Instructions for Retrofit Kit AK-2A-100

Retrofit Kit Styles 8186A52G19 8186A52G20 8186A52G21

I.L. 33-851-8

GENERAL INFORMATION

The retrofit kit which you have received contains all the necessary parts to convert your AK breaker from a device using an electro-mechanical tripping system to one which will have solid state tripping. To understand the transition, one should be acquainted with the basic components and their functions.

The circuit breaker is tripped on fault conditions by combined operation of three components:

(a) Sensors – Quantity of Three
(b) Amptector – Solid-State Trip Unit – Quantity of One
(c) Actuator – Quantity of One

Schematically this can be shown in Figs. 1 and 3. This makes a very flexible system covering a wide range of tripping characteristics, due to the adjustable amptector and the range of sensors available. All necessary tripping energy is derived from the load current flowing through the sensors, no separate power source is required. The tripping characteristics for a specific breaker rating, as established by the sensor rating, are determined by the continuously variable settings of the Amptector static trip unit. This unit supplies a pulse of tripping current to the actuator which trips the breaker.

SENSORS

The sensors produce an output proportional to the load current, so the breaker continuous current rating within the frame size can be changed simply by changing the tap setting or the sensors. Proper polarities must be maintained.

It is the sensor rating (or tap) that determines the actual current for one (1) per unit current on the amptector.

All sensors are mounted on the rear upper studs on the back of the breaker base.

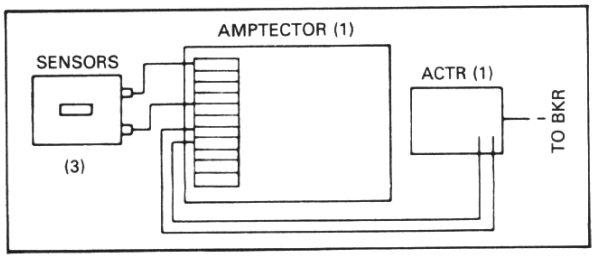

Fig. 1 *Schematic of Solid State Tripping*

WARNING

High voltages are present in a circuit breaker and associated accessories. Before working on a circuit breaker or accessories installed in an electrical system, make sure the circuit breaker is OPEN and there is no voltage present where work is to be performed. The voltages in energized equipment can cause serious injury or death.

Before closing a circuit breaker, make sure that no work is being carried out by personnel on equipment serviced by the circuit breaker. The voltages from energized circuit breakers can cause serious injury or death.

AMPTECTOR

The Westinghouse Amptector IA is a solid state device that provides adjustable overcurrent tripping for the retrofitted AK breaker. Only one amptector is required per breaker; it receives all of its energy from a set of sensors – one mounted on each pole of the breaker. It develops an output for its associated trip actuator when preselected conditions of current magnitude and duration are exceeded.

The Amptector IA for retrofit is supplied with three models of combination of four (4) independent continuously adjustable overcurrent tripping functions:

Long Delay	(L)	Instantaneous	(I)
Short Delay	(S)	Ground	(G)

The following combinations of the amptector are available.

LIG Long Delay and Instantaneous
LSG Long Delay and Short Delay
LSIG Long Delay, Short Delay and Instantaneous

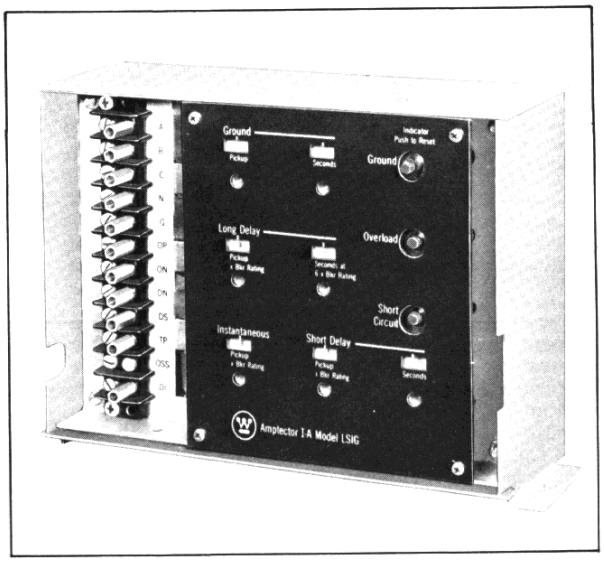

Fig. 2 *Amptector IA*

ADJUSTMENTS

There are a maximum of seven (7) adjustable controls on the Amptector IA, each can be adjusted with a screwdriver through openings in the front face plate, Fig. 2.

