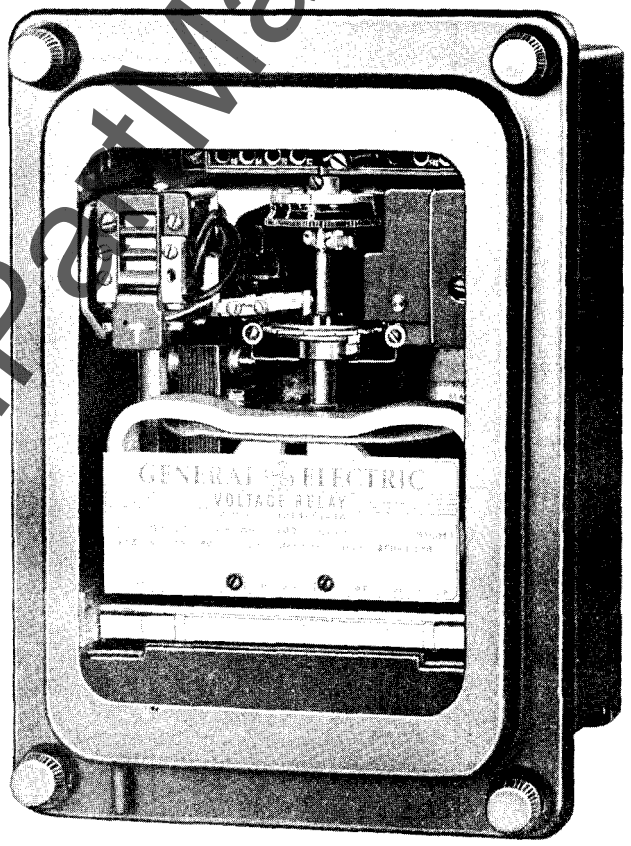
INSTRUCTIONS

GEH-1814A
SUPERSEDES GEH-1814

VOLTAGE RELAYS



Types

IAV51A
IAV51D
IAV51K
IAV52A
IAV52C
IAV53A
IAV53B
IAV53C
IAV53D

A

SWITCHGEAR DEPARTMENT

GENERAL ELECTRIC

PHILADELPHIA, PA.

