Digitrip Retrofit System for Federal Pioneer FP25 Molded Back Plate Breakers

SAFETY PRECAUTIONS

⚠ WARNING

POWER CIRCUIT BREAKERS ARE EQUIPPED WITH HIGH SPEED, HIGH ENERGY OPERATING MECHANISMS. THE BREAKERS AND THEIR ENCLOSURES ARE DESIGNED WITH SEVERAL BUILT-IN INTERLOCKS AND SAFETY FEATURES INTENDED TO PROVIDE SAFE AND PROPER OPERATING SEQUENCES. TO PROVIDE MAXIMUM PROTECTION FOR PERSONNEL ASSOCIATED WITH THE INSTALLATION, OPERATION, AND MAINTENANCE OF THESE BREAKERS, THE FOLLOWING PRACTICES MUST BE FOLLOWED. FAILURE TO FOLLOW THESE PRACTICES MAY RESULT IN DEATH, PERSONAL INJURY, OR PROPERTY DAMAGE.

- Only qualified persons, as defined in the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers and their associated switchgear assemblies should perform any work associated with these breakers.
- Completely read and understand all instructions before attempting any installation, operation, maintenance, or modification of these breakers.
- **Always turn off and lock out the power source feeding the breaker prior to attempting any installation, maintenance, or modification of the breaker. Do not use the circuit breaker as the sole means for isolating a high voltage circuit. Follow all lockout and tagging rules of the National Electric Code and all other applicable codes, regulations, and work rules.**
- Do not work on a closed breaker or a breaker with the closing springs charged. Trip (open) the breaker and be sure the stored energy springs are discharged before performing any work. The breaker may trip open or the charging springs may discharge, causing crushing or cutting injuries.
- For drawout breakers, trip (open), and then remove the breaker to a well-lit work area before beginning work.
- Do not perform any maintenance: including breaker charging, closing, tripping, or any other function which could cause significant movement of the breaker while it is on the extension rails. Doing so may cause the breaker to slip from the rails and fall, potentially causing severe personal injury to those in the vicinity.
- **Do not leave the breaker in an intermediate position in the switchgear cell. Always leave it in the connected, disconnected, or (optional) test position. Failure to do so could lead to improper positioning of the breaker and flashover, causing death, serious personal injury, and / or property damage.**
- **Do not defeat any safety interlock. Such interlocks are intended to protect personnel and equipment from damage due to flashover and exposed contacts. Defeating an interlock could lead to death, severe personal injury, and / or property damage.**

Digitrip Retrofit System for Federal Pioneer FP25 Molded Case Breakers

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INTRODUCTION

Cutler-Hammer Digitrip Retrofit Kits are available in a number of configurations that provide a wide range of features. The Digitrip System starts with the 510 Basic Kit which offers true RMS sensing, overcurrent protection, and self-testing features. Advanced Digitrip Retrofit Kits feature zone interlocking, digital alphanumeric displays, remote alarm signals, PowerNet communications, energy monitoring capabilities, power factors, and harmonic content measurements.

Table 1 provides a quick reference of the components supplied with each level of Retrofit Kit. Before beginning the Retrofit process, take a minute to review the information contained in Table 1. It is important that the Retrofitter understands which level of Retrofit Kit is to be installed and which components are included with the Kit.

The instructions contained in this manual cover the installation of all levels of Retrofit Kit. If the Kit you are installing does not contain a certain component, skip the instructions for that component and proceed to the next.

Throughout the Retrofit process, refer to the Torque Tables at the back of this manual for specific torque values.

If you have any questions concerning the Retrofit Kit and / or the Retrofit process, contact Cutler-Hammer at 1-800-937-5487.

Table 1 Available Retrofit Kits

Components	510 Basic	510 with Zone Interlock	610	810	910
Trip Unit					
Rating Plug					
Auxiliary Current Transformer (CT) Module					
Auxiliary CT Harness					
Sensors					
Sensor Harness					
Direct Trip Actuator (DTA)					
Mounting Brackets and Hardware					
External Harness	Plug	1 Connector Harness	2 Connector Harness	4 Connector Harness	4 Connector Harness
Cell Harness					
Breaker Mounted Control Power Transformer (CPT)					
Potential Transformer (PT) Module					
Auxiliary Switch					

STEP 1: GENERAL BREAKER PREPARATION

Before attempting to remove the Breaker from the cell or perform any Retrofit Operation, be sure to read and understand the Safety Precautions section of this manual. In addition, be sure to read and understand the Instructions for the Application of Digitrip RMS Retrofit Kits on Power Circuit Breakers (Retrofit Application Data – Publication AD 33-855-2), supplied with the Digitrip Retrofit Kit.

DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. SEVERE PERSONAL INJURY OR DEATH CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING.

A. Trip the Breaker and remove it from the Cell. Move the Breaker to a clean, well-lit work area.

NOTE: It is the responsibility of the Retrofitter to insure that the Breaker and all original components are in good condition. Visually inspect all Breaker components for signs of damage or wear. If any signs of damage or wear are detected for components not included in the Retrofit Kit, secure the necessary replacement parts before beginning the Retrofit Process.

The force necessary to trip the Breaker should not exceed three (3) lbs.

NOTE: It is the responsibility of the Retrofitter to insure that the proper, manufacturer's recommended crimping tools and terminals are used for each type of connector. It is also the responsibility of the Retrofitter to insure that all wire preparations, connections, strippings, terminations, and wiring techniques are performed according to the latest IEEE, NEC, and / or NEMA industry standards, specifications, codes, and guidelines.

To begin the Retrofit Process, refer to the components list at the end of this manual. Layout the components and hardware according to the steps outlined. The parts bags are labeled with the corresponding step number. The components and hardware will be used to complete each step in the Retrofit Process.

STEP 2: REMOVING THE ORIGINAL TRIP SYSTEM AND PREPARING THE BREAKER FOR RETROFITTING

Refer to the Federal Pacific FP25 Instruction Manual, originally supplied with the Breaker, to perform the following procedures.

A. Remove and save the hardware securing the Charging Handle to the Breaker. Remove and save the Charging Handle.

B. Remove and save all mounting hardware securing the Front Box Cover to the Breaker. Remove and save the Front Box Cover.

C. Remove and save all mounting hardware securing the Front Box to the Breaker. Remove and save the Front Box.

D. Remove the mounting hardware securing the Electromechanical Trip Units to the Breaker Stabs. Scrap the bolts, nuts, and washers but save the spacers.

NOTE: As the mounting hardware is being removed, note the location of each of the six (6) spacers. These will be used in their original locations in Step 3 of the Retrofit.

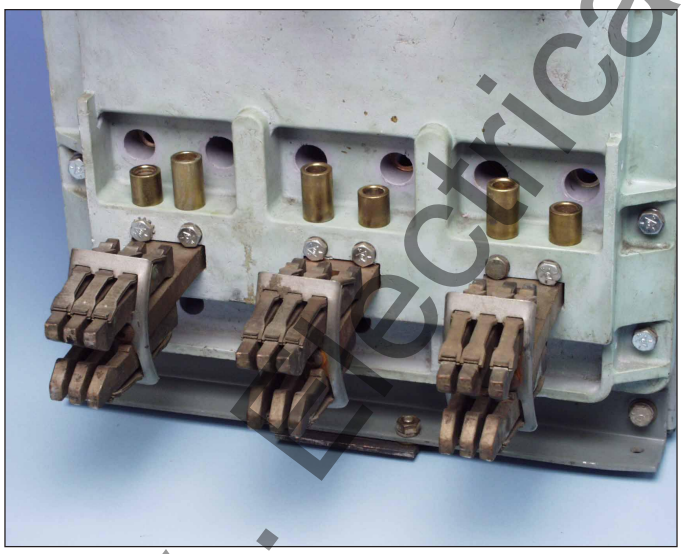

Fig. 1 Note the Original Spacer Location

E. Remove and scrap all mounting hardware securing the Electromechanical Trip Units to the Electromechanical Trip Unit Mounting Platform. Remove and scrap the Trip Units.

F. Remove and scrap the mounting hardware securing the Electromechanical Trip Unit Mounting Platform to the bottom of the Breaker. Remove and scrap the Electromechanical Trip Unit Mounting Platform and attached Trip Rod Guide.

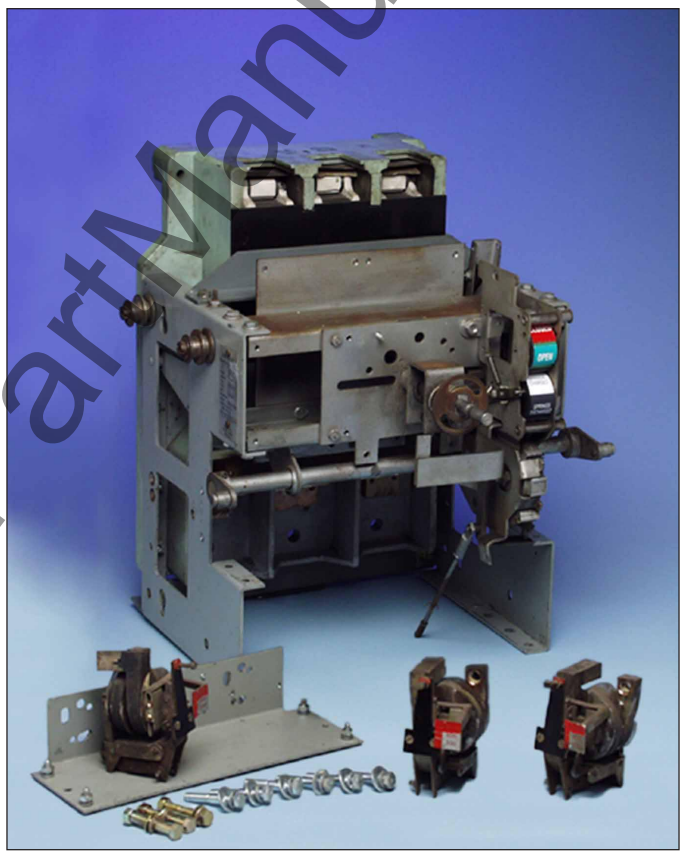

Fig. 2 Electromechanical Components Removed from the Breaker

G. Remove and save the top Finger Clusters and mounting hardware.

STEP 3: INSTALLING THE COPPER CONNECTORS

Fig. 3 Overview: Copper Connectors Installed in the Breaker

A. Align the new Copper Connectors with the existing holes in the Stationary Contact Assemblies.

B. Secure the Copper Connectors to the Stationary Contact Assemblies using the (6) original spacers and the (6) .375-16 × 2.25" bolts, (12) flat washers, (6) lock washers, and (6) nuts supplied. Be sure to install the spacers in the same locations as noted in Step 2-D.

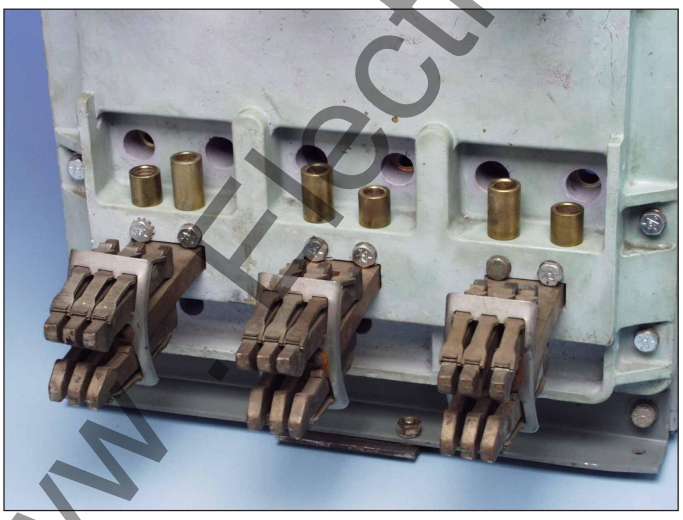

Fig. 4 Spacer Location

For Kits Supplied with a PT Module Only: Only tighten one (1) bolt on each Copper Connector. The other bolts will be used to connect the PT Wires later in the Retrofit Process.

