INSTRUCTION MANUAL

For

PROTECTIVE RELAY TEST SET

MODEL SR-76A

SERIAL NO.

It is essential that this instruction book be read thoroughly before putting the equipment in service.

Part _ 12438
Rev. 2

IMPORTANT

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TABLE OF CONTENTS

TABLE OF CONTENTS Continued

TABLE OF CONTENTS Continued

SECTION **PAGE**

This table lists alphabetically by type, relays covered by procedures in this manual.

THEORY OF OPERATION

Multi-Amp Model SR-76A is housed in two heavy-duty formica enclosures, each equipped with carrying handles and removable hinged covers which protect instruments and controls during transportation and storage. A single multiple conductor cable with screw-in plugs on each end is provided to interconnect the two sections. Facilities are incorporated so that up to four independent outputs can be obtained simultaneously.

The control section incorporates the main transformer load and the five ampere DC current output, which is used for testing DC targets, operation indicators and seal-in units. This section also contains the primary controls of the test set along with the solid state digital timer. The auxiliary section contains all other outputs of the test set.

Model SR-76A is designed so that the main control section can be used independently from the other section for the convenience in testing overcurrent relays and similar simple devices. To obtain the outputs from the smaller section, the two sections must be interconnected.

DESCRIPTION OF CONTROLS AND INSTRUMENTATION

CONTROL SECTION

The Control Section of Model SR-76A comprises two output channels of the test set; one is controlled by the large AC control knob and the other is controlled by the smaller DC or VERNIER knob. The following is a description of the controls and instrumentation in the control section.

Input Line Cord	The test set is equipped with a standard line cord which is permanently mounted through the panel. A bracket is mounted in the lid for easy storage of the line cord. The nameplate should be checked for verification of input voltage before connecting the line cord to the source of power.
POWER ON/OFF Switch	Functions as main input switch for the test set.
POWER ON Light	Indicates when the POWER ON/OF Switch is in the ON position and that input power to the test set is available.
INITIATE Button	The INITIATE button serves to start operation of the test set. An internal light indicates whenever the test set is initiated. NOTE: Refer to the "NOTE" in the INITIATE CONTROL circuit section for discussion on use of INITIATE button.
EXT. INITIATE Jack	The test set can be initiated from a remote location by closing a circuit plugged into the EXT. INITIATE jack.
RELAY CONTACTS Binding Posts	Binding posts where the trip circuit contacts of electromechanical relays or solid state relays not utilizing an SCR are connected.
S.C.R TRIP Binding Posts (Red +, Black -)	Binding posts where the SCR trip circuit of solid state relays is connected.

WARNING

Care must be exercised to avoid applying potential to the RELAY CONTACTS OR SCR TRIP binding posts. Applying potential can result in damage to the timer, as well as damaging the tone generator circuit.

TONE/CONTINUITY Switch	A CONTINUITY light or TONE generator can be used to monitor contact action or circuit continuity, when the INITIATE CONTROL lever is in the CONTINUITY position. When the TONE generator is used, the CONTINUITY light does not operate.
CONTINUITY Light	A low voltage circuit is used to monitor contact action or circuit continuity.

Timer — Used to measure the elapsed time of operation of the device under test. The Timer is equipped with a CYCLES/SECONDS Switch for selection of counting mode as well as a switch for use in selection of the range when in the seconds mode. Additionally, a RESET button is provided to reset the timer, initiate circuitry and display.

INITIATE CONTROL Circuit:
The control circuit of model SR-76A provides facilities for observing contact action by use of a CONTINUITY light or a TONE generator, as well as for the timing of devices with normally open (NO) or normally closed (NC) contacts, or with an SCR trip circuit. Operation of the control circuit is determined by the INITIATE CONTROL Switch, which is divided into two sections...knob and lever. A description of each section follows:

Lever Section — In order to eliminate changing test leads, this switch connects the RELAY CONTACTS binding posts to three different circuits. A relay's trip circuit can be connected and by simply using this switch, its contact action can be monitored, the timer can be stopped, or DC can be applied to the target and seal-in unit.

D.C.: In this position, the RELAY CONTACTS binding posts are connected in parallel with the 0-5A D.C. output binding posts. The D.C. output can be used to test the relay's target and seal-in unit.

The Knob Section of the switch must be in either the N.O. MOM. or N.O. MAINT. position in order to obtain a D.C. output. The timer will not run and closure of the contacts of the device under test will not de-energize the test set.

CONT: In this position the RELAY CONTACTS binding posts are connected to the continuity circuit. Therefore, contact action can be observed by the continuity light or by the tone generator.

TIMER: In this position, the RELAY CONTACTS binding posts or SCR TRIP binding posts are used in conjunction with the Knob Section of the switch to control the operation of the digital timer.

NOTE: When the lever is in the TIMER position, it is necessary to reset the digital timer by depressing the RESET button on the timer before the test set can be INITIATED. Therefore, should the test set fail to INITIATE upon depressing the INITIATE button, reset the timer and then re-initiate. If the timer still fails to INITIATE, check the NORMAL/DROPOUT Switch which is located in the auxiliary section and make sure it is in the NORMAL position. When the lever is in either the CONT. or D.C. position, it is normally not necessary to depress the RESET button to re-initiate the test set; however, occasionally, it may be necessary.

Knob Section

N.O. MOM. (Normally Open Momentary):

When the device under test has normally open contacts which are connected to the RELAY CONTACTS terminals, the outputs of the test set are energized by depressing the INITIATE button. The selected outputs will remain energized as long as the INITIATE button is held depressed or, if the Lever Section is in the TIMER position, until the contacts of the device under test close.

N.O. MAINT. (Normally Open Maintained):

The function of this position is exactly the same as above except that the INITIATE button only needs to be depressed momentarily to lock-in a circuit which maintains the output of the test set. If the Lever Section is in the TIMER position, the timer will stop and the output of the test set will de-energize upon contact closure of the device under test.

NC.C. MOM. (Normally Closed Momentary):

When the device under test has normally closed contacts which are connected to the RELAY CONTACTS terminals, the outputs of the test set are energized by depressing the INITIATE button. The selected outputs will remain energized as long as the INITIATE button is held depressed or, if the Lever Section is in the TIMER position, until the contacts of the device under test open.

N.C. MAINT. (Normally Closed Maintained):

The function of this position is exactly the same as the N.C. MOM. position except that the initiate button only needs to be depressed momentarily to lock-in a circuit which maintains the output of the test set. If the Lever Section is in the TIMER position, the timer will stop and the output of the test set will de-energize when the contacts of the device under test open.

0-A.C. Control Knob

This knob controls the main A.C. output of the test set.

A.C. Output Terminals

The output controlled by the main A.C. control knob is available at the terminals located at the bottom of the Control Section. There is one common terminal and five output ranges. Each range can be used either as source of AC voltage or AC current. Each range is capable of supplying the indicated current, provided the voltage is sufficient to push the current through the impedance of the load circuit. Where the voltage is sufficient to "push" higher than rated current through the impedance of the load circuit, the current ratings are designed to be overloaded for short durations. For overload capabilities, refer to the OVERLOAD CAPABILITY OF THE MAIN AC OUTPUT section of this manual.

A.C. AMPERES Ammeter:	Measures the AC output current. The meter is equipped with an adjustable "pointer preset mechanism" which is used to aid in measuring currents of short duration.
A.C. AMMETER RANGE Switch	Selects full scale range of the AC ammeter. Always use the lowest range which will not over-range the meter.
EXT. USE A.C. AMMETER Terminals	These two terminals enable the ammeter to be used in conjunction with the A.C. Ammeter and A.C. AMMETER RANGE Switch to measure external currents up to 250 amperes. When using the ammeter to measure external currents, connect the EXT. USE AMMETER terminals in series with the current to be measured and select the appropriate range on the A.C. AMMETER RANGE Switch.
D.C. AMPERES Ammeter	Measures the D.C. output current.
D.C. AMMETER RANGE Switch	Selects full scale range of the D.C. ammeter.
D.C. VERNIER CONTROL Knob and D.C./VERNIER Switch	When the DC/VERNIER Switch is in the D.C. position, this knob controls the D.C. CURRENT output. When in the VERNIER position, it is a fine-adjustment for the main A.C. output.
0-5A D.C. OUTPUT Binding Posts (Red +, Black -)	Binding posts for the D.C. current output. These binding posts are in parallel with the relay CONTACTS binding posts when the INITIATE CONTROL Lever is in the D.C. position and therefore, D.C. current can be obtained from either set of binding posts.
120V SYNC. Binding Posts	These terminals are energized with 120 volts whenever the unit is initiated. This voltage may be used as a control source to initiate an external device such as an auxiliary relay.
P.A.M. Jack	This jack is in series with the five-ampere secondary of the AC ammeter current transformer. It is used to connect external instrumentation such as the current coil of a phase angle meter. The current in the PAM circuit is 0-5 amperes, as long as the ammeter is not over-ranged.
HARMONIC RESTRAINT/NORMAL Switch	In the NORMAL position, the harmonic restraint circuitry is completely isolated in the test set. When switched to the HARMONIC RESTRAINT position, the 0-25A Output (Blue) Binding Post in the AUX. SECTION will provide the necessary half-wave rectified output for testing the harmonic restraint element in harmonic restraint differential relays. The output is controlled by the large 0-25A/0-300V control knob in the AUX. SECTION. The magnitude of D.C. output can be read on the D.C. Ammeter in the CONTROL SECTION, next to the HARMONIC RESTRAINT/NORMAL Switch.

Fuses (all dual element, slow-blow fuses)

F1, 1.5A	Protects Digital Timer Circuit and Initiate Circuit.
F2, 15A (7.5A for 240-volt units)	Provides overload and short-circuit protection for the input of the test set.
F3, 15A	Provides overload and short-circuit protection for the main AC output circuit.
F4, 2.5A	Protects DC/VERNIER output circuit.

AUXILIARY SECTION

The Auxiliary Section of Model SR-76A comprises two output channels on the test set; one controlled by the large knob and the other by the small knob. The following is a description of the various controls and instrumentation in the Auxiliary Section.

POWER ON INDICATOR	A Yellow lamp indicates when input power is available to the Auxiliary Section.
AC AMPERES Ammeter	Measures the magnitude of the 0-25 ampere current output available at the Blue and White output binding posts. The meter is equipped with a pointer preset mechanism to facilitate measuring currents of short durations.
A.C. AMMETER RANGE Switch	Selects full scale range of the AC ammeter. Always use the lowest range which will not over-range the meter.
0-25A/0-300V AC Switch, Control Knob and Output Binding Posts	The switch is used to select whether a current output of 0-25 amperes at 40 volts or a potential output of 0-300 volts at 0.5 amperes is available at the Blue and White output binding posts labeled 0-25A or 0-300V AC. The White binding post is the instantaneous (±) polarity binding post.
AUXILIARY OUTPUTS Selector Switch, Control Knob and Output Binding Posts	The AUXILIARY OUTPUTS Switch is used to select one of four output potentials or one of three special test circuits. The magnitude of the selected output is controlled by the AUXILIARY OUTPUTS knob (small knob). A description of each of the seven AUXILIARY OUTPUTS follows:
0-150V DC:	0-150V DC @ 1.0 amperes is available at the Red (+) and Black (-) binding posts.
0-300V DC:	0-300V DC @ 0.5 amperes is available at the Red (+) and Black (-) binding posts.
0-150V AC:	0-150V AC @ 1.0 amperes is available at the Red and Black binding posts. The Black binding post is the (±) instantaneous polarity binding post.
0-300V AC:	0-300V AC @ 0.5 amperes is available at the Red and Black binding posts. The Black binding post is the (±) instantaneous polarity binding post.
V.RLY.:	In conjunction with the V. RLY/DET. Switch and the 0-25A or 0-300V AC control knob, a special test circuit is provided for testing over and under-voltage relays. For further details, refer to the description of the V. RLY/DET. Switch.

DET.: In conjunction with the V. RLY/DET. Switch and the 0-25A or 0-300V AC control knob, a special test circuit provides a voltage and current exactly in or out of phase for testing directional elements. For further details, refer to the description of the V. RLY/DET. Switch.

I. RES.: 0-500 volts DC for measuring insulation resistance. The output is available at the small Red and Black pin sockets labeled I. RES. and is controlled by the AUXILIARY OUTPUTS knob. For further details, refer to the description of I. RES. SET/TEST Switch.

AC/DC Voltmeter — Used in conjunction with the VOLTMETER CIRCUIT SELECTOR Switch and the VOLTMETER RANGE Switch and the magnitude of the various potential outputs of the test set or of an external AC or DC potential.

VOLTMETER RANGE Switch — Selects the full scale range of the AC/DC voltmeter. Always use the lowest range which will not over-range the meter.

VOLTMETER CIRCUIT SELECTOR Switch — Used to select the circuit whose potential is to be measured by the AC/DC VOLTMETER. A description of each position follows:

300V AC: Measures the 0-300V AC output of the Auxiliary Section

AUX. A.C.: Measures either the 0-150V AC or the 0-300V AC output, whichever is selected by the AUXILIARY OUTPUTS Switch.

AUX. D.C.: Measures either the 0-150V DC or the 0-300V DC output, whichever is selected by the AUXILIARY OUTPUTS Switch.

V. RLY: Measures the outputs of the voltage relay test circuit.

DET.: Measures the potential output of the directional element test circuit.

I. RES.: Measures insulation resistance in conjunction with the insulation resistance test circuit.

EXT. AC: Used to measure an external AC potential applied to the Red and Black binding posts located next to the VOLTMETER CIRCUIT SELECTOR Switch.

EXT. DC: Used to measure an external DC potential applied to the Red (+) and Black (-) binding posts located next to the VOLTMETER CIRCUIT SELECTOR Switch.

V. RLY/DET. Switch — Used in conjunction with the voltage relay and directional element test circuits. The functions of each position are as follows:

V. RLY. NORM: Used to apply the normal relay voltage to the voltage relay under test. The output is available at the AUXILIARY OUTPUTS Red and Black binding posts and is controlled by the 0-25A or 0-300V AC knob.

V. RLY. FAULT: Used to preset the fault voltage to be applied to voltage relay under test. When in this position, the normal voltage set in the V. RLY. NORM. position remains on the relay. The magnitude of the fault voltage is controlled by the AUXILIARY OUTPUTS knob.

V. RLY. TEST: The fault voltage which was preset in the V. RLY. FAULT position is applied to the relay and the digital timer is simultaneously started. When the relay operates, the timer will stop.