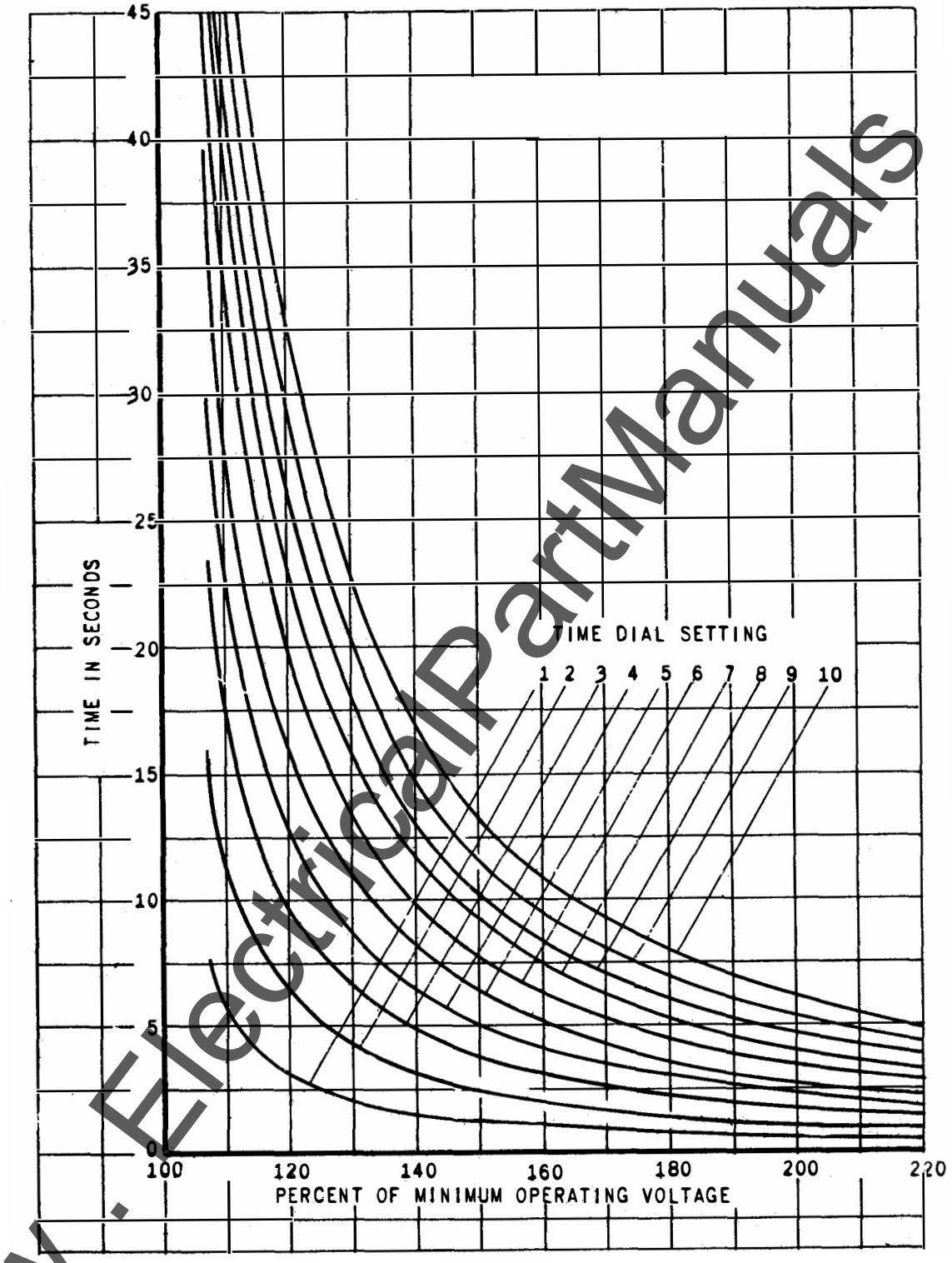


Fig. 1 Time-Voltage Curves For Types IAV51A And IAV52A Relays

Fig. 1 (K-6306850)

(8007381) Cover

VOLTAGE RELAYS
TYPE IAV

INTRODUCTION

These relays are of the induction disk construction. The disk is actuated by a potential operating coil on a laminated U-magnet. The disk shaft carries the moving contact, which completes the trip or alarm circuit when it touches the stationary contact or contacts. The disk shaft is restrained by a spiral spring to give the proper contact closing voltage, and its motion is retarded by permenanet magnets acting on the disk to give the correct time delay.

There is a seal-in unit mounted to the left of the shaft as shown in Fig. 16. This unit has its coil in series and its contacts in parallel with the main contacts such that when the main contacts close, the seal-in unit picks up and seals in. When the seal-in unit picks up, it raises a target into view which latches up and remains exposed until released by pressing a button beneath the lower-left corner of the cover.

The case is suitable for either surface or semi-flush panel mounting and an assortment of hardware is provided for either mounting. The cover attaches to the case and also carries the reset mechanism when one is required. Two of the cover screws have provision for a sealing wire.

The case has studs or screw connections at both ends or at the bottom only for the external connections. The electrical connections between the relay units and the case studs are made through spring backed contact fingers mounted in stationary molded inner and outer blocks between which nests a removable connecting plug which completes the circuits. The outer blocks, attached to the case, have the studs for the external connections, and the inner blocks have the terminals for the internal connections.

The relay mechanism is mounted in a steel framework called the cradle and is a complete unit with all leads being terminated at the inner block. This cradle is held firmly in the case with a latch at the top and the bottom and by a guide pin at the back of the case. The cases and cradles are so constructed that the relay cannot be inserted in the case upside down. The connecting plug, besides making the electrical connections between the respective blocks of the cradle and case, also locks the latch in place. The cover, which is fastened to the case by thumbscrews holds the connecting plug in place.

To draw out the cradle from a single ended case, the cover must first be removed. Then the connecting plug can be drawn out. In so doing, the trip circuit is first opened, then the voltage circuits are opened. After the connecting plug has been removed, the lower latch can be released and the cradle easily drawn out. To replace the cradle, the reverse order should be followed.

APPLICATION

These relays are protective devices to close trip or alarm circuits whenever the voltage applied to their operating coils reaches some predetermined value. Figures 5 through 8 demonstrate some of the applications. The functions are described in greater detail in the paragraphs the follow.

