INSTRUCTIONS

GEI-83956A

TIME OVERCURRENT RELAYS

IAC60E, 80E & 90E

GENERAL ELECTRIC

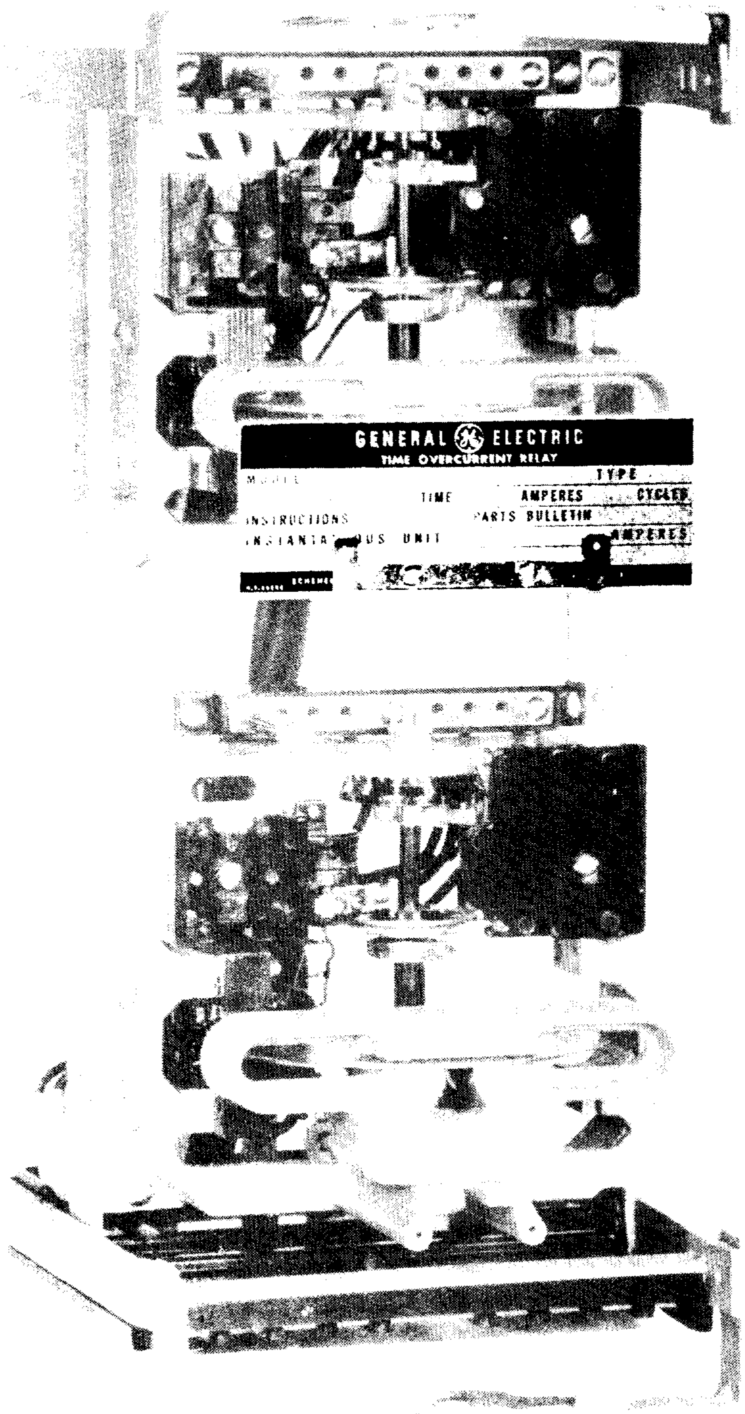


Fig. 1 (8031565) 121AC60E1A Relay Removed From Case

TIME OVERCURRENT RELAYS IAC60E, 80E AND 90E

DESCRIPTION

The IAC60E, IAC80E and IAC90E relays are composed of two induction disk time overcurrent units and one d-c auxiliary unit in an M1 case. The three models differ only in the characteristics of their time overcurrent units, the IAC60E being inverse, the IAC80E very inverse and the IAC90E extremely inverse. Since these relays were designed for use in conjunction with a three-phase mho distance relay to provide the second zone of protection against multi-phase faults on subtransmission lines, they have no targets but rather utilize the targets in the associated distance relay.

APPLICATION

The IAC60E, IAC80E and IAC90E relays were specifically designed to be used in conjunction with the second zone of distance relays to provide torque controlled time delay protection for the second zone. The time-overcurrent characteristics make the scheme suitable for coordination with fuses which may be used to protect transformers that are tapped off the protected lines or adjacent bus sections.

Fig. 2 illustrates how any one of the three IAC relays covered by this book may be used in conjunction with the CEY16A for second zone protection against all multi-phase faults. The CEY16A is the second zone directional mho relay that operates the d-c auxiliary unit in the IAC relay to torque control the time-overcurrent unit. The time-overcurrent unit then trips the breaker through the CEY16A contacts. Target indication is provided by the CEY relay. Separate ground relays must be used for protection against single-phase-to-ground faults.

If an offset mho relay is desired for the second zone of protection, the CEB16B relay may be used instead of the CEY16A.

There are several ranges of these IAC relays available. The range and the characteristics of the time overcurrent units should be selected to accommodate the desired pickup setting and at the same time facilitate time coordination with fuses and other relays on the system. The proper d-c rating should be specified for the auxiliary torque controlling unit. Please refer to the sections of RATINGS and CHARACTERISTICS for the necessary information.

One IAC60E, IAC80E or IAC90E and one CEY16A (or one CEB16B) are required per terminal to provide second zone distance protection for multi-phase faults on subtransmission lines.

RATINGS

CURRENT COILS

The continuous and short time ratings of the operating coil circuits are shown in Table A.

TABLE A

Tap Range (Amps)	Tap Ratings (Amps)	*Cont. Rating (Amps)	One Sec. Rating (Amps)
4/16	4, 5, 6, 8, 10, 12, 16	10	220

AUXILIARY UNIT

The auxiliary unit "A" is available with dual ratings 125/250 volts. The relay coil has a resistance of 2500 ohms. It has a series resistor of 1200 ohms when used on 125 volts D.C. and a 2500 ohm resistor when used on 250 volts D.C.

CONTACTS

The contacts of the time overcurrent units will close and carry 30 amperes DC momentarily for tripping duty at control voltages of 250V DC or less. The breaker trip coil circuit should, however, always be opened by a circuit breaker auxiliary switch or other suitable means. If the tripping current exceeds 30 amperes an auxiliary tripping relay should be used.

CHARACTERISTICS

OPERATING PRINCIPLES

The time overcurrent units are of the induction disk construction in which a disk rotates between the pole faces of an electromagnet. Force or torque is developed in this movable disk by the interaction of the electromagnetic flux from the actuating coil with eddy currents that are induced in the disk by another flux. There must be two fluxes out of phase with each other and then each will produce an eddy current capable of producing a torque in conjunction with the other flux. The second out of phase flux is produced in the subject relays as follows:

In the inverse time overcurrent units the out of phase magnetic field is produced by the shaded pole principle in which a portion of the U-magnet pole face is short circuited by wound shading coils. When the shading coil circuit is completed, the flux

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

in the shaded section will lag the flux through the unshaded area, producing the required flux field.