Fig. 5 Copper Connector Installation

STEP 4: INSTALLING THE TRIP ROD GUIDE

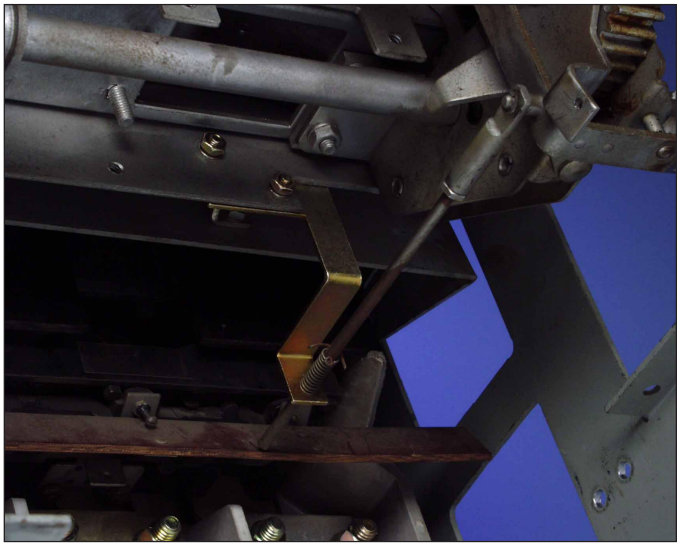

Fig. 6 Overview: Trip Rod Guide Installed in the Breaker

A. Align the new Trip Rod Guide with the Trip Rod and the existing holes in the middle Breaker Shelf, as shown in Fig. 7.

B. Secure the Trip Rod Guide to the middle Breaker Shelf using the (2) .190-32 × .500" screws, (4) flat washers, (2) lock washers, and (2) nuts supplied.

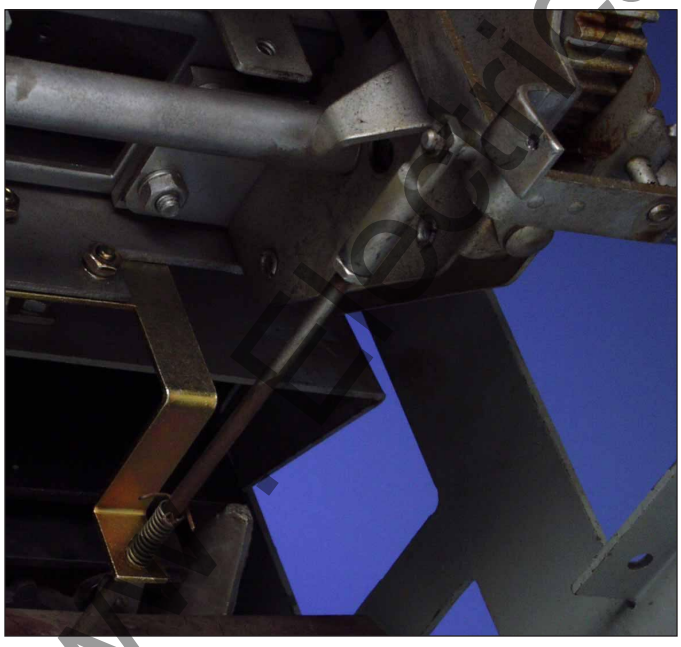

Fig. 7 Installing the Trip Rod Guide

STEP 5: DRILLING THE BREAKER FOR MOUNTING THE RETROFIT COMPONENTS

NOTE: Throughout the drilling process detailed in this Step, insure that no drill shavings fall into the Breaker.

A. Using Drilling Plan "A", drill two (2) .266" diameter holes in the right Breaker Frame. These will be used later in the Retrofit Process to mount the DTA.

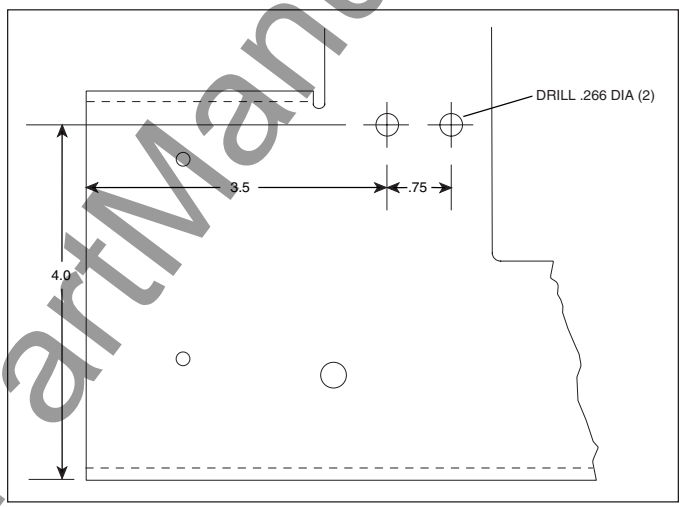

Fig. 8: Drilling Plan "A"

B. *For Kits Supplied with an Auxiliary Switch Only:* Using Drilling Plan "B", drill two (2) .170" diameter holes in the front left edges of the top and middle Breaker Shelves. These will be used later in the Retrofit Process to mount the Auxiliary Switch Assembly.

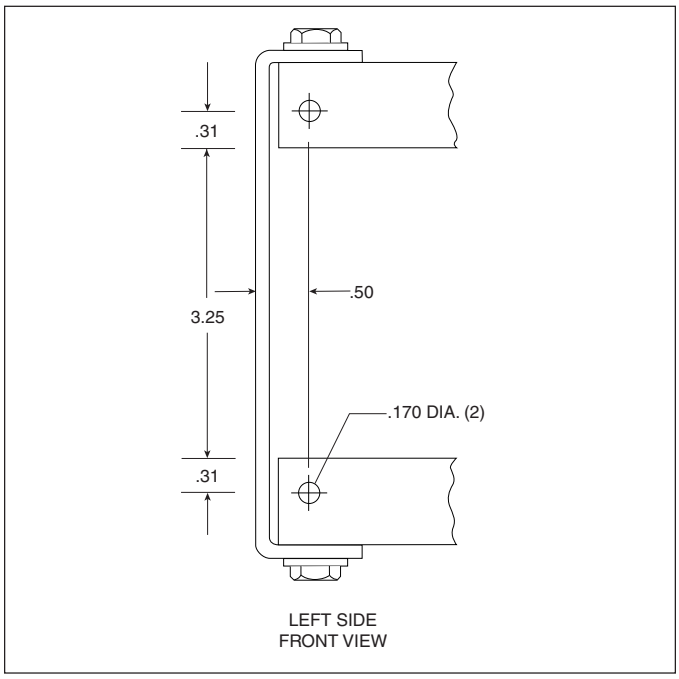

Fig. 9: Drilling Plan "B"

C. *For Kits Supplied with a Breaker Mounted CPT Only:* Using Drilling Plan "C", drill two (2) .266" diameter holes in the left Breaker Frame. These will be used later in the Retrofit Process to mount the Breaker Mounted CPT.

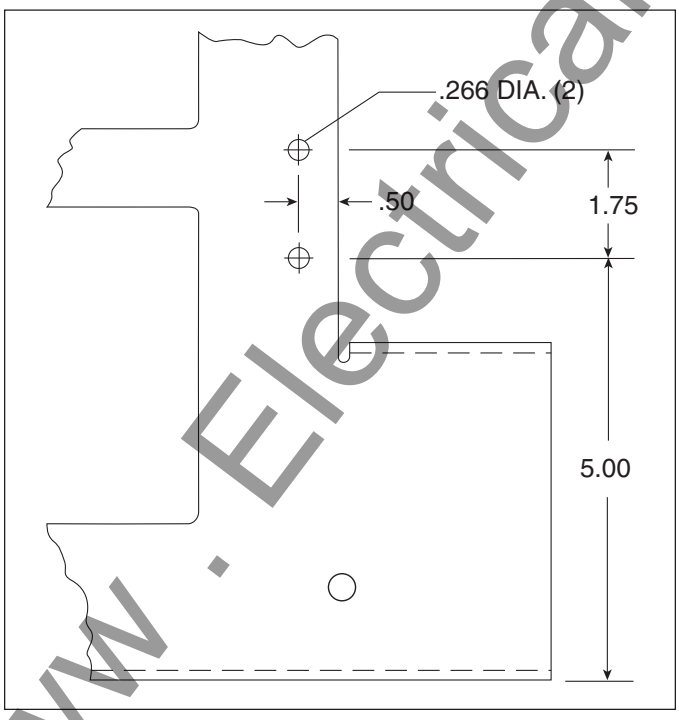

Fig. 10: Drilling Plan "C"

STEP 6: INSTALLING AND ADJUSTING THE DTA ASSEMBLY

Fig. 11 Overview: DTA Installed in the Breaker

A. Align the DTA Assembly with the holes drilled in Step 5-A. Apply Loc-Tite® 243 to the threads of the bolts then secure the DTA Assembly to the right Breaker Frame, as shown, using the (2) .250-20 × .500" bolts, (2) lock washers, and (2) flat washers supplied. Note that the DTA should be parallel to the edge of the right Breaker Frame.

When installing the DTA, insure that the Reset Arm is below the Breaker Cross Bar.

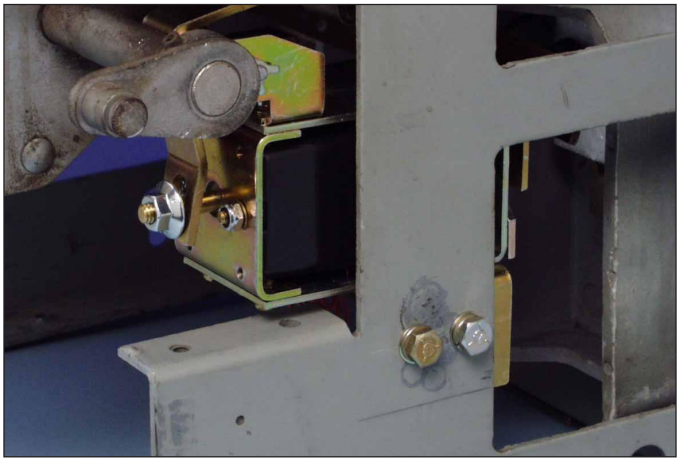

Fig. 12 DTA Mounted to the Breaker Frame

Fig. 13 Correct Orientation of the DTA Reset Arm

B. Loosen the lock nut on the Trip Screw. Apply Loc-Tite® 243 to the threads, then turn the Trip Screw until a gap of .06" to .09" is achieved between the screw and the Breaker Trip Bar. Tighten the lock nut on the Trip Screw.

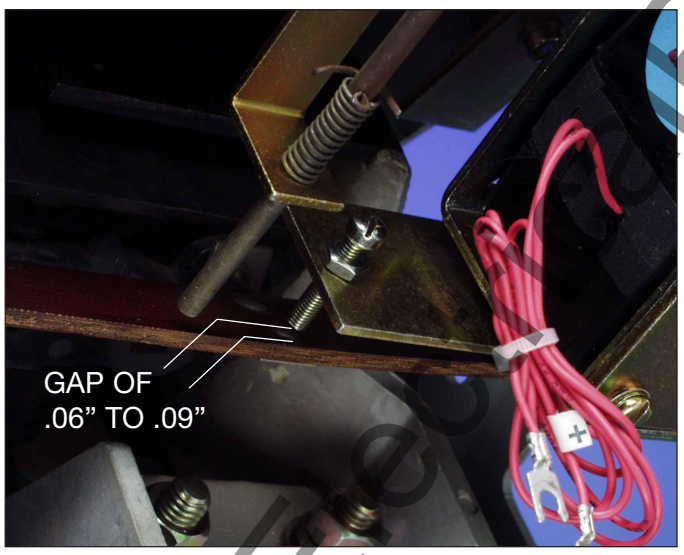

Fig. 14 Setting the Trip Screw to Breaker Trip Bar Gap

C. Temporarily reinstall the Charging Handle and “charge” the Closing Springs.

⚠ WARNING

GUARD AGAINST THE BREAKER UNINTENTIONALLY CLOSING DURING THE FOLLOWING STEPS. KEEP HANDS AND FINGERS AWAY FROM MOVING PARTS WITHIN THE BREAKER. FAILURE TO DO SO COULD RESULT IN SEVERE PERSONAL INJURY.

D. Check the cage height on the DTA Reset Spring. The cage height should be .50". If the cage height does not measure .50", turn the Reset Spring Adjusting Nut until the correct cage height is achieved.

Fig. 15 Adjusting the Reset Spring Cage Height

E. Release the Charging Springs.

F. Connect a 24 VDC power supply to the DTA Wires; positive to positive and negative to negative. Close the Breaker manually. Energize the DTA to trip the Breaker; de-energize when the Breaker trips. Make certain that the DTA resets. If the Breaker fails to properly trip or reset, make the necessary adjustments to insure a .06" to .09" gap between the top of the DTA Trip Screw and the Breaker Trip Bar (for Trip function) and .50" cage height on the Reset Spring (for Reset function). Repeat the procedure until proper trip and reset is achieved.

