKE SURE THAT ALL EQUIPMENT ON THE LOAD END OF THE CIRCUIT BREAKER IS DISCONNECTED BEFORE OPERATING THE ELECTRICAL OPERATOR. SWITCHING OPERATIONS COULD CAUSE DAMAGE TO EQUIPMENT, ESPECIALLY EQUIPMENT REQUIRING A CONTROLLED SHUTDOWN.**

**DO NOT ENERGIZE THE ELECTRICAL OPERATOR MORE THAN ONE OPERATION PER MINUTE.**

**EXCEEDING THE MAXIMUM OPERATING RATE CAN DAMAGE THE OPERATING SOLENOIDS.**

**DO NOT CONNECT THE ELECTRICAL OPERATOR TO VOLTAGES ABOVE THE RATED VOLTAGE OF THE DEVICE. VOLTAGES THAT EXCEED THE RATED VOLTAGE CAN CAUSE DAMAGE.**

#### NOTICE

The operating solenoids will operate within 10% of the electrical operator rated voltage. If the supply voltage is below this limit, it is possible for the solenoids to attempt to toggle the circuit breaker handle but not have enough energy. If this occurs, the cutoff switch S1 will operate. Therefore, it is necessary to reverse the operation of the solenoids to reset the operating sequence, but only when the correct operating voltage is restored.

#### *Remote Electrical CLOSE/OPEN Operation*

Check remote electrical CLOSE/OPEN operation using the remote CLOSE and OPEN control devices. Perform the following steps:



#### CAUTION

**WHEN PERFORMING STEPS 3-1 THROUGH 3-9, OBSERVE THE MAXIMUM OPERATING RATE OF ONE OPERATION PER MINUTE. FAILURE TO OBSERVE THIS OPERATING RATE CAN RESULT IN DAMAGE TO THE ELECTRICAL OPERATOR.**

- 3-1. Slide REMOTE OPERATION switch to the CLOSE position by moving padlock bracket to the non-padlock position. (See Figure 3-1.)
- 3-2. Determine the electrical operator mechanism position (CLOSE, Trip, or OPEN).
- 3-3. Operate the remote control device corresponding to the electrical operator mechanism position. (If the display indicates the CLOSE position, operate CLOSE remote control device.) Verify that the electrical operator does not switch the circuit breaker.
- 3-4. Operate the OPEN remote control device. Verify that the electrical operator switches the circuit breaker to the OPEN position.
- 3-5. If circuit breaker is in the Trip position, operate the OPEN remote control to reset the circuit breaker.
- 3-6. Operate the CLOSE remote control device again, and verify that the electrical operator switches the circuit breaker.
- 3-7. With a screwdriver, press the manual PUSH-TO-TRIP button on the circuit breaker. (See Figure 3-1.) Verify that the display indicates the Trip position.
- 3-8. Operate the OPEN remote control device, and verify that the display indicates the OPEN (reset) position.

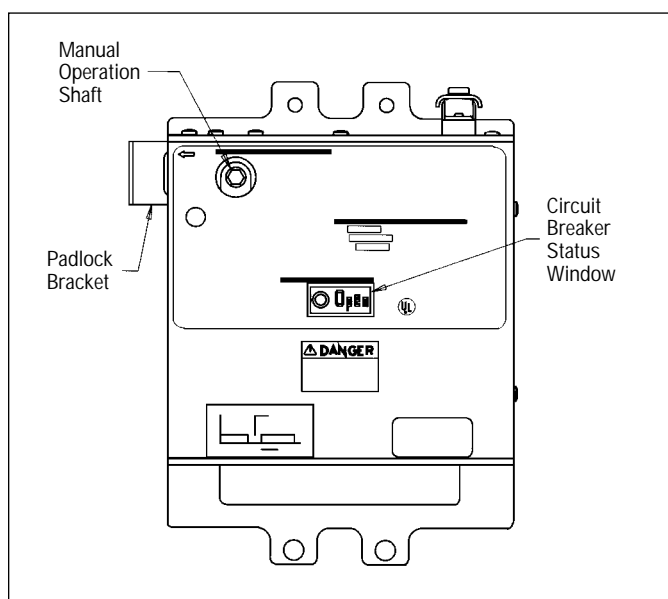


Figure 3-1 Location of External Operating Devices



- 3-9. Operate the CLOSE remote control device, and verify that the display indicates the CLOSE position.

### **Manual CLOSE/OPEN Operation**

Check the mechanical CLOSE/OPEN operation with a hexagonal or socket wrench. Perform the following steps:

- 3-10. Using hexagonal wrench or socket to turn the manual operation shaft. Move electrical operator mechanism through each circuit breaker position and back again. Leave mechanism in the ON position.
- 3-11. Press the manual PUSH-TO-TRIP button on the circuit breaker. Check that the display indicates the TRIP position.
- 3-12. Move the electrical operator mechanism to the OPEN (reset) position.