In the very inverse and extremely inverse time overcurrent units the out-of-phase magnetic field is produced by a wattmetric construction similar in operating principle to the familiar watthour meter. The flux lag is obtained by means of a floating winding (transformer type) on the center leg of the upper portion of the iron structure, which is wound concentrically with the operating coil. This floating winding is connected in series with a resistor (and capacitor in the extremely inverse unit) and the two out of phase flux producing coils on the lower legs of the magnet structure. When this floating circuit is completed, it produces an out phase flux across the air gap which cuts the disk with the result that torque is produced in the disk element.

The circuit which produces the out of phase flux is completed by a contact of the auxiliary unit "A". This auxiliary unit "A" is in turn picked up by the operation of the second zone directional distance relay thus the time overcurrent unit is activated.

PICKUP AND RESET

The time overcurrent units can be set to pick up, i.e. close the left hand contacts, at any one of the operating coil tap values listed in Table A by inserting the tap screw into the desired tap. Pickup will be within $\pm$ 5 percent of the tap value selected. Closer adjustment of pickup current or adjustment for a pickup point between tap positions, can be obtained by adjusting the lower control spring as described under INSTALLATION PROCEDURE. The units will reset i.e. the disk will return to the de-energized position, at 90 percent or more of the tap value for the inverse unit, and 85 percent or more for the very inverse and extremely inverse units.

OPERATING AND RESET TIMES

Operating time curves for the time overcurrent unit are shown in Figs. 3, 4 and 5 respectively for the inverse, very inverse and extremely inverse units. For the same operating conditions the units will operate repeatedly within one or two percent of the same time.

Reset time, i.e. the time required for the contact and shaft assembly to reset against the stop after the unit has been de-energized, will of course depend on the time dial setting. It is approximately 6 seconds for the inverse unit and 60 seconds for the very inverse and extremely inverse units from the No. 10 time dial setting. In each instance reset time will be proportionately less for lower time dial settings.

The dropout time i.e. the time required for the contact of the time overcurrent unit to reopen after the unit has been de-energized, is 0.1 seconds.

BURDEN

The burden imposed on the current transformers by the time overcurrent units is listed in Table B.

CONSTRUCTION

The inverse time overcurrent units consist of a tapped current operating coil wound on a U-magnet iron structure. The several taps on the operating coil are connected to tap points on a tap block to provide a ready means of selecting the pickup point. The U-magnet includes wound shading coils which are connected to a contact of the auxiliary unit "A".

The very inverse and extremely inverse time overcurrent units are the wattmetric type.. The upper portion of the iron structure has two concentric windings on the middle leg of the magnetic circuit. One of these is a tapped operating current winding connected to tap points on a tap block. The other is a floating winding which is connected in series with a resistor (and capacitor on the extremely inverse units) and the two coils on the lower legs of the magnetic circuit. This floating circuit is connected to a contact of the auxiliary unit "A".

In both types of time overcurrent unit the disk and shaft assembly carries the moving contact which completes the trip circuit when it touches the stationary contact. The shaft is restrained by a spiral spring which gives the proper contact closing current depending on tap setting. Its motion is retarded by an Alnico drag magnet which acts on the disk to produce the desired time characteristic. The lower bearing for the shaft assembly consists of a polished pin driven into the shaft and riding on a sapphire jewel, spring mounted in a screw-type assembly. The upper bearing consists of an adjustable pivot assembly mounted on the frame and having a polished pin which projects into a bronze guide ring located at the top of the shat.

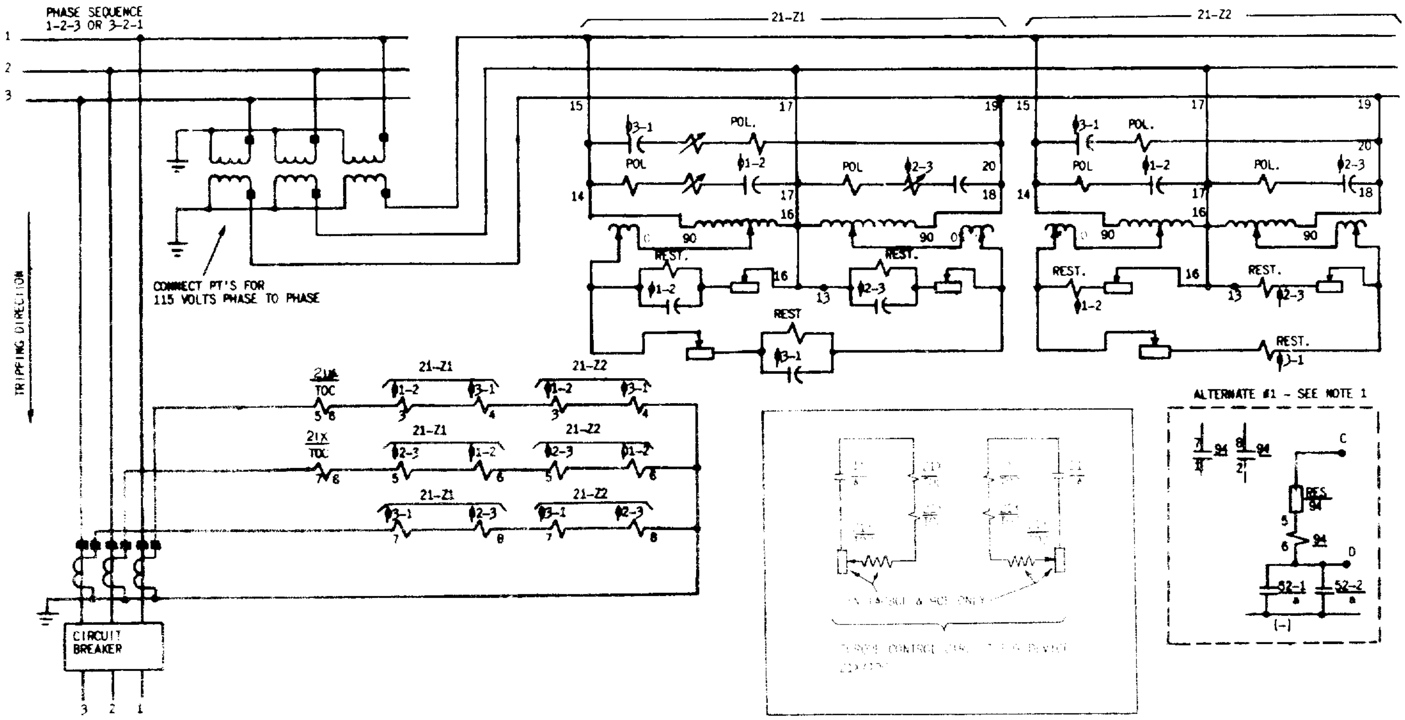
The variable retarding force resulting from the gradient of the spiral spring is compensated by the spiral shape of the induction disk, which results in an increased driving force as the spring winds up. A calibrated time dial determines the distance of travel of the moving contact and thus controls the pickup time.

