Instructions for Retrofit Kit AK-2A-25

Retrofit Kit Styles 8186A52G22 8186A52G23

I.L. 33-851-1A

NOTICES FOR COMMERCIAL GRADE COMPONENTS

The descriptions and specifications for the products described herein are provided for general commercial use and are not applicable for use in a nuclear power plant. Additional certification may be available upon specific request to qualify these products for use in safety-related applications in a nuclear facility.

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) RK – Solid-state Trip Unit – Quantity of One
(c) Actuator – Quantity of One

Schematically this can be shown in Figs. 1 and 2. This makes a very flexible system covering a wide range of tripping characteristics, due to the adjustable RK unit 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 RK 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 RK.

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

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.

ACTUATOR

When the actuator receives a tripping current from the RK, it releases a mechanical force to trip the breaker. The actuator is made up of a permanent magnet and a spring (see Fig. 2). 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 tripping current from the RK unit counteracts the efforts of the permanent magnet allowing the spring to separate the keeper from the magnet and move the plunger to actuate the trip lever.

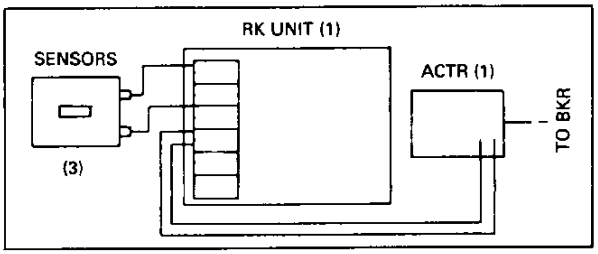

Fig. 1. *Schematic of Solid State Tripping*

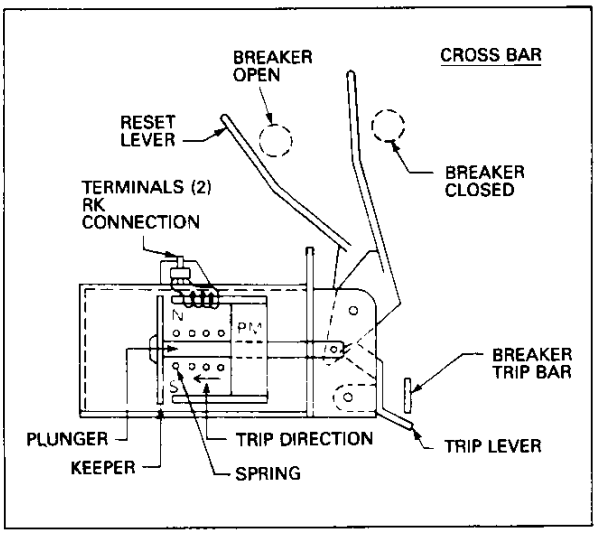

Fig. 2. *Actuator Diagram*

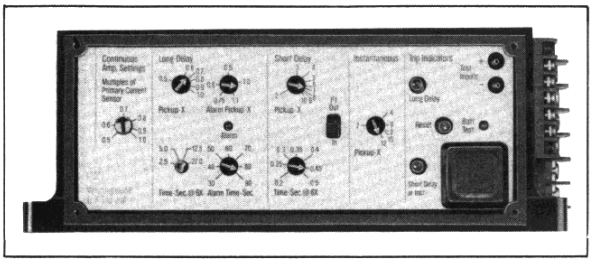

Fig. 3 *RK Unit*

RK UNIT

The Westinghouse RK unit is a solid state device that provides adjustable overcurrent tripping for the retrofitting of AK breakers.

Only one unit is required per breaker; it receives all 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 RK is supplied in two (2) models of a combination of three (3) independent continuously adjustable overcurrent tripping functions; Long delay (L), Short delay (S), and Instantaneous. The combination of RK unit are:

LS – Long Delay and Short Delay
LSI – Long Delay, Short Delay and Instantaneous

Adjustments:

There are a maximum of eight (8) adjustable controls on the RK with LSI and seven (7) on the LS, all adjustable with a screwdriver after removal of the protective cover.

(1) Continuous Current Setting (Cont. Adj.) 0.5x to 1.0x External Sensor Rating
(2) Long Delay Current Pickup (Cont. Adj.) 0.5x to 1.0x Cont. Current Rating
(3) Long Delay Time (Discreet Adj.) 2.5, 5.0 12.5 and 27.0 Sec. @ 6x
(4) High Current Alarm Pickup (Relay Contact) (Closure of Form C Contacts Min. of 40% Sensor Rated Current Required)
(5) High Current Alarm Time 30-90 Sec. Delay
(6) Short Delay Current Pickup (Cont. Adj.) 2x to 10x
(7) Short Delay Time (Cont. Adj.) 0.18 Sec. to 0.5 Sec. @ 6x
(8) Instantaneous Current Pickup (Cont. Adj.) 2x to 12x

In addition to the standard LSI and LS settings the RK unit has several other added features.