G. Remove the Charging Handle. It will be reinstalled later in the Retrofit Process.

For Kits Supplied with a Breaker Mounted CPT Only.

STEP 7: INSTALLING THE BREAKER MOUNTED CPT

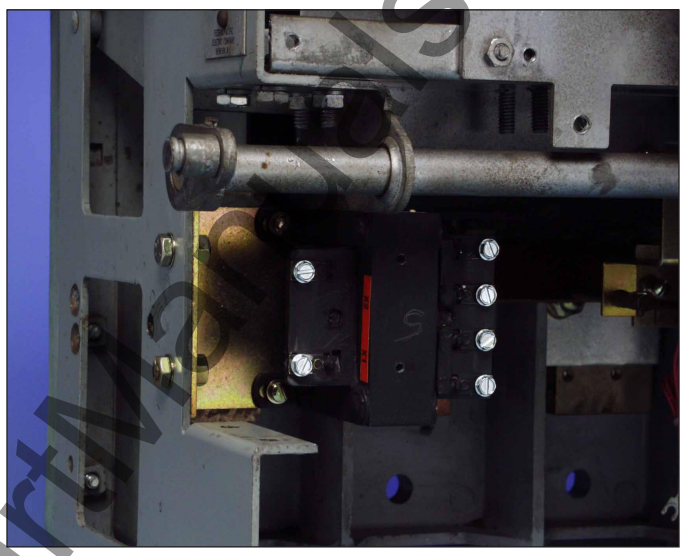

Fig. 16 Overview: CPT Installed in the Breaker

A. Align the CPT with the holes in the CPT Mounting Bracket, as shown. Secure the CPT to the CPT Mounting Bracket using the (4) .190-32 × .625" screws, (4) lock washers, (8) flat washers, and (4) nuts supplied.

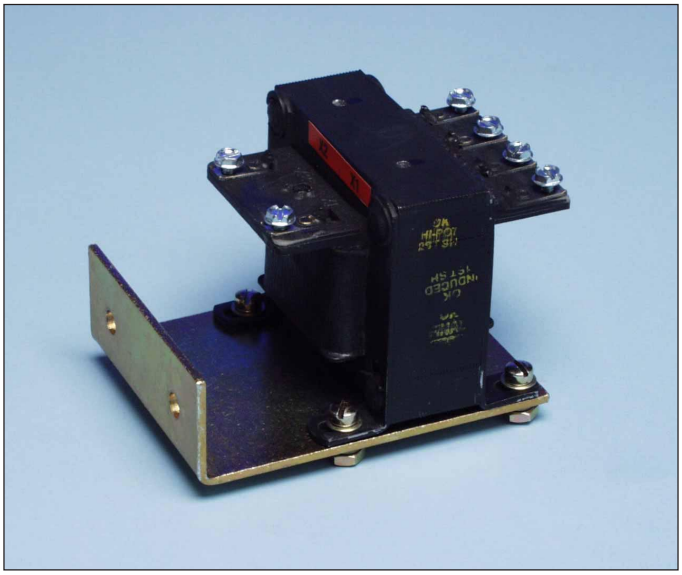

Fig. 17 CPT Mounted to the CPT Mounting Bracket

B. Align the CPT Assembly with the holes drilled in the left Breaker Frame in Step 5-C. Secure the CPT Assembly to the Breaker, as shown, using the (2) .250-20 × .625" bolts, (2) lock washers, (4) flat washers, and (2) nuts supplied.

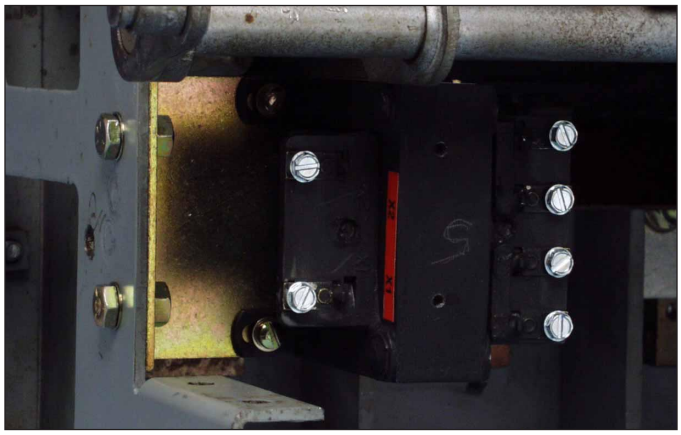

Fig. 18 CPT Assembly Mounted in the Breaker

STEP 8: PREPARING THE TRIP UNIT ASSEMBLY

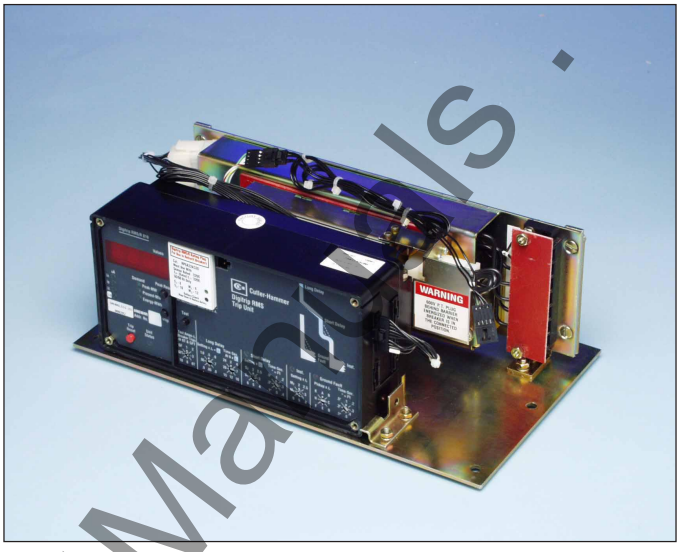

Fig. 19 Overview: Trip Unit Assembly Prepared for Installation

A. Align the Aux. CT Module Mounting Brackets, as shown, with the holes in the Trip Unit Mounting Platform. Secure the Brackets to the Mounting Platform using the (4) .190-32 × .500" screws, (4) lock washers, (8) flat washers, and (4) nuts supplied. Note that the screws are inserted through the Trip Unit Mounting Platform first.

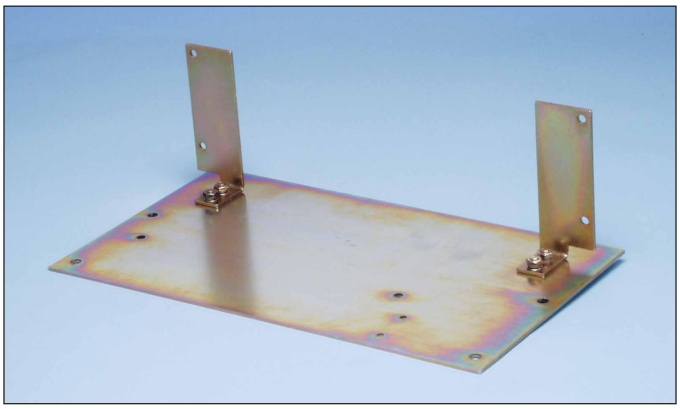

Fig. 20 Aux. CT Mounting Brackets Attached to the Trip Unit Mounting Platform

B. *For Kits Supplied with a PT Module Only:* Align the Glass Poly Insulation Barrier and the PT Module with the holes in the top of the Aux. CT Module, as shown. Secure the PT Module and Insulation Plate to the Aux. CT Module using the (2) .138-32 × .375" thread cutting screws, (2) flat washers, and (2) lock washers supplied.

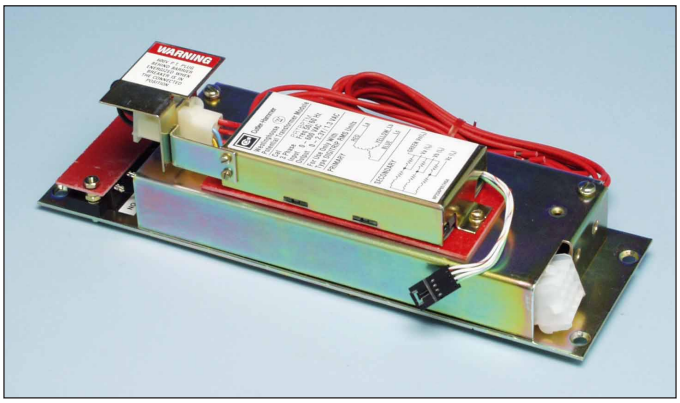

Fig. 21 PT Module Installed on the Aux. CT Module

Attached the new PT Module Warning Label over the existing label in the orientation shown in Fig. 22.

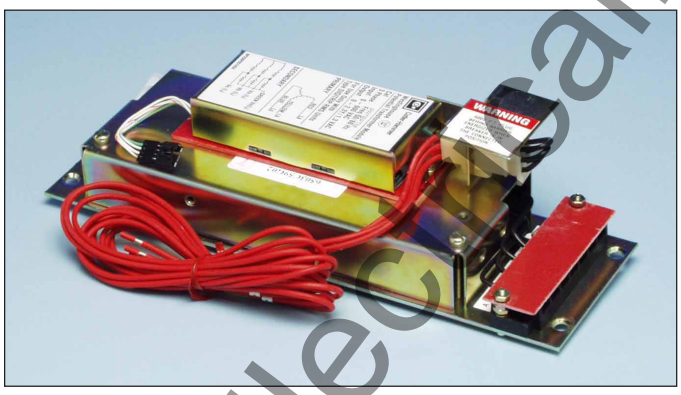

Fig. 22 Correct Orientation of the PT Module Warning Label

C. Align the Aux. CT Module and the two (2) Spacer Plates, as shown, with the holes in the Aux. CT Module Mounting Brackets. Secure the Aux. CT Module and the spacer plates to the Mounting Brackets using the (4) .190-32 × .500" flat head screws, (4) lock washers, (4) flat washers, and (4) nuts supplied.

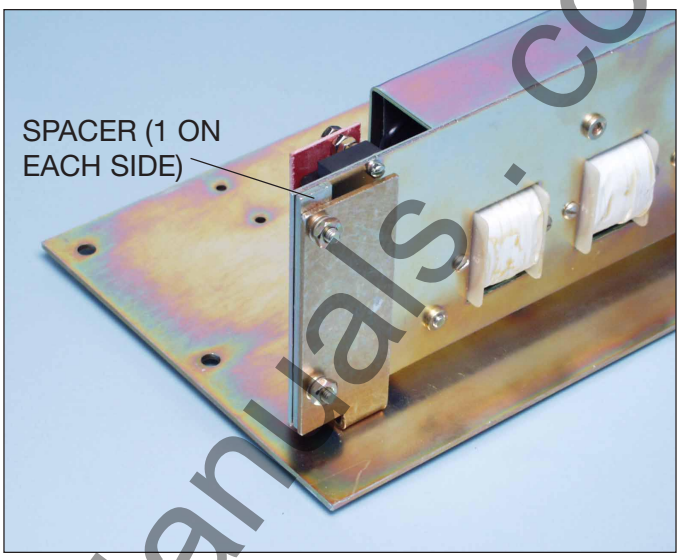

Fig. 23 Spacer Placement and Mounting of the Aux. CT Module

D. *For Kits Supplied with a PT Module Only:* Route the PT Wires under the PT Module and Aux. CT Module to the rear of the Assembly.

E. Align the Trip Unit with the holes in the Trip Unit Mounting Platform, as shown. Secure the Trip Unit to the Trip Unit Mounting Platform using the (2) brass spacers, (2) .190-32 × 4.00" screws, (4) flat washers, (2) lock washers, and (2) nuts supplied. Note that the brass spacers are placed between the bottom of the Trip Unit and the Mounting Platform and that the 4.00" screws are inserted through the Trip Unit Mounting Platform first.

F. Position the Trip Unit Support Clip on the right side of the Trip Unit so it "pinches" the Trip Unit in place. Secure the Trip Unit Support Clip to the Trip Unit Mounting Platform using the (2) .138-32 × .375" screws, (2) lock washers, (4) flat washers, and (2) nuts supplied.