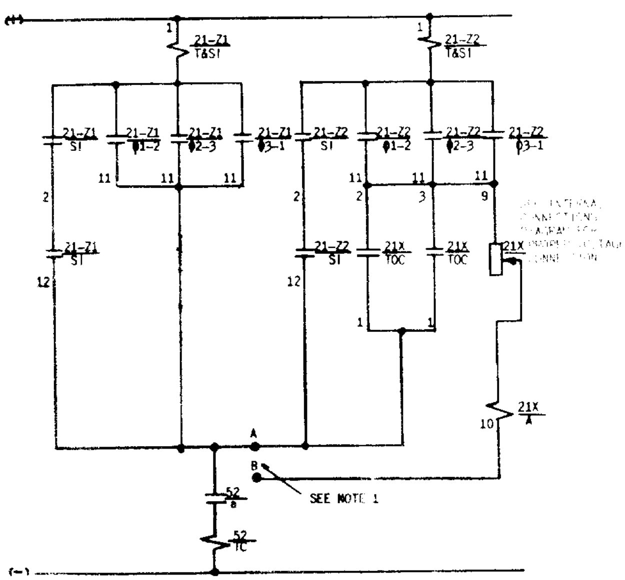
The auxiliary unit "A" is a telephone type relay. The construction of a typical telephone type relay is shown in Fig. 6.

Internal connections for the IAC60E, IAC80E and IAC90E are shown in Figs. 7, 8 and 9 respectively.

The components of each relay are mounted on a cradle assembly which can be easily removed from the relay case. The cradle is locked in the case by means of latches at the top and bottom. The electrical connections between the case blocks and cradle blocks are completed through removable connection plugs. Separate testing plugs can be inserted in place of the connection plugs to permit testing the relay in its case. The cover is attached to the case from the front and includes an interlock arm which prevents the cover from being replaced until the connection plug has been inserted.

The case is suitable for either semi-flush or surface mounting on panels up to two inches thick.





NOTE 1 - WHEN TRIPPING ONLY ONE BREAKER, MAKE CONNECTIONS AS SHOWN AND JUMPER A TO B. WHEN USING AUXILIARY TRIPPING RELAY (94) TO TRIP TWO BREAKERS USE CONNECTIONS SHOWN ON ALTERNATE #1 BY CONNECTING A TO C AND B TO D.

LEGEND			
DEVICE NO.	DEVICE TYPE	INCL. ELEM.	DESCRIPTION
21-Z1	CEY15A		3 PHASE 1st ZONE MHO RELAY
		ϕ1-2	PHASE 1-2 UNIT ETC.
		T&SI	TARGET AND SEAL-IN UNIT
21-Z2	CEY16A		3 PHASE 2nd ZONE MHO RELAY
		ϕ1-2	PHASE 1-2 UNIT ETC.
		T&SI	TARGET AND SEAL-IN UNIT
94	HGA14AM OR AL		AUXILIARY TRIPPING RELAY
21X	IAC60E,80E,90E		FAULT DETECTOR AND OVERCURRENT TIMING RELAY
		A	AUXILIARY UNIT
		TOC	OVERCURRENT TIMING UNIT

TABULATION OF DEVICES		
TYPE OR DESCRIPTION	INTERNAL CONNECTIONS	OUTLINE
CEY15A	0127A9412	K-6209276
CEY16A	0127A9418	K-6209276
HGA14AM (BACK CONN.)	K-6400533	K-6400533
HGA14AL (FRONT CONN.)	377A139	377A139
IAC60E (INVERSE)	0148A4075	K-6209278
IAC80E (VERY INVERSE)	0148A4077	K-6209279
IAC90E (EXTREMELY INVERSE)	0148A4079	K-6209279

Fig. 2 (7381B39AB-1) Elementary Diagram Showing the CEY16A Relay User in Conjunction With the IAC60E, 80E or 90E For Second Zone Protection Against Multi-phase Faults

TABLE B

60 Cycle Current Burden At Minimum Pickup						Burden In Ohms Imped. at:		
		Range	Eff. Res. Ohms	React. Ohms	Imped. Ohms	3X Pickup	10X Pickup	20X Pickup
Time O.C. Unit	Inverse	4/16	0.10	0.34	0.35	0.18	0.09	0.08
	Very Inverse	4/16	0.04	0.07	0.08	0.08	0.06	0.05
	Extremely Inverse	4/16	0.025	0.043	0.05	0.05	0.05	0.05

Hardware is available for all panel thicknesses up to two inches, but panel thickness must be specified on the order to insure that the proper hardware will be provided. Outline and panel drilling dimensions are shown in Fig. 13.

RECEIVING, HANDLING AND STORAGE

These relays, when not included as a part of a control panel will be shipped in cartons designed to protect them against damage. Immediately upon receipt of a relay, examine it for any damage sustained in transit. If injury or damage resulting from rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

Reasonable care should be exercised in unpacking the relay. If the relays are not to be installed immediately, they should be stored in their original cartons in a place that is free from moisture, dust and metallic chips. Foreign matter collected on the outside of the case may find its way inside when the cover is removed and cause trouble in the operation of the relay.

ACCEPTANCE TESTS

Immediately upon receipt of the relay an inspection and acceptance test should be made to insure that no damage has been sustained in shipment and that the relay calibrations have not been disturbed.

VISUAL INSPECTION

Check the nameplate stamping to insure that the model number, rating and calibration range of the relay received agree with the requisition.

Remove the relay from its case and check by visual inspection that there are no broken or cracked molded parts or other signs of physical damage, and that all screws are tight. The drag magnets should be fastened securely in position on their mounting shelves. There must not be any metallic particles or other foreign matter in the air gap of either the drive magnet or the drag magnet.

MECHANICAL INSPECTION

It is recommended that the following mechanical adjustments be checked:

(A) Time Overcurrent Units

1. With the time dial at the zero position the moving contact should just touch the stationary contact. There should be sufficient clearance between the stationary contact brush and its backing strip to allow for at least 1/32" wipe. Then set the dial at the approximate setting which will be used when the relay is installed.

2. The disk and shaft assembly should have a vertical end play of from 1/64" to 1/32". The set screws for the upper pivot and lower jewel screw must be tight. The disk should be approximately centered in the air gap of both the driving magnet assembly and the drag magnet. The minimum permissible clearance between the disk and either the driving or drag magnet is .008". The disk and shaft assembly should turn freely without noticeable friction.

3. Check the stop arm assembly located near the top of the disk shaft. There should be approximately 1/64" deflection of the leaf spring.