(A) High Load Alarm Contact, which closes after a selected delay time of 30-90 sec. when the High Current Alarm pickup current reaches a predetermined value and resets when the current recedes below the setpoint. Adjustable from 0.75 to 1.1 of the long delay pickup, it provides an early warning on a possible trip out.

(B) I^2t Switch provides options in I^2t slope in fixed short time delay or short-time delay of 0.085 sec. @ 6x.

(C) LED Indicators – for overload and short circuit fault trip indication, lithium battery powered.

(D) Reset Button – for LED indicator and battery check.

MAKING CURRENT RELEASE (DISCRIMINATOR)

All RK trip units which do not have an instantaneous trip function (LS version) 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.

SERVICING OF THE RK

The RK unit is the intelligence of the overcurrent protection provided by the breaker. It is made up of many solid state components; the only moving parts are for setpoint adjustments. All internal components, including the printed circuit board are coated to give effective environmental protection.

Each RK unit includes two (2) test pin terminals for field checking of operation and calibration. A specially designed portable test device with a plug to match the receptacle on the front of the unit is available and recommended for verifying the functional operation of the RK unit. The tester can be plugged into any 120V, 60 HZ outlet and can provide enough current to check any pickup and time calibration.

If there is any reason to suspect that the RK unit is not operating correctly, it should not be tampered with; tampering can result in loss of vital overcurrent protection. If the unit is questionable it should be substituted with a new unit and returned to the factory for service. **NOTE: RK UNITS ARE NOT FIELD REPAIRABLE.**

REQUIREMENTS

Before proceeding with the conversion the following should be noted.

1. Items on hand:

   Ratchet (⅜") socket set with ¼", ⅜", ½" sockets, straight edge, scriber, center punch, file, screwdriver, hammer.
   Electric drill, ¼", ⅜", ½" twist drill.
   28 Vdc volt source.
   Test apparatus, RK unit Tester S#1232C08G01.

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. 2) and then trip by applying 28 Vdc (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.

MOUNTING THE HARNESS AND SENSORS

1. Acquaint yourself with the wiring scheme, see Fig. 8.
2. Check each lug on the harness to ensure they are properly secured to the wires.
3. Connect colored wires to the RK unit per wiring diagram.
4. Connect the black wires to the actuator using .38 nut, lock and flat washers, being careful to observe polarity mark on one wire.

   Attach the ground lead to the screw holding the actuator-spacer and control relay Figs. 5 and 6. This now grounds the sensor star point.
5. Thread the sensor end of the harness through the opening between the frame and support panel on the right side of the breaker.

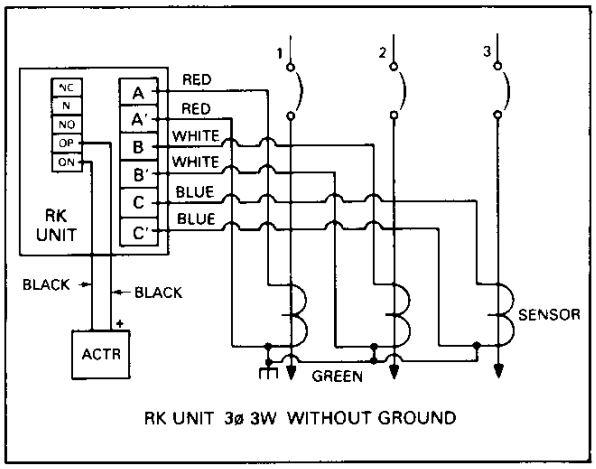

Fig. 8 *Wiring Diagram*

6. Remove the finger clusters from the three upper stabs, place the sensors on the studs Fig. 5. Now re-install the finger clusters.
7. Connect the wire ends to the sensors ascertaining that the polarities are correct.
8. Secure the wiring harness to the back frame using the nylon clamp, .190-32 hardware.
9. Secure the harness to the bracket holding the RK unit with nylon clamp and, .190-32 hardware.

TEST

NOTE: The amptector test sets identified by style 140D481G02 or 140D481G03 should not be used to check calibration of the RK trip units. These test units are not regulated well enough to provide an undistorted waveform to the trip unit. All timing values will not be consistent with the time-current curve.