DET. positions: Four ranges are provided to conduct pickup tests on directional elements. To obtain a voltage and a current exactly in phase, the instantaneous polarity terminal of the relay's current coil is connected to the Blue 0-25A or 0-300V AC binding post. The non-polarity terminal is connected to the Black AUXILIARY OUTPUTS binding post. The instantaneous polarity terminal of the relay's potential coil is connected to the Black AUXILIARY OUTPUTS binding post and the non-polarity terminal is connected to the Red AUXILIARY OUTPUTS binding post.

The magnitude of the voltage and current is controlled by the 0-25A or 0-300V AC knob.

Reversing either the current coil or the potential coil connections will result in the current and potential being 180^{o} out of phase.

NORMAL/DROPOUT Switch Used to perform a dropout timing test on an AC or DC auxiliary relay. When the switch is changed from the NORMAL to the DROPOUT position, the relay under test is de-energized and the digital timer is simultaneously started.

NOTE: When the Control Section and the Auxiliary Section are interconnected, the NORMAL/DROPOUT Switch must be in the NORMAL position in order to start the timer by depressing the INITIATE pushbutton. If the NORMAL/DROPOUT Switch is inadvertently left in the DROPOUT position, the timer will not start. The operator should make sure the switch is left in the NORMAL position except when running a dropout test.

NORMAL/EXT. Power Input Switch and Binding Posts	Selects whether the AUXILIARY OUTPUTS variable autotransformer is energized from an internal (NORMAL) or an external source. When it is desirable to energize from an external source of power (not over 120 volts AC) such as a phase shifter or frequency generator, the source is connected to the Yellow and White (±) binding posts. The potential is then controlled by the AUXILIARY OUTPUTS knob.
I. RES. SET/TEST Switch and Output Pins	Used in conjunction with the AUXILIARY OUTPUTS Selector Switch and Control Knob, the AC/DC voltmeter, VOLTMETER CIRCUIT SELECTOR Switch and the VOLTMETER RANGE Switch for measuring insulation resistance. The AUXILIARY OUTPUTS control knob is used to calibrate the megohm range on the AC/DC voltmeter to the infinity calibration mark with the SET/TEST Switch in the SET position. In the TEST position, 500 volts DC is applied and the insulation resistance is indicated on the AC/DC voltmeter. The output is available at the Red (+) and Black (-) output pins.
I. RES. TEST Lamp	Indicates whenever the I. RES. test circuit is energized.
INITIATE NORM/BYPASS Switch	This switch is used in conjunction with the AUX. OUTPUT in order to obtain a DC voltage without initiating the test set. When in the NORM position, output cannot be obtained from the AUX. OUTPUT until the INITIATE Switch is initiated. When in the BYPASS position an AC or DC voltage up to 300 volts can be obtained from the AUX. OUTPUT without having to initiate the test set.

Fuses (all dual element, slow blow fuses)

F6, 5A	Protects the 0-25 or 0-300V AC output circuit
F7, 1.5A	Protects the 0-300V AC output transformer
F8, 1.5A	Protects the AUXILIARY OUTPUTS circuit

AC AMMETER CIRCUITS

The AC output current of Multi-Amp Model SR-76A is indicated on ammeters connected in series with the output circuits by appropriate current transformers and ammeter range switches. The desired full scale value is selected by means of range switches.

The ammeters are moving iron-vane instruments of ± 1% full scale accuracy. When using an indicating instrument of full scale accuracy, the user should use a range which will give an indication as close to full scale as possible. It should be noted that there is no relationship between the ammeter ranges and the rating of the output terminals. **ANY AMMETER RANGE CAN BE USED WITH ANY OUTPUT TERMINAL.**

The ammeters are equipped with an adjustable pointer preset mechanism, the ammeter pointer may be preset to any position on the scale and held there with no current in the meter circuit. This is a mechanical operation accomplished by use of an insulated knob on the front of the meter. It is used to overcome the inertia of the iron-vane moving system of the meter so that currents of short duration can be preset or read accurately.

In use, the pointer is mechanically adjusted approximately one division below the desired current. The device under test is connected to the test set and the output is momentarily turned on and then turned off (pulsed or jogged) several times with the INITIATE button and the INITIATE CONTROL KNOB pointing to either the N.O. MOM. or N.C. MOM. position, depending upon the circuit being tested. Prior to each energization of the output, the output current is increased by rotating the output control knob. Some quivering of the pointer will be seen as the output current approaches the preset value. Continue to increase the output until the meter pointer lifts off the preset mechanism and moves up scale to the desired test current. At this point, hold the INITIATE button on long enough to be certain the ammeter needle has stabilized.

SELECTION OF OUTPUT TAPS

On Unit 1, Control Section, the Main AC Output, there are several output terminals at various voltage and current ratings provided to adapt the SR-76A to a wide variety of test circuit impedances. The ratings shown on the output taps have a 30 minute duty cycle ratings. The test set works at its peak efficiency when the outputs are used at or slightly above their ratings, (for overload capability see page 15). In this way, finer adjustment can be obtained by making maximum use of the variable auto transformer. The LOW CURRENT terminals should be used when testing high impedance devices, where current terminals do not have sufficient voltage to "push" the desired test current through the relay under test, without waveform distortion.

IT SHOULD BE NOTED THAT THERE IS NO RELATIONSHIP BETWEEN THE AMMETER RANGES AND THE CURRENT TAPS. ANY AMMETER RANGE CAN BE USED ON ANY TAP.

SERVICE DATA

Multi-Amp Model SR-76A uses straight forward circuits and components requiring little or no routine servicing except for cleanliness.

The following maintenance is recommended:

1. Open the unit every six months and examine for:
   a. Dirt
   b. Moisture
   c. Corrosion
   d. Condition of relay contacts

2. Remove dirt with dry compressed air.

3. Remove moisture by opening unit as much as possible and putting it in a warm dry environment.

4. As corrosion may take many forms, no specific recommendations can be made for its removal.

5. The contacts on relays and contactors should be examined for pitting and burning. The contacts on control relays and contactors may be burnished with a diamond dressing tool if not too badly damaged. If excessive pitting or burning has occurred, the relay or contactor should be replaced.

If factory service is required or desired, contact the factory for return instructions.

A Return Authorization (RA) number will be assigned for proper handling of the unit when it arrives at the factory.

If desired, a letter with the number and instructions can be provided.

Provide the factory with model number, serial number, nature of the problem or service desired, return address, your name, and where you can be reached should the factory need to contact you.

A purchase order number, cost limit, billing, and return shipping instructions may also be provided if desired.

National Institute of Standards and Technology recommends traceable calibration and certification once a year. Calibration and certification of two types is available if desired at an additional cost.

CLASS ONE: A certificate is provided verifying the traceability and calibration of the equipment.

CLASS N: That which is required for nuclear power plants. A certificate of traceability and calibration along with "as found" and "as left" data are provided.

If an estimate is requested, provide the name and contact information of the person with approval/disapproval authority.

Pack the equipment appropriately to prevent damage during shipment. If a reusable crate or container is used, the unit will be returned in it if in suitable condition.

Put the RA number on the address label of the shipping container for proper identification and faster handling.

WARRANTY

Multi-Amp Corporation warrants to the original purchaser that the product is free of defects in material and workmanship for a period of one (1) year from date of shipment. This warranty is limited and shall not apply to equipment which has damage, or cause of defect, due to accident, negligence, improper operation, faulty installation by the purchaser, or improper service or repair by any person, company or corporation not authorized by Multi-Amp Corporation.

Multi-Amp Corporation will, at its option, either repair or replace those parts and/or materials that it deems to be defective. Any costs incurred by the purchaser for the repair or replacement of such parts and/or materials shall be the sole responsibility of the original purchaser.

THE ABOVE WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED ON THE PART OF THE MULTI-AMP CORPORATION, AND IN NO EVENT SHALL THE MULTI-AMP CORPORATION BE LIABLE FOR THE CONSEQUENTIAL DAMAGES DUE TO THE BREACH THEREOF.

OVERLOAD CAPABILITY OF THE MAIN AC OUTPUT

The main AC output of Model SR-76A incorporates five ranges which are designed to make use of their overload capability, provided the voltage is sufficient to "push" the current through the impedance of the load circuit, each range is capable of supplying its rated current for 30 minutes, to be followed by a 30 minute cool down period. Where the voltage is sufficient to "push" more than rated current, each range may be overloaded for short durations in accordance with the table below. Fuse protection is incorporated to prevent overloading the output for too long; however, the user must make certain the correct fuse size is used (F3, 15-ampere dual element) and must observe the OFF times to avoid the possibility of damaging the output transformer and/or variable autotransformer. When the "ON" is less than the times indicated below, the time "OFF" can be proportionally Reduced.

10-Volt, 140-Ampere Range

Current	Maximum Time ON	Minimum Time ON
140A	30 min.	30 min.
210A	6 min.	10 min.
250A	20 sec.	3 min.

20-Volt, 70-Ampere Range

70A	30 min.	30 min.
140A	6 min.	10 min.
200A	20 sec.	3 min.

40-Volt, 35-Ampere Range

35A	30 min.	30 min.
70A	6 min.	10 min.
100A	20 sec.	3 min.

80-Volt, 17.5-Ampere Range

17.5A	30 min.	30 min.
35A	6 min.	10 min.
50A	20 sec.	3 min.

160-Volt, 8.75-Ampere Range

8.75A	30 min.	30 min.
17.5A	6 min.	10 min
25A	20 sec.	3 min.

TESTING INDUCTION DISC OVERCURRENT RELAYS
Westinghouse Type CO
General Electric Type IAC

The following procedure outlines the most efficient manner to consecutively perform all tests on an overcurrent relay. This procedure involves the least possible number of changes in connecting test leads and setting test set controls.

Always refer to the instruction book of the relay being tested to ascertain the manufacturer's recommendations for accuracy limits, adjusting procedures, etc.

The Control Section of Model SR-76A can be used independently from the auxiliary section for conducting all of the following tests:

Zero check
Pickup - Induction Unit
Timing - Induction Unit
D.C. Target and Seal-In
Pickup - Instantaneous Unit

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N. O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main AC Control Knob	"0"
D.C./VERNIER Switch	VERNIER
A.C. AMMETER RANGE Switch	Set to read test current in upper section of meter scale
D.C. OR VERNIER Control	"0"
D. C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

ZERO CHECK

This test is usually performed on a new relay to determine that the relay contacts close when the time dial is set to zero. If an "As Found Test" is to be performed on the relay, do not perform zero check Steps 3, 4, 5 or 6.

1. Connect the SR-76A test set to a suitable source of power as indicated on the nameplate. Be sure the POWER ON Switch is OFF. Check the POWER ON light.

2. Connect light leads from binding posts marked RELAY CONTACTS to trip circuit contact terminals of the relay induction unit.

3. Turn POWER ON Switch ON. POWER ON light should glow.

4. Manually rotate time dial on the relay toward zero until the continuity light glows or tone signal sounds. Record reading on time dial.

5. Adjust for any irregularities uncovered and return time dial to specified setting.

6. Turn POWER ON Switch OFF.

PICKUP - INDUCTION UNIT

This test is to determine the minimum operating current of the relay; that is, the minimum current needed to close the relay contacts for any particular tap setting. Most manufacturers specify that the pickup current should be equal to tap value ± 5%.

7. Connect induction unit operating coil of relay to the common (±) and 80-volt terminals (use 160-volt terminal for ground relays, i.e., those with tap ranges of 0.5 - 2A).

8. Set A.C. AMMETER RANGE Switch so that the anticipated pickup current (relay tap value) will be read in upper section of ammeter scale.

9. Turn POWER ON Switch ON.

10. Initiate unit by pressing INITIATE Switch.

11. Rotate Main AC Control knob (clockwise) to increase output until relay picks up and continuity light flickers or tone signal wavers. VERNIER control may be used for fine adjustment.

12. Read current on ammeter. Record.

13. Turn POWER ON Switch OFF.

TIMING TEST - INDUCTION UNIT

14. Return both Main AC Control knob and VERNIER control to zero.

15. Adjust INITIATE CONTROL knob to N.O. MOM., lever to CONT.

16. Set A.C. AMMETER RANGE Switch so that test current will be read in upper section of meter scale. Use preset mechanism to set meter pointer approximately one division below desired test current.

    NOTE: See AMMETER CIRCUIT section on page 12 for instructions on use of pointer preset mechanism.

17. Turn POWER ON Switch ON. POWER ON light should glow.

18. Initiate unit by pressing INITIATE button.

19. Set desired test current by jogging unit with INITIATE Switch and rotating Main AC Control knob (clockwise) to increase output until ammeter needle quivers. Hold in INITIATE Switch and rotate VERNIER control to make final current adjustment.

2. Set INITIATE CONTROL knob to N. O. MAINT., lever to TIMER.

21. Reset timer to zero with RESET button.

22. Initiate unit by pressing INITIATE button. Timer will run and test current will flow. The test set will automatically shut off and the timer will stop when relay operates.

    NOTE: Check ammeter while test is on. Minor adjustment may be made with VERNIER control.

23. Read timer. Time shown is total time of test. Record time.

24. If it is desired to obtain another point of relay curve, reset INITIATE CONTROL knob to N.O. MOM, lever to CONT. and proceed from Step 16.

25. When test is concluded, return Main AC Control knob to zero setting.

TESTING DC TARGET AND SEAL-IN

26. Adjust INITIATE CONTROL knob to N.O. MAINT. and INITIATE CONTROL lever to D.C.

27. Select proper range for D.C. ammeter with the D.C. AMMETER RANGE Switch.

28. Set D.C./VERNIER Switch to D.C.

29. Select proper range for AC ammeter so that a current of approximately 150% of the relay tap value may be read in the upper section of the meter scale.

30. Turn POWER ON Switch ON.

31. Initiate test unit by pressing INITIATE button.

32. Rotate Main AC Control knob clockwise to energize induction unit operating coil of relay with a current equal to approximately 150% of the tap value. This is simply to make the relay operate and complete the trip circuit.

33. When the induction unit trip circuit contacts of the relay close, slowly rotate VERNIER control clockwise to energize target coil of relay with D.C. When target drops, read and record D.C. amperes.

34. Rotate Main AC Control knob counterclockwise to zero. If the D.C. circuit remains energized when the induction unit trip circuit contacts of relay open, the seal-in unit is working properly.

35. Return VERNIER control to zero and turn test set OFF.

TESTING INSTANTANEOUS PICKUP

36. Connect instantaneous unit operating coil of relay to the Common and 0-10 volt terminal of test set.

37. Connect instantaneous unit trip circuit contacts of relay to the RELAY CONTACTS binding posts of test set.

38. Set AC AMMETER RANGE Switch so that anticipated instantaneous test current will be read in upper section of meter scale.