(B) Auxiliary Unit "A"

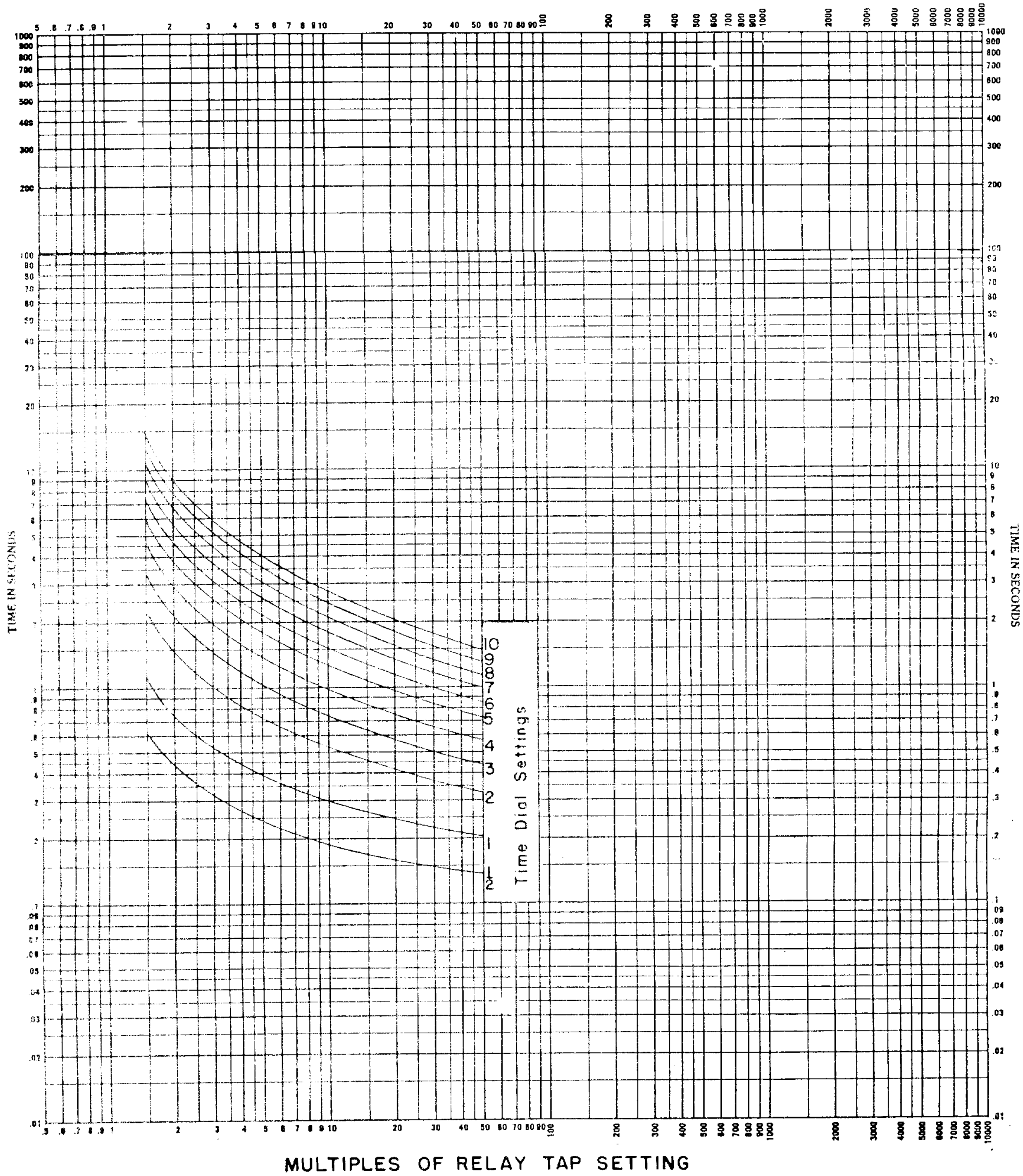
1. With the unit in the de-energized position each normally open contact should have a gap of .010" - .015". The wipe on each normally open contact should be approximately .005". This can be checked by inserting a .002" shim between the residual screw and the pole piece and operating the armature by hand. The normally open contacts should make before the residual screw strikes the shim.

(C) General

Check the location of the contact brushes on the cradle and case blocks against the internal connection for the relay. Be sure that the shorting bars are in the proper locations on the case block and that the long and short brushes on the cradle block agree with the internal connection diagram. Fig. 10 is a sectional view of the case and cradle blocks with connection plug in place. Note that there is an auxiliary brush in each position on the case block. This brush should be formed high enough so that when the connection plug is inserted it engages the auxiliary brush before striking the main brush. This is especially important in current circuits and other circuits with shorting bars since an improper adjustment of the auxiliary brush could result in a CT secondary circuit being momentarily open circuited.

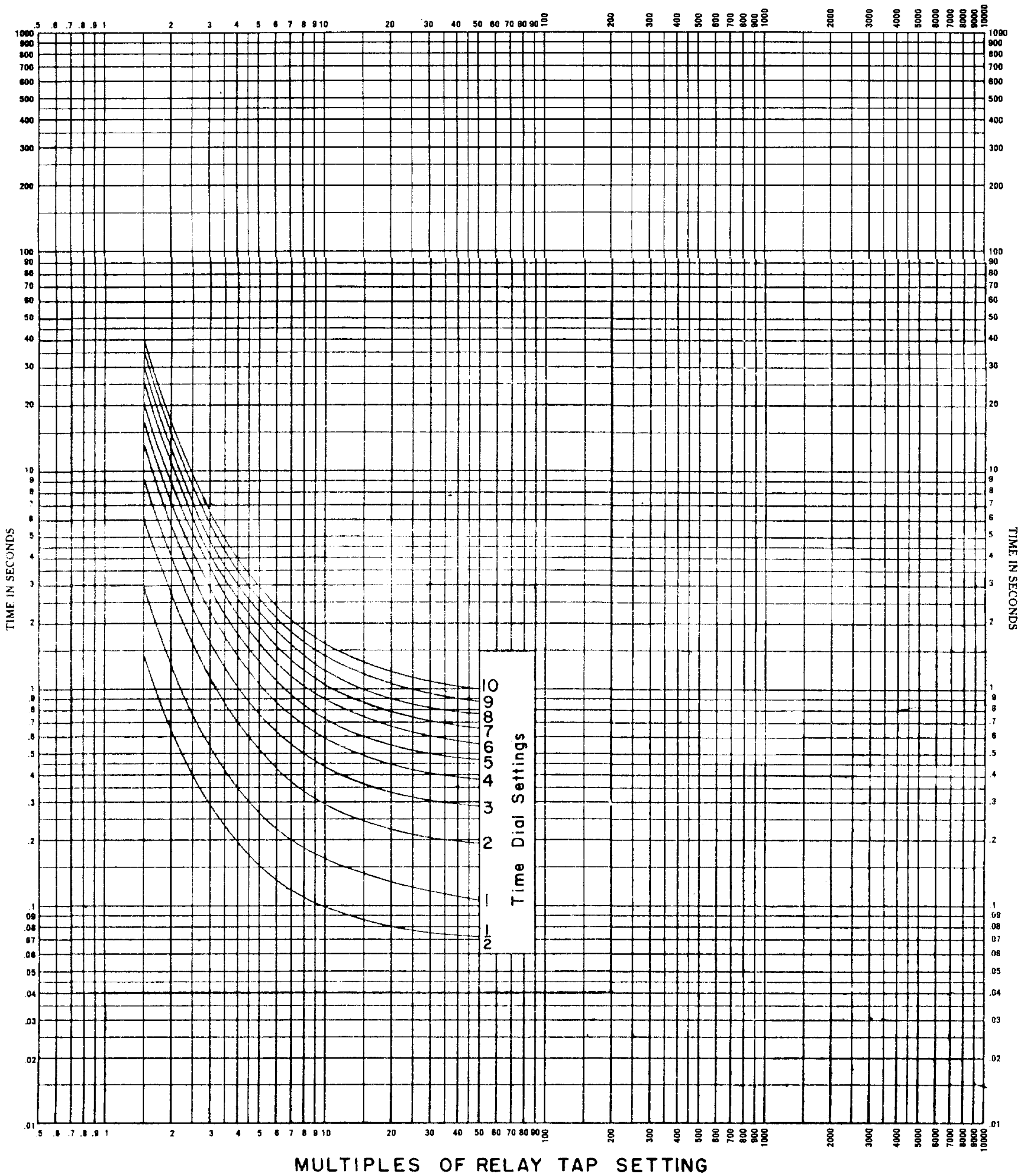
ELECTRICAL TESTS

It is recommended that the following electrical checks be made immediately upon receipt of the relay.