1. Long delay current pickup
2. Long delay time
3. Short delay current pickup
4. Short delay time
5. Instantaneous current pickup
6. Ground current pickup
7. Ground delay time

NOTE: The term "pickup" as used here means the magnitude of current at which the amptector timing function begins.

ACTUATOR

When the actuator receives a tripping pulse from the Amptector, it releases a mechanical force to trip the breaker. The actuator is made up of a permanent magnet and a spring (see Fig. 3). When the breaker is open, the cross bar pushes the reset lever. The reset lever moves the plunger out, and the plunger then compresses the spring and pulls the keeper until it contacts the pole pieces of the magnet. Although the magnet cannot pull and reset the keeper against the force of the spring acting on the plunger, it can hold the spring force when the keeper is in contact with the magnet. A current pulse from the Amptector counteracts the effects of the permanent magnet allowing the spring to separate the keeper from the magnet and move the plunger to actuate the trip lever.

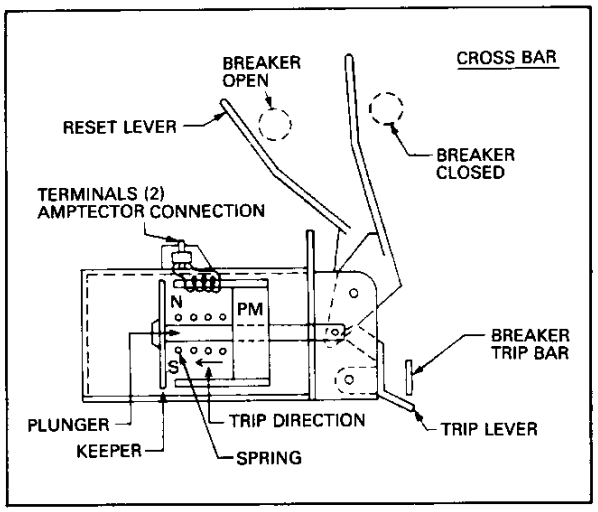

Fig. 3 *Actuator Diagram*

GROUND PROTECTION

All the Amptectors IA in retrofit kits are supplied with a ground element. The ground fault protection is provided by energizing this element with the residual of the currents (from the three properly polarized phase sensors in a 3-phase 3-wire system, or from the three phase sensors plus a neutral sensor in a 3-phase 4-wire system, or from a separate ground current sensor.) The Amptector IA can also be wired so that there is no ground fault protection (see Fig. 4).

The ground pick-up values as shown in Table A are the required currents to initiate the pick-up of the ground element and must be the actual current into the "G" terminal of the Amptector. It must be noted that when testing the Amptector for ground pick-up, the sensors may need to be disconnected in order to obtain the results in the table, otherwise higher currents may be required due to the exciting current lost to the sensors. The secondary test current is injected into a phase terminal say "A" and back out of "G".

Table A — Ground Pick-up Values — Amperes (All Pick-up Values May Vary ± 10%)

Dial Settings	Secondary Current
A	1.0
B	1.5
C	1.9
D	3.0

SERVICING OF THE AMPTECTOR

The Amptector is the intelligence of the overcurrent protection provided by the breaker. This device is made up of many solid state components; the only moving parts are for the adjustments. All internal components and connections, including the printed circuit board, are coated to give effective environmental protection. The Amptector is not field serviceable and should give long trouble-free service.

Each Amptector includes terminal receptacles to permit easy field checking of operation and calibration with an external current source. A specially designed portable test device with a plug to match the Amptector receptacle is available and recommended to provide the utmost in simplicity for checking amptector operation. The tester can be plugged into any 120V, 60 HZ outlet and can provide enough current to check any pick-up calibration. Accurate values for short time pick-up can be checked, to verify proper operation.

If there is any reason to suspect that the Amptector is not operating correctly, it should not be tampered with; since tampering could result in loss of vital overcurrent protection.

If the Amptector is not operating correctly a spare Amptector should be substituted and the questionable unit returned to the factory for service. Amptectors are not field repairable.