39. Set D.C./VERNIER Switch to VERNIER.

40. Set INITIATE CONTROL knob to N.O. MOM., lever to CONT.

41. Turn POWER ON Switch ON. POWER ON light should glow.

42. Initiate unit by *holding in* INITIATE button.

43. Rotate Main AC Control knob clockwise to increase current until the continuity light glows or tone signal sounds. Make sure this is *minimum setting* on the Main AC Control where the instantaneous unit of the relay will consistently pickup as the INITIATE button is alternately opened and closed. The glowing of the continuity light or the tone signal should be simultaneous with the depression of the INITIATE button.

44. Rapidly read this value of current and release INITIATE button.

WARNING

CURRENT IS FLOWING THROUGH THE RELAY COIL UNTIL INITIATE BUTTON IS RELEASED. THEREFORE , IT IS IMPORTANT TO READ THE VALUE OF CURRENT RAPIDLY.

45. Record ammeter reading.

46. Turn test set OFF.

TESTING OVER/UNDER VOLTAGE RELAYS
Westinghouse Type CV
General Electric Type IAV

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OF Switch	OFF
INITIATE CONTROL Knob	N. O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
MAIN A.C. Control Knob	"0"
D.C./VERNIER Switch	VERNIER (counterclockwise)
A.C. AMMETER RANGE Switch	250A
D.C. OR VERNIER CONTROL	"0"(counterclockwise)
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

0-25A/0-300V AC Switch	0-300V AC
A.C. AMMETER RANGE Switch	So that the desired test voltage will be read in upper 1/3 of scale
EXT. POWER INPUT/NORMAL Switch	NORMAL
V. RELAY/D.E.T. Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. A.C.
AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
AUXILIARY OUTPUT Selector Switch	0-150V AC or 0-300V AC (depending on nominal operating voltage of the relay)
NORM./DROPOUT Switch	NORM.
NORM./BYPASS Switch	NORM.

TESTING FOR PICKUP

1. Connect Model SR-76A to a suitable source of power in accordance with nameplate. Be sure the ON/OFF Switch is OFF.

2. Interconnect the Control Section to the Auxiliary Section.

3. Connect the relay operating coil to the Red and Black binding posts under the AUXILIARY OUTPUT Section.

4. Connect light leads from binding posts marked RELAY CONTACTS to the trip circuit contact terminals of the relay induction unit.

5. Switch POWER ON/OFF Switch ON. POWER ON light should glow.

6. Initiate unit by pressing the INITIATE Switch.

7. Rotate the AUXILIARY OUTPUT Control Knob (clockwise) to increase output until CONTINUITY light flickers or the TONE generator output breaks.

8. Record this value of voltage as pickup of the relay.

TESTING TIMING

9. Set the VOLTMETER CIRCUIT SELECTOR Switch and the AUXILIARY OUTPUT Selector Switch to the V. RLY. position.

10. Rotate the 0-300V AC Control Knob (clockwise) to increase output until normal relay voltage (see relay nameplate) is observed on voltmeter.

11. Switch the INITIATE CONTROL LEVER to TIMER and switch the V. RLY. Test Switch to FAULT position.

12. Set faulted relay voltage (over or under normal) by rotating AUXILIARY OUTPUT control knob to increase or decrease output. Read the fault voltage on the voltmeter. NOTE: Set the fault voltage approximately one to two volts higher than the desired test voltage.

13. Switch the V. RLY. Test Switch to the TEST position. The fault voltage set in Step 12 will be impressed on the relay operating coil and the digital timer will automatically start.

14. When the relay trip circuit contacts make, the timer will stop to indicate the elapsed time of the test.

15. If a retest is desired, turn the test set off and return the V. RLY. Test Switch to NORM. position and return the RELAY CONTACTS CONTROL Lever to the CONT. position. Turn test set ON and INITIATE. Repeat Steps 1 through 14 for the other values of fault voltage.

TESTING D.C. TARGET AND SEAL-IN

16. Return all output controls to zero and switch the main POWER ON/OFF Switch OFF.

17. The D.C. TARGET and SEAL-IN unit can be tested following the procedure given in the test procedures for testing an overcurrent relay.

TESTING PERCENTAGE DIFFERENTIAL RELAYS
Westinghouse Type CA
General Electric Type IJD

TYPES OF TESTS

Pickup
Time Current Characteristic
Through Fault
Slope

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N. O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Current Control Knob	"0"
A.C. AMMETER RANGE Switch	So that the desired test current can be read in the upper 1/3 of the scale.
D. C. VERNIER/Switch	VERNIER
D. C. or VERNIER Control Knob	"0"
D. C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-25A/300V AC Switch	0-25A
A. C. AMMETER RANGE Switch	So that the desired test current can be read in UPPER 1/3 of scale
0-25A or 0-300V AC Control Knob	"0"
VOLTMETER RANGE Switch	300V
NORMAL/EXT. POWER INPUT Switch	NORMAL

V.RLY./DET. Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	300V AC
AUXILIARY OUTPUT Selector Switch	0-300V AC
AUXILIARY OUTPUT Control Knob	"0"
NORM./DROPOUT	NORM.
NORM./BYPASS	NORM.

TESTING PICKUP

1. Connect Model SR-76A to a suitable source of power. Be sure the ON/OFF Switch is OFF.

2. Interconnect the Control Section and the Auxiliary Section.

3. Connect the operating coil and one restraint coil of the relay to the 0-10V/140A terminal and the ± COMMON.

4. Connect light leads from binding posts marked Relay Contacts to Trip circuit terminals of the relay.

   NOTE: These type relays usually have one moving contact and two fixed contacts. Use terminals for moving contact and one of the fixed contacts.

5. Set A.C. AMMETER RANGE Switch so that expected pickup current will be read in upper 1/3 of the ammeter scale.

6. Turn POWER ON/OFF Switch ON. POWER ON light should glow.

7. Initiate test set by pressing INITIATE Switch.

8. Rotate Main A.C. Current Control Knob to increase output until relay picks up and CONTINUITY light glows or the TONE generator sounds. The vernier control may be used for fine adjustment. Read and record current.

9. Move one light lead to relay terminal for other fixed contact of the relay and repeat Steps 5 through 8.

10. Return controls to "0" position and switch power OFF.

TESTING TIME CURRENT CHARACTERISTICS

11. Set A.C. AMMETER RANGE Switch so that the desired test current can be read in upper 1/3 of the meter scale. Set ammeter preset mechanism ½ division below desired test current.

12. Turn POWER ON/OFF Switch ON. POWER ON light should glow.

13. Set INITIATE CONTROL knob to N.O. MOM. and INITIATE CONTROL lever to CONT.

position.

14. Set test current by "jogging" with the INITIATE Switch and rotating the Main A.C. Current Control Knob to increase the output until the ammeter pointer preset lifts to indicate desired test current.

15. Set INITIATE CONTROL knob to N.O. MAINT. and the INITIATE CONTROL lever to the TIMER position.

16. Reset digital timer by depressing the RESET button.

17. Initiate the test set by pressing the INITIATE Switch. The unit will energize and the Timer will begin to run. When the relay contacts close, the Timer will stop and the unit will de-energize itself.

18. Read and record time indicated on the Timer.

19. Return all controls to zero and switch the POWER ON/OFF Switch OFF.

TESTING THROUGH FAULT

20. Connect the restraint coil terminals of the relay to the appropriate output current tap so that current flows through the restraint coils in series.

21. Select the proper ammeter range.

22. Set the INITIATE CONTROL knob to N.O. MAINT. and INITIATE CONTROL lever to CONT.

23. Switch POWER ON/OFF Switch ON. The POWER ON light should glow.

24. Initiate unit by pressing INITIATE Switch.

25. Rotate the Main AC Current Control knob to increase output to desired value. Read current on ammeter.

26. Manually turn relay disc for evidence of restraint current.

27. Return control to zero and switch test set OFF.

TESTING SLOPE

28. Connect the operating coil and one restraint coil to the 0-300V AC/0-25A terminals. Connect the two restraint coil terminals of the relay to the 0-80V/17.5A output terminals so that current flows through the restraint coils in series. Observe polarities.

29. Select the proper ammeter ranges for both AC Ammeters.

30. Connect light leads from the binding posts marked RELAY CONTACTS to the trip circuit terminals of the relay.

31. Set INITIATE CONTROL knob to N.O. MAINT. and INITIATE CONTROL lever to CONT.

32. Turn POWER ON/OFF Switch ON. POWER ON light should glow.

33. Initiate the test set by pressing the INITIATE Switch.

34. Rotate the main control knob until the restraining current is obtained.

35. Rotate to 0-300V AC/0-25A control knob until the CONTINUITY light flickers, or the TONE generator sounds. The slope of the relay is determined by dividing the operating current by the restraint current.

36. If desired, the test may be repeated for the opposite restraint coil by disconnecting test leads from the operating coil terminal and re-connecting test leads to opposite restraint coil terminal and operating coil terminal.

37. After test is completed, turn all current controls to zero and switch the POWER ON/OFF Switch OFF.

TRANSFORMER DIFFERENTIAL RELAY WITH PERCENTAGE AND HARMONIC RESTRAINT
General Electric Type BDD

GENERAL

The Type BDD relay is a single-phase transformer differential relay provided with the features of percentage and harmonic restraint and has a sensitive polarized relay as the operating element. Percentage restraint permits accurate determination between internal and external faults at high currents. Harmonic restraint enables the relay to distinguish, by the difference in waveform, between the differential current caused by an internal fault and that caused by an internal fault and that caused by transformer magnetizing inrush.

The harmonic restraint and slope tests are written based on testing the relay with all restraint windings set in the 5A tap. If the relay is to be tested with any other tap settings, please refer to the G.E. instruction book under "Periodic Testing".

The Type BDD 15 relay is designed to be used for the protection of two-winding power transformers and has two (2) through-current restraint circuits and one (1) differential current circuit.

The Type BDD 16 relay is designed to be used with three-winding power transformers and has three (3) through-current restraint circuits and one (1) differential current circuit.

TYPES OF TESTS

Pickup of DHR Unit
Slope
Harmonic Restraint
Pickup of Instantaneous Unit

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING
SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
TONE/CONTINUITY Switch	Either position
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
Main A.C. Current Control Knob	"0"
A.C. AMMETER RANGE Switch	So that the desired AC current can be read in upper 1/3 meter scale
D.C./VERNIER Switch	VERNIER
D.C. OR VERNIER Control Knob	"0"

D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-25A/0-300V AC Switch	0-25A
A.C. AMMETER RANGE Switch	2.5A
0-25A or 0-300V AC Control Knob	"0"
VOLTMETER RANGE Switch	150V
NORMAL/EXT. POWER INPUT Switch	NORMAL
V. RLY/DET Selector Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. D.C.
AUXILIARY OUTPUT Control Knob	"0"
AUXILIARY OUTPUT Selector Switch	0-150V DC
NORM./DROPOUT Switch	NORM.
NORM/BYPASS Switch	BYPASS

INITIAL TEST CONNECTIONS

1. a. 0-25A Output (Blue) binding Post on Auxiliary Section to terminal five of relay.

   b. 0-25A ± (White) Binding Post on Auxiliary Section to COMMON (±) tap on Control Section.

   c. COMMON (±) tap on Control Section to terminal four of relay.

   d. AUXILIARY OUTPUTS Binding Posts to terminal one and seven of relays. Red (+) to terminal seven.

   e. RELAY CONTACTS Binding Posts to terminals one and two of relay.

2. Turn POWER ON Switch to ON Position. POWER ON Lamps and TIMER display should be lighted.

3. Rotate AUXILIARY OUTPUTS Control Knob clockwise until rated DC voltage is indicated on the AC/DC Voltmeter.

   NOTE: For the duration of the test, rated voltage is present on the relay.

4. Reset TIMER by depressing TIMER RESET Pushbutton.

5. Initiate unit by depressing INITIATE Pushbutton. INITIATE Pushbutton should be lighted.

TESTING PICKUP

6. Rotate 0-25A Control Knob in a clockwise direction until an indication of pickup is detected by the CONTINUITY Lamp or TONE Generator. Read and record the value of pickup current observed on the A.C. AMMETER in the Auxiliary Section.

7. Return 0-25A Control Knob to "0".

8. Observe that target element (T) "dropped" during Step 6.

9. Move test lead connected to COMMON (±) from terminal four of relay to terminal six of relay.

10. Rotate 0-25A Control Knob in a clockwise direction until an indication of pickup is detected by the CONTINUITY Lamp or TONE Generator. Read and record the value of pickup current observed on the A.C. AMMETER in the Auxiliary Section.

11. Return 0-25A Control Knob to "0".

TESTING SLOPE

12. Connect 0-160V (8.75A) current output Binding Post to terminal four of relay.

13. Place INITIATE CONTROL Knob in the N.O. MOM. position.

WARNING

The relay coils are energized as long as the test set is initiated. Therefore, this test should be conducted as rapidly as possible to prevent damage to relay coils.

14. Preset and hold INITIATE Pushbutton and rotate MAIN A.C. Control Knob until an indication of 20 amperes is observed on the A.C. AMMETER in the Control Section. Release INITIATE Pushbutton.

15. Move A.C. AMMETER Range Switch on Auxiliary Section to 5A position.

16. Press and hold INITIATE Pushbutton and rotate 0-25A Control Knob until pickup is detected by the CONTINUITY Lamp or TONE Generator. Read value of current indicated on A.C. AMMETER in the Auxiliary Section. Release INITIATE Pushbutton.

17. Record value of current read in step 16.

18. Return MAIN-A.C. Control Knob to "0".

19. Return 0-25A Control Knob to "0".

TESTING HARMONIC RESTRAINT

20. Place INITIATE CONTROL Knob in the N.O. MAINT. position.

21. Place A.C. AMMETER Range Switch on Auxiliary Section in the 1A position.

22. Place A.C. AMMETER Range Switch Control Section on the 5A position.

23. Place the HARMONIC RESTRAINT Switch in the HARMONIC RESTRAINT position. Connect the 0-25A Output (Blue) Binding Post to terminal five of the relay.

24. Move 0-160V (8.75A) test lead from terminal four of relay to terminal five of the relay.

25. Initiate test set by pressing INITIATE Pushbutton.

26. Rotate 0-25A Control Knob clockwise until an indication of four amperes is observed on the DC AMMETER in the CONTROL SECTION.