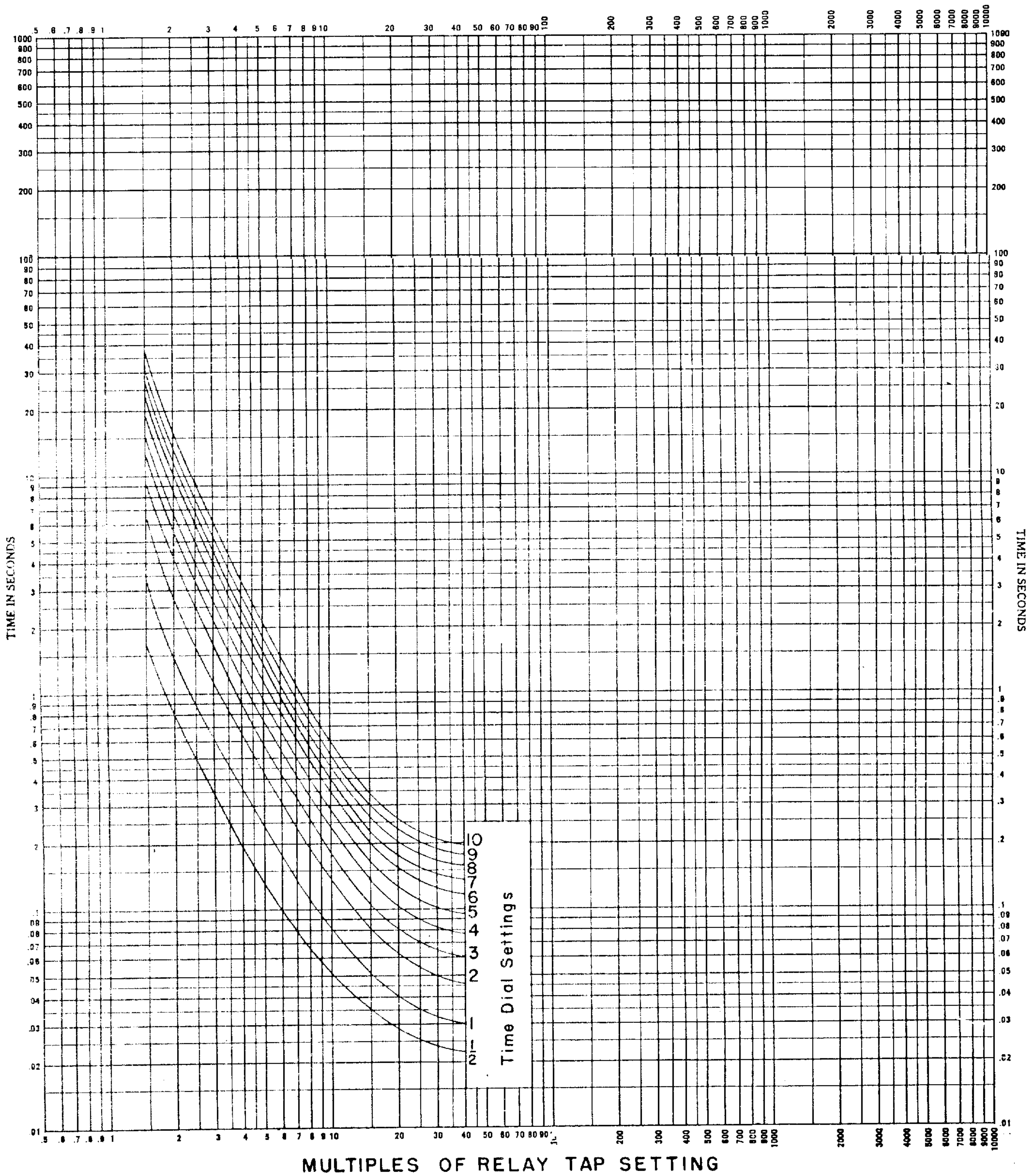
* Fig. 3 (0888B0269 [3]) Inverse Time-current Curves for the IAC60E Relay

* Revised since last issue



* Fig. 4 (0888B0270 [3]) Very Inverse Time-current Curves for the IAC80E Relay

* Revised since last issue



* Fig. 5 (0888B0274 [5]) Extremely Inverse Time-current Curves for the IAC90E Relay

* Revised since last issue

Note that all tests should be made with the relay in its case and in a level position.

(A) Time Overcurrent Units

1. Pick Up

Connect the relay as shown in Fig. 11. With the tap plug in the minimum position and the time dial set in the No. 1/2 position, check the current required to just close the contact. It should be within ± 5 percent of the minimum pickup shown on the tap plate.

2. Pick Up Time

Set the time dial on the No. 5 position and check the pickup time at 5 times minimum pickup current using the circuit shown in Fig. 11. Operating time should be within ± 10 percent of the values shown in Table C.

TABLE C

Type of Unit	Pickup Time (No. 5 Pos.- 5X P. U.)
Inverse	1.78
Very Inverse	1.31
Extremely Inverse	0.93

(B) Auxiliary Unit "A"

The relays are normally shipped from the factory with the coil circuit of unit "A" connected for the lower value of the dual DC voltage rating shown on the nameplate. Apply 60 percent of the lower voltage rating across terminals 9 and 10 and check that unit "A" picks up and wipes in with one continuous motion of the armature.

INSTALLATION PROCEDURE

If after the ACCEPTANCE TESTS the relay is held in storage before shipment to the job site it is recommended that the visual and mechanical inspection described under the section on ACCEPTANCE TESTS be repeated before installation.

RELAY SETTINGS

(A) Time Overcurrent Units

The relay should be set as required in its final location and checked.

1. Pickup

The minimum current at which the contacts will just close is determined by the position of the tap screw in the tap block at the top of each unit. The tap plate on these blocks is marked in amperes as shown in Table A. If the position of the tap screw is changed be sure that the screw is securely tightened. If the tap setting is to be changed on a relay already in service be sure to remove the connection plugs before changing the tap screw position.

After a change in tap setting the actual pickup current should be checked using the test connections of Fig. 12. Fig. 12 shows test plug connections for testing the relay from the front of the panel. The minimum current required to rotate the disk slowly and to just close the contacts should be within ±5 percent of the value marked on the tap plate. Use a test source of 120 volts or greater with good wave form and constant frequency. Step down transformers or "phantom loads" should not be employed in testing induction units since their use may cause a distorted wave form. The "A" unit must be picked up during this test. In most instances a setting obtainable by one of the tap positions will be satisfactory and no further adjustment will be required. In some cases, however, it may be desirable to have a pickup setting which falls between available tap positions. Such intermediate settings may be obtained by placing the tap screw in the tap position nearest to the required pickup and adjusting the control spring until the required pickup is obtained. Refer to the section on SERVICING for a more detailed description of pickup adjustment.