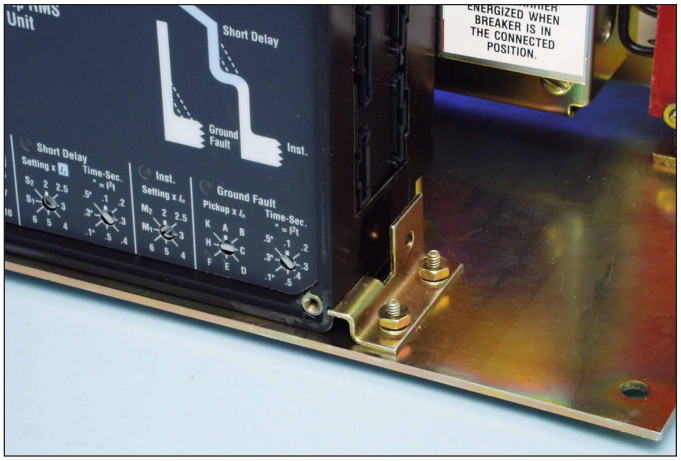

Fig. 24 Correct Installation of the Trip Unit Support Clip

G. Remove the Trip Unit Cover and install the Rating Plug. Reinstall the cover.

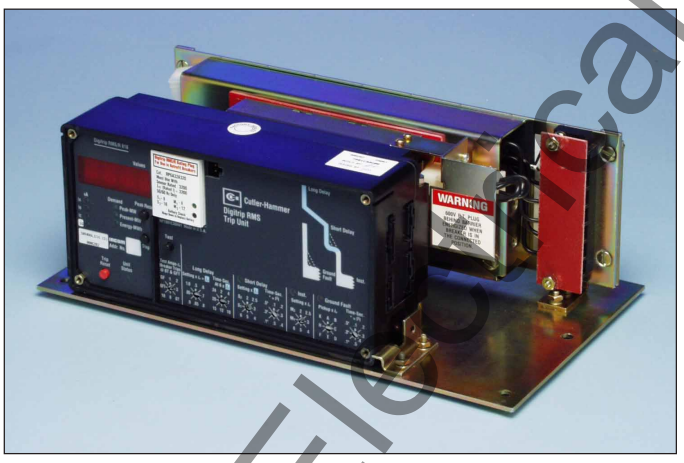

Fig. 25 Trip Unit Assembly with Rating Plug Installed

H. Connect the Aux. CT Harness to the Aux. CT Module and the Trip Unit. Note that the Aux. CT Harness is positioned between the Aux. CT Module and the back of the Trip Unit.

For Kits Supplied with a PT Module Only: Connect the PT Extension Harness to the PT Harness. As with the Aux. CT Harness, route the PT Extension Harness between the Aux. CT Module and the back of the Trip Unit to the right side of the Trip Unit. The other connector on the PT Extension Harness will be connected to the External Harness later in the Retrofit Process.

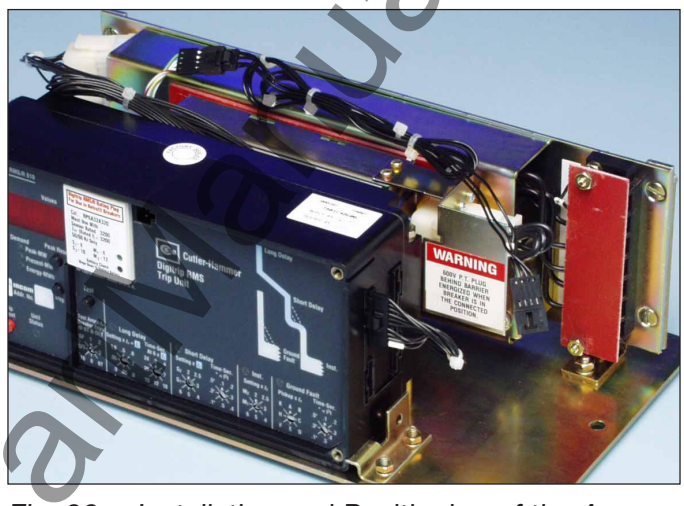

Fig. 26 Installation and Positioning of the Aux. CT and PT Extension Harnesses

I. Remove the cover from the 7-Point Terminal Block on the Aux. CT Module. Note that the cover will be reinstalled later in the Retrofit Process after connection of the DTA Wires.

J. Connect the Sensor Harness to the proper terminals on the Aux. CT Module. Refer to Section 12 of the Retrofit Application Data, supplied with the Retrofit Kit, for detailed wiring specifications.

Connect the green ground wire from the Sensor Harness (with the ring terminal) to the right side (top) of the Aux. CT Module, as shown, using the (1) .190-32 × .375" screw, (1) lock washer, and (1) flat washer supplied.

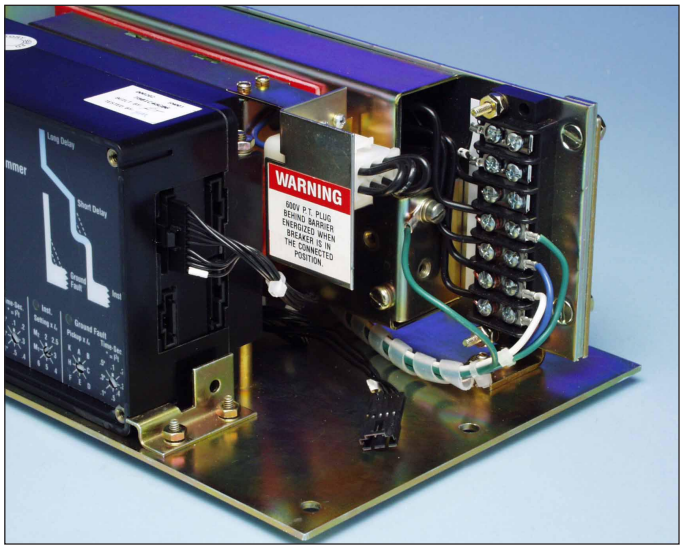

Fig. 27 Sensor Harness Connections

K. Route the Sensor Harness under the Aux. CT Module to the rear of the Assembly.

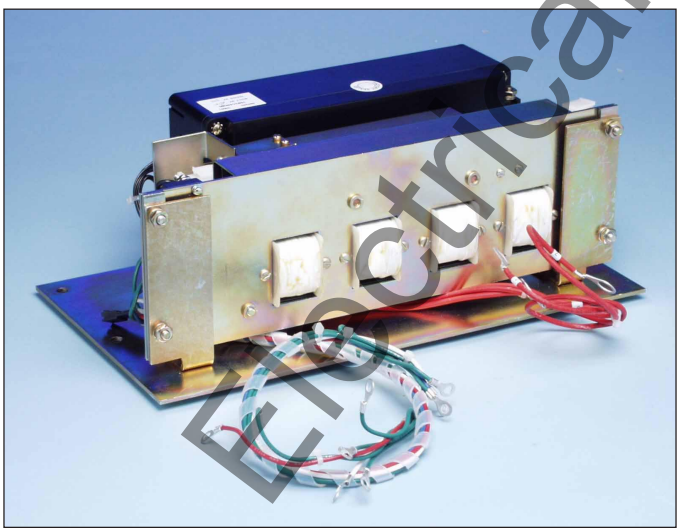

Fig. 28 Routing of the Sensor Harness

STEP 9: INSTALLING THE TRIP UNIT ASSEMBLY

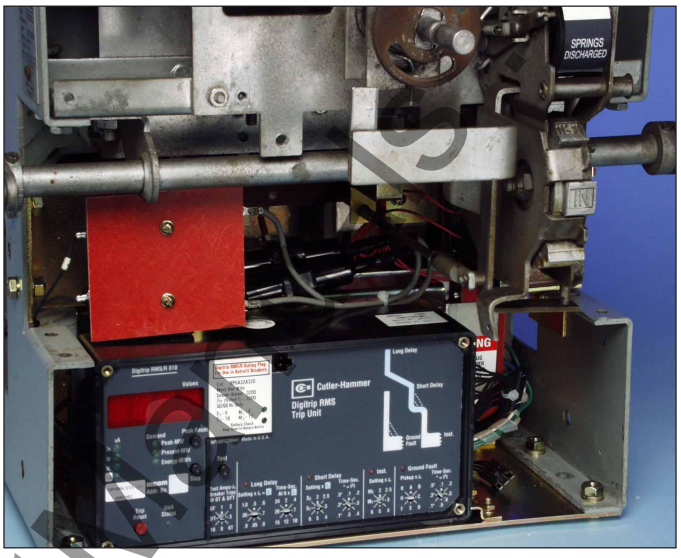

Fig. 29 Overview: Trip Unit Assembly Installed in the Breaker

NOTE: Steps 9-A through 9-I are performed with the Trip Unit Assembly on the work bench, close to the front of the Breaker.

A. Connect the “+” DTA Wire to the “OP” terminal of the Aux. CT Module’s 7-Point Terminal Block and the unmarked wire to the “ON” terminal.

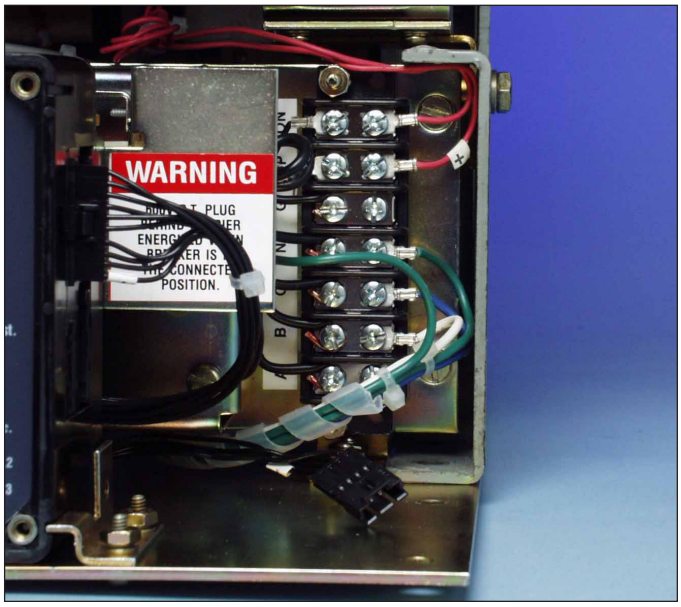

Fig. 30 DTA Wires Connected to the 7-Point Terminal Block

B. Reinstall the 7-Point Terminal Block Cover removed in Step 8-I.

C. Route the Sensor Harness through the existing hole near the bottom right corner of the Molded Breaker Back Plate.

D. *For Kits Supplied with a PT Module Only:* Refer to Section 7-3, Power Flow Convention of the Retrofit Application Data, supplied with the Retrofit Kit for additional wiring information and to verify the Phase Convention used on this Breaker Application.

NOTE: Before cutting the PT Wires, verify the Phase Convention used on the Breaker Application.

Route the PT Wires to a position suitable for attachment to the bottom Stationary Contact Assemblies. Move the PT Wire markers to a position where they will still be attached to the wires after cutting. Cut the wires to length, strip an appropriate length of insulation from each wire, and install a .375" ring terminal on each wire.

Connect the wires to the bottom Stationary Contact Assemblies using the (3) .375-16 × 2.25" bolts left loose in Step 3-B.

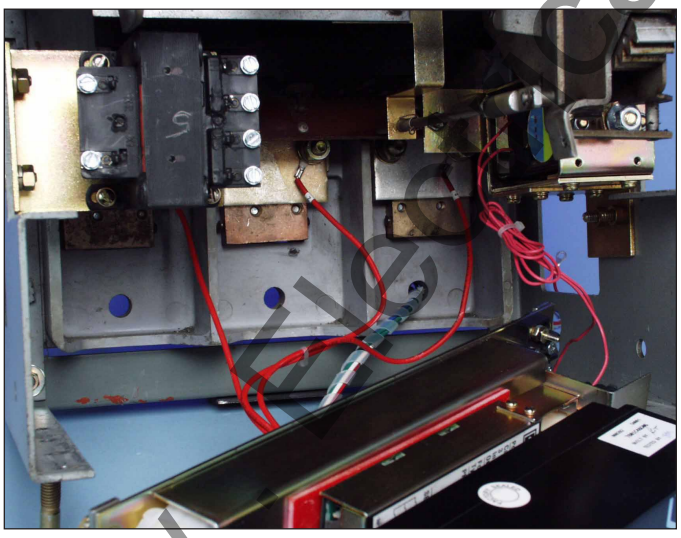

Fig. 31 Connection of the PT Wires and Routing of the Sensor Harness

For Kits Supplied with a Breaker Mounted CPT Only.

NOTE: The High Voltage (HV) Wires have a LOAD Side and a LINE Side. The HV Wires must be installed in the correct orientation during the following procedure. For the purpose of identification, the words “Load Side” are marked on the female fuse receptacle of each HV Wire.