OPERATING CHARACTERISTICS

The Type IAV51A is an overvoltage relay with single-circuit closing contacts which close when the voltage increases to pick-up value as set on the tap block. The time delay in closing the contacts is determined by the setting of the time dial at the top of the shaft. The time-voltage characteristics of this relay are shown in Fig. 1.

The Type IAV51D relay is a low pick-up, voltage relay normally used for ground fault protection on a-c rotating machines. It is of the same general construction as the Type IAV51A relay except that it has a capacitor and tapped resistor connected in series with the operating coil. The capacitor is added to tune the circuit, giving a low pick-up voltage at rated frequency. At rated voltage the operating U-magnet is highly saturated, increasing the impedance of the circuit thus limiting the current to a safe value. The taps on the resistor are connected to the tap block to provide a four-to-one range of pickup. As shown in the typical external connection diagram, Fig. 6, this relay is connected to the machine neutral potential transformer through a closed contact on the auxiliary tripping relay, hence is energized only when a ground occurs. To obtain still lower pickup than the normal calibration, it is permissible to insert an inverted potential transformer between the machine neutral transformer and the relay coil circuit. Time curves are shown in Fig. 3.

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.

The IAV51K relay is similar to the IAV51D except that it has an external capacitor.

The IAV52A relay is similar in every respect to the IAV51A relay except that it has additional contacts for closing a second circuit.

The IAV53A relay is an under-and overvoltage relay with double-throw contacts. The left-hand contacts close as the voltage increases to some predetermined value. The right-hand contacts close when the voltage decreases to some lower value. Between these two voltage values both contacts are open. Time-voltage characteristics are shown in Fig. 2.

The Type IAV53B relay differs from the Type IAV53A relay in that it does not have seal-in elements. Time-voltage characteristics are shown in Fig. 2.

The Type IAV53C relay is similar to the Type IAV53A relay except that there are no taps on the coil. The relay is adjusted to close its right contacts in 10 seconds when the voltage is reduced from 58% rated voltage to zero voltage; with this calibration the relay closes its left contacts in approximately 10 seconds when the voltage is increased from 58% of rated voltage to rated voltage. These relays are used connected line-to-ground so that under normal conditions the relay receives 58% of rated phase-to-phase voltage and both relay contacts are open. If the phase to which the relay is connected is grounded, the relay voltage goes to zero and the right-hand contacts close in 10 seconds. If either of the other two phases are grounded, the relay voltage increases to rated voltage and the left-hand contacts close in approximately 10 seconds.

The IAV53D relay is similar to the Type IAV-53B relay except that it has a shorter time curve. Time-voltage characteristics are shown in Fig. 4.

RATINGS

The operating circuit ratings available are 115 or 230 volts at 60, 50 or 25 cycles. The operating coil will stand rated voltage continuously on any tap and will stand tap voltage continuously on the taps above rated voltage.

The current closing rating of the contacts is 30 amperes for voltages not exceeding 250 volts. The current-carrying ratings are affected by the selection of the tap on the seal-in coil as indicated in the following table.

Function	Amperes	
	2-Amp Tap	0.2-Amp Tap
Tripping Duty	30	3
Carry Continuously	3	0.3

The 2-ampere tap has a d-c resistance of 0.13 ohms and a 60 cycle impedance of 0.53 ohms while the 0.2-ampere tap has a 7 ohm d-c resistance and a 52 ohm 60 cycle impedance. The tap setting used on the seal-in element is determined by the current drawn by the trip coil.

The 0.2-ampere tap is for use with trip coils that operate on currents ranging from 0.2 up to 2.0 amperes at the minimum control voltage. If this tap is used with trip coils requiring more than 2 amperes, there is a possibility that the 7-ohm resistance will reduce the current to so low a value that the breaker will not be tripped.

The 2-ampere tap should be used with trip coils that take 2 amperes or more at minimum control voltage, provided the tripping current does not exceed 30 amperes at the maximum control voltage. If the tripping current exceeds 30 amperes an auxiliary relay should be used, the connections being such that the tripping current does not pass through the contacts of the target and seal-in coil of the protective relay.