27. Rotate Main AC Control Knob until pickup is detected by the CONTINUITY Lamp or TONE Generator. Read and record the value of current indicated by the A.C. AMMETER on the Control Section.

NOTE: While adjusting the Main AC Control Knob, make necessary adjustments using 0-25A AC Control Knob to maintain four amperes DC on the DC ammeter.

28. Return the Main A.C. Control Knob to "0".

29. Return the 0-25A Control Knob to "0".

30. Return AUXILIARY Outputs Control Knob to "0".

TESTING INSTANTANEOUS UNIT

31. Place INITIATE CONTROL Knob in the N.O. MOM. position.

32. Disconnect test lead from the 0-25A Output (Blue) Binding Post and terminal five of the relay.

33. Set A.C. AMMETER RANGE Switch on Control Section to 50A position.

34. Move test lead from 0-160V (8.75A) current output Binding Post to the 0-40V (35A) Binding Post.

35. Initiate unit by holding in INITIATE Pushbutton.

NOTE: Steps 36 and 37 should be performed as quickly as possible to avoid relay damage.

36. Rotate Main AC Control Knob clockwise to increase current until pickup is detected by the CONTINUITY Lamp or TONE Generator.

37. Read the value of current on the A.C. AMMETER on Control Section and release INITIATE Pushbutton.

38. Record value of current observed in Step 37.

39. Turn test set OFF. Remove all test leads.

TYPICAL TEST FOR D.C. AUXILIARY RELAYS

TYPES OF TESTS

Pickup
Dropout
Timing Dropout

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
TONE/CONTINUITY Switch	Either position
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
Main A.C. Current Control Knob	"0"
A.C. AMMETER RANGE Switch	250A
D. C. or VERNIER Control Knob	"0"
D. C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-300V AC/0-25A Switch	0-300A
A. C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0"
VOLTMETER RANGE Switch	So that the desired test current can be read in UPPER 1/3 of scale
NORMAL/EXT. POWER INPUT Switch	NORMAL
V.RLY./DET. Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. D.C.
AUXILIARY OUTPUT Control Knob	"0"

AUXILIARY OUTPUT Selector Switch	Either 150V DC or 300V DC
NORM./DROPOUT Switch	NORM.
NORM./BYPASS Switch	NORM.

TESTING PICKUP

1. Connect Model SR-76A to a suitable source of power. Be sure the ON/OFF Switch is OFF.
2. Interconnect the Control Section and the Auxiliary Sections.
3. Connect the operating coil terminals to the AUXILIARY OUTPUT Red (+) and Black (-) binding posts of the AUXILIARY OUTPUT section.
4. Connect light leads from binding posts marked Relay Contacts to trip circuit contact terminals of the relay.
5. Switch POWER ON/OFF Switch ON. POWER ON light should glow.
6. Initiate unit by pressing INITIATE Switch.
7. Rotate AUXILIARY OUTPUT Control knob clockwise to increase output until continuity light flickers or tone generator sound.s
8. Read pickup voltage on voltmeter. Record.
9. Rotate AUXILIARY OUTPUT Control knob counterclockwise to decrease output until continuity light extinguishes or output from tone generator breaks.
10. Read dropout voltage on voltmeter. Record.

TESTING DROPOUT TIME

11. Switch INITIATE CONTROL Knob to N.C. MAINT. and INITIATE CONTROL Lever to TIMER. Output of test set will de-energize as INITIATE CONTROL is adjusted.
12. Put NORM/BYPASS Switch in the BYPASS position. Rotate AUXILIARY OUTPUT control clockwise until rated voltage is applied to relay.
13. Manually close trip circuit contacts so that the D.C. contacts will pickup and seal-in. Release trip contacts. The D.C. contacts should stay sealed in.
14. RESET digital timer.
15. Switch NORM/DROPOUT Switch to the DROPOUT position. The D.C. voltage is switched OFF and the digital timer is automatically started. When the D.C. contacts dropout, the timer will stop.
16. Return output control to full counterclockwise position and switch POWER ON/OFF,

OFF.

TESTING INSULATION RESISTANCE

NOTE: NEVER PERFORM AN INSULATION RESISTANCE TEST ON A SOLID STATE OR STATIC RELAY.

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N. O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Current Control Knob	"0"
A.C. AMMETER RANGE Switch	250A
D. C. VERNIER/Switch	VERNIER
D. C. or VERNIER Control Knob	"0"
D. C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-25A/300V AC Switch	0-300V AC
A. C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0"
VOLTMETER RANGE Switch	I. RES.
NORMAL/EXT. POWER INPUT Switch	NORMAL
V.RLY./DET. Selector Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	I. RES.
AUXILIARY OUTPUT Control Knob	"0"
AUXILIARY OUTPUT Selector Switch	I. RES.
NORM./DROPOUT Switch	NORM.
NORM./BYPASS	NORM.

TESTING

1. Connect Model SR-76A to a suitable source of power. Be sure the ON/OFF Switch is OFF.

2. Interconnect the Control Section and the Auxiliary Section.

3. Switch power ON/OFF Switch ON. POWER ON light should glow.

4. Initiate unit by depressing INITIATE Switch. The insulation resistance test circuit light should glow.

5. Switch and hold TEST/SET Switch to SET position, and rotate AUXILIARY OUTPUT Control Knob to increase output until the voltmeter pointer is aligned with the infinity mark on the meter scale. Release TEST/SET Switch.

6. Connect high voltage test probes to the output terminals and to the relay under test. The relay components will not be harmed as long as one probe is applied to relay frame and the other to all external terminals of the relay.

7. Switch TEST/SET Switch to TEST position. 500 volts DC is now applied to the relay and the insulation resistance can be read on the megohm scale on the voltmeter.

8. Return AUXILIARY OUTPUT Control knob to "0" and switch main power ON/OFF Switch OFF.

TESTING I.T.E. CIRCUIT SHIELD
SOLID-STATE OVERCURRENT RELAYS

The following procedure outlines the most efficient manner to consecutively perform all tests on an I.T.E. solid state overcurrent relay. This procedure involves the least possible number of changes in the connecting of test leads and setting of test controls.

TYPES OF TESTS

Pickup - Timing Circuit
Time Delay Test
Instantaneous Pickup Test
DC Target - Timing Circuit
DC Target - Instantaneous Circuit

CAUTION

NEVER FEED VOLTAGE INTO THE SCR CIRCUIT OR TONE CIRCUIT OF MODEL SR-76A. INCORRECT WIRING CAN RESULT IN DAMAGE TO THE SOLID STATE COMPONENTS IN MODEL SR-76A AS WELL AS TO THE RELAY.

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N. O. MOM.
INITIATE CONTROL Lever	TIMER
TONE/CONTINUITY Switch	Either position
D. C. AMMETER RANGE Switch	5A
D. C. or VERNIER Control Knob	"0" (full counterclockwise)
A.C. AMMETER RANGE Switch	To read test current in the upper 1/3 of meter scale.
A.C. Main Current Control Knob	"0"
D. C. VERNIER/Switch	VERNIER
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION

0-25A/300V AC Switch	300V AC
A. C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0"
VOLTMETER RANGE Switch	150V
NORMAL/EXT. POWER INPUT Switch	NORMAL
V.RLY./DET. Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. D.C.
AUXILIARY OUTPUT Control Knob	"0"
AUXILIARY OUTPUT Selector Switch	0-150V DC
NORM./DROPOUT Switch	NORM.
NORM./BYPASS	NORM.

PICKUP- TIMING CIRCUIT

1. Connect Model SR-76A to a suitable source of power. Be sure the ON/OFF Switch is OFF. Check the POWER ON light.

2. Connect relay input circuit (relay terminals 1-2, 3-4, or 5-6) to the Main Output terminals of the test set. It is recommended that the 80 volt tap be used. Use the 160 volt tap for .5 to 2 amp tap block.

3. Connect light leads from binding post marked S.C.R. TRIP to terminals 8 and 12.

   NOTE: Relay terminal 12 should be connected to the Red binding post and terminal 8 to the Black binding post.

4. Select A.C. AMMETER RANGE Switch so that relay tap value of current may be read on the upper 1/3 of the ammeter scale.

5. Connect leads form Red and Black binding posts of the AUX. OUTPUT Section to terminals seven and eight with Black (±) post to terminal eight. Switch the NORM/BYPASS Switch to the BYPASS position.

6. Turn POWER ON/OFF Switch ON, DO NOT INITIATE test set at this time.

7. Rotate AUX. CONTROL knob on unit two until rated D.C. logic voltage is read on the voltmeter.

8. Reset timer and initiate unit by pressing and holding the INITIATE Switch.

9. Rotate Main A.C. Current Control Knob to increase output until test current on relay is -5% of tap value. The VERNIER control can be used for fine adjustment.

10. Adjust INITIATE CONTROL knob to N.O. MAINT and reset timer.

11. Initiate test set by pressing INITIATE Switch. Relay input circuit will "see" test current. Relay **should not** operate to de-energize test set under these conditions (allow 1½ minutes). De-energize test set by adjusting the INITIATE CONTROL knob to N.O. MOM and reset timer.

12. Repeat Steps 6 through 8 above, except test current should be relay tap value +5%.

13. Initiate test set by pressing INITIATE Switch. Relay input circuit will "see" test current and should operate to de-energize test set and stop timer (allow 1½ minutes). Target should operate.

TIME DELAY AND TARGET TEST

14. Adjust INITIATE CONTROL knob to N.O. MOM.

15. Select AC AMMETER RANGE Switch so that desired test current may be read on the upper 1/3 or ammeter scale.

16. Adjust the AC AMMETER pointer preset mechanism so that the ammeter pointer is approximately two divisions below desired test current.

17. Set desired test current by jogging unit with INITIATE Switch and rotating Main A.C. current control knob to increase output until desired test current is indicated by the ammeter pointer lifting off preset mechanism to the desired current. The VERNIER Control Knob may be used for final adjustment of output current. Release INITIATE Switch.

18. Adjust INITIATE CONTROL knob to N.O. MAINT. Reset timer.

19. Initiate unit by pressing INITIATE Switch. Timer will run and test current will be indicated on ammeter. The test set will automatically cut off and the timer will stop when relay's SCR "FIRES". Relay target should operate.

INSTANTANEOUS PICKUP AND TARGET TEST

20. Adjust INITIATE CONTROL knob to N.O. MOM.

21. Relay terminal connections will be the same as for the above tests except jumper terminals nine and ten.

22. Select an A.C. AMMETER RANGE so that desired test current may be read o;n the upper 1/3 of ammeter scale.

23. Initiate unit by pressing and holding INITIATE Switch. Rotate Main A.C. Current Control Knob to increase output until test current on relay is -10% of instantaneous setting. (For 0.5-2 ampere tap range, the setting should be -20%).

24. Release INITIATE Switch. Reset timer.

25. Press and hold INITIATE Switch. Relay instantaneous circuit **should-not** pickup to stop timer (allow 0.30 second).

26. Repeat Step 23, except test current should be +10% of relay instantaneous setting. (For 0.5-2 ampere tap range, the settings should be +20%).

27. Press and hold INITIATE Switch. Relay instantaneous circuit should pick-up and stop the timer. Relay target should operate.

28. Release INITIATE Switch.

WARNING

CURRENT INDICATED ON AMMETER IS PRESENT IN RELAY CIRCUIT UNTIL INITIATE SWITCH IS RELEASED: THEREFORE, IT IS IMPORTANT TO PERFORM THIS TEST AS RAPIDLY AS POSSIBLE TO AVOID OVERHEATING RELAY.

29. Turn POWER ON/OFF Switch OFF.

DIRECTIONAL OVERCURRENT RELAY
Westinghouse Type CR
General Electric Type IBC

GENERAL

A Directional Overcurrent Relay trips a circuit when it senses two abnormal conditions in the following sequence:

1. Current flow must be reversed.

2. The reversed current flow must be higher than a prescribed amount, and the flow must continue for a predetermined time.

This relay is composed of two units, a directional unit and an overcurrent unit. The directional unit is similar to a single phase wattmeter. It contains a voltage actuated and current actuated coil. When these two coils are energized, a torque is produced on the unit's disc. A 180^{o} shift in phase relationship between the voltage and current produces a reverse torque on the disc. Normally, the torque produced holds the directional unit contacts open. When the current flow in the circuit reverses, the directional unit contact will close.

The overcurrent unit of the relay is similar to the time delay overcurrent relay. In modern designs, the directional unit contacts must be closed before operating torque will be produced on the induction disc of the overcurrent unit. Thus, the directional overcurrent relay requires reversal as well as a minimum quantity of current flow before it may operate to trip a breaker.

The test procedure is arranged to test each element of the relay individually. The directional element contacts must be blocked, closed, or bypassed to permit complete testing of the overcurrent element.

TYPES OF TESTS

Directional Unit - Minimum Pickup
Overcurrent Unit
1. Minimum pickup
2. Time current characteristics

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N. O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Current Control Knob	"0" (counterclockwise)

D. C. VERNIER/Switch	VERNIER
A.C. AMMETER RANGE Switch	250A
D. C. or VERNIER Control Knob	"0"
D. C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	**POSITION**
0-25A/300V AC Switch	0-25A
A. C. AMMETER RANGE Switch	5A
0-25A or 0-300V AC Control Knob	"0" (counterclockwise)
VOLTMETER RANGE Switch	1.5V
NORMAL/EXT. POWER INPUT Switch	NORMAL
VOLTMETER CIRCUIT SELECTOR Switch	D.E.T.
AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
NORM./BYPASS Switch	NORM.
AUXILIARY OUTPUT Voltage Selector Switch	D.E.T.
NORM./DROPOUT	NORM.

DIRECTIONAL UNIT MINIMUM PICKUP

1. Connect Model SR-76A to a suitable source of power. Be sure the ON/OFF Switch is in the OFF position.
2. Connect polarity terminal (±) of relay directional unit, current operating coil to the polarity terminal (Black ±) of the voltage AUX. OUTPUT section. The other relay current operating coil terminal should be connected to the Blue non-polarity, 0-25A or 0-300V AC terminal.
3. Connect the polarity (±) terminal of the relay voltage polarity coil to the Red non-polarity voltage terminal of the AUX. OUTPUT section.
4. Place jumper from non-polarity terminal of voltage polarizing coil to polarity (±) terminal of the current polarizing coil.
5. Switch D.E.T. selector switch to desired position.

6. Turn POWER ON/OFF Switch to ON. POWER ON Light should glow. Reset the timer and initiate the test set by pressing the INITIATE Button.