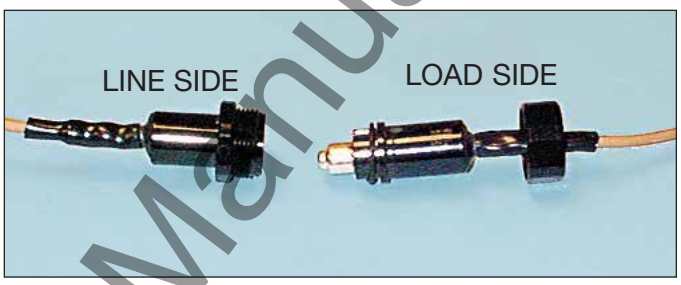

Fig. 32 Identification of the Line and Load Side HV Wires

NOTE: The Load Side HV Wires are longer than necessary and are cut during the following steps. Before cutting the wires, be sure that sufficient length is left so that the connections can be made to the correct terminals on the CPT.

E. Temporarily place the HV Fuses near the top of the Trip Unit. Route the Load Side HV Wires to the “H” terminals on the CPT. Mark and cut the Load Side of each HV Wire to an appropriate length for connection to the CPT. Strip an appropriate length of insulation from the Load Side HV Wires and attach a .138" ring terminal to each. Attach the HV Wires to the CPT terminals to achieve the required voltage (see Table 2).

Table 2 CPT Voltage Taps

Voltage Required	*CPT Terminals Used*
480 Volt Circuit	H1 & H4
240 Volt Circuit	H1 & H3
208 Volt Circuit	H1 & H2

NOTE: The terminals to which the Load Side HV wires are connected determine the voltage of the CPT which, in turn, limits the voltage of the Breaker. Verify that the line voltage of the circuit matches the CPT voltage BEFORE putting the Breaker into service.

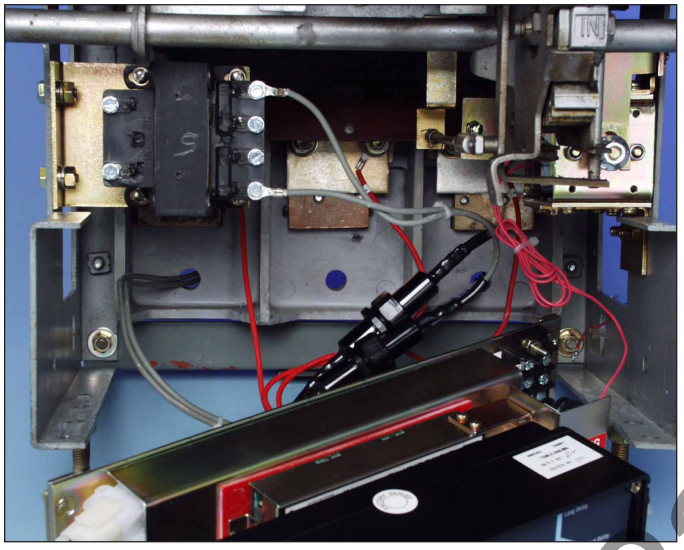

Fig. 33 HV Wires Connected to the CPT

F. Route the Line Side HV Wires through the existing hole near the bottom left corner of the molder Breaker Back Plate.

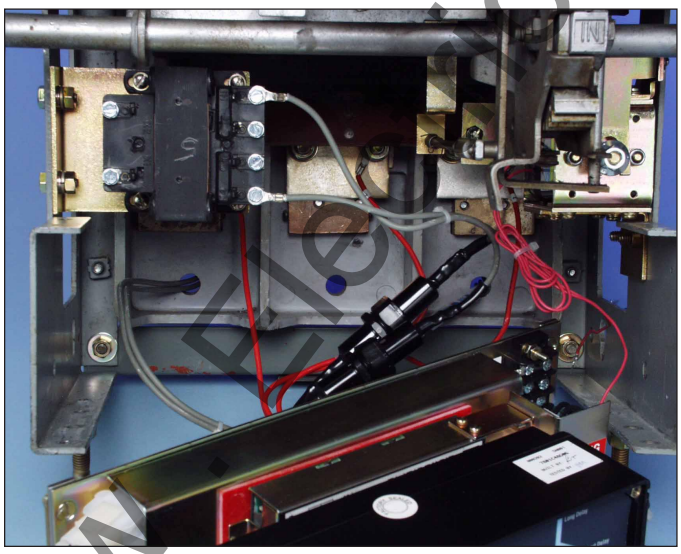

Fig. 34 Routing of the Line Side HV Wires

NOTE: The power convention of the FP25 Breakers is normally *Top to Bottom*, meaning the Top Breaker Stabs are on the *Line Side* of the Breaker and the Bottom Breaker Stabs are on the *Load Side*.

The HV Wires from the CPT MUST BE ATTACHED to the *Line Side* of the Breaker. If it is determined that the power flow for the Breaker application is opposite the normal convention, the HV Wires must be attached to the bottom Stationary Contact Assemblies. The bolts used to connect the PT Wires in Step 9-D can be used to connect the HV Wires. Therefore DO NOT route the Line Side HV Wires through the molder Breaker Back Plate at this time. Connection details will be given in Step 10.

G. Connect the CPT Harness to its receptacle on the Trip Unit.

H. Route the CPT Harness up to the X1 and X2 terminals on the CPT. Connect the CPT Harness to the X1 and X2 terminals on the CPT.

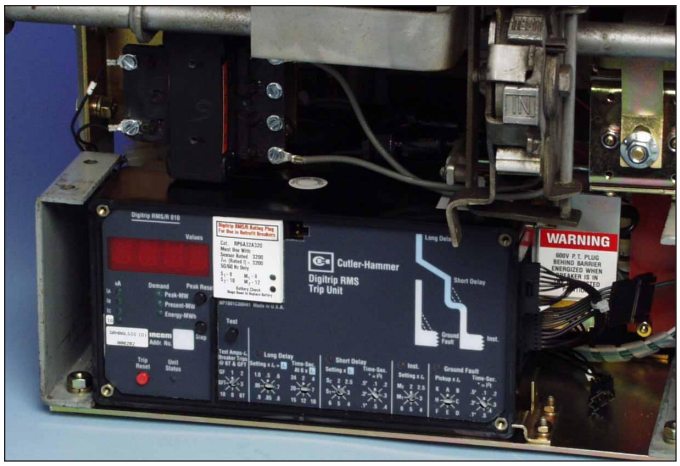

Fig. 35 CPT Harness Connected to the Trip Unit and the CPT

I. Attach the Glass Poly Insulation Plate to the top of the CPT, as shown, using the (2) .138-20 × .375" thread cutting screws, (2) lock washers, and (2) flat washers supplied.

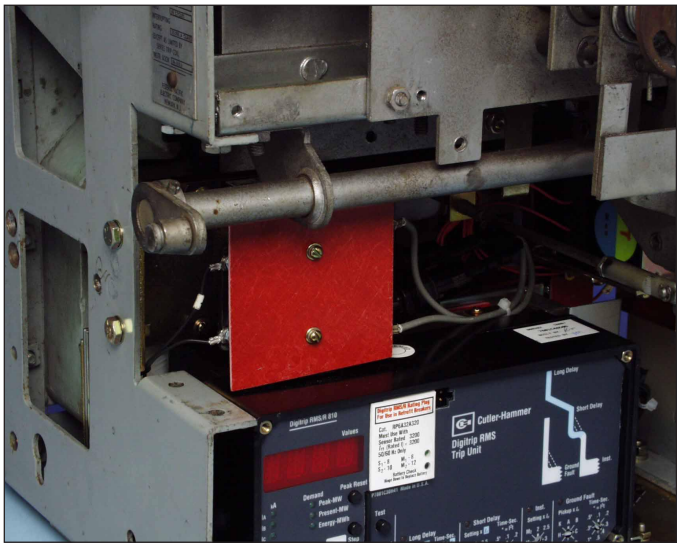

Fig. 36 Insulation Plate Mounted to the CPT

For All Breakers.

J. Align the Trip Unit Assembly with the bottom of the Breaker Frame. Note that the Aux. CT Module Mounting Brackets are "notched" to form a natural guide for the Trip Unit Assembly.

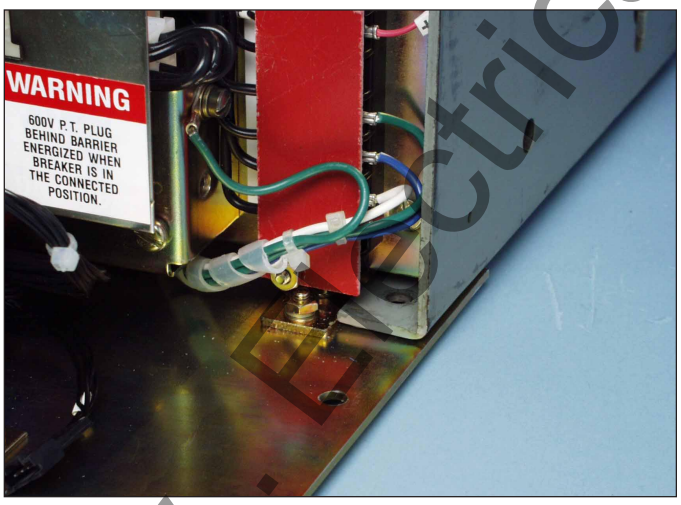

Fig. 37 Alignment of the Trip Unit Assembly and the Bottom Breaker Frame

K. Align the Trip Unit Assembly with the existing holes in the bottom Breaker Frame. Secure the Trip Unit Assembly to the Breaker, as shown, using the (4) .250-20 × .750" screws, (4) lock washers, (8) flat washers, and (4) nuts supplied. Note that the bolts are inserted from the bottom of the Breaker.

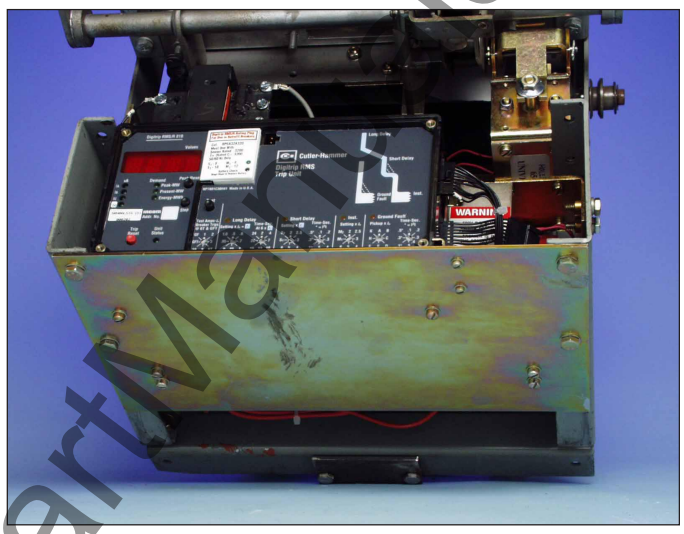

Fig. 38 Trip Unit Assembly Installed in the Breaker

L. Install the Digitrip Retrofit Label on the top Breaker Shelf.

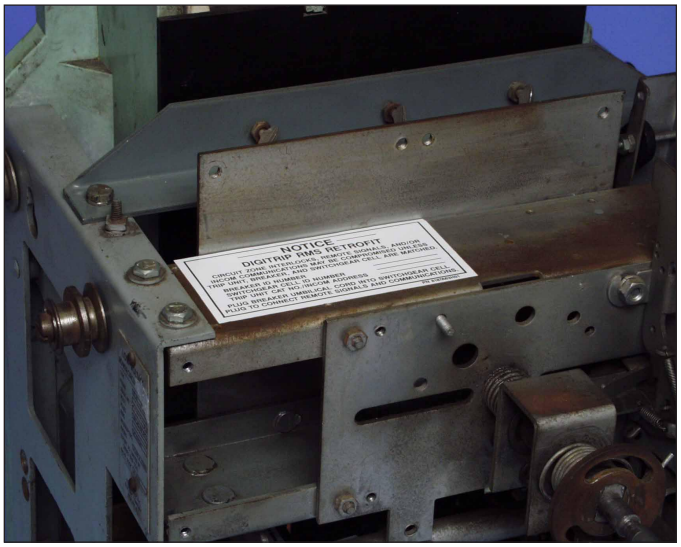

Fig. 39 Digitrip Retrofit Label Installed on the Breaker

For Kits Supplied with a Breaker Mounted CPT Only.