The above data in regard to contact rating applies to all relays covered by these instructions except the Types IAV53B and IAV53C which do not have seal-in units. In these cases, the contact ratings are limited in their current-carrying capacity by the interrupting ratings as shown below:

Function	Volts	Amperes	
		AC	DC
Make and	125	1.5	0.3*
Interrupt	250	0.75	0.15*
at	600	0.00	0.00

* Noninductive Load

BURDENS

Burdens for the various relay types are given in the following table:

Relay Types	Voltage Rating	Tap* Setting	Volt-Amps	Power Factor	Watts
60 - Cycle Burdens					
IAV51A & IAV52A	115	140	1.3	0.34	0.4
		120	1.8	0.35	0.5
		105	2.4	0.34	0.7
		93	3.1	0.33	0.9
		82	3.9	0.32	1.2
		70	5.4	0.31	1.7
		64	6.6	0.31	2.1
		55	9.2	0.35	3.2
IAV51D	199	A(16)	35.2	0.08	2.85
		B(24)	30.8	0.32	9.75
		C(40)	23.9	0.68	16.2
		D(64)	14.9	0.90	13.5
IAV51D	115	A(10)	31.3	0.20	6.25
		B(15)	26.4	0.38	9.9
		C(25)	20.7	0.72	14.95
		D(40)	13.8	0.93	12.85
IAV51D	345	A(28)	38.6	0.15	5.82
		B(42)	33.4	0.41	13.8
		C(70)	24.8	0.78	19.2
		D(112)	15.9	0.96	15.2
IAV51K	67	A(5.4)	35.5	0.15	5.3
		B(7.5)	32.5	0.33	10.7
		C(12.5)	25.6	0.69	17.7
		D(20)	17.4	0.92	16.1
IAV52C	199	No taps	36.4	0.23	8.5
IAV53A, IAV53B, & IAV53D	115	140	2.2	0.32	0.7
		120	3.0	0.30	0.9
		105	4.0	0.31	1.2
		93	5.4	0.31	1.7
		82	7.0	0.32	2.2
		70	9.9	0.34	3.4
		64	12.0	0.36	4.3
		55	17.0	0.39	6.6
IAV53C	115	No taps	5.7	0.29	1.7
50 - Cycle Burdens					
IAV51A & IAV52A	115	140	1.2	0.34	0.4
		120	1.6	0.34	0.5
		105	2.1	0.34	0.7
		93	2.8	0.38	1.9
		82	3.6	0.36	1.3
		70	5.1	0.34	1.7
		64	6.2	0.34	2.1
		55	8.2	0.34	2.9

Relay Types	Voltage Rating	Tap* Setting	Volt-Amps	Power Factor	Watts
50 - Cycle Burdens (Con't.)					
IAV51D	199	A(16)	27.4	0.10	2.76
		B(24)	24.7	0.37	9.05
		C(40)	19.1	0.70	13.4
		D(64)	13.3	0.93	12.2
IAV51D	115	A(10)	37.4	0.21	7.8
		B(15)	30.6	0.52	16.
		C(25)	22.2	0.82	18.3
		D(40)	13.6	0.97	13.2
IAV51D	345	A(28)	31.4	0.15	4.55
		B(42)	27.6	0.42	11.6
		C(70)	20.6	0.76	15.6
		D(112)	13.8	0.94	13.0
IAV51K	67	A(5.4)	29.8	0.12	3.58
		B(7.5)	26.8	0.36	9.6
		C(12.5)	21.4	0.69	14.7
		D(20)	14.95	0.92	13.7
IAV52C	199	No taps	29.6	0.23	7.6
IAV53A & IAV53B	115	140	1.9	0.32	0.6
		120	2.5	0.30	0.8
		105	3.4	0.29	1.0
		93	4.6	0.31	1.4
		82	6.0	0.32	1.9
		70	8.4	0.35	2.9
		64	12.9	0.29	3.7
		55	13.2	0.35	4.6
IAV53C	115	No taps	4.8	0.32	1.6
25 Cycle Burden					
IAV51A & IAV52A	115	140	1.1	0.50	0.5
		120	1.5	0.49	0.8
		105	2.1	0.49	1.0
		93	2.7	0.47	1.2
		82	3.4	0.49	1.7
		70	4.8	0.49	2.4
		64	5.8	0.49	2.9
		55	8.2	0.49	4.0
IAV53A & IAV53B	115	140	1.7	0.32	0.5
		120	2.3	0.30	0.7
		105	2.9	0.30	0.9
		93	4.2	0.30	1.3
		82	5.3	0.32	1.7
		70	7.5	0.34	2.6
		64	9.5	0.34	3.3
		55	12.9	0.39	5.0
IAV53C	115	No taps	4.2	0.38	1.6