7. Rotate large control knob (0-25 or 0-300V AC knob) clockwise to increase output until directional unit contacts close. Reduce output just until the contacts start to open. Read and record values.

8. Reverse leads from test set to potential coil of the relay. Relay directional unit contacts should reset closer.

TESTING PICKUP AND TIMING OF OVERCURRENT UNIT

1. Block directional unit contacts closed and follow procedure for Induction Disk Overcurrent Relay.

NOTE: AT END OF TEST REMOVE ALL BLOCKING MATERIAL

VOLTAGE RESTRAINT OVERCURRENT RELAY
General Electric Type IJCV

GENERAL

The IJCV contains an induction disc which is influenced by the magnetic fields of two electromagnets. The current actuated electromagnet produces torque on the disc *to close* the relay trip circuit contacts and is known as the operating coil. The potential actuated electromagnet produces torque on the disc *to open* the relay trip circuit contacts and is known as the restraint coil. When the voltage applied to the restraint coil is decreased, a smaller amount of current is required to operate the relay and close the trip circuit contacts. This relay may operate to close trip circuit contacts even though the voltage applied to the restraint coil may remain at full system voltage.

The IFCV relay is normally used to protect a generator against bus faults.

TYPES OF TESTS

Pickup of Overcurrent Unit, Zero Voltage Restraint
Pickup of Overcurrent Unit, System Voltage Restraint
Timing of Overcurrent Unit, Zero Voltage Restraint
Timing of Overcurrent Unit, System Voltage Restraint

ALWAYS REFER TO MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
MAIN A.C. Control Knob	"0"
D.C./VERNIER Switch	VERNIER
A.C. AMMETER RANGE Switch	So that desired test current may be read on upper 1/3 of meter scale
D.C. or VERNIER Control	"0" (counterclockwise)
D.C. AMMETER RANGE Switch	5A

TESTING FOR PICKUP - ZERO VOLTAGE RESTRAINT

1. Connect Model SR-76A to a suitable source of power in accordance with nameplate. Be sure the ON/OFF Switch is OFF.

2. Interconnect the Control Section to the Auxiliary Section.

3. Connect the relay voltage restraint coil terminals to the Red and Black binding posts under the AUXILIARY OUTPUT Section.

4. Connect the relay current operating coil terminals to the 0-80 volt current output terminal and common.

5. Connect a set of light leads from the relay trip circuit contact terminals to the test set's Yellow binding posts marked "Relay Contacts".

6. Turn POWER ON Switch ON. POWER ON light should glow.

7. Push the timer reset button and Initiate unit by pressing INITIATE Switch.

8. Increase current through the current operating coil of relay to a value 50% above relay trip setting by rotating Main AC Control knob (clockwise).

9. When relay contacts close, CONTINUITY light should glow or TONE Generator should sound.

10. Slowly decrease current by rotating Main AC Control knob counterclockwise until CONTINUITY light flickers, or TONE breaks. Record this value of current as "Pickup - Zero voltage restraint".

11. Return Main AC Control knob to zero and turn POWER ON Switch OFF.

TESTING FOR PICKUP - SYSTEM VOLTAGE RESTRAINT

1. Repeat Steps 1 - 7 above.

2. Apply system voltage to voltage restraint coil of relay by rotating the AUXILIARY OUTPUT Control Knob (clockwise).

3. Repeat steps 8 - 11 above and record "Pickup - System Voltage Restraint".

TESTING TIMING - OVERCURRENT UNIT - ZERO VOLTAGE RESTRAINT

1. Connect Model SR-76A to a suitable source of power in accordance with nameplate. Be sure the POWER ON/OFF Switch is OFF.

2. Interconnect the Control Section to the Auxiliary Section.

3. Connect the relay voltage restraint coil terminals to the Red and Black binding posts under the AUXILIARY OUTPUT Section.

4. Connect the relay current operating coil terminals to the Red and Black binding posts

under the AUXILIARY OUTPUT Section.

5. Connect a set of light leads from the relay trip circuit contact terminals to the test set's Yellow binding posts marked "Relay Contacts".

6. Preset Main Ammeter needle 1/2 division below desired test current.

7. Adjust INITIATE CONTROL knob to N.O. MOM.

8. Turn POWER ON Switch ON. POWER ON light should glow.

9. Push the timer reset button and initiate unit by pressing and holding INITIATE Switch.

10. Set test current to desired value by rotating Main AC Control knob (clockwise) while jogging INITIATE Switch.

11. Set INITIATE CONTROL knob to N.O. MAINT. and INITIATE CONTROL lever to TIME.

12. Reset timer to zero by pressing timer reset button.

13. Initiate unit by pressing INITIATE SWITCH. Timer will run and test current will flow until the relay trip circuit contacts close.

14. Read timer. Time shown is total time of test. Record time.

15. Turn POWER ON Switch OFF.

TESTING TIMING - OVERCURRENT UNIT - SYSTEM VOLTAGE RESTRAINT

1. Repeat Steps 1 - 9 above.

2. Rotate AUXILIARY OUTPUT Control Knob (clockwise) to increase voltage until equal to relay system voltage.

3. Repeat steps 10 - 15 above. Record time shown as Overcurrent Timing Test with System Voltage Applied.

VOLTAGE CONTROLLED OVERCURRENT RELAY
Westinghouse Type COV

GENERAL

The COV relay contains an induction disc overcurrent unit and instantaneous undervoltage unit. The undervoltage unit supervises the operation of the overcurrent unit. Regardless of the amount of current passing through the operating coil of the overcurrent unit, no operation takes place unless the undervoltage unit has "dropped out". This means that the overcurrent unit may be set to operate on less than full load current when the voltage falls below a predetermined value. Conversely, the overcurrent unit will not operate as long as the voltage is above the predetermined value.

This relay is normally used to protect a generator against a bus fault.

TYPES OF TESTS

Pickup - Undervoltage Unit
Dropout - Undervoltage Unit
Voltage Control of Overcurrent Unit
Pickup - Overcurrent Unit
Time Current Characteristics - Overcurrent Unit

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

CONTROL	POSITION
POWER ON/OF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
TONE/CONTINUITY Switch	Either position
MAIN A.C. Control Knob	"0"
D.C./VERNIER Switch	VERNIER
A.C. AMMETER RANGE Switch	250A
D.C. or VERNIER Control	"0" (counterclockwise)
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-25A/0-300V AC Switch	0-300V AC
A.C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0" (counterclockwise)
VOLTMETER RANGE Switch	So that the desired test voltage will be read in upper 1/3 of scale
EXT. POWER INPUT/NORMAL Switch	NORMAL
V. RELAY/D.E.T. Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. A.C.
AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
AUXILIARY OUTPUT Selector Switch	0-150V AC or 0-300V AC (depending on nominal operating voltage of the relay)
NORM./DROPOUT Switch	NORM.
NORM./BYPASS Switch	NORM.

TESTING PICKUP AND DROPOUT OF UNDERVOLTAGE UNIT

1. Connect the SR-76A to a suitable source of power as indicated on the nameplate. Be sure the POWER ON Switch is OF.
2. Connect the Red and Black binding posts of the AUXILIARY OUTPUT Section to the undervoltage unit operating coil terminals.
3. Connect a pair of light leads from the Yellow Relay Contact terminal posts of the test set to the relay undervoltage unit contact terminals.
4. Turn the POWER ON Switch ON. The POWER ON light and the Continuity light should glow.
5. Press the timer reset button and initiate the test st by pushing the INITIATE Switch.
6. Rotate the AUX. OUTPUT Control knob (clockwise) to increase voltage applied to the undervoltage unit operating coil until the continuity light just goes out. Read and record this value of voltage as the pick-up voltage of the undervoltage unit.
7. Continue to rotate AUX. OUTPUT Control knob clockwise to increase applied voltage until relay rated voltage is read on the test set voltmeter.
8. Rotate the AUX. OUTPUT Control knob counterclockwise to decrease applied voltage until the Continuity light first lights. Read and record this voltage value as the drop out

voltage of the undervoltage unit.

9. Return AUX. OUTPUT Control knob to zero and turn the POWER ON/OFF Switch OFF.

TESTING VOLTAGE CONTROL OF OVERCURRENT RELAY

1. Connect the SR-76A to a suitable source of power as indicated on the nameplate. Be sure the POWER ON Switch is OFF.

2. Connect the AUX. OUTPUT Red and Black binding posts of the AUX. OUTPUT section to the undervoltage unit operating coil terminals.

3. Connect the Main A.C. Current Output Terminals of the Control Section to the overcurrent operation coil terminals.

4. Adjust the Main A.C. AMMETER Range Switch so that the desired test current may be read on the upper 1/3 of the meter scale.

5. Connect a set of light leads from the Yellow Relay Contact terminals to the relay trip circuit contact terminals.

6. Adjust the INITIATE CONTROL lever to the TIMER position.

7. Turn the POWER ON Switch ON.

8. Press the timer reset button and initiate the test set by pressing the INITIATE Switch.

9. Rotate AUX. OUTPUT Control knob clockwise until relay rated voltage is read on the voltmeter.

10. Rotate the Main A.C. Control Knob clockwise until the value of current read on the main A.C. AMMETER is approximately four times tap value of the overcurrent unit.

11. The overcurrent unit ***should not operate*** to close the relay trip circuit contacts.

12. Rotate the AUX. OUTPUT Control knob counterclockwise to Reduce the voltage until the undervoltage unit drops out.

13. The overcurrent unit should operate to close the relay trip circuit contacts. This will stop the timer and de-energize the test set. There is no need to record the timer indicated on the timer, this not the timing set.

TESTING PICKUP AND TIMING OF THE OVERCURRENT UNIT

1. Insure that the undervoltage contacts are closed before conducting tests.

2. Follow the test procedures for testing an overcurrent relay as on pages 15 through 19.

TRANSFORMER DIFFERENTIAL RELAY WITH PERCENTAGE AND HARMONIC RESTRAINT
Westinghouse Type HU

GENERAL

The Type HU relay is a single-phase transformer differential relay provided with the features of percentage and harmonic restraint and has a sensitive polarized relay as the operating element. Percentage restraint permits accurate determination between internal and external faults at high currents Harmonic restraint enables the relay to distinguish, by the differences in waveform, between the differential current caused by an internal fault and that caused by transformer magnetizing inrush.

The Type HU relay is designed to be used for the protection of two-winding power transformers and has two (2) through-current restraint circuits with one (1) deferential current circuit.

The Type of HU-1 relay is designed to be used with three-winding power transformers and has three (3) through-current restraint circuits and one (1) differential current circuit.

TYPE OF TESTS

Pickup
DC Target
Slope
Harmonic Restraint
Instantaneous Unit

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	As Desired
Main - A.C. Control Knob	0
D.C./VERNIER Switch	DC
A.C. AMMETER RANGE Switch	10A
D.C. or VERNIER Control	0
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

0-25A/0-300V AC Switch	0-25A
A.C. AMMETER RANGE Switch	2.5A
0-25A or 0-300V AC Control Knob	0
VOLTMETER RANGE SWITCH	150V
EXT. POWER INPUT/NORMAL Switch	NORMAL
V. RELAY/DEST. Switch	NORMAL
VOLTMETER CIRCUIT SELECTOR Switch	AUX. D.C.
AUXILIARY OUTPUT Control Knob	0
AUXILIARY OUTPUT Selector Switch	0-150 V DC
NORM./DROPOUT Switch	NORM
NORM./BYPASS Switch	NORM

INITIAL TEST CONNECTIONS

1. a. 0-160V (8.75A) current output binding Post on Control Section to terminal 5 of relay.

   b. COMMON (±) tap on Control Section to terminal seven of relay.

   c. COMMON (±) tap on Control Section to 0-25A (±) (White) Binding Post on Auxiliary Section.

   d. 0-25A Output (Blue) Binding Post on Auxiliary Section to terminal three of relay.

   e. RELAY CONTACTS Binding Post to terminals one and ten of relay.

TESTING PICKUP

2. Block relay contact on the harmonic restraint unit closed.

3. Turn POWER ON Switch to ON position. POWER ON Lamps on Control and Auxiliary Sections should light and TIMER display should be lighted.

4. Reset TIMER by depressing TIMER RESET Pushbutton.

5. Initiate unit by depressing INITIATE Pushbutton.

6. Rotate 0-25A Control Knob in a clockwise direction until an indication of pickup is detected by the CONTINUITY Lamp or TONE Generator. Read and record the value or pickup current observed on the A.C. AMMETER in the Auxiliary Section.

7. Return 0-25A CONTROL Knob to "0".

TESTING DC TARGET AND SEAL-IN

8. Place INITIATE CONTROL Lever to the D.C. Position.

9. Rotate 0-25A Control Knob in a clockwise direction until an indication on the A.C. AMMETER in the Auxiliary Section of the value recorded for pickup plus 0.5 amperes is obtained.

10. Rotate D.C. or VERNIER Control Knob in a clockwise direction until the Target and Seal-In unit operates and the target "drops". Read and record value of current observed on D.C. AMMETER.

11. Return 0-25A Control Knob to "0". Observe D.C. AMMETER to verify that DC current continues to flow.

12. Reduce the D.C. or VERNIER Control Knob to "0". The D.C. AMMETER should indicate "0" current and the Target and the Seal-In unit should be released.

13. Return the -25A Control Knob to "0".

TESTING SLOPE

14. Move INITIATE CONTROL Lever to CONT. Position.

15. Set A.C. AMMETER Range Switch on Auxiliary Section to 5A position.

16. Rotate Main-A.C. Control Knob until 10 amperes is indicated by the A.C. AMMETER on the Control Section.

17. Rotate 0-25A Control Knob until pickup is indicated by the CONTINUITY Lamp or TONE Generator. Read and record the value of current indicated by the A.C. AMMETER on the Auxiliary Section.

NOTE: While adjusting the 0-25A output, make necessary adjustments using the Main-A.C. Control Knob to maintain the 10 amperes established in step 15.

18. Return 0-25A Control Knob to "0".

19. Return Main-AC Control Knob to "0".

TESTING HARMONIC RESTRAINT

20. Remove blocking on harmonic restraint unit and block differential unit contacts closed.

21. Place the HARMONIC RESTRAINT Switch in the HARMONIC RESTRAINT position. Connect the 0-25A Output (Blue) Binding Post on the Auxiliary Section to terminal three of the relay.

22. Move 0-160V (8.75A) test lead from terminal five of relay (see step 1 a.) to terminal three of relay.

23. Set A.C. AMMETER RANGE Switch on Control Section 10A position.

24. Set A.C. AMMETER RANGE Switch on AUXILIARY SECTION to 1A position.

25. Rotate 0-25A Control Knob clockwise until an indication of four ammeters is observed on the D.C. AMMETER in the CONTROL SECTION.