STEP 10: CONNECTING THE LINE SIDE HV WIRES

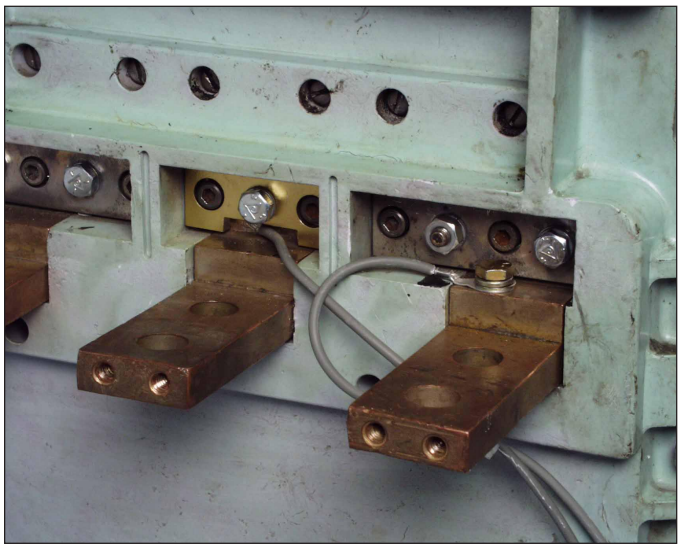

Fig. 40 Overview: Line Side HV Wires Connected to the Top Breaker Stabs

NOTE: The power convention of the FP25 Breakers is normally *Top to Bottom*, meaning the Top Breaker Stabs are on the *Line Side* of the Breaker and the Bottom Breaker Stabs are on the *Load Side*.

The HV Wires from the CPT MUST BE ATTACHED to the *Line Side* of the Breaker. If it is determined that the power flow for the Breaker application is opposite the normal convention, the HV Wires must be attached to the bottom Stationary Contact Assemblies. The bolts used to connect the PT Wires in Step 9-D can be used to connect the HV Wires.

A. Remove and save the Retaining Plate and mounting hardware that secures the Phase 1 or Phase 3 top Breaker Stab.

B. Remove and save the Phase 1 or Phase 3 Breaker Stab.

C. Using drilling plan “D”, drill and tap the Phase 1 or Phase 3 Breaker Stab to accept a .250-20 bolt.

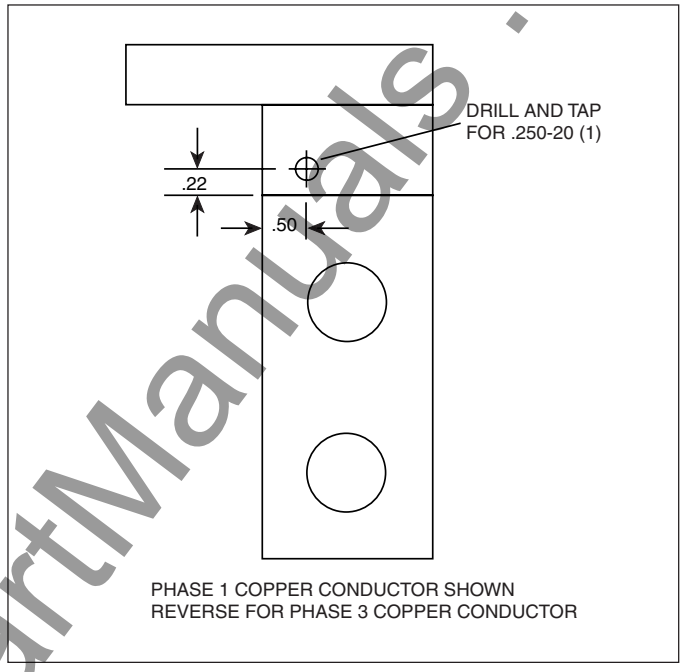

Fig. 41 Drilling Plan “D”

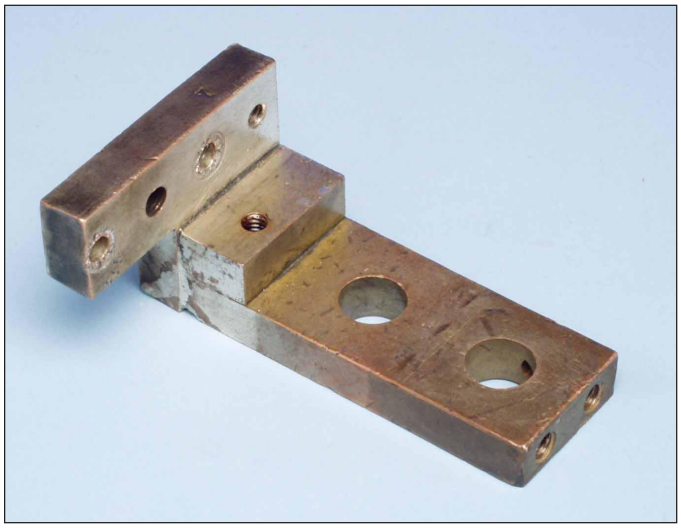

Fig. 42 Drilled and Tapped Breaker Stab

D. Remove the Retaining Plate and mounting hardware that secures the Phase 2 Breaker Stab. Save the mounting hardware but scrap the Retaining Plate.

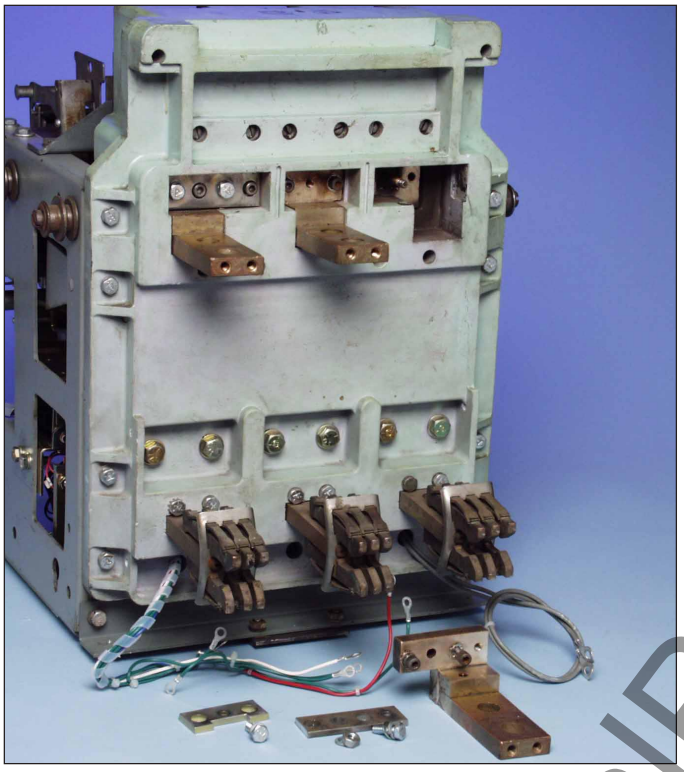

Fig. 43 Breaker Ready for HV Wire Attachment

E. Reinstall the Phase 1 or Phase 3 top Breaker Stab using the original mounting hardware.

NOTE: The *Line Side* HV Wires are longer than necessary and are cut during the following steps. Before cutting the wires, be sure that sufficient length is left so that the connections can be made to the correct Breaker Stabs.

F. Route the Line Side HV Wires to the Phase 1 and 2 or Phase 2 and 3 top Breaker Stabs. Cut each wire to a suitable length for connection.

G. Strip an appropriate length of insulation then attach a .250 ring terminal to each HV Wire.

H. Remove one of the hex cap bolts that secure the Phase 2 Breaker Stab. Connect a HV Wire to the Phase 2 Breaker Stab using the hex cap bolt just removed.

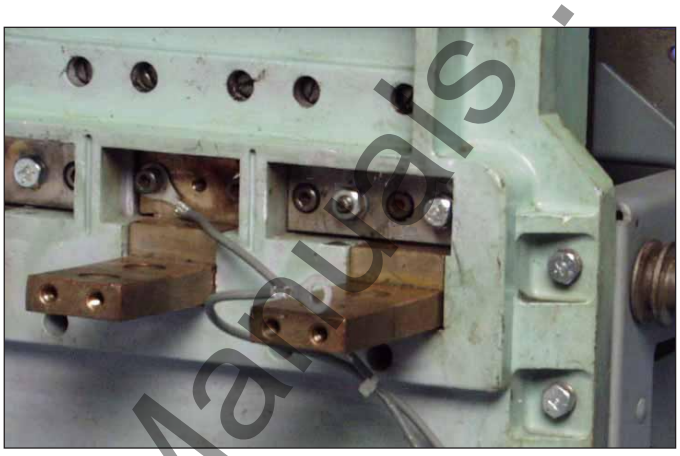

Fig. 44 HV Wire Connected to the Phase 2 Breaker Stab

I. Connect the other HV Wire to the Phase 1 or Phase 3 top Breaker Stab using the (1) .250-20 × .500" bolt, (1) lock washer, and (1) flat washer supplied.

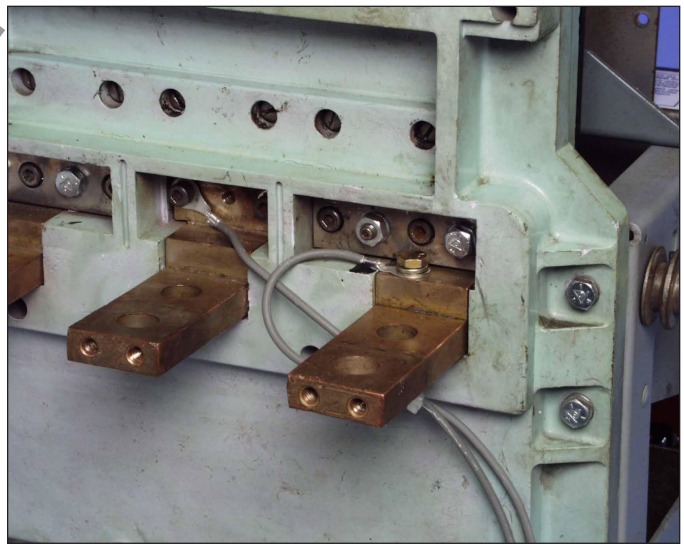

Fig. 45 HV Wire Connected to the Phase 1 Breaker Stab

J. Install the new Retaining Plate on the Phase 2 Breaker using the original mounting hardware removed in Step 10-D.

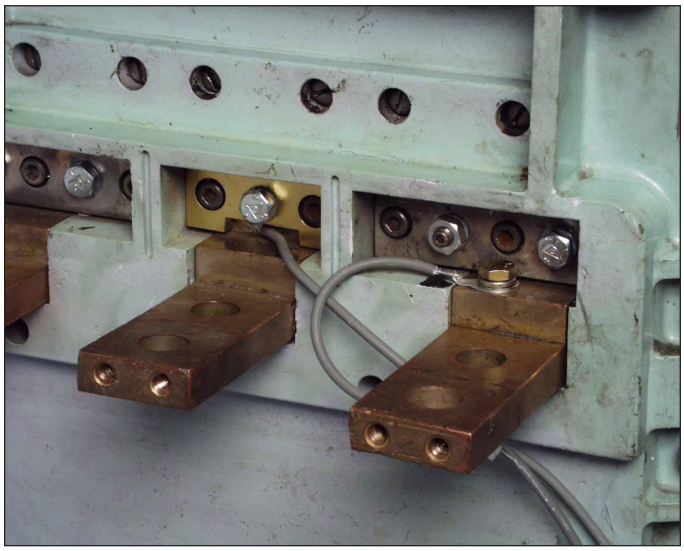

Fig. 46 New Retaining Plate Installed on Phase 2

STEP 11: INSTALLING THE SENSORS

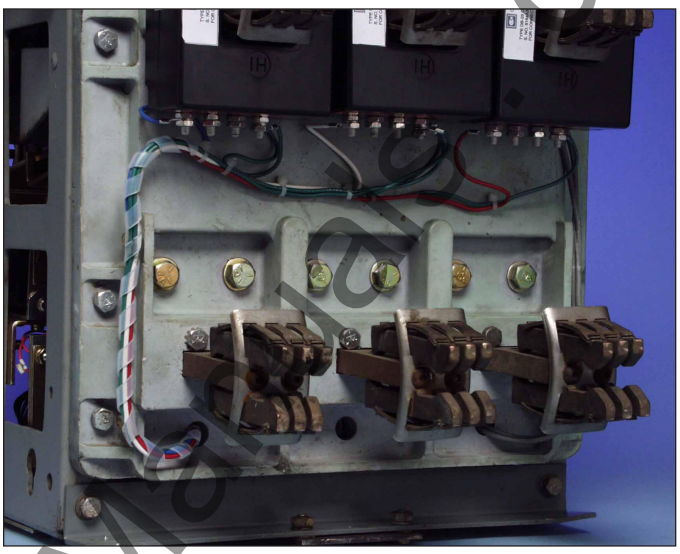

Fig. 47 Overview: Sensors and Sensor Harness Installed on the Breaker

A. Slide a Sensor over each top Breaker Stab, as shown. Note that the Sensors must be installed with the label facing away from the Breaker and the terminals on the bottom.