### **Troubleshooting**

If operator is energized, but no action occurs, check to insure that voltage leads to operator terminal block are secure and connected. With all power disconnected, manually operate the mechanisms to verify mechanical operation as well as setting the cut off switch sequence.

If operator tries but does not operate breaker, check to verify adequate voltage and power capability to operator.

Check to insure proper breaker handle - operator engagement and secure mounting. Refer to electrical and mounting sections of the instructions.

EOP Electrical Operators are suitable for use on Series C, J and K frame circuit breakers only.

Manual operating hex wrench is to be located close to electrical operator for emergency use. Replace wrench in locating clips after use.

### **4-0 INSPECTION**



### **WARNING**

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**BEFORE INSPECTING OR PERFORMING MAINTENANCE ON THE ELECTRICAL OPERATOR, MAKE SURE THERE IS NO VOLTAGE PRESENT WHERE WORK IS TO BE PERFORMED. SPECIAL ATTENTION SHOULD BE MADE TO REVERSE FEED APPLICATIONS TO ENSURE THAT NO VOLTAGE IS PRESENT. THE VOLTAGE IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.**

After the electrical operator is placed in service, it should be inspected on a periodic basis (after every 500 operations). The inspection should include the following items:

- 4-1. Check wiring for loose connections. Tighten if necessary.
- 4-2. Check all hardware for looseness, including the internal solenoid cap screws, operator body external screws, and operator mounting hardware. Tighten if necessary.
- 4-3. Electrically and mechanically check operation (see Part 3 Operation).

### **5-0 DIMENSIONS**

Dimensions for electrical operator are shown in Figure 5-1.