2. Time Setting

The operating time at a given multiple of pickup current is determined by the setting of the time dial. This operating time is inversely proportional to the current magnitude as illustrated by the time curves in Figs. 3, 4 and 5 for the inverse, very inverse and extremely inverse units respectively. If the required operating time at a given multiple of pickup is known, the necessary time dial setting can be determined from the time curves in one of the above mentioned figures. When set in this manner the unit will operate within ± 10 percent of the value indicated by the time curve. It is suggested that after a unit has been set in accordance with the time curves, the actual operating time be checked using the test connections in Fig. 12.

(B) Auxiliary Unit "A"

The operating coil circuit of the auxiliary unit "A" has a dual DC voltage rating as shown on the relay nameplate. As shipped from the factory the unit is connected for the lower of the two DC voltage ratings. If it is desired to operate the unit at the higher DC voltage the leads to terminal points 9 and 9A should be interchanged so the entire resistance of resistor R1 is in series with the coil. (Refer to the internal connection diagram, Figs. 7, 8 or 9).

PERIODIC CHECKS AND ROUTINE MAINTENANCE

In view of the vital role of protective relays in the operation of a power system it is important that a periodic test program be followed. It is recognized that the interval between periodic checks will vary depending upon environment, type of relay, and the user's experience with periodic testing. Until the user has accumulated enough experience to select the test interval best suited to his individual requirements it is suggested that the following points be checked at an interval of from one to two years.

MECHANICAL CHECKS

(A) Time Overcurrent Units

Operate the disk and shaft assembly by hand and check that the contacts are making with the proper wipe. Allow the disk to reset and check that there is no sign of excessive friction or tendency to bind. If there are signs of friction refer to the paragraph on friction in SERVICING.

Examine the contact surfaces for signs of tarnishing or corrosion. Fine silver contacts should be cleaned with a burnishing tool, which consists of of a flexible strip of metal with an etched, roughened surface. Burnishing tools designed especially for cleaning relay contacts can be obtained from the factory. Do not use knives, files, or abrasive paper or cloth of any kind to clean relay contacts.

(B) Auxiliary Unit "A"

Operate the auxiliary unit armature by hand and check that the N.O. contacts are all making with approximately .005" wipe. With the armature dropped out the N.O. contact gap should be .010" - .015".

ELECTRICAL CHECKS

Time Overcurrent Units

With the relay connected as shown in Fig. 12 check the pickup current. This should be within ± 3 percent of the corresponding reading recorded under INSTALLATION PROCEDURE. Note that the "A" unit must be picked during these tests. Using the connections of Fig. 12 make a spot check of the pickup time. This check should be made at three points on the time characteristic, say at 3, 5 and 10 times pickup. The pickup times should be within ± 5 percent of the times recorded for the same pickup multiples during INSTALLATION.

NOTE: The test source should be at least 120 volts (rated frequency) of good wave form and constant frequency. A resistive load box should be used in the supply to the current circuits. Low voltage transformers or "phantom loads" should not be used for testing induction relays since the distorted wave forms which may result will affect relay performance.

It is not recommended that the overcurrent units be readjusted when minor deviations from the previous test, within the prescribed limits, are noted. Such deviation can be introduced by differences in test equipment or by human error.

SERVICING

If any of the mechanical or electrical check points described in the previous sections are found to be out of limits, the following points should be observed in restoring them.

MECHANICAL ADJUSTMENTS

Time Overcurrent Units

1. Contact Adjustments

The contacts should have approximately 1/32 inch wipe. That is, the stationary contact should be deflected about 1/32 inch when the disk completes its travel. The contact wipe is adjusted by turning the screws in the contact brush which regulates the position of the brush, in relation to the brush stop.

When the time dial is moved to a position where the contacts just close, the time-dial scale should indicate zero. If this is found incorrect, and the brushes are correctly adjusted, regulate the dial to read zero. This is done by changing the position of the arm attached to the shaft, which is located below the time dial. Loosen the screw which clamps the arm to the shaft and turn the arm relative to the shaft, until the contacts just make at the zero time-dial setting.

The leaf spring on the stop arm should be so formed that there is approximately 1/64" deflection. The deflection can be increased if necessary by forcing a thin screwdriver blade between the leaf spring and the stop arm.

2. Shaft End Play

End play is determined by the relative positions of the lower jewel bearing and upper pivot. Both bearing and pivot are held in position by means of set screws in the die-cast supporting frame. The lower jewel must be located so that the disk is approximately centered in the airgaps of the driving magnet and the drag magnet. The upper pivot should then be located so that the shaft has 1/64 inch to 1/32 inch end play. Be sure that both set screws are securely tightened after the adjustment is completed.

3. Friction

If a tendency to bind or excessive friction is evident, first check for obstructions to the disk travel. Dirt or metallic particles in the wattmetric or drag magnet gaps can interfere with the motion of the disk.

ELECTRICAL ADJUSTMENTS

(A) Time Overcurrent Units

1. Pickup Adjustments

The current at which the contacts operate is normally controlled by means of the tap screw in the tap block at the top of the unit. The tap screw should be screwed firmly into the tap position marked with the desired pickup current. Note that if the relay is in service the tap screw must not be removed until the relay connection plugs have been withdrawn.

The pickup of the unit for any current tap is adjusted by means of a spring-adjusting ring. The ring may be turned by inserting a screw driver in the notches around the edge. By turning the ring, the operating current of the unit may be brought into agreement with the tap setting employed. If for some reason, this adjustment has been disturbed. This adjustment also permits any desired setting intermediate between the various tap settings to be obtained. The unit is adjusted at the factory to close its contacts from any time-dial position at a minimum current within five percent of the tap-plug setting.

In making pickup checks use the connections in Fig. 11 if the relay is being tested in the laboratory, or in Fig. 12 if the relay is being tested in position on the panel.

2. Pickup Time Adjustments

Normally pickup time is controlled by means of the time dial at the top of the unit. If the pickup time for a particular time dial setting and pickup multiple is found to be outside the limits mentioned in ACCEPTANCE TESTS and PERIODIC CHECKS, it can be restored by changing the position of the drag magnet on its supporting shelf. Moving the magnet towards the shaft decreases the time while moving it away from the shaft increases the time. If the drag magnet is moved towards the shaft be sure that, in its final position it clears the counter weight on the disk for all positions of the disk and shaft assembly. If the magnet is moved away from the shaft its outer edge must be at least 1/8" from the edge of the disk at the smallest radius of the disk.

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any that are worn, broken, or damaged.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specify quantity required, name of part wanted, and give complete nameplate data. If possible, give the General Electric Company requisition number on which the relay was furnished.