26. Rotate Main-A.C. Control Knob until pickup is detected by the CONTINUITY Lamp or TONE Generator. Read and record the value of current indicated by the A.C. AMMETER on the Control Section.

    NOTE: While adjusting the Main - A.C. Control Knob, make necessary adjustments using 0-25A Control Knob to maintain four amperes D.C. on the D.C. AMMETER.

27. Return the Main-A.C. Control Knob to"0".

28. Return the 0-25A Control Knob to "0".

29. Remove the blocking from differential unit contacts.

TESTING INSTANTANEOUS UNIT

30. Place INITIATE CONTROL Knob in the N.O. MOM. Position.

31. Set A.C. AMMETER RANGE Switch on Control Section to 50A position.

32. Move test lead from 0-160V (8.75A) current output Binding Post to the 0-40V (35A) Binding Post.

33. Disconnect test lead from 0-25A Output (Blue) Binding Post and terminal three of the relay.

34. Block harmonic and differential units *open*.

35. Initiate unit by ***holding in*** INITIATE Pushbutton.

36. Rotate Main-A.C. Control Knob clockwise to increase current until pickup is detected by the CONTINUITY Lamp or TONE Generator.

37. Read value of current on A.C. AMMETER and release INITIATE Pushbutton.

38. Record value of current on A.C. AMMETER.

39. Remove all blocking from relay.

40. Turn test set OFF. Remove all test leads.

TEST FOR GENERAL ELECTRIC
PHASE SEQUENCE AND UNDERVOLTAGE RELAY (TYPE ICR)
OR
WESTINGHOUSE REVERSE PHASE RELAY (TYPE CP)

GENERAL

Westinghouse Type CP and General Electric Type ICR relays are three-phase voltage induction disc relays used to protect against undervoltage or phase reversal in AC systems.

The CP and ICR relay electromagnets contain three (3) coils. When the three (3) coils are energized, out-of-phase fluxes are produced causing the disc to rotate toward closure of the high voltage contact. The out-of-phase fluxes produced when a phase is reversed cause the disc to rotate to close the low voltage contacts. Low voltage with proper phase rotation may not produce enough torque on the disc to overcome mechanical tension in a spring and the low voltage contacts will close. Pickup, Dropout and Operating Time of the relay may be varied by adjustments.

TYPE OF TESTS

Pickup - Minimum voltage to close Normally Open contact
Dropout - Maximum voltage at which Normally Closed contacts will close
Loss of One Phase
Phase Sequence
Timing

EQUIPMENT REQUIRED

Model SR-76A Relay Tester
1-3PH Synthesizer Accessory
NOTE: If model CS-7 Phase Shifter and Phase Angle Meter unit is supplied, 1-3PH Synthesizer is not requiRed. Refer to instructions on testing of these relays in CS-7 instruction manual.

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT
TONE/CONTINUITY Switch	As desired
Main A.C. Control Knob	"0" Counterclockwise
D.C./VERNIER Switch	DC

A.C. AMMETER RANGE Switch	10A
D.C. or VERNIER Control	0
D.C. AMMETER RANGE Switch	5A

SET-UP CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-25A/0-300V AC Switch	0-300V AC
A.C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0" (counterclockwise)
VOLTMETER RANGE Switch	So that the desired test voltage will be read in upper 1/3 of scale (Normally 150V range).
EXT. POWER INPUT/NORMAL Switch	NORMAL
V. RLY/D.E.T. Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. A.C.
AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
AUXILIARY OUTPUT Selector Switch	0-150V AC or 0-300V AC (depending on nominal operating voltage of the relay)
NORM./DROPOUT Switch	NORM
NORM./BYPASS Switch	NORM

1-3PH Accessory

Balance	Red Dot

TESTING PICKUP

1. Connect the SR-76A to a suitable source of power, as indicated on the nameplate, and ground. **BE SURE THE MAIN SWITCH IS OFF. CHECK THE "POWER ON" LIGHT.**

2. Connect AUXILIARY OUTPUT Red and Black binding posts to Yellow terminals marked "Input" on 1-3PH accessory unit.

3. Connect Red and Black EXT. A.C. binding posts on SR-76A to White terminals marked "EXT" VOLTMETER 0-150" ON 1-3PH accessory unit.

4. Using #18 flexible leads, make the following connections between the 1-3PH accessory and the relay under test:

a. Red terminal "A" to relay terminal for Phase 1 or A
b. Yellow terminal "B" to relay terminals for Phase 2 or B
c. Blue terminal "C" to relay terminal for Phase 3 or C

5. Connect two #18 flexible leads from Yellow terminals on SR-76A marked Relay Contacts to relay terminals which will permit observation of operation of relay Normally Open contacts.

6. Turn POWER ON Switch to ON. POWER ON light should glow.

7. Initiate SR-76A test set. Press INITIATE Switch. Light in switch should glow.

8. Rotate AUXILIARY OUTPUT Control Knob clockwise until CONTINUITY light flickers.

9. Check AB-AC-BC Switch positions for balance of voltage. Re-adjust Balance of 1-3PH as necessary to get the three voltages as close as possible.

10. Record the average of the three voltages (AB-AC-BC) as pickup.

11. Turn POWER ON Switch OFF. Return AUX. Control to zero.

TESTING DROPOUT

1. Repeat Steps 1-4 above.

2. Connect two #18 flexible leads from Yellow terminals on SR-76A marked RELAY CONTACTS to relay terminals which will permit observation of operation of relay Normally Closed contacts.

3. Turn POWER ON Switch ON. POWER ON light and Green CONTINUITY light should glow.

4. Press Initiate Switch.

5. Rotate AUXILIARY OUTPUT Control Knob clockwise until CONTINUITY light extinguishes.

6. Check AB-AC-BC Switch positions for balance of voltages. Re-adjust balance of 1-3PH as necessary to get the three voltages as close as possible.

7. Record the average of the three voltages as dropout.

TESTING LOSS OF ONE PHASE

1. Repeat Steps 1-4 under "Testing Dropout".

2. Rotate AUXILIARY OUTPUT Control Knob clockwise until rated voltage has been applied to relay coils. CONTINUITY light should be extinguished.

3. Check AB-AC-BC Switch positions for balance. adjust as necessary.

4. Carefully remove lead from Red terminal "A" on 1-3PH accessory. After a few seconds, the Green CONTINUITY light should glow.

5. Turn POWER ON Switch OFF. Return Aux. Control to zero.

TESTING PHASE SEQUENCE

1. Repeat Steps 1-3 under "Testing Loss of One Phase".

2. Carefully interchange the connections on the 1-3PH accessory. Lead connected to Red terminal "A" should be moved to Yellow terminal "B" and lead on Yellow terminal "B" moved to Red terminal "A".

3. The moveable contact on the relay should make the low voltage contact. The Green continuity light should glow.

4. Replace "A" and "B" test leads in proper sequence.

5. Turn POWER ON Switch to OFF. Return Aux. Control to zero.

TESTING TIMING

1. Repeat Steps 1-4 under testing "Dropout".

2. Set the VOLTMETER CIRCUIT SELECTOR Switch and the AUXILIARY OUTPUT Selector Switch to the V. RLY. position.

3. Rotate the 0-300V AC Control Knob (clockwise) to increase output until normal relay voltage (see relay nameplate) is observed on voltmeter.

4. Switch the INITIATE CONTROL lever to TIMER and switch the V. RLY/D.E.T. TEST Switch to FAULT position.

5. Set faulted relay voltage (over or under normal) by rotating AUXILIARY OUTPUT Control knob to increase or decrease output. Read the fault voltage on the voltmeter.

   NOTE: Set the fault voltage approximately 1 to 2 volts higher than the desired test voltage.

6. Switch the V. RLY/D.E.T Switch to the TEST position. The fault voltage set in Step 5 will be impressed on the relay operating coil and the digital timer will automatically start.

7. When the relay trip circuit contacts make, the timer will stop to indicate the elapsed time of the test.

8. Turn POWER ON Switch to OFF.

9. Remove all test leads.

CURRENT PHASE BALANCE RELAYS
Westinghouse Type CM
General Electric Type IJC

GENERAL

The Current Phase Balance Relay operates to trip a circuit breaker when the phase currents in a circuit become unbalanced by some predetermined amount. This relay compares the three phase currents of a line.

GENERAL ELECTRIC TYPE IJC

The General Electric IJC relay is composed of three individual induction discs with two coils per disc. One coil produces a contact closing torque on the disc and is called an operating coil. The second coil produces a contact opening torque on the disc and is called a restraint coil. These two coils see currents from different phases of the circuit and the relay will operate when the phase currents become sufficiently unbalanced. The trip circuit contacts associated with all three induction discs are connected in parallel.

TYPES OF TESTS

Pickup
Timing
Slope
Target and Seal-In

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Control Knob	"0"
D.C./VERNIER Switch	VERNIER (counterclockwise)
A.C. AMMETER RANGE Switch	Set to read test current in upper section of meter scale.
D.C. or VERNIER Control	"0" (counterclockwise)
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-25A/0-300V AC Switch	0-25A
A.C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0" (counterclockwise)
VOLTMETER RANGE Switch	150
EXT. POWER INPUT/NORMAL Switch	NORMAL
V. RLY/D.E.T Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. A.C.
AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
AUXILIARY OUTPUT Selector Switch	0-150V AC
NORM./DROPOUT Switch	NORM.
NORM./BYPASS Switch	NORM.

TESTING PICKUP

1. Connect Model SR-76A to a suitable source of power. Be sure the ON/OFF Switch is OFF.
2. Interconnect the Control Section and the Auxiliary Section.
3. Connect one operating coil of the relay to the 0-10V/140A terminal and the ± COMMON.
4. Turn POWER ON/OFF Switch to ON. POWER ON light should glow.
5. Initiate test set by pressing INITIATE Switch.
6. Slowly increase current by rotating Main A.C. and Vernier controls clockwise until disc moves and contacts are almost closed. Then decrease current until disc remains stationary at this point.
7. Record this value of current as Pickup.
8. Repeat for operating coils of the other two relay units.
9. Return controls to "0" position and switch power OFF.

TESTING TIMING

1. Repeat Steps 1 and 2 under "TESTING PICKUP".

2. Set A.C. AMMETER RANGE Switch so that the desired test current can be read in upper 1/3 of the meter scale. Set ammeter preset mechanism 1/2 division below desired test current.

3. Turn POWER ON/OFF Switch to ON. POWER ON light should glow.

4. Set INITIATE CONTROL knob to N.O. MOM. and INITIATE CONTROL lever to CONT. position.

5. Set test current by "jogging" with the INITIATE Switch and rotating the Main A.C. Current Control Knob to increase the output until the ammeter pointer preset lifts to indicate desired test current.

6. Set INITIATE CONTROL knob to N.O. MAINT. and the INITIATE CONTROL lever to the TIMER position.

7. Using a pair of light leads, connect relay trip circuit contact terminals to RELAY CONTACTS binding posts on the SR-76A.

8. Reset digital timer by depressing the RESET button.

9. Initiate the test set by pressing the INITIATE Switch. The unit will energize and the Timer will begin to run. When the relay contacts close, the Timer will stop and the unit will de-energize itself.

10. Read and record time indicated on the Timer.

11. Repeat Steps 1-10 for operating coils of the other two relay units.

TESTING SLOPE

1. Repeat Steps 1 through 3 under TESTING PICKUP.

2. Connect restraint coil for same relay unit that was used in step 3 under TESTING PICKUP to 0-300V AC/0-25A terminals.

3. Select the proper ammeter ranges for both AC Ammeters.

4. Set INITIATE CONTROL knob to N.O. MAINT. and INITIATE CONTROL lever to CONT.

5. Turn POWER ON/OFF Switch to ON. POWER ON light should glow.

6. Initiate the test set by pressing the INITIATE Switch.

7. Rotate Main A.C. Control knob clockwise to energize operating coil of relay unit under test.

8. Rotate 0-300V/0-25A Control knob clockwise to energize restraint coil of relay unit under test.

9. Regulate the two currents until the disc of the relay under test is stopped with that unit's

trip circuit contacts. (About halfway between full open position and trip position.)

10. Record both values of current and calculate slope.

11. Repeat Steps 1-10 for the other relay units.

WESTINGHOUSE TYPE CM RELAY

The Westinghouse Type CM relay has two individual induction discs. Each disc has two current coils. One coil produces torque to move the disc to the left and the other coil produces torque to move the disc to the right. As long as the currents energizing the two coils are equal, the torques cancel and the disc remains stationary. In connecting the relay in the circuit, the coil production rotation to the right on one disc is in "A" Phase, while the coil producing rotation to the left on the same disc is in "B" Phase. Each unit of the relay has a moving contact attached to the disc shaft and two stationary contacts, one on the right and one on the left. When the relay is energized with balanced 3-phase currents, the moving contacts of both relay units should be midway between the left and right stationary contacts. An unbalance of the phase currents will cause either or both of the discs to rotate with subsequent closing of the relay trip circuit contacts. The relay trip circuit contacts are connected in parallel.

TYPES OF TESTS

Electrical Balance
Minimum Trip Setting
Operating Curve
Time Curve

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Control Knob	"0"
A.C. AMMETER RANGE Switch	So that the desired test current can be read in the upper 1/3 of the scale.
D.C./VERNIER Switch	VERNIER
D.C. or VERNIER Control Knob	"0"
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-25A/300V AC Switch	0-25A
A.C. AMMETER RANGE Switch	So that the desired test current can be read in UPPER 1/3 of scale
0-25A or 0-300V AC Control Knob	"0"
VOLTMETER RANGE Switch	300V
NORMAL/EXT. POWER INPUT Switch	NORMAL
VOLTMETER CIRCUIT SELECTOR Switch	300V AC
AUXILIARY OUTPUT Selector Switch	0-300V AC
AUXILIARY OUTPUT Control Knob	"0"
NORM./DROPOUT	NORM.
NORM./BYPASS	NORM.

TESTING ELECTRICAL BALANCE

1. Connect Model SR-76A to a suitable source of power in accordance with nameplate. Be sure the ON/OFF Switch is OFF.

2. Interconnect the Control Section to the Auxiliary Section.

3. Connect front operating coil of one induction disc unit to the 0-80V/17.5A terminal and ± common.

4. Connect rear operating coil of the same induction disc unit to the 0-300V AC/0-25A terminals.

5. Switch POWER ON/OFF Switch to ON. POWER ON light should glow.

6. Initiate unit by pressing the INITIATE Switch.

7. Rotate Main A.C. Control Knob clockwise to obtain a reading of 6 amperes on Main Ammeter.

8 Rotate 0-300AC/0-25A control clockwise to obtain a reading of 6 amperes on the second AC Ammeter on test set.

9. The moving contact of the induction disc unit under test should be in a balanced position as described in relay the manufacturer's literature.