MAKING CURRENT RELEASE (DISCRIMINATOR)

All Amptector trip units which do not have instantaneous trip elements (Amptector IA models LS and LSG) are provided with a "making current release" which is referred to as a "Discriminator". This is a circuit in the trip unit which determines at the time of a fault whether or not there has been any current flow in the primary circuit previous to the fault. If there has been no measurable current flow previous to the fault, indicating that the circuit breaker is just being closed (or possibly that a switching device ahead of the breaker has just been closed) and if the primary current flow exceeds approximately twelve times the sensor rating, the trip unit will function instantaneously. If the "Discriminator" circuit determines that there has been a measurable current flow prior to the fault, the instantaneous operation will not occur and the normal short time delay element will take over to delay tripping. The purpose of this unique tripping concept is that selectivity and continuity of service in un-faulted sections of the system can be maintained if there is any need, but if there is no previously operating load on the circuit, the instantaneous function takes over to limit extensive damage which might occur due to a delayed tripping operation.

REQUIREMENTS

Before proceeding with the conversion the following should be noted.

1. Items on hand:

   Ratchet (⅜") socket set with ½", 7/16" sockets straight edge, scriber, center punch, file, screwdriver, hammer.

   Electric drill, ⅛", ¾", twist drills, for ¼-20 taps, 10-32 taps, tap holder, pliers.

   9 or 12 volt dry cell battery.

   Test apparatus, such as Amptector Tester Style No. 140D481G02 or Multiamp tester.

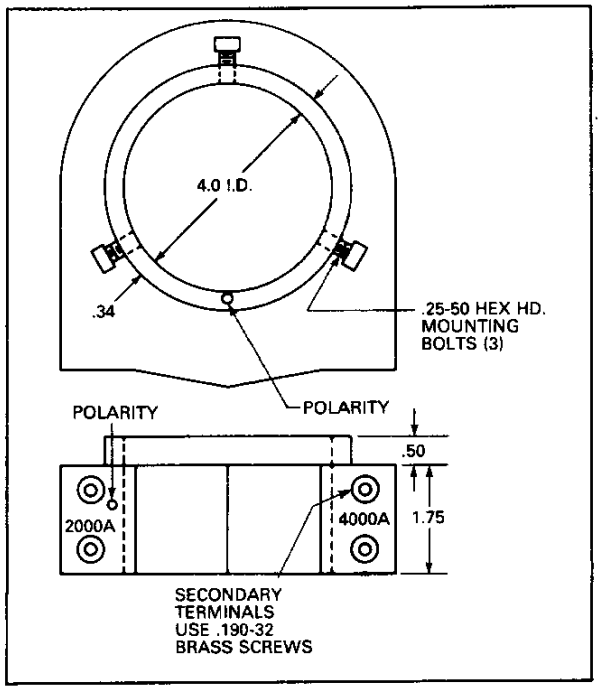

Fig. 7. *Tapped Current Sensor for GE. AK-2A-100 D.O. Breaker*

5. Viewing the breaker from the front, remove the .375-16 x 1.5 hex bolt located on the far left side of the cross bar. Place the reset arm between the bolt head and the lock-washer (Figs. 5 and 6), tighten the bolt being positive that the locking clip is in its previous position.

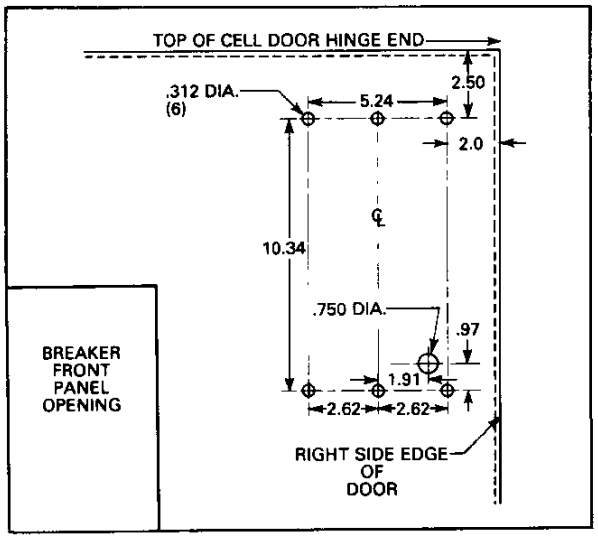

Fig. 8 *Amptector Mounting Details Vertical Mount AK-2A-50/75/100 Front View of Cell Door*