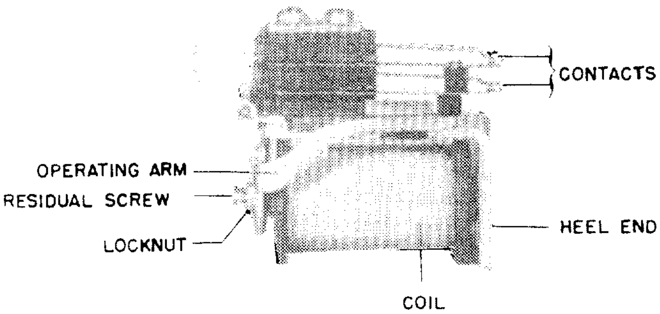


Fig. 6 (8030546) Typical Telephone Relay Unit Used In These IAC Relays

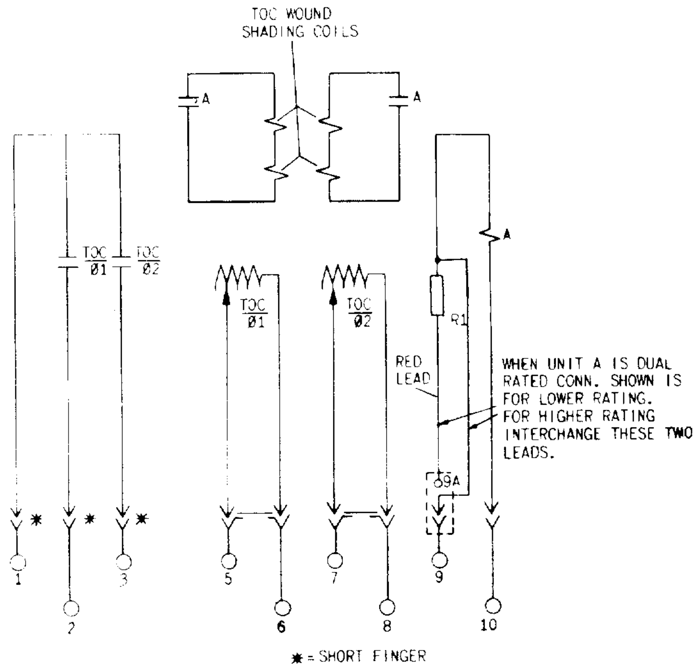


Fig. 7 (0148A4075-1) Internal Connections (Front View) For The IAC60E Relay

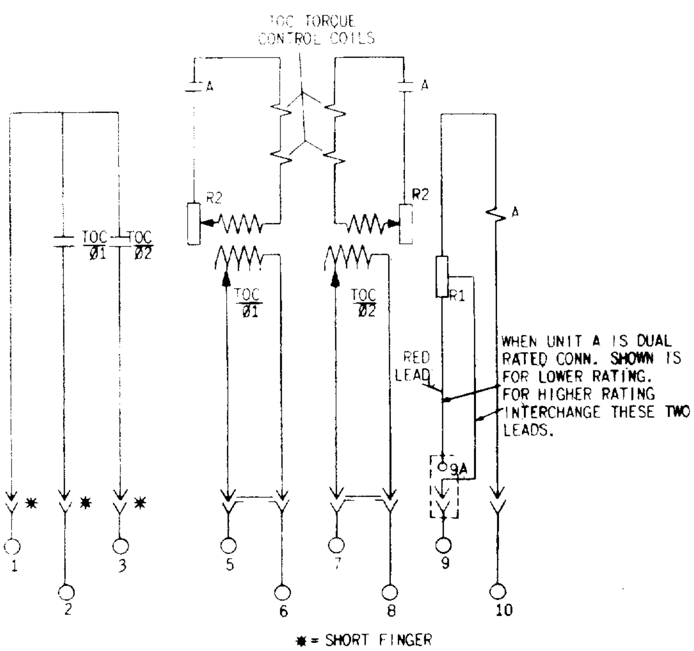


Fig. 8 (0148A4077-1) Internal Connections (Front View) For The IAC80E Relay

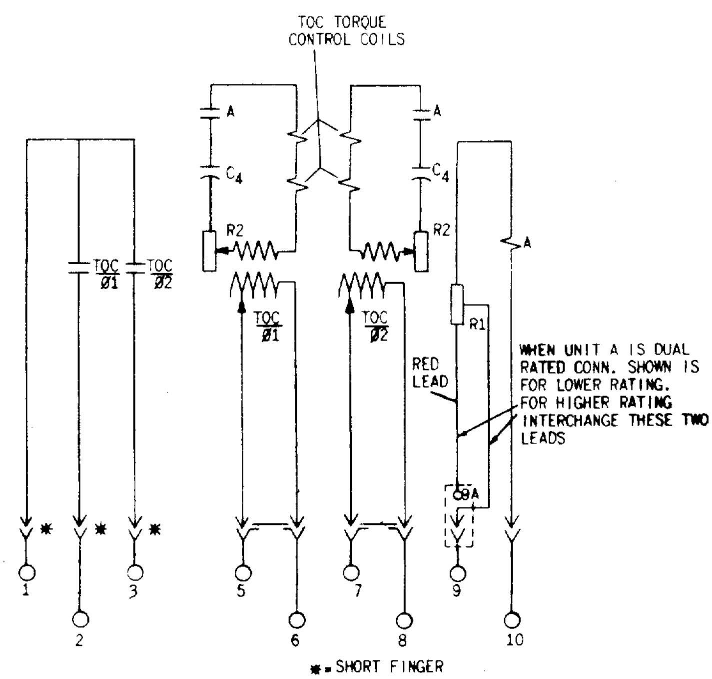
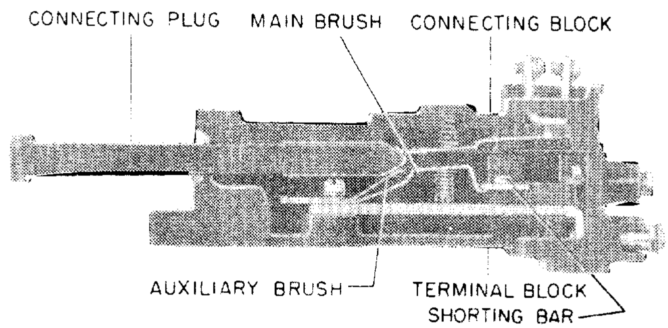
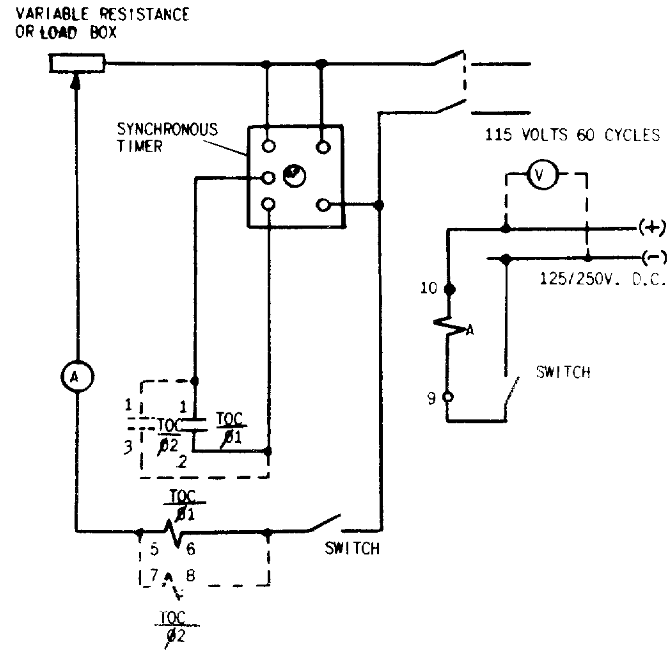


Fig. 9 (0148A4079-1) Internal Connections (Front View) For The IAC90E Relay



NOTE AFTER ENGAGING AUXILIARY BRUSH, CONNECTING PLUG TRAVELS 1/4 INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK

Fig. 10 (8025039) Cross Section of Drawout Case Showing Position of Auxiliary Brush



DOTTED CONNECTIONS ARE FOR PHASE 2 UNIT TEST.