Using the RK unit test kit S#1232C08G01:

1. Check operation of the RK/Actuator system sufficient number of times to insure proper operation.
2. Set the RK dials to the required settings and verify that the RK is in calibration.
3. Record the settings on the side of the RK unit 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.

5. Review the illustrations to acquaint yourself with the items and location, especially the right and front side view of the breaker Figs. 4, 5, 6 and 7.

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-25 RETROFIT KIT BILL OF MATERIAL

Quantity per Breaker	Description	Style Number
1	LSI RK Unit	1375D25G02
or 1	LS RK Unit	1375D25G01
1	Actuator	693C370G02
3	Sensors Multi-Current (200-400-600 Amperes)	8257A65H01
1	RK Mounting Bracket	6502C11H01
1	Wiring Harness	6502C13G01
3	Copper "Z" Jumpers	8209A64H01
1	Hardware Kit	8186A53G05

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

PROCEDURE

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

1. Remove the three (3) electro-mechanical trip units.

2. Place the 2.0" × 2.38" × .25" "Z" copper connector over top of the upper stationary and lower stationary terminals, lining up the holes. Secure connector using .375-16 × 1.0 hex bolt, washer and lockwasher. See Fig. 4.

PLACEMENT OF ACTUATOR

If the breaker is electrically operated:

Step 1: Remove the two screws holding the control relay, do not remove relay allow it to lie on the platform.

Step 2: Assemble trip paddle on breaker trip bar using 25-20 × .75 carriage bolt trip bar finger and elastic nut, do not tighten nut. Fig. 5