MOUNTING THE AMPTECTOR AND COMPLETING HARNESS WIRING

1. Acquaint yourself with the location of the mounting holes and placement of the amptector, Fig. 8.
2. Facing the front of the cell door scribe a horizontal line 2.5 inches down from the top of the door and parallel to the top edge of the door. Scribe a vertical line 2.0 inches from the top right side of the door and parallel to edge. The intersection of these two lines locates the hole for the screw holding the amptector at the top right side of the door, Fig. 8.
3. From the vertical line measure a distance of 5.24 inches and scribe a parallel line, Fig. 8 and from the horizontal line measure a distance of 10.34 inches and scribe a line parallel to the horizontal line. This now locates the four (4) outer hole locations. Now locate the center line and the two inner holes, Fig. 8.
4. Using the centerline and the left vertical line locate the center of the grommet hole, Fig. 8.

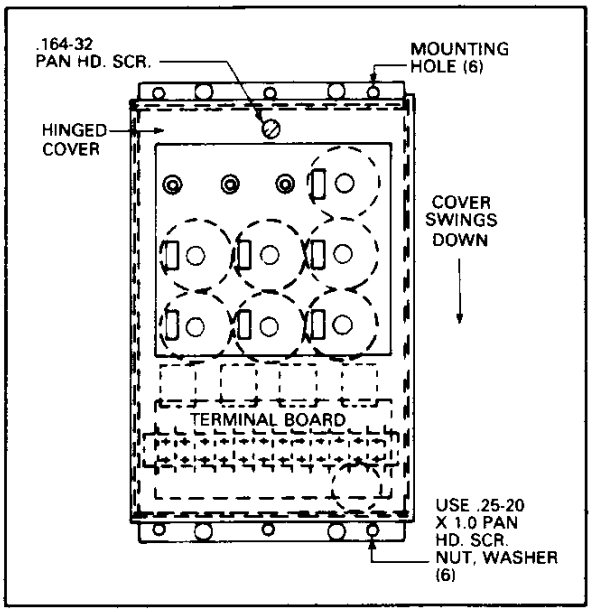

Fig. 9 *Amptector in Vertical Position*

5. Center punch all locations, drill six (6) .312 diameter holes and one (1) .750 diameter hole.
6. Mount the amptector on the door, Fig. 9 using .25-20 x 1.0 pan hd. scr., washer, lockwasher and nut. Finger tighten the nuts on the screws. Place the grommet into the .750 diameter hole.
7. With cell door in the closed position, remove the .164-32 x .375 pan hd. scr. on the amptector cover, see Fig 9, swing the cover downward 180 degrees to expose the terminals on the amptector, Fig. 9.
8. Open the cell door and place the breaker into the cell and in **full disconnect position**.
9. Thread the amptector end leads from the back of the door through the grommet and the amptector. Connect the leads per wiring diagram, Fig. 4.
10. Viewing from the back of the cell door, remove the .25-20 nut and washer from the screw that is below and to the left of the grommet hole. Attach a nylon clamp on the harness and secure with the nut and washer. Fig. 10.

2. Check items received against bill of material as listed for each type of breaker and for proper style numbered kit.

3. Operate the actuator a few times. Alternately pull back on the reset lever (see Fig. 3) and then trip by applying 9 to 12 volts D-C (be sure to use correct polarity) to the terminals.

   NOTE: Arm must be manually reset after each operation.

4. Review the procedure for each type of breaker involved and the sensor tap connections for the various current ratings.

5. Review the photographs, drawings and wiring diagrams to acquaint yourself with the items and location.

6. Arc chutes need not be removed and breaker should be worked on in the upright position.

RETROFIT KIT

All retrofit kits are style numbered and contain the parts necessary to fulfill your requirements, therefore check to see that you have received the styles as ordered. Remove items from box and check against bill of material for appropriate parts.