* Min. pick-up volts

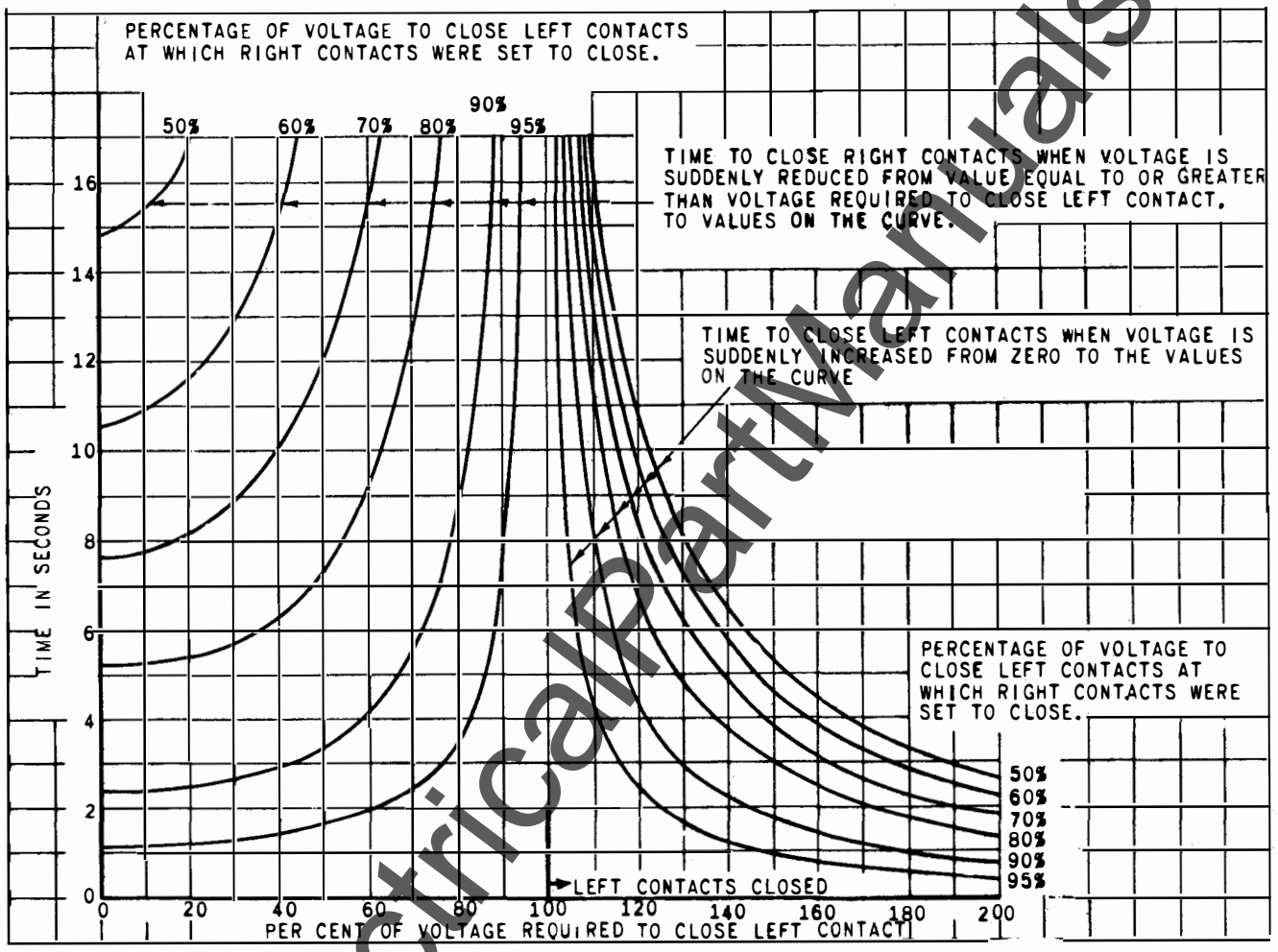


Fig. 2 (K-6306849)