10. Turn POWER ON Switch to OFF.

MINIMUM TRIP SETTING

1. Repeat Steps 1 through 6 under TESTING ELECTRICAL BALANCE.

2. Connect light leads from RELAY CONTACTS binding posts on test set to the trip circuit contacts of the relay.

3. Rotate MAIN A.C. Control Knob clockwise to obtain a reading of one ampere on Main Ammeter.

4. Adjust left stationary contact until it just makes with the moving contact as indicated by glowing of the CONTINUITY light or the sounding of the TONE generator.

5. Return Main Control to zero.

6. Rotate 0-300V/0-25A Control knob clockwise to obtain a reading of one ampere on second AC Ammeter of test set.

7. Adjust right stationary contact until it just makes with moving contact, as indicated by glowing of CONTINUITY light or the sounding of the TONE generator.

OPERATING CURVE

1. Repeat Steps 1 through 6 under TESTING ELECTRICAL BALANCE.

2. Connect light leads from RELAY CONTACTS binding posts on the test set to the trip circuit contacts of the relay.

3. Rotate the 0-300V/0-25A Control knob clockwise until the moving contact and the right stationary contact just make, as indicated by flickering of the CONTINUITY light. Record readings of both ammeters.

4. Slowly decrease current output of 0-300V/0-25A Control knob by rotating the Control counterclockwise until the moving contact and left hand stationary contact just makes, as indicated by flickering of CONTINUITY light. Record readings of both ammeters.

TIME CURVE

1. Repeat Steps 1 through 5 under TESTING ELECTRICAL BALANCE. Set INITIATE CONTROL knob to N.O. MOM. position.

2. Connect a pair of light leads from RELAY CONTACTS binding posts of the test set to trip circuit contact terminals of the relay.

3. Jog INITIATE Switch and rotate Main Control to obtain a reading of 10 amperes on main ammeter.

4. Manually set moving contact to "Balance" position.

5. Set INITIATE CONTROL knob to N.O. MAINT. and the INITIATE CONTROL lever to the TIMER position.

6. Reset digital timer by depressing the RESET button.

7. Initiate the test set by pressing the INITIATE Switch. The unit will energize and the Timer will begin to run. When the relay contacts close, the Timer will stop and the unit will de-energize itself.

8. Read and record time indicated on the Timer.

9. Return Main A.C. Control to zero. Set INITIATE CONTROL knob to N.O. MOM. position.

10. Jog INITIATE Switch and rotate 0-300V/0-25A Control knob to obtain a reading of 10 amperes on second A.C. Ammeter.

11. Manually set moving contact to "Balance" position.

12. Repeat steps 5 through 8 above.

Repeat all four tests, i.e. Electrical Balance, Minimum Trip Setting, Operating Curve and Time Curve for the other induction disc unit.

HIGH IMPEDANCE BUS DIFFERENTIAL RELAY
Westinghouse Type KAB

GENERAL

The type KAB relay is connected so that under normal operating conditions, the voltage at the relay terminals is approximately zero. For an external fault, assuming that neither the source or feeder C.T.'s saturate, the voltage at the relay terminals remains zero.

In the case of an internal fault, the C.T.'s have, in effect, open-circuited primaries. The source C.T.'s will product high voltages to drive the fault current through the feeder C.T.'s secondaries. This high voltage will appear at the relay terminals and cause the relay to operate.

The overcurrent unit will operate on current flow during severe internal faults when the varistor conducts current to limit the secondary voltage.

TYPES OF TESTS

Pickup Overvoltage
Timing Overvoltage
Pickup Overcurrent
Target and Seal-In

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

SET-UP OF CONTROLS IN CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Control Knob	"0"
D.C./VERNIER Switch	VERNIER (counterclockwise)
A.C. AMMETER RANGE Switch	250A
D.C. or VERNIER Control	"0"(counterclockwise)
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION

0-25A/0-300V AC Switch	0-300V AC
A.C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0" (counterclockwise)
VOLTMETER RANGE Switch	So that the desired test voltage will be read in UPPER 1/3 of scale.
EXT. POWER INPUT/NORMAL Switch	NORMAL
V. RLY/D.E.T. Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. A.C.
AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
AUXILIARY OUTPUT Selector Switch	0-150V AC of 0-300V AC (depending on nominal operating voltage of the relay)
NORM./DROPOUT Switch	NORM.
NORM./BYPASS Switch	NORM.

TESTING FOR PICKUP

1. Connect Model SR-76A to a suitable source of power in accordance with nameplate. Be sure the ON/OFF Switch is OFF.
2. Interconnect the Control Section to the Auxiliary Section.
3. Connect the relay potential operating coil to the Red and Black binding posts under the AUXILIARY OUTPUT Section.
4. Connect light leads from binding posts marked RELAY CONTACTS to the trip circuit contact terminals of the relay induction unit.
5. Switch POWER ON/OFF Switch to ON. POWER ON light should glow.
6. Initiate unit by pressing the INITIATE Switch.
7. Rotate the AUXILIARY OUTPUT Control Knob (clockwise) to increase output until CONTINUITY light flickers or the TONE generator output breaks.
8. Record this value of voltage as pickup of the relay.

TESTING TIMING

9. Set the VOLTMETER CIRCUIT SELECTOR Switch and the AUXILIARY OUTPUT SELECTOR Switch to the V. RLY position.
10. Switch the INITIATE CONTROL lever to TIMER and switch the V. RLY Test Switch to the FAULT position.

11. Set faulted relay voltage by rotating AUXILIARY OUTPUT control knob to increase output. Read the fault voltage on the voltmeter. NOTE: Set the fault voltage approximately one to two volts higher than the desired test voltage (Westinghouse recommends two times pickup).

12. Switch the V. RLY. Test Switch to the TEST position. the fault voltage set in step 11 will be impressed on the relay operating coil and the digital timer will automatically start.

13. When the relay trip circuit contacts make, the timer will stop to indicate the elapsed time of the test.

TESTING FOR PICKUP OF OVERCURRENT UNIT

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	**POSITION**
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N.O. MOM.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Control Knob	"0"
A.C. AMMETER RANGE Switch	So that the desired test current can be read in the UPPER 1/3 of the scale
D.C./VERNIER Switch	VERNIER
D.C. or VERNIER Control Knob	"0"
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

Return the V. RLY/D.E.T. Switch back to NORM. Since the AUXILIARY OUTPUT SECTION is not used to conduct the following test no other changes to the AUXILIARY Controls need by made.

1. Connect Model SR-76A to a suitable source of power in accordance with nameplate. Be sure the POWER ON/OFF Switch is OFF. BE SURE THE POWER ON/OFF Switch is OFF.

2. Connect the relay overcurrent unit operating coil to the (±) COMMON and the appropriate output tap, for the LO setting use the 0-160 volt, 8.75 ampere binding post. For the HI setting use the 0-40 volt, 35 ampere output binding post.

3. Connect the overcurrent unit trip circuit contacts to the RELAY CONTACTS binding posts of the test set.

4. Select the Main Ammeter range so that desired test current will be read in UPPER 1/3 of meter scale.

5. Turn POWER ON Switch to ON. POWER ON light should glow.

6. Initiate unit by *holding in* INITIATE button.

7. Rotate Main AC Control knob clockwise to increase current until the CONTINUITY light glows or TONE signal sounds. Make sure this is *minimum setting* on the Main AC Control where the overcurrent unit of the relay will consistently pickup as the INITIATE button is alternately opened and closed. The glowing of the CONTINUITY light or the TONE signal should be simultaneous with the depression of the INITIATE button.

8. Rapidly read this value of current and release INITIATE button.

WARNING

CURRENT IS FLOWING THROUGH THE RELAY COIL UNTIL INITIATE BUTTON IS RELEASED. THEREFORE, IT IS IMPORTANT TO READ THE VALUE OF CURRENT RAPIDLY.

9. Turn test set to OFF.

TARGET AND SEAL-IN

The DC TARGET AND SEAL-IN unit can be tested following the procedure given in the test procedures for testing an overcurrent relay, page 18.

DIFFERENTIAL VOLTAGE RELAY
General Electric Type PVD

GENERAL

This relay is a high speed bus differential relay which contains two operating units connected in parallel. One of the units (known as 87L) is an instantaneous voltage unit having a high impedance operating coil connected across the DC terminals of a full wave rectifier. The rectifier is connected in series with a reactor-capacitor combination tuned for resonance at rated frequency. The other unit (known as 87H) is an instantaneous overcurrent unit with a low impedance operating coil which is connected in series with Thyrite resistor stacks. Both of these units are connected in parallel with the secondaries of all current transformers on all the circuits associated with the bus to be protected. The current transformers on all the circuits associated with the bus to be protected. The current transformers should all have the same rations.

The purpose of the 87L unit is to allow designation of the minimum internal fault that will operate the relay to trip all circuit breakers associated with the protected bus. The purpose of the 87H unit is to provide instantaneous operation for extremely severe internal faults.

Testing General Electric Type PVD11C Relays

NOTE: Set both the 87L and 87H units in low ranges.

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TESTING

TESTS

1. PICKUP OF 87L ELEMENT
2. PICKUP OF 87H ELEMENT
3. TESTING LEAKAGE OF THYRITE

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OF Switch	OFF
INITIATE CONTROL Knob	N.O. MOM
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Control Knob	"0"
D.C./VERNIER Switch	VERNIER (counterclockwise)
A.C. AMMETER RANGE Switch	250A
D.C. or VERNIER Control	"0" (counterclockwise)

D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-250A/0-300V AC Switch	0-300V AC
A.C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0" (counterclockwise)
VOLTMETER RANGE Switch	So that the desired test voltage will be read in UPPER 1/3 OF SCALE
EXT. POWER INPUT/NORMAL Switch	NORMAL
V. RLY./D.E.T Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. A.C.
AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
AUXILIARY OUTPUT Selector Switch	0-150V AC or 0-30V AC (depending on nominal operating voltage of the relay)
NORM./DROPOUT Switch	NORM.
NORM./BYPASS Switch	NORM.

TESTING FOR PICKUP OF 87L ELEMENT

1. Connect Model SR-76A to a suitable source of power in accordance with nameplate. Be sure the ON/OFF Switch is OFF.
2. Interconnect the Control Section to the Auxiliary Section.
3. Connect the relay 87L unit operating coil to the Red and Black binding posts under the AUXILIARY OUTPUT Section.
4. Connect light leads from binding posts marked RELAY CONTACTS to the trip circuit contact terminals of the relay induction unit.
5. Jumper the relay terminals so that the relay 87H operating coil circuit is connected in parallel with the 87L operating coil circuit.
6. Switch POWER ON/OFF Switch to ON. POWER ON light should glow.
7. Initiate unit by pressing and holding in the INITIATE Switch.
8. Rapidly rotate the AUXILIARY OUTPUT control clockwise until the meter indicates an

applied voltage approximately 25 volts higher than setting of the relay 87L unit. The CONTINUITY light should glow. Release the INITIATE Switch.

9. Jog (press, read voltage and release) INITIATE Switch while Reducing applied voltage by rotating the AUXILIARY OUTPUT Control counterclockwise. Determine minimum voltage which closed the relay 87L trip circuit contacts as indicated by the CONTINUITY light.

10. Record this value of voltage as pickup of 87L element.

TESTING PICKUP OF 87L ELEMENT

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	**POSITION**
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Control Knob	"0"
A.C. AMMETER RANGE Switch	So that the desired test current can be read in the UPPER 1/3 of the scale
D.C./VERNIER Switch	VERNIER
D.C. or VERNIER Control Knob	"0"
D.C. AMMETER RANGE Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

Since the AUXILIARY OUTPUT SECTION is not used to conduct the following test, leave the AUXILIARY SECTION set-up as is.

1. Connect Model SR-76A to a suitable source of power. Be sure the ON/OFF Switch is OFF.

2. Leave the Control Section and the Auxiliary Section interconnected.

3. Connect the appropriate current output binding posts to the relay terminals so that the operating coil of the relay 87H unit may be energized with the Thyrite resistor discs *out of the circuit*.

4. Connect the RELAY CONTACTS binding posts of the test set to the trip circuit contacts terminals of the relay.

5. Turn POWER ON Switch to ON. POWER ON light should glow.

6. Initiate unit by pressing INITIATE Switch.

7. Slowly increase current to the relay operating coil by rotating Main A.C. Control and VERNIER Control clockwise until CONTINUITY light glows or TONE generator sounds.

8. Record this value of current as "pickup" of the 87H unit.

TESTING THYRITE LEAKAGE

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	**POSITION**
POWER ON/OFF Switch	OFF
TONE/CONTINUITY Switch	Either Position
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
Main A.C. Current Control Knob	"0"
A.C. AMMETER RANGE Switch	250A
D.C. or VERNIER Control Knob	"0"
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-300V AC/0-25A Switch	0-300V AC
A.C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0"
VOLTMETER RANGE Switch	So that the desired test voltage can be read in the UPPER 1/3 of the meter scale
NORMAL/EXT. POWER INPUT Switch	NORMAL
V.RLY/DET Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. D.C.
AUXILIARY OUTPUT Control Knob	"0"
AUXILIARY OUTPUT Selector Switch	Either 150V DC or 300V DC
NORM/DROPOUT Switch	NORM.
NORM/BYPASS Switch	NORM.

1. Connect Model SR-76A to a suitable source of power. Make sure POWER ON/OFF Switch is OFF.
2. Interconnect the control and auxiliary sections.
3. Connect the Red (+) and Black (-) AUXILIARY OUTPUT binding posts of the test set to the relay terminals so that the Thyrite resistor discs may be independently energized. A 0-15 milliampere DC meter should be connected in series with this circuit.
4. Switch POWER ON/OFF Switch to ON. POWER ON Light should glow.
5. Initiate unit by pressing INITIATE Switch.
6. Rotate AUXILIARY OUTPUT Control knob clockwise to increase output to 120 volts DC.
7. Read current on milliammeter. Compare with relay manufacturer's specifications.