AK-2A-100 RETROFIT KIT BILL OF MATERIAL

Quantity per Breaker	Description	Style Number
1	Amptector	693C364G01
or 1	Amptector	693C364G02
or 1	Amptector	693C364G03
1	Actuator	693C365G01
3	Sensors 4000 Amperes	8257A69H01
1	Wiring Harness	6502C14G04
1	Hardware Kit	8186A53G07

*Note: Kits contain more hardware than required due to multi-purpose use, check all figures for number and size of hardware.

PROCEDURE

After you have read the requirements and you are familiar with all details, proceed in the following manner:

1. Remove the three electro-magnetic trip units, no copper jumpers required.

MOUNTING THE HARNESS AND SENSORS

1. Acquaint yourself with the wiring scheme, Fig. 4.

2. Check each lug on the harness to ensure they are properly secured to the wires.

3. Place a grommet in the .50 diameter hole located in the lower end of the right hand side of the frame.

4. Thread the sensor end of the harness through the grommet.

   If there is difficulty getting harness through the grommet, remove approximately 18 inches of the harness cover.

5. Remove the finger clusters from the top studs, place the sensors on the studs and secure them by tightening the set screws. See Figs. 5 and 7.

6. Connect the leads to the sensors ascertaining that they are correct according to the wiring diagram and reinstall the finger clusters.

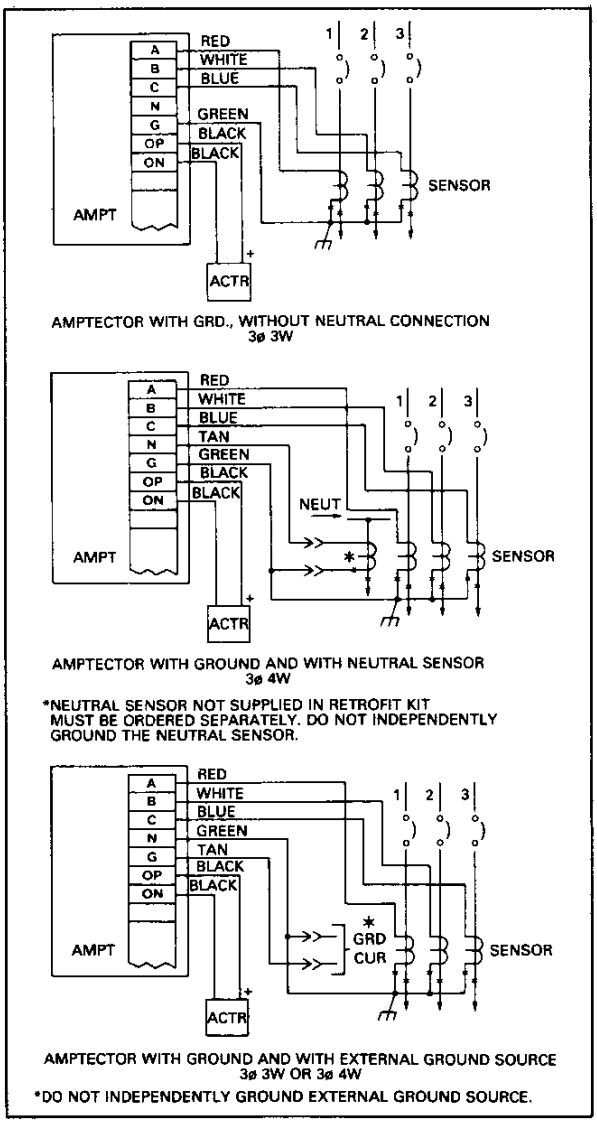

Fig. 4.

7. Bring the amptector end of the harness up towards the front of the breaker. Estimate the amount of harness required for attaching to the retaining bar (steps 8 and 9) and the ground connection, Fig. 5.

8. Facing the front of the breaker remove the bolt on the right hand side holding the retainer bar which holds the arc quencher. Place the nylon connector of the harness on the bolt and reinstall.

   CAUTION: DO NOT OVER TIGHTEN BOLT

9. Directly downward about five inches from the retainer bar and to the right you will locate a .190 hole on the side frame, Fig. 5. Attach both the green colored lead and the harness at this point using .190-32 x .75 fil. hd. scr. nylon clamp washer and nut. This now grounds the sensor star point.

10. The two leads going to the actuator are brought down under motor housing and over to the hole which secures the motor leads, using a nylon tie attach the two leads to the motor leads.