Fig. 2 Time-Voltage Curves For Type IAV53A And IAV53B Relays

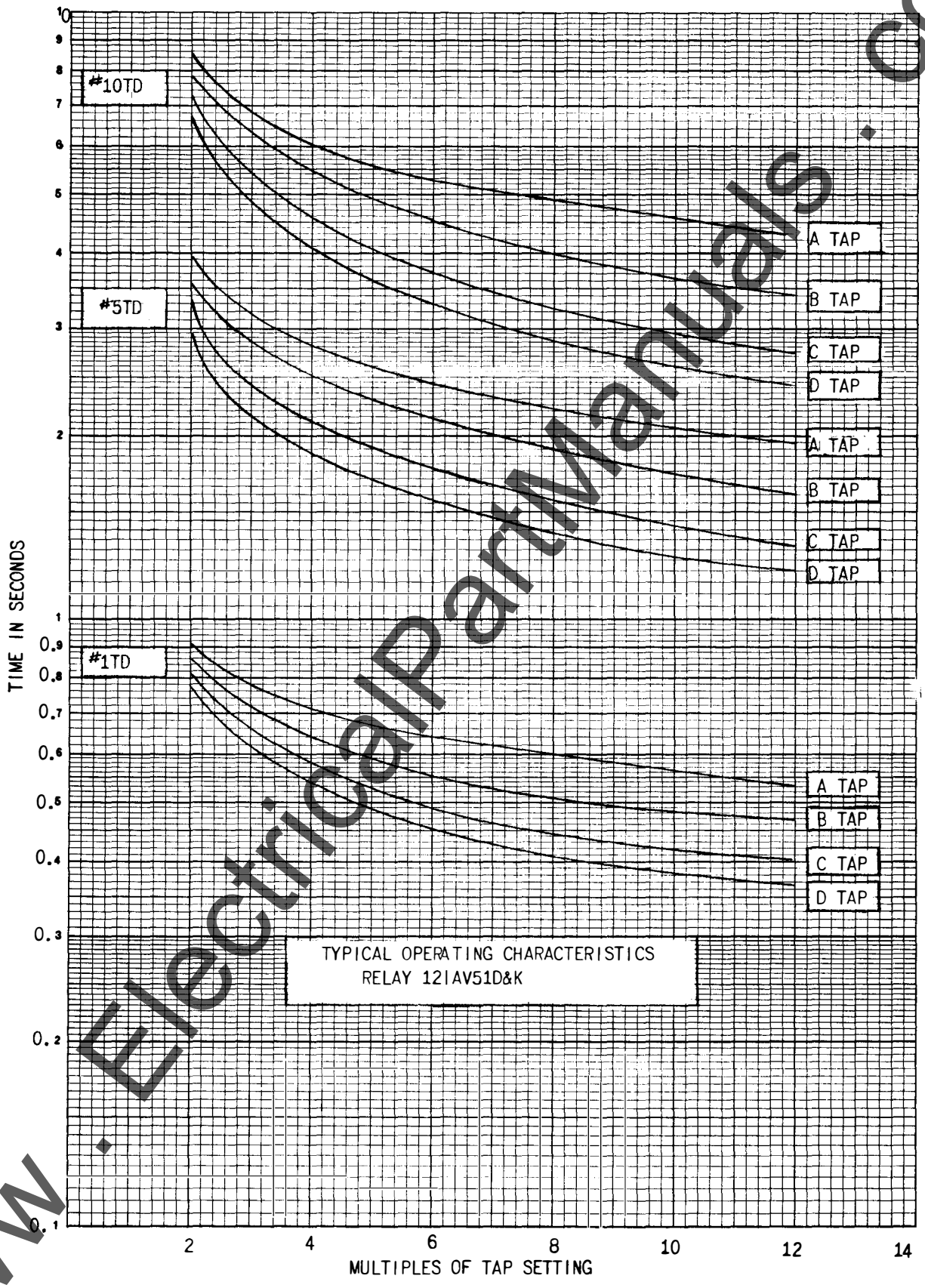


Fig. 3 (0178A8140)