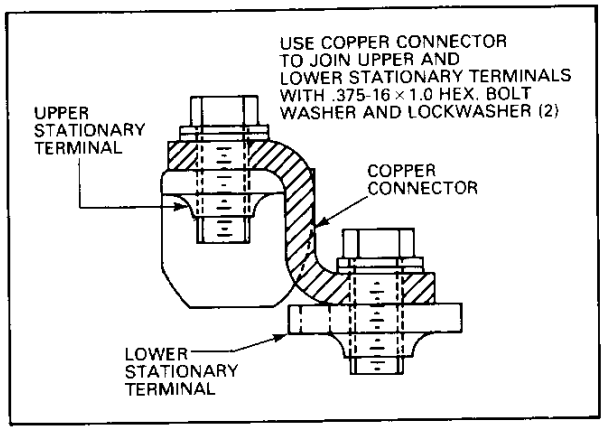

Fig. 4 *Connecting Upper and Lower Stationary Terminals*

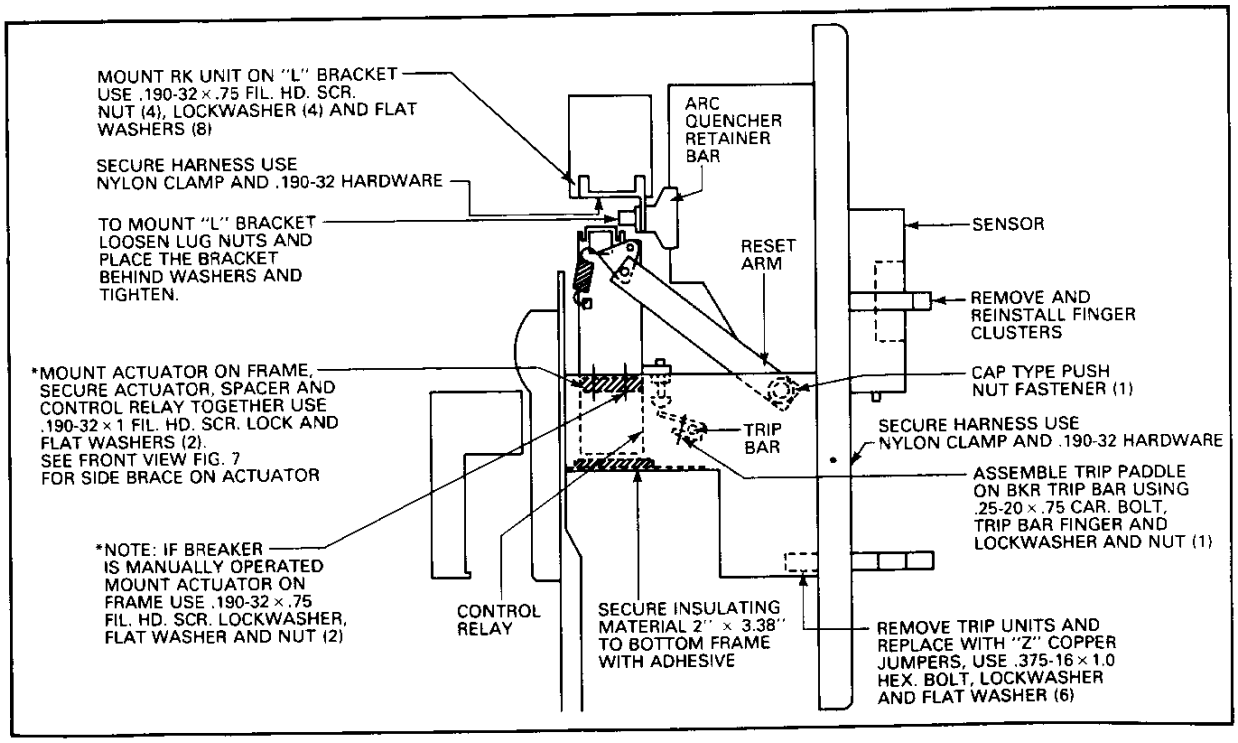

Fig. 5

Step 3: Position the actuator above the holes that held the control relay, slide the bottom of the reset arm on the .50 shaft on the right side of breaker, and attach the cap type push nut fastener. Fig. 5

Step 4: Place the insulating material 2" × 3.38" under where the terminals of the control relay will be. Fig. 6. Secure with adhesive.

Step 5: Position the ½" × 1⅝" spacer beneath the holes under the actuator. Slide the control relay over so that the holes match those of the spacer. Fasten the actuator, spacer and control relay with the .190 - 32 × 1 field screws and washers. Figs. 4 and 5.

If the breaker is to be manually operated Steps 4 and 5 are not required. Secure actuator to frame Fig. 5. Use .190-32 x .75 Fil. Hd. Scr., lockwasher, flat washer and nut.

Step 6: Secure the cross brace between the actuator and the existing .25-20 × ⅝" phillips head screw located on top right of the front panel, using a .25-20 nut. See Fig. 6.

Step 7: Move the assembled trip paddle to line up directly under the trip adjustment screw on the actuator. Spacing between the trip paddle and trip adjustment screw is approximately ⅛" with breaker in closed position. See Fig. 5.

Step 8: Close breaker manually, using a 28 Vdc source, check tripping and reset functions of actuator, repeat numerous times to verify proper functioning. It may be necessary to reset trip adjustment screw for proper setting of the actuator tripping.