11. Bring the leads directly under the bottom front of the breaker and with a nylon tie attach the lead to the welded clete. Continue with the actuator leads under the left side of the breaker to a position half way between the left side frame and the middle frame. At this point you will find a .190 diameter hole, tap the hole with a .164-32 tap. Secure the actuator leads using .190-32 hardware.

12. Do not attach the actuator leads at this time to the actuator terminal board.

13. Drill and tap a .190-32 hole at the top of the right hand side front frame. See Fig. 5 using a nylon clamp around harness secure with .190-32 pan hd. scr., washer, lockwasher.

PLACEMENT OF THE ACTUATOR

1. Viewing the breaker from the left side, position and assemble trip paddle on breaker trip bar using .25-20 x .75 carriage bolt, trip bar finger, washer and nut. **Do not tighten this assembly.** See Fig. 6.

2. Attach the two actuator leads to the terminal board on the actuator, the leads should be to the left of the actuator housing, Fig. 5.

3. Locate the two (2) .50 holes on the left side of the breaker frame, see Fig. 6. Attach the actuator base to the left side using .375-16 x 1.0 hex bolt, lockwasher, flat washer and nut. The two (2) actuator leads should be located between the left inside frame and the actuator housing.

4. Move the trip paddle assembly so that the paddle is located under the left side of the flange nut (viewing from the front) and secure the trip assembly to the bar. See Fig. 6.