TESTING INSTANTANEOUS VOLTAGE RELAYS
Westinghouse Type SV, SV-1
General Electric Type PJV

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TEST

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either position
Main A.C. Control Knob	"0"
D.C./VERNIER Switch	VERNIER (counterclockwise)
A.C. AMMETER RANGE Switch	250A
D.C. or VERNIER Control	"0" (counterclockwise)
D.C. AMMETER RANGE Switch	5A

SET-UP OF CONTROLS ON AUXILIARY SECTION

0-25A/0-300V AC Switch	0-300V AC
A.C. AMMETER RANGE Switch	25A
0-25A or 0-300V AC Control Knob	"0" (COUNTERCLOCKWISE)
VOLTMETER RANGE Switch	So that the desired test voltage will be read in upper 1/3 of scale.
EXT. POWER INPUT/NORMAL Switch	NORMAL
V. RLY/D.E.T. Switch	NORM.
VOLTMETER CIRCUIT SELECTOR Switch	AUX. A.C.
AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
AUXILIARY OUTPUT Selector Switch	0-150V AC or 0-300V AC (depending on nominal operating voltage of the relay)
NORM./DROPOUT Switch	NORM.
NORM./BYPASS Switch	NORM.

TESTING FOR PICKUP

1. Connect Model SR-76A to a suitable source of power in accordance with nameplate. Be sure the ON/OFF Switch is OFF.

2. Interconnect the Control Section to the Auxiliary Section.

3. Connect the relay operating coil to the Red and Black binding posts under the AUXILIARY OUTPUT Section.

4. Connect light leads from binding posts marked RELAY CONTACTS to the trip circuit contact terminals of the relay induction unit.

5. Switch POWER ON/OFF Switch to ON. POWER ON light should glow.

6. Initiate unit by pressing the INITIATE Switch.

7. Rotate the AUXILIARY OUTPUT Control Knob (clockwise) to increase output until CONTINUITY light flickers or the TONE generator output breaks.

8. Record this value of voltage as pickup of the relay.

9. Continue to rotate Control Knob clockwise until relay normal voltage (on relay nameplate) is read on voltmeter.

10. Rotate Control Knob counterclockwise to decrease voltage until the CONTINUITY light just glows.

11. Read and record this value of voltage as dropout.

12. Turn test set to OFF.

PILOT WIRE RELAY
Westinghouse Type HCB

GENERAL

The HCB relay is a three-phase high speed pilot wire relay designed for simultaneous tripping at the terminals of a power line. The power line three-phase currents energize the relay operating circuits through current transformers and are converted by a combination positive and zero sequence filters into a single phase output voltage. The single-phase output voltages from the HCB relays which are located at each power line terminal, normally have polarity to cause a circulating current through the pilot wire. When a fault occurs between the terminals of the power line, polarity of the single-phase output voltages to oppose each other in the pilot wire. Therefore, the output voltage of each relay is bypassed through the relay operating coil causing relay trip circuit contact closure.

ALWAYS CONSULT THE MANUFACTURER'S INSTRUCTION LEAFLET FOR PROPER CONNECTIONS AND INFORMATION ON RELAY CHARACTERISTICS BEFORE TESTING.

TYPE OF TESTS

Phase to Neutral Pickup
Phase to Phase Pickup
Target and Seal-In Pickup

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OFF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	As desired
Main A.C. Control Knob	0
D.C./VERNIER Switch	VERNIER
A.C. AMMETER RANGE Switch	As desired
D.C. or VERNIER Control	0
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-25A/0-300V AC Switch	0-25A
A.C. AMMETER RANGE Switch	2.5A
0-25A or 0-300V AC Control Knob	0
VOLTMETER RANGE Switch	150V
EXT. POWER INPUT/NORMAL Switch	NORMAL
V. RLY/D.E.T. Switch	NORMAL
VOLTMETER CIRCUIT SELECTOR Switch	AUX. D.C.
AUXILIARY OUTPUT Control Knob	0
AUXILIARY OUTPUT Selector Switch	0-150V DC
NORM./DROPOUT Switch	NORM
NORM./BYPASS Switch	NORM

TESTING PHASE TO NEUTRAL PICKUP

1. Connect Model SR-76A to a suitable source of power as indicated on the nameplate and ground. **BE SURE THE MAIN SWITCH IS OFF. CHECK THE POWER ON LIGHT.**
2. Connect 0-160V (8.75A) and Common (±) terminals so as to pass current "Phase A" to Neutral.
3. Connect binding posts marked RELAY CONTACTS to relay trip circuit contacts.
4. Turn POWER ON Switch to ON. POWER ON light should glow.
5. Initiate unit by pressing INITIATE Switch.
6. Slowly increase current by rotating Main A.C. Control and the VERNIER Control clockwise until CONTINUITY light glows or TONE breaks.
7. Record this value of current as pickup.
8. Repeat for "B" to Neutral and "C" to Neutral.

TESTING PHASE TO PHASE PICKUP

Repeat Steps 1 through 7 above except that the current output of SR-76A is connected to relay terminals so as to pass current Phase B to Phase C in series. Repeat for Phase "C" to "A' and Phase "A" to "B".

TESTING TARGET AND SEAL-IN PICKUP

Block relay trip circuit contacts closed and follow test procedures for testing DC Target and Seal-In on page 18.

TESTING GROUND DIRECTIONAL OVERCURRENT RELAYS
Westinghouse Type IRD, KRD and
General Electric Type JBCG

PLEASE REFER TO THE MANUFACTURER'S INSTRUCTION BULLETIN BEFORE PROCEEDING WITH TEST.

EQUIPMENT REQUIRED

Multi-Amp Model SR-76A relay test set

POWER REQUIRED

120 volts, 60 Hz., 1Ø at approximately 1.4 kVA.

TYPES OF TESTS

1. Pickup - voltage polarized directional element
2. Pickup - current polarized directional element
3. Pickup - overcurrent element
4. Timing - overcurrent element
5. Pickup - instantaneous element
6. D.C. TARGET
7. D.C. Auxiliary Switch (IRD)

TESTING PICKUP - Voltage Polarized Directional Element

SR-76A Set-up of Controls before Test

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TEST

SET-UP OF CONTROLS ON CONTROL SECTION

POWER ON/OF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either Position
Main A.C. Control Knob	"0" (counterclockwise)
D.C./VERNIER Switch	VERNIER
A.C. AMMETER RANGE Switch	1A
D.C. or VERNIER Control	"0"
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	POSITION
0-25A/0-300V AC Switch	0-25A
A.C. AMMETER RANGE Switch	5A
0-25A or 0-300V AC Control Knob	"0" (counterclockwise)
VOLTMETER RANGE Switch	1.5V
NORMAL/EXT.PWR. Switch	Normal
VOLTMETER CIRCUIT SELECTOR Switch	D.E.T.
AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
NORM./BYPASS Switch	NORM.
AUX. OUTPUT Voltage Selector Switch	D.E.T.
NORM./DROPOUT	NORM.

1. Connect SR-76A to a suitable power source. Insure POWER ON/OFF Switch is in OFF position.

2. Connect polarity terminal (±) of the relay directional unit, current operating coil to the polarity terminal (Black ±) of the voltage AUX. OUTPUT section. The other relay current operating coil terminal should be connected to the Blue non-polarity, 0-25A or 0-300V AC terminal.

3. Connect the polarity ± terminal of the relay voltage polarizing coil to the Red non-polarity voltage terminal of the AUX. OUTPUT section. Place jumper from non-polarity terminal of voltage polarizing coil to polarity (±) terminal of the current polarizing coil.

4. Switch D.E.T selector switch to desired position.

   NOTE: Positions 1, 2, 3, and 4 are factory wired to product values given below:

POSITION	VOLTS	AMPERES
1	1	4
2	2	4
3	1	8
4	2	8

5. The instantaneous element contacts on the IRD, the overcurrent element (I) contacts on the KRD relay and the (10C) contacts on the JBCG relays should be blocked closed.

6. Connect a set of leads from the binding posts labeled "Relay Contacts" on the test set to the relay terminals associated with the normally open contacts of directional element.

7. Turn the Power ON Switch ON. Power ON light should glow.

8. Initiate unit by pressing INITIATE Switch.

9. Rotate Main control Knob clockwise to increase output until the relay directional unit contacts close. Read and record the values of voltage and current on the respective meters.

10. Reverse leads from test set to potential coil of relay. Relay directional unit contacts should resist closure.

11. Rotate Main AC Control Knob to a full counterclockwise position and turn Power ON Switch OFF.

12. Remove blocking from relay.

TESTING PICKUP - Current Polarized Directional Element

1. Connect the test set to a suitable source of power and ground as indicated on the nameplate. Check the Power ON light to be sure the Power ON Switch is OFF.

2. Connect a set of leads from the 0-160 volt/8.75A tap and associated common to the directional unit operating and polarizing current coils so the current will pass through the two coils in series. This can be done by connecting the (±) Common terminal of the main AC current output to the polarity (±) terminal of the directional unit current operating coil. Connect a jumper from the other side of coil to the polarity (±) terminal of the directional unit current polarizing coil. The non-polarity terminal of the polarizing coil is connected to the 0-160 volt 8.75A tap of the main AC current output on the test set.

3. The instantaneous element contacts on the IRD and JBCG relays and the overcurrent element (I) contacts on the KRD relay should be blocked close.

4. Connect a set of leads from the binding posts labeled Relay Contacts on the test set to the relay terminals associated with the normally open contacts of the directional element.

5. Turn the Power ON Switch ON. Power ON light should glow.

6. Initiate unit by pressing INITIATE Switch.

7. Rotate Main and Vernier Controls clockwise to increase test set output until the relay directional element contacts close. Read and record value of current on the Main Ammeter.

8. Rotate Main and Vernier controls to a full counterclockwise position and turn the Power ON Switch OFF.

9. *Remove blocking* from relay.

TESTING D.C. AUXILIARY Switch - Minimum Pickup (IRD only)

SET-UP OF CONTROLS ON CONTROL SECTION

POWER ON/OF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either Position
Main A.C. Control Knob	"0" (counterclockwise)
D.C./VERNIER Switch	VERNIER
A.C. AMMETER RANGE Switch	1A
D.C. or VERNIER Control	"0"
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

SET-UP OF CONTROLS ON AUXILIARY SECTION

CONTROL	**POSITION**
0-25A/0-300V AC Switch	0-25A
A.C. AMMETER RANGE Switch	5A
0-25A or 0-300V AC Control Knob	"0" (counterclockwise)
VOLTMETER RANGE Switch	So that test voltage will be read in the upper 1/3 of scale.
NORMAL/EXT.PWR. Switch	Normal
VOLTMETER CIRCUIT SELECTOR Switch	AUX D.C.

AUXILIARY OUTPUT Control Knob	"0" (counterclockwise)
NORM./BYPASS Switch	NORM.
AUX. OUTPUT Voltage Selector Switch	0-150 V D.C.
NORM./DROPOUT	NORM.

1. Connect the test set to a suitable source of power and ground as indicated on the nameplate. Check the POWER ON light to be sure the Power ON Switch is OFF.

2. Block one of the directional elements normally open contacts closed.

3. Connect a set of leads from the Red (+) and Black (-) binding posts of the AUXILIARY OUTPUT Section to the auxiliary switch coil terminals of the relay.

4. Turn the Power ON Switch ON. Power ON light should glow.

5. Initiate the test set by pressing the INITIATE Switch.

6. Rotate the AUXILIARY OUTPUT Section to the auxiliary switch coil terminals of the relay.

4. Turn the Power ON Switch ON. Power ON light should glow.

5. Initiate the test set by pressing the INITIATE Switch.

6. Rotate the AUXILIARY OUTPUT Control Knob clockwise to increase test set output until auxiliary switch in relay operates as indicated by a click. Read and record voltage indicated on voltmeter.

7. Rotate the AUXILIARY OUTPUT Control Knob to a full counterclockwise position and turn the Power ON Switch OFF.

8. *Remove blocking* from relay.

TESTING OVERCURRENT ELEMENT - Pickup and Time Current Characteristics;
INSTANTANEOUS ELEMENT - Pickup; and DC TARGET and SEAL-IN

1. Block *ONE SET OF DIRECTIONAL ELEMENT CONTACTS IN THE CLOSED POSITION.* On the IRD, the auxiliary switch contacts must also be blocked in a closed position.

2. Follow the procedure for testing "Induction Disc Overcurrent Relay Type IAC or CO".

3. **Remove all blocking from relay when testing is completed.**

FAULT DETECTOR RELAY
General Electric Type CHC

GENERAL

The CHC11A relay is a three-phase, nondirectional overcurrent relay, with ground fault detection.

The CHC11B is similar to the CHC11A except it has a dual rated auxiliary telephone relay.

The CHC12A is a 3Ø, high speed, nondirectional overcurrent relay. The relay consists of a (PFD) induction CUP unit.

TYPE OF TESTS

Pickup - (PFD) Cup Unit
Pickup - (GFD) Hinged Armature Unit (11 A & B only)
Target and Seal-In

ALWAYS REFER TO THE MANUFACTURER'S LITERATURE BEFORE TEST

SET-UP OF CONTROLS ON CONTROL SECTION

CONTROL	POSITION
POWER ON/OF Switch	OFF
INITIATE CONTROL Knob	N.O. MAINT.
INITIATE CONTROL Lever	CONT.
TONE/CONTINUITY Switch	Either Position
Main A.C. Control Knob	"0" (counterclockwise)
D.C./VERNIER Switch	VERNIER
A.C. AMMETER RANGE Switch	Set to read test current in upper section of meter scale
D.C. or VERNIER Control	"0"
D.C. AMMETER RANGE Switch	5A
HARMONIC RESTRAINT/NORMAL Switch	NORMAL

TESTINGS PICKUP - (PFD) CUP UNIT

To test pickup of the (PFD) Cup Unit on the CHC11, will be necessary to place two phases in series by placing a jumper from relay terminal 4 to 6, on the CHC 12, jumper 3 to 6.

Proceed to page 17 of this manual and conduct the pickup test the same as pickup for a single

overcurrent relay. Connect the 0-160 volt 8.75 terminal to relay terminal 3 and the common to relay terminal number 5.

PICKUP - (GFD) HINGED ARMATURE UNIT

To test this pickup of the (GFD) Hinged Armature Unit, proceed to page 19 of this manual and conduct the test using the procedure Testing Instantaneous pickup. Because the pickup point for the GFD unit varies from only 0.5 to 8 amperes, use the 0-160V, 8.75 ampere output terminal instead of the 10 volt, 140 amperes terminal.

TARGET AND SEAL-IN

Turn to page 18 of this manual and use the procedure for testing DC Target and Seal-In.