Fig. 3 Time-Voltage Curves For Types IAV51D And IAV51K Relays

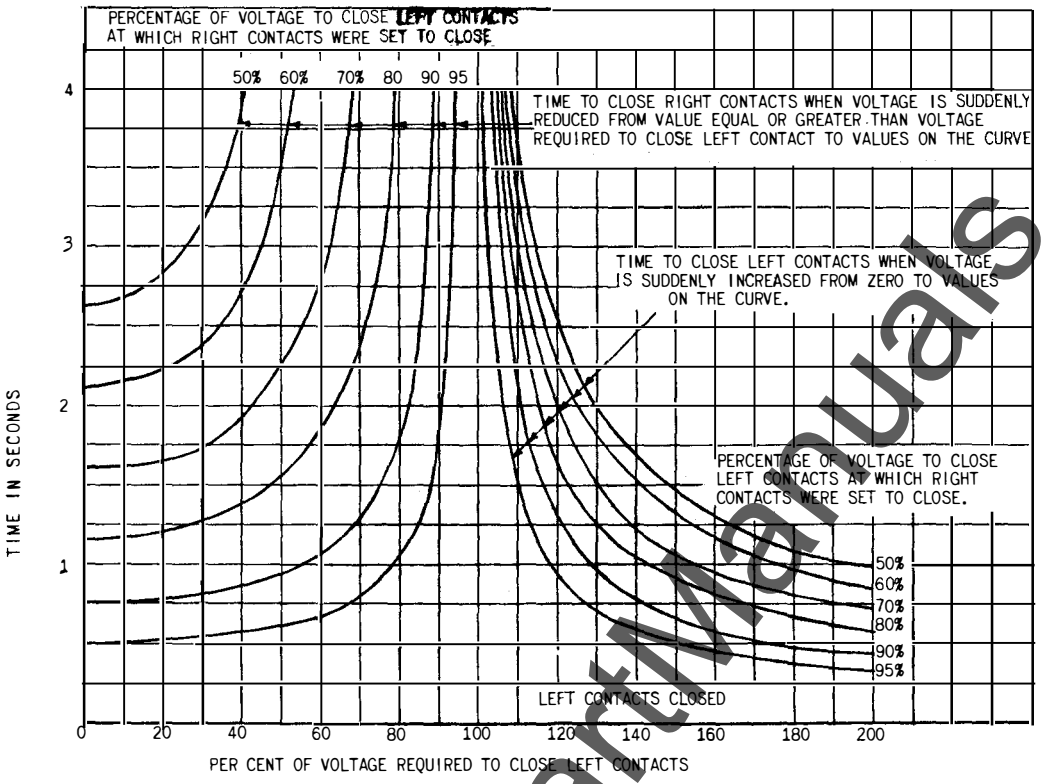
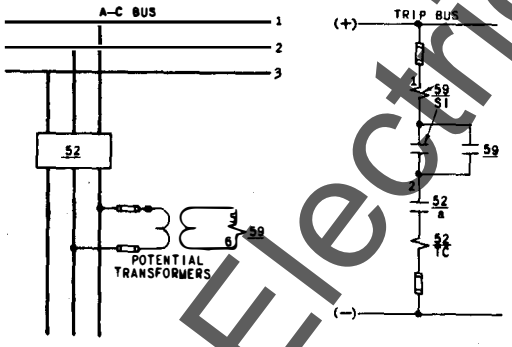


Fig. 4 (104A8993)

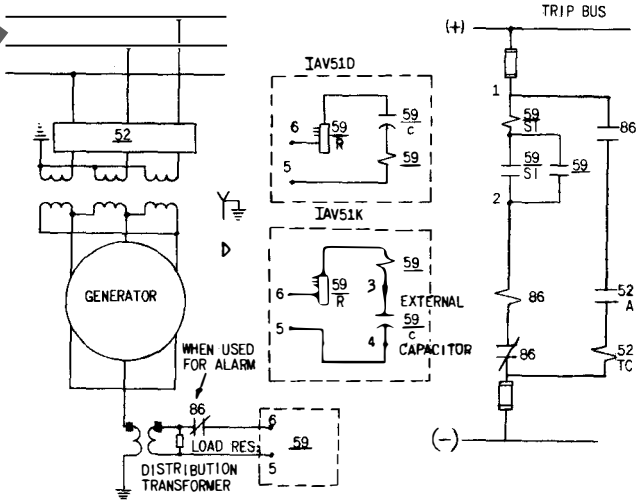
Fig. 4 Time-Voltage Curves For Type IAV53D Relay