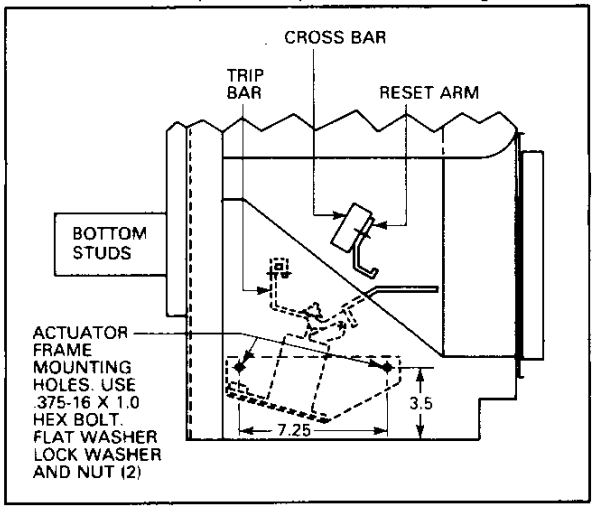

Fig. 6. *Left Side View*

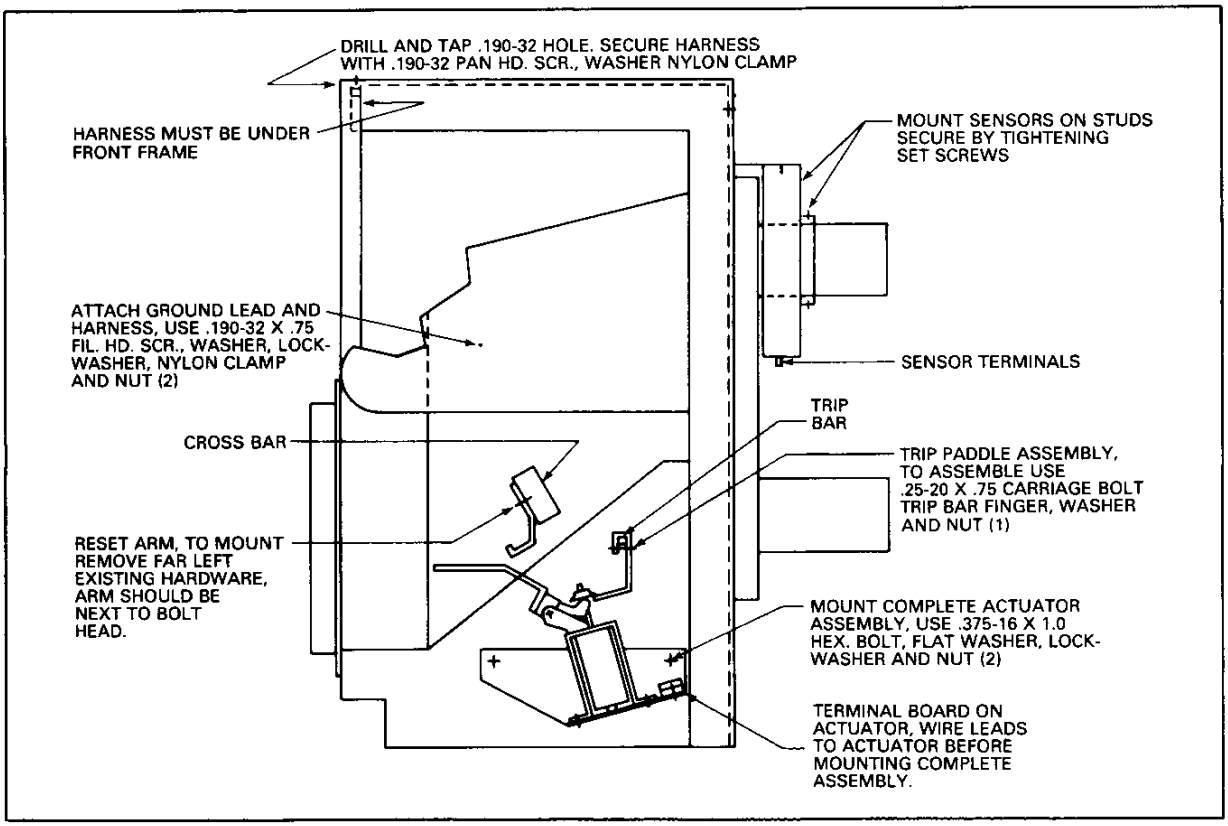

Fig. 5. *Left Inside View of Breaker Looking Through From Right Side.*

11. At this point estimate the amount of harness required between the top of the right front frame of the breaker and the harness clamp which will be located at the left top amptector securing screw, Fig. 10. There should be enough harness length for the breaker to be in **full connect position**.

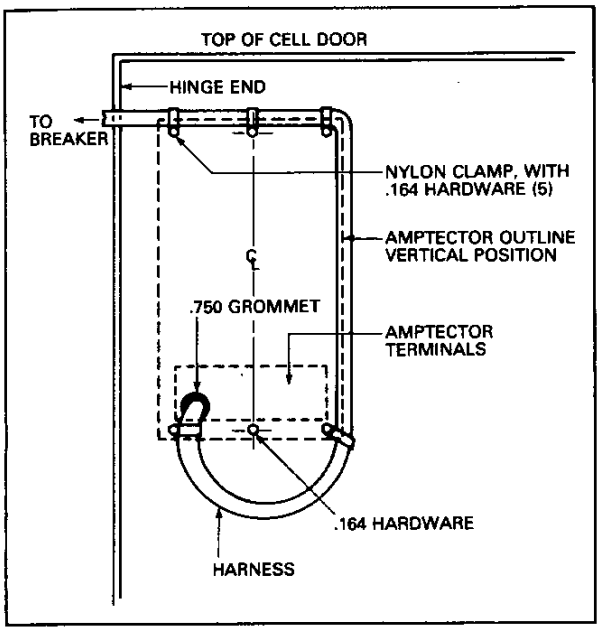

Fig. 10 *Amptector Wiring Harness Mounting Details Rear View of Cell Door AK-2A-50/75/100*

12. Once the proper length is established, place a nylon clamp on the harness at this point. Remove the .25-20 nut and washer, place the nylon clamp on the screw and secure with washer and nut.

13. Moving from left to right, place another nylon clamp on the harness so it lines up with the far right screw, secure the harness. Place another nylon clamp at lower right bottom screw and secure. There should be loop between this point and the location in step 10.

TEST

CAUTION: BREAKER MUST BE IN FULL DISCONNECT POSITION.

Using the amptector test kit or a power supply.

1. Check operation of the amptector/actuator system sufficient number of times to insure proper operation.

2. Set the amptector dials to the required settings, and verify that the amptector is in calibration.

3. Record the settings to the side of the amptector for a permanent record.

WARNING

Circuit breakers applied in systems with available fault currents in excess of their interrupting/withstand capabilities can cause severe personal injury or death. To avoid misapplication, the interrupting/withstand rating of the breaker together with the maximum possible settings of the trip unit used, must equal or exceed the maximum fault current available in the applied system.