Fig. 11 (0165A6029-0) Laboratory Connections for Testing Time Overcurrent Units of the IAC60E, 80E and 90E Relays

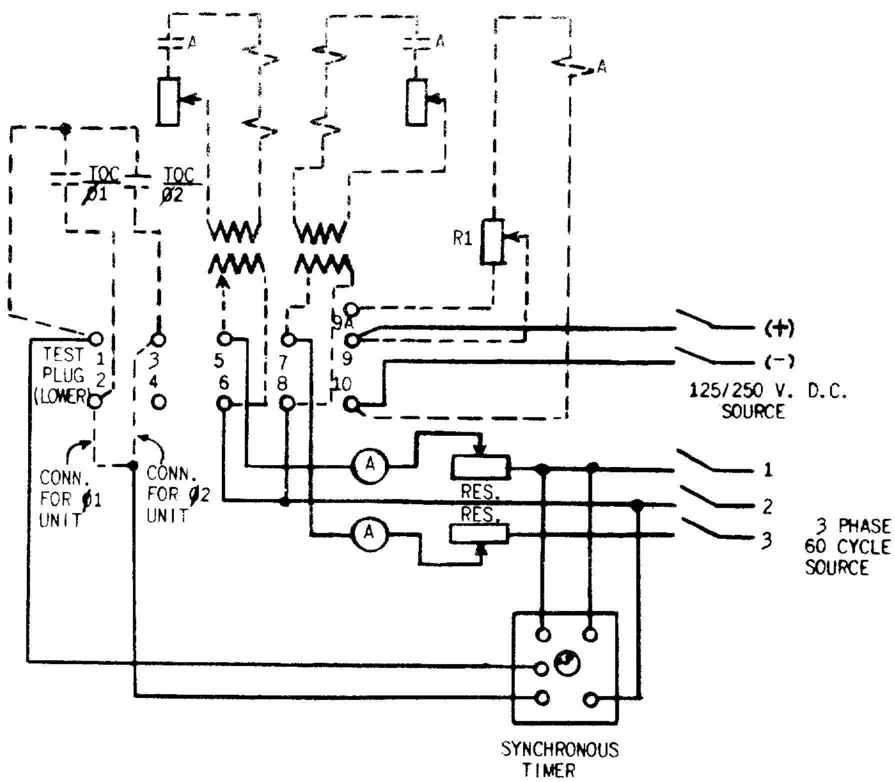
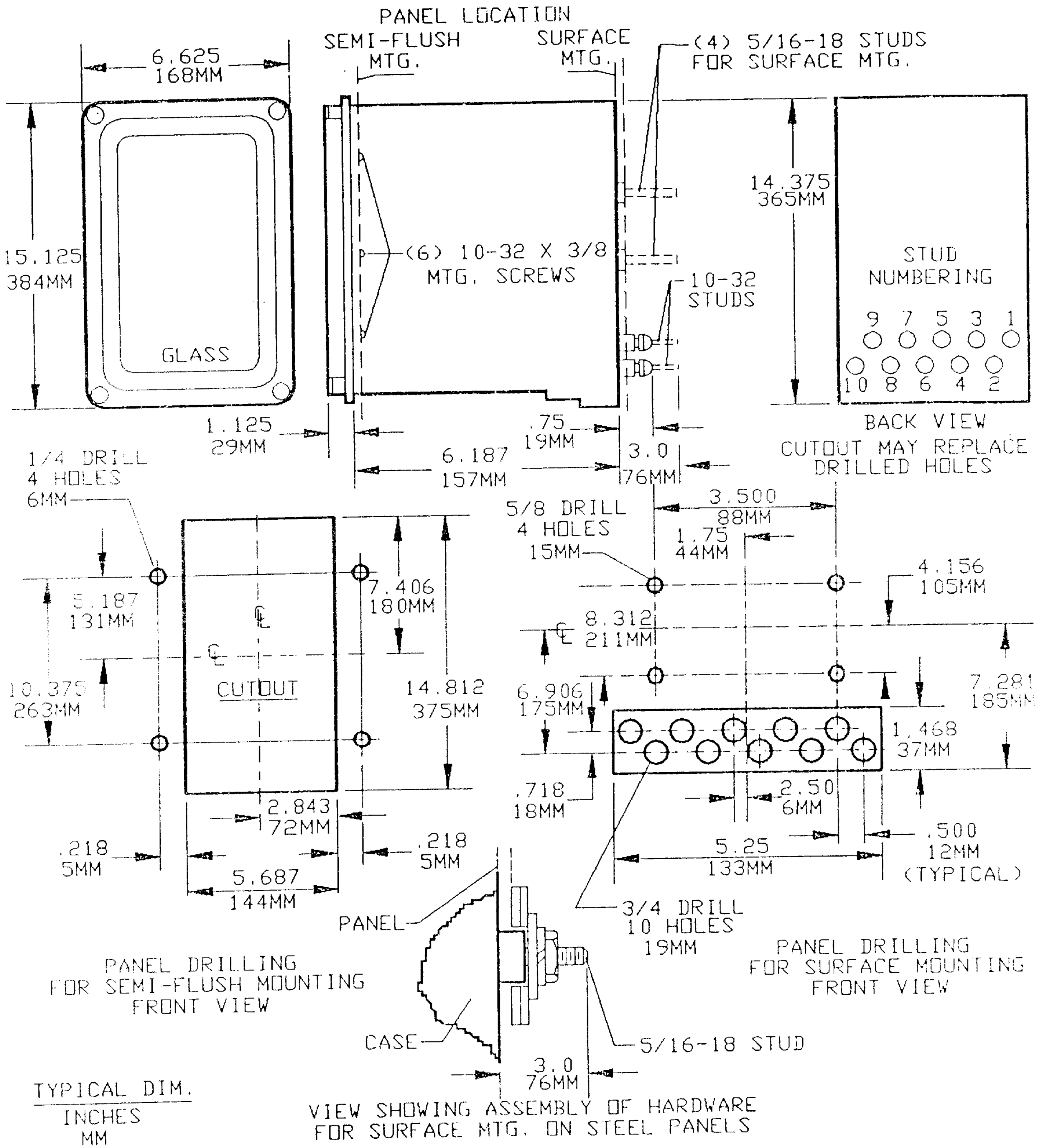


Fig. 12 (0165A6027-0) Field Connections for Testing Time Overcurrent Units of the IAC60E, 80E and 90E Relays



* **Fig. 13** (6209273 [5]) **Outline and Panel Drilling Dimensions for the IAC60E, 80E and 90E Relays**

* Revised since last issue

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