B. Reinstall the Finger Clusters, removed in Step 2-G.

Fig. 48 Sensors Installed on the Breaker

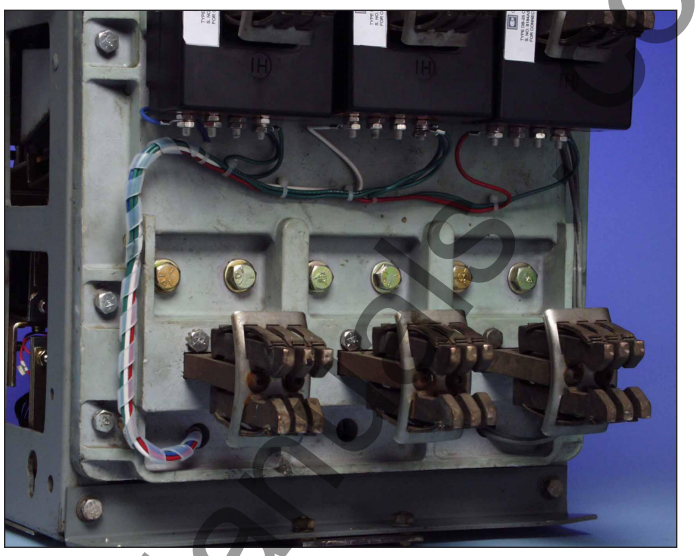

Fig. 49 Sensors Harness Connected to the Sensors

C. Route the Sensor Harness to the Sensors. Connect the ring terminals of the Sensor Harness to the Sensors. Refer to Section 12 of the Retrofit Application Data, supplied with the Retrofit Kit, for detailed wiring specifications.

Depending on the Sensors supplied with the Retrofit Kit, the following Ratings apply.

Table 3 Sensor Taps Rating

Sensor Style No.	*Terminal Com.*	*Amps*
8184A39H01	X1 - X4 =	600 A
	X2 - X4 =	400 A
	X1 - X2 =	200 A

STEP 12: CONNECTING THE EXTERNAL HARNESS AND FINAL WIRING

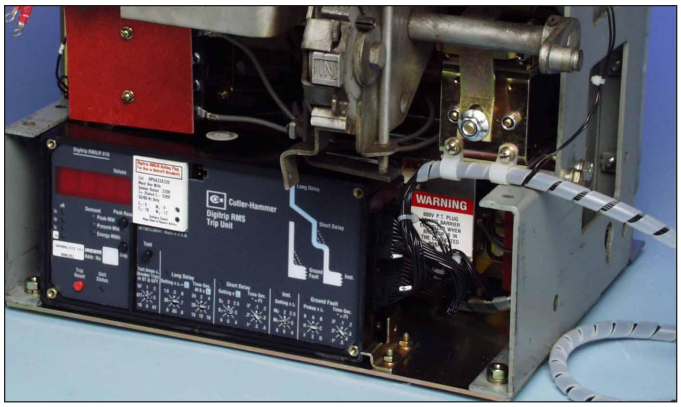

Fig. 50 Overview: Final Harnesses Connected to the Breaker

A. Connect the External Harness to the Trip Unit.

NOTE: For 510 Basic Retrofit Kits, the External Harness is the plug pictured here. It is to be plugged into the right side of the Trip Unit.

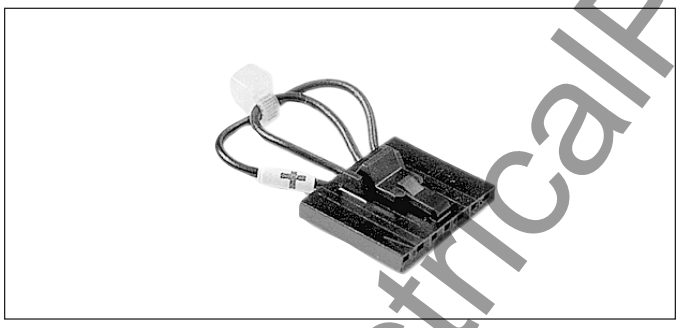

Fig. 51 510 Basic Kit External Harness Plug

B. Secure the External Harness to the DTA Assembly, as shown, using the (2) wire clamps, (2) .164-32 × .312" screws, (2) lock washers, and (2) flat washers supplied.

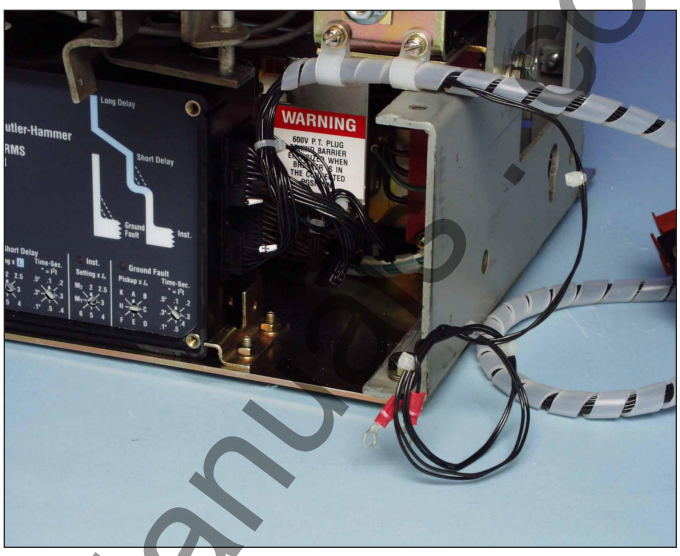

Fig. 52 External Harness Secured to the DTA Assembly

C. *For Kits Supplied with a PT Module Only:* Connect the PT Harness to the External Harness.

For Kits Supplied with an Auxiliary Switch Only.

D. Route the two (2) wires (with ring terminals) from the External Harness up to the middle Breaker Shelf, then across the Shelf to the left side of the Breaker, as shown.

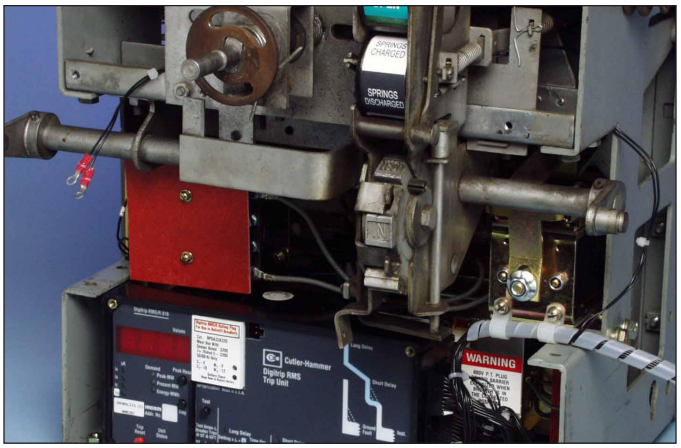

Fig. 53 Routing of the Auxiliary Switch Wires

E. Align the Microswitch with the holes in the Auxiliary Switch Mounting Bracket, as shown. Secure the Microswitch to the Auxiliary Switch Mounting Bracket using the (2) .138-32 × 1.00" screws, (4) flat washers, (2) lock washers, and (2) nuts supplied.

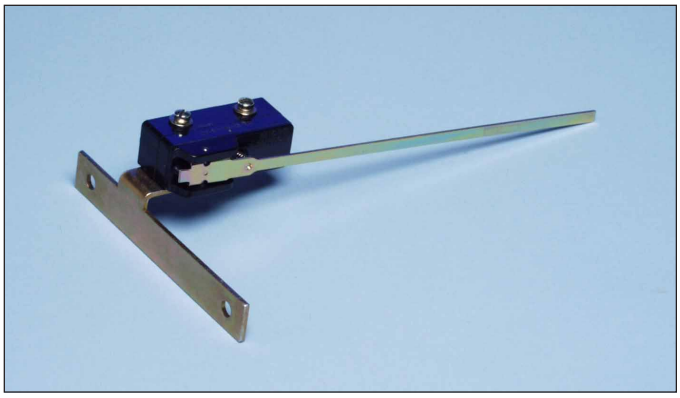

Fig. 54 Microswitch Mounted to the Auxiliary Switch Mounting Bracket

F. Connect the two (2) wires (with ring terminals) from the External Harness to the Auxiliary Switch. Connect one wire to the normally "Closed" terminal and the other wire to the "Common" terminal.

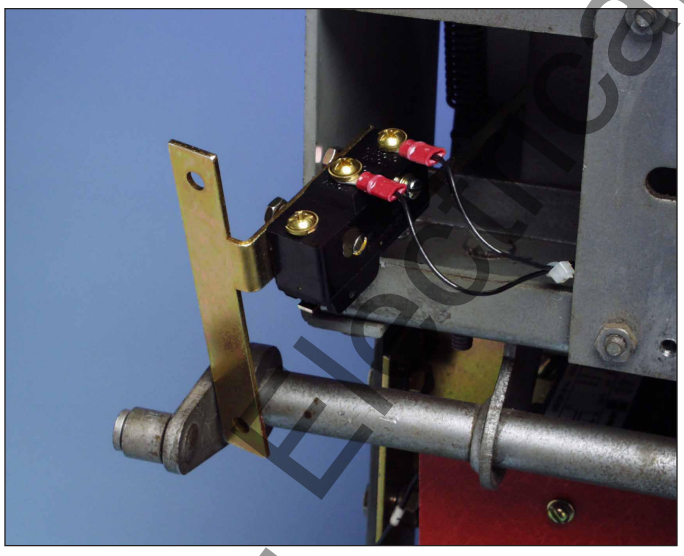

Fig. 55 External Harness Wires Connected to the Auxiliary Switch

G. Align the Auxiliary Switch Assembly with the holes drilled in the top and middle Breaker Shelves in Step 5-B. Secure the Auxiliary Switch Assembly to the Breaker using the (2) .190-16 × .500" thread cutting screws, (2) lock washers, and (2) flat washers supplied. When Installing the Auxiliary Switch Assembly, insure that the Microswitch Arm is above the Breaker Cross Bar.

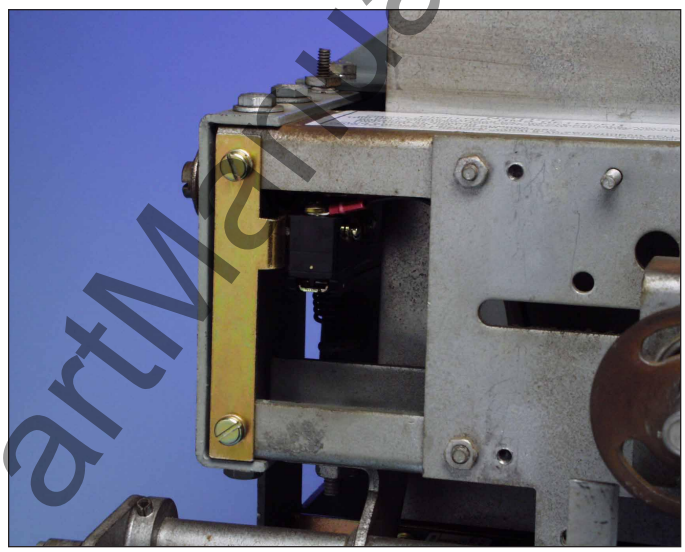

Fig. 56 Auxiliary Switch Installed on the Breaker

For All Breakers.

H. Use the wire ties supplied to secure all harnesses and wires away from moving parts within the Breaker.

STEP 13: REINSTALLING THE ORIGINAL BREAKER FRONT COMPONENTS

Fig. 57 Overview: Original Front Components Installed on the Breaker

A. Using the original mounting hardware, reinstall the Breaker Front Box.

B. *For Kits Supplied with a Breaker Mounted CPT Only:* Attach the appropriate CPT Voltage Warning Label for the Breaker on the outside of the Front Box Cover. If the Retrofitter opts to attach this label in a different position, it must be in a prominent position.