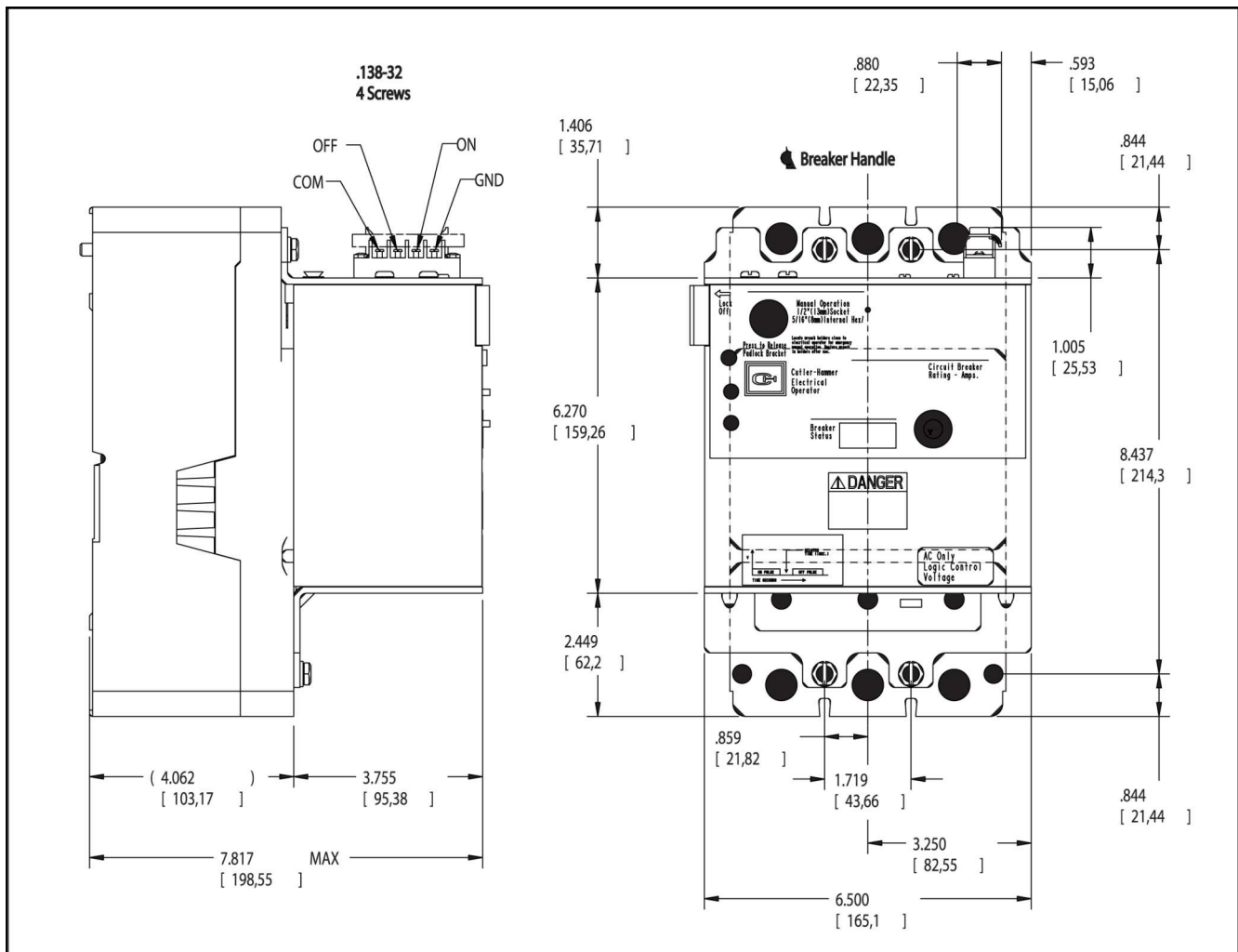


Fig. 5-1 Electrical (Solenoid) Operator Mounted on 3-Pole K-Frame Breaker

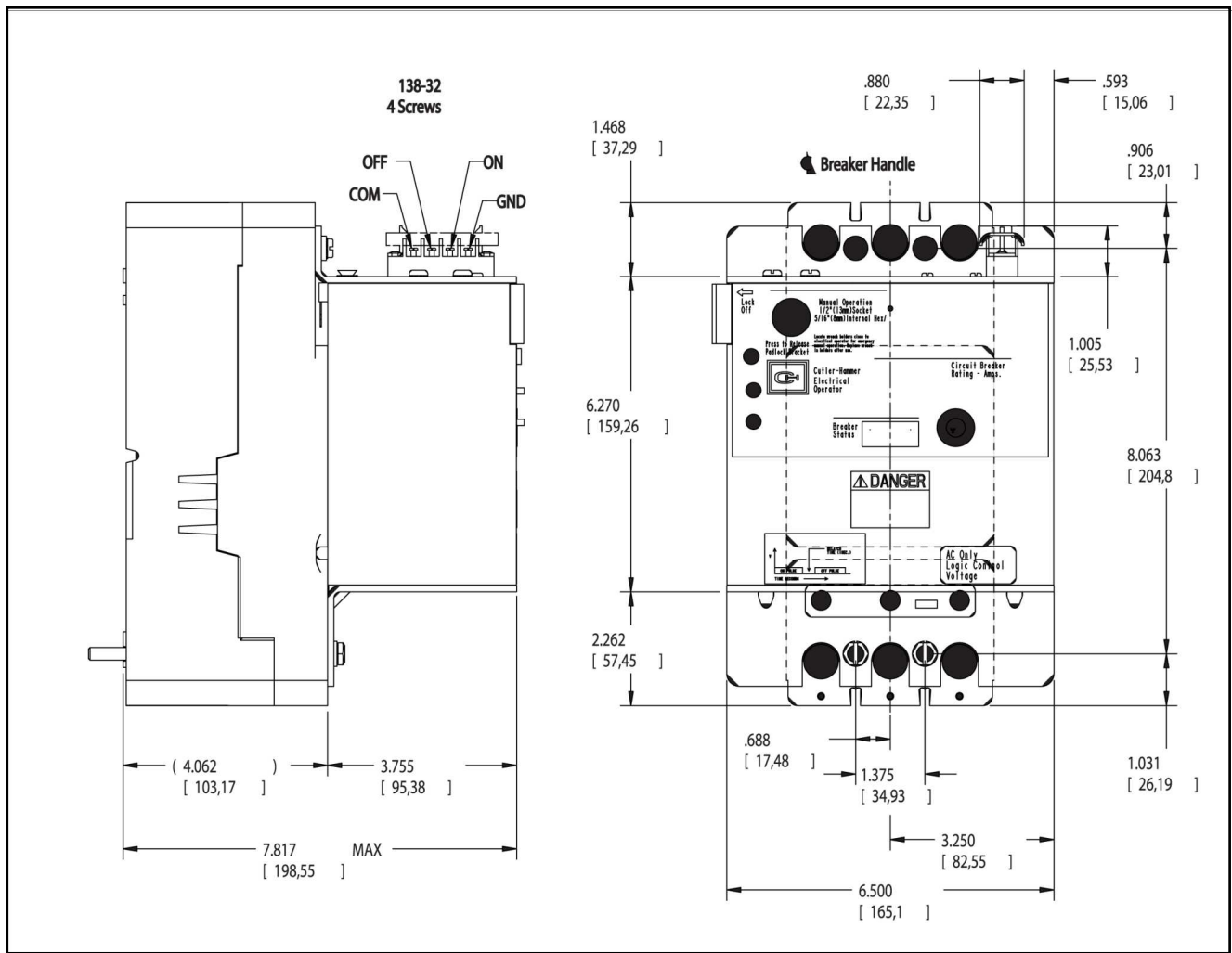


Fig. 5-2 Electrical (Solenoid) Operator Mounted on 3-Pole J-Frame Breaker

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