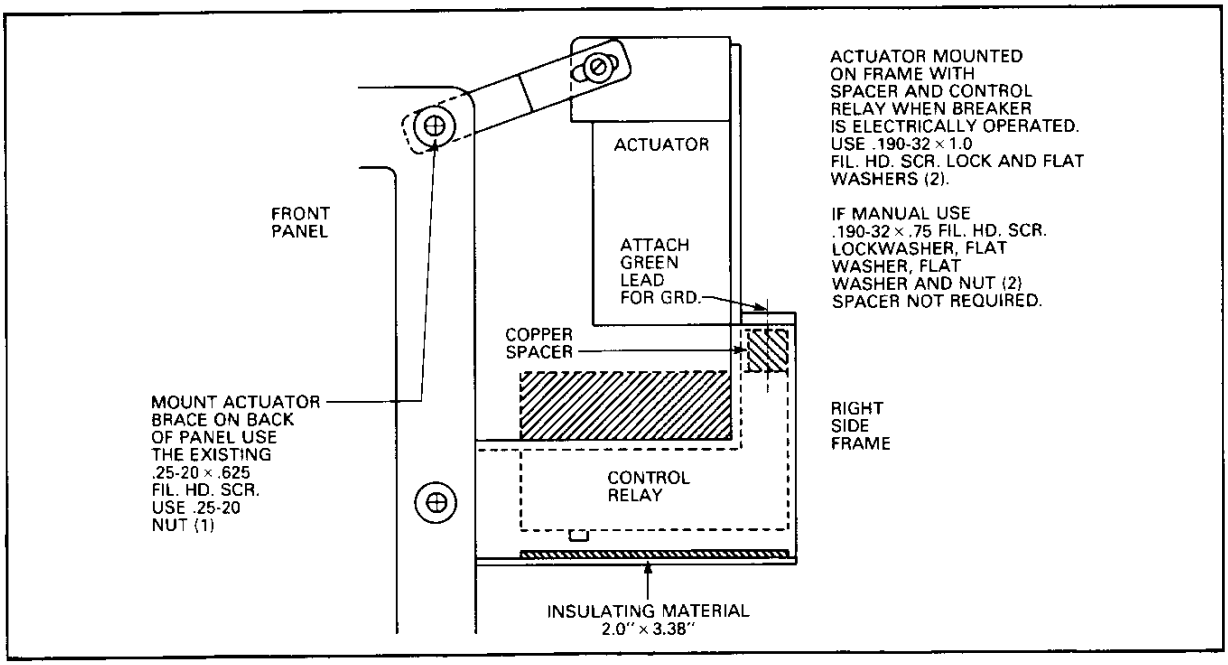

Fig. 6

MOUNTING THE RK UNIT

1. Loosen the two lug nuts Fig. 7 (which are located in front of the arc quencher) enough to allow the mounting bracket to be placed behind the washers. Tighten the lug nuts to firmly hold the bracket.

2. Secure the RK unit to the bracket using the .190-32 × .375 Fil. Hd. Scr., washers, lockwasher and nut, Fig. 5. and 7.

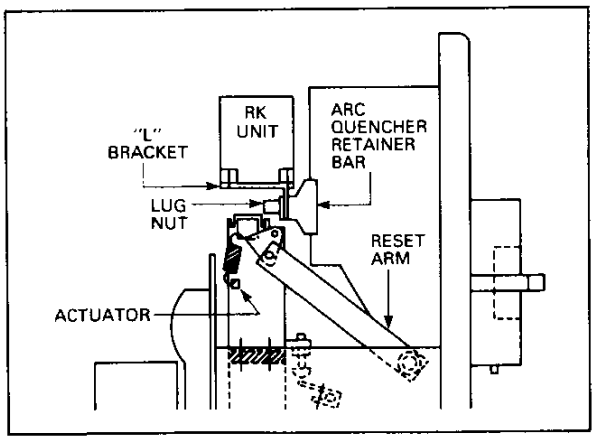

Fig. 7

MOUNTING THE HARNESS AND SENSORS

1. Acquaint yourself with the wiring scheme, see Fig. 8.
2. Check each lug on the harness to ensure they are properly secured to the wires.
3. Connect colored wires to the RK unit per wiring diagram.
4. Connect the black wires to the actuator using .38 nut, lock and flat washers, being careful to observe polarity mark on one wire.

   Attach the ground lead to the screw holding the actuator-spacer and control relay Figs. 5 and 6. This now grounds the sensor star point.
5. Thread the sensor end of the harness through the opening between the frame and support panel on the right side of the breaker.

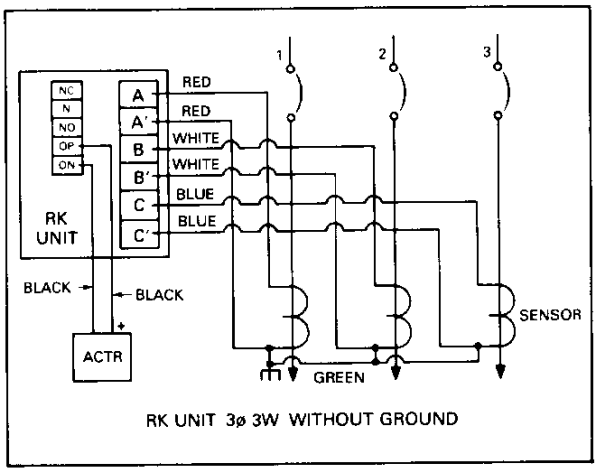

Fig. 8 *Wiring Diagram*

6. Remove the finger clusters from the three upper stabs, place the sensors on the studs Fig. 5. Now re-install the finger clusters.
7. Connect the wire ends to the sensors ascertaining that the polarities are correct.
8. Secure the wiring harness to the back frame using the nylon clamp, .190-32 hardware.
9. Secure the harness to the bracket holding the RK unit with nylon clamp and, .190-32 hardware.

TEST

NOTE: The amptector test sets identified by style 140D481G02 or 140D481G03 should not be used to check calibration of the RK trip units. These test units are not regulated well enough to provide an undistorted waveform to the trip unit. All timing values will not be consistent with the time-current curve.

Using the RK unit test kit S#1232C08G01:

1. Check operation of the RK/Actuator system sufficient number of times to insure proper operation.
2. Set the RK dials to the required settings and verify that the RK is in calibration.
3. Record the settings on the side of the RK unit 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.