Fig. 58 Supplied CPT Voltage Labels

C. Using the original mounting hardware, reinstall the Breaker Front Box Cover.

D. Using the original mounting hardware, reinstall the Charging Handle.

Fig. 59 Original Front Components Reinstalled on the Breaker

STEP 14: TESTING THE BREAKER

A. Measure the force necessary to trip the Breaker at the point where the Trip Adjusting Screw Finger impacts the Breaker trip Plate. The force necessary to trip the Breaker MUST NOT EXCEED THREE (3) lbs.

B. The Retrofit must be tested using primary injection. Refer to Section 8 of the Instructions for the *Application of Digitrip RMS Retrofit Kits on Power Circuit Breakers* (Publication AD 33-855-2), supplied with the Retrofit Kit, for detailed testing procedures and specifications. For test information specific to the Trip Unit, refer to the IL publication supplied with the Retrofit Kit (see the Pick List for the IL number).

C. While Section 8 of the *Instructions for the Application of Digitrip RMS Retrofit Kits on Power Circuit Breakers* provides the information necessary for testing the Breaker, please keep the following notes in mind when reviewing other sections of the publication.

⚠ CAUTION

WHEN ALL TESTING IS COMPLETE, THE TRIP UNIT MUST BE RESET. FAILURE TO DO SO MAY CAUSE THE BATTERY IN THE RATING PLUG TO RUN DOWN.

NOTES:

1. *For All Kits Other Than 510 Basic.* If testing the Breaker with Short Delay or Ground Fault functions, be sure to either plug in the Cell Harness Assembly or use the Zone Interlock Shorting Plug. Failure to do so may result in shorter than expected trip times.

2. *For 810 and 910 Kits Only.* Without any power applied to the system (neither the 120 volt power supply nor the Aux. Power Module connected), plug the External Harness into the Cell Harness and check the impedance between COM 1 and COM 2. The impedance should be between one (1) and three (3) ohms. If the impedance is not within this range, trace the wiring and examine each connection to assure its integrity.

Confirm that the PowerNet communication wiring is correct by following the procedures detailed in Section 7.4 of the Instructions for the Application of Digitrip RMS Retrofit Kits on Power Circuit Breakers. Note that for 810 and 910 Kits, the impedance between COM 1 and COM 2 should be between one (1) and three (3) ohms.

When testing is complete, disconnect the External Harness from the Cell Harness. Final External Harness connection will be performed later in the Retrofit Process.

For Kits Supplied with a Cell Harness Only.

STEP 15: MOUNTING THE CELL HARNESS

A. The Cell Harness is to be mounted in the Breaker Cell. The connector end is to be mounted on the right front side of the Cell, in a location suitable for connection with the External Harness. The Terminal Blocks can be mounted anywhere space is available in the Cell as long as connection to the External Harness can be made.

B. Route the Cell Harness wiring to keep it away from any moving parts within the Cell Housing.

STEP 16: INSTALLING THE RETROFITTED BREAKER IN THE CELL

⚠ WARNING

DO NOT LEAVE THE BREAKER IN AN INTERMEDIATE POSITION IN THE SWITCHGEAR CELL. ALWAYS LEAVE IT IN THE CONNECTED, DISCONNECTED, OR (OPTIONAL) TEST POSITION. FAILURE TO DO SO COULD LEAD TO IMPROPER POSITIONING OF THE BREAKER AND FLASHOVER, CAUSING DEATH, SERIOUS PERSONAL INJURY, AND / OR PROPERTY DAMAGE.

NOTE: It is the responsibility of the Retrofitter to insure proper Breaker / Cell fit. When racking the Breaker into the Connected position, the Retrofitter MUST FOLLOW BOTH the manufacturer's instructions and the customer's safety standards and procedures for racking a Breaker into the Connected position.

A. With the Breaker in the Open position and the springs discharged, slowly rack the Breaker into the Connected position, making sure there is no interference or binding. The Breaker should rack smoothly and without mechanical interference between any Breaker and Cell parts. The Retrofitter will feel some resistance when the primary fingers connect onto the stabs of the Cell. This is normal.

   However, if any unusual resistance is detected that could be abnormal interference between the Breaker and Cell parts, stop immediately and move the Breaker out of the Connected position. Examine what is causing the interference and correct the situation.

Digitrip Retrofit Kit Installation Components for FP25 Molded Back Plate Breakers

Step	Description	Style No.	Qty.	Comment
Step 3	Copper Connector Parts	9A10010G04	1	
	Copper Connector		3	
	.375-16 × 2.25 Lng. Hex Bolt		6	
	.375 Flat Washer Stl.		12	
	.375 Lock Washer Stl.		6	
	.375-16 Nut Hex Stl.		6	
Step 4	Trip Rod Guide Parts	9A10010G05	1	
	Trip Rod Guide		1	
	.190-32 × .500 Lng. Screw Pan		2	
	.190 Flat Washer Stl.		4	
	.190 Lock Washer Stl.		2	
	.190-32 Nut Hex Stl.		2	
Step 6	DTA Assembly	9A10010G33	1	
	DTA Mounting Parts	9A10010G06	1	
	.250-20 × .500 Lng. Hex Bolt		2	
	.250 Flat Washer Stl.		2	
	.250 Lock Washer Stl.		2	
	Loc-Tite® 243		1	
Step 7	Breaker Mounted CPT Kit	8259A91G05	1	
	HV Wires		2	
	CPT Harness		1	
	.138-20 × .375 Lng. Screw T. C.		2	
	Ring Terminal (.138, .190, .250, .312, .375, .500 - Each Size)		2	
	CPT Mounting Parts	9A10010G20	1	
	Mounting Bracket		1	
	.250-20 × .625 Lng. Hex Bolt		2	
	.250 Flat Washer Stl.		4	
	.250 Lock Washer Stl.		2	CPT Only
	.250-20 Nut Hex Stl.		2	
	.190-32 × .625 Lng. Screw Fil.		4	
	.190 Flat Washer Stl.		8	
	.190 Lock Washer Stl.		4	
	.190-32 Nut Hex Stl.		4	
	.138 Flat Washer Stl.		2	
	.138 Lock Washer Stl.		2	
	Warning Label (208, 240, 480 Volt Each)		1	
Step 8	Trip Unit	See Pick List	1	
	Rating Plug	See Pick List	1	
	Trip Unit Mounting Parts	9A10010G07	1	
	Mounting Platform		1	
	Support Clip R.H.		1	
	Spacer Brass		2	
	.190-32 × 4.00 Lng. Screw Fil.		2	

Step	Description	Style No.	Qty.	Comment
Step 8 (Cont.)	.190 Flat Washer Stl.		4	
	.190 Lock Washer Stl.		2	
	.190-32 Nut Hex Stl.		2	
	.138-32 × .375 Lng Screw Pan.		2	
	.138 Flat Washer Stl.		4	
	.138 Lock Washer Stl.		2	
	.138-32 Nut Hex Stl.		2	
	Aux. CT Module	6503C59G__	1	
	Aux. CT Module Mounting Parts	9A10010G08	1	
	Mounting Bracket R. H.		1	
	Mounting Bracket L. H.		1	
	Spacer Plate		2	
	.190-32 × .500 Lng. Screw Fil.		4	
	.190-32 × .500 Lng. Screw Flat Head		4	
	.190-32 × .375 Lng. Screw Fil.		1	
	.190 Flat Washer Stl.		13	
	.190 Lock Washer Stl.		9	
	.190-32 Nut Hex Stl.		8	
	PT Module Kit	6502C82G01	1	
	PT Module		1	
	Glass Poly Insulation		1	
	.138-32 × .500 Lng. Screw Fil.		2	
	.138 Flat Washer Stl.		4	
	.138 Lock Washer Stl.		2	
	.138-32 Nut Hex Stl.		2	Comm. Only
	Ring Terminal (.190, .250, .312, .375, .500 - Each Size)		3	
	PT Module Mounting Parts	9A10010G09	1	
	.138-32 × .375 Lng. Screw T. C		2	
	.138 Flat Washer Stl.		2	
	.138 Lock Washer Stl.		2	
	PT Warning Label		1	
	Auxiliary CT Harness	6502C84G02	1	
	PT Extension Harness	6502C85G01	1	Comm. Only
	Sensor Harness	See Pick List	1	
Step 9	Trip Assembly Mounting Parts	9A10010G10	1	
	.250-20 × .750 Lng. Hex Bolt		4	
	.250 Flat Washer Stl.		8	
	.250 Lock Washer Stl.		4	
	.250-20 Nut Hex Stl.		4	
	Digitrip Retrofit Label		1	
	Ring Terminal (.375)		3	Comm. Only, From Step 8
	HV Wires		3	
	CPT Harness		1	CPT Only, From Step 7
	.138-20 × .375 Lng. Screw T. C.		2	
	.138 Flat Washer Stl.		2	

Step	Description	Style No.	Qty.	Comment
Step 9 (Cont.)	.138 Lock Washer Stl.		2	CPT Only, From Step 7
	Ring Terminal (.138)		4	
Step 10	HV Wire Connecting Parts	9A10010G11	1	
	Retaining Plate		1	
	.250-20 × .500 Lng. Hex Bolt		1	CPT Only
	.250 Flat Washer Stl.		1	
	.250 Lock Washer Stl.		1	
	Ring Terminal (.250)		2	From Step 7
Step 11	Sensors	See Pick List	3	
Step 12	External Harness	6502C83G__	1	
	External Harness Mounting Parts	9A10010G12	1	
	.164-32 × .312 Lng. Screw Fil.		2	
	.164 Flat Washer Stl.		2	
	.164 Lock Washer Stl.		2	
	Wire Clamp Nylon		2	
	Wire Tie Nylon		12	
	Aux. Switch Kit	9A10010G02	1	
	Microswitch		1	
	Mounting Bracket		1	
	.190-16 × .500 Lng. Screw T. C.		2	
	.190 Flat Washer Stl.		2	Comm. Only
	.190 Lock Washer Stl.		2	
	.138-32 × 1.00 Lng. Screw Fil.		2	
	.138 Flat Washer Stl.		4	
	.138 Lock Washer Stl.		2	
	.138-32 Nut Hex Stl.		2	
Step 13	CPT Voltage Label		1	CPT Only, From Step 7
Step 15	Cell Harness	6503C57G__	1	Except 510 Basics

NOTE: Due to the wide variety of Breakers and the multiple functions of the Retrofit components, some excess hardware may remain when the Retrofit is complete.

Table 4 Torque Values for General Mounting and Screw Size Conversion

Decimal Size (in)	*Standard Size*	*Torque (in-lbs)*	*Torque (ft-lbs)*
.112	4-40	10	0.8
.138	6-32	18	1.5
.164	8-32	36	3.0
.190	10-32	46	3.8
.250	1/4-20	100	8.3
.312	5/16-18	206	17.2
.375	3/8-16	356	29.7
.438	7/16-14	572	47.7
.500	1/2-13	856	71.3

Table 5 Torque Values for Copper BUS Connectors

Decimal Size (in)	*Standard Size*	*Torque (in-lbs)*	*Torque (ft-lbs)*
.250	1/4-20	60	5
.312	5/16-18	144	12
.375	3/8-16	240	20
.500	1/2-13	600	50

Fig. 60 Retrofit Components

A. Sensors
B. Trip Unit
C. Aux. CT Module
D. Direct Trip Actuator (DTA)
E. CPT Transformer
F. Rating Plug
G. HV Wires
H. Aux. CT Harness
I. Sensor Harness
J. External Harness
K. Cell Terminal Block
L. Aux. Switch
M. PT Module
N. CPT Harness
O. PT Extension Harness
P. Copper Connectors
Q. Trip Rod Guide

Notes

Notes

We wish to thank you for purchasing the Digitrip Retrofit System. Digitrip Retrofit Kits are designed and manufactured in America with pride. All the components are engineered to fit the existing Circuit Breaker with little or no modifications to the existing Breaker. However due to the wide variety and vintage of Breakers in use today, an occasional problem may arise. Please contact us with any questions, comments or concerns.

Phone: **1-800-937-5487** Fax. (724) 779-5899

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.

The information, recommendations, descriptions, and safety notations in this document are based on Cutler-Hammer's experience and judgement with respect to Retrofitting of Power Breakers. This information should not be considered to be all inclusive or covering all contingencies. If further information is required, Cutler-Hammer should be consulted.

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