DEVICE FUNCTION NUMBERS
52 - POWER CIRCUIT BREAKER
59 - A-C OVERVOLTAGE RELAY, TYPE IAV51A
a - AUXILIARY CONTACT CLOSED WHEN BREAKER CLOSES
SI - SEAL-IN UNIT WITH TARGET
TC - TRIP COIL

Fig. 5 (K-6375692)

Fig. 5 Connection Diagram Of Type IAV51A Relays Used For Overvoltage Protection



LEGEND		
DEVICE NO.	INCL ELEM	DESCRIPTION
52		CIRCUIT BREAKER
59		AC OVERVOLTAGE RELAY TYPES IAV51D & IAV51K
	c	CAPACITOR
	SI	SEAL-IN UNIT WITH TARGET
86		AUXILIARY HAND RESET RELAY TYPE HEA

Fig. 6 (K-6400445)

Fig. 6 Connection Diagram For The Type IAV51D And IAV51K Relay

RECEIVING, HANDLING AND STORAGE

RECEIVING

These relays, when not shipped as a part of a control panel, will be shipped in cartons designed to protect them against damage. Immediately upon receipt of the relay, an examination should be made for any damage sustained during shipment. If injury or rough handling is evident, a damage claim should be filed at once with the transportation company and the nearest General Electric Sales Office should be notified promptly.

HANDLING

Reasonable care should be exercised in unpacking the relay in order that none of the parts get injured or the adjustments disturbed.

STORAGE

If the relays are not to be installed immediately, they should be stored in their original carton in a place that is free from moisture, dust, and metallic chips.

INSTALLATION

LOCATION

The location should be clean and dry, free from dust and excessive vibration, and well lighted to facilitate inspection and testing.

MOUNTING

The relay should be mounted on a vertical surface. The outline and panel drilling dimensions are shown in Fig. 20 for relay Types IAV51A, IAV51D, IAV52A, and IAV53C. Fig. 21 shows outline and panel drilling for relay Types IAV51K, IAV53A, IAV53B and IAV53D.

CONNECTIONS

Internal connections are shown in Figs. 9 to 15 for the various relays.

GROUND CONNECTIONS

One of the mounting studs or screws should be permanently grounded by a conductor not less than No. 12 B&S gage copper wire or its equivalent.

ADJUSTMENTS

TARGET AND SEAL-IN UNIT

For trip coils operating on currents ranging from 0.2 up to 2.0 amperes at the minimum control voltage, set the target and seal-in tap plug in the 0.2-ampere tap.

For trip coils operating on currents ranging from 2 to 30 amperes at the minimum control voltage, place the tap plug in the 2.0-ampere tap.

The tap plug is the screw holding the right-hand stationary contact of the seal-in element. To change the tap setting, first remove the connecting plug. Then, take a screw from the left-hand stationary contact and place it in the desired tap. Next, remove the screw from the other tap, and place it in the left-hand contact. This procedure is necessary to prevent the right-hand stationary contact from getting out of adjustment. Screws should not be in both taps at the same time as pickup for d-c will be the higher tap value and a-c pickup will be increased.

VOLTAGE SETTING

The voltage at which the contacts operate may be changed by changing the position of the tap plug in the tap block at the top of relay for relays such as the IAV51A, IAV52A, IAV53A, IAV53B, and IAV53D which have tapped coils. The range of this adjustment is from 55 to 140 volts on the 115 volt ratings and 110 to 280 volts on the 230 volt ratings. The Type IAV51D is provided with a four-tap resistor in series with an untapped coil. For relays provided with taps, screw the tap plug firmly into the tap marked for the desired voltage (below which the relay is not to operate).

The pickup of the relay for any voltage tap is adjusted by means of a spring adjusting ring. The ring may be turned by inserting a tool in the notches around the edge (see Fig. 16). By turning the ring, the operating voltage of the relay may be brought into agreement with the tap setting employed if, for some reason, this adjustment has been disturbed. The adjustment also permits any desired setting between the various taps. The relay is adjusted at the factory to operate from any time-dial position at a minimum voltage within five percent of the tap setting for the relays with tapped coil mentioned above. For those relays with untapped coils, pickup occurs at a voltage which is 8 percent of rated voltage. The relays reset at 80 percent of the operating value on all of the over-voltage relays. Operating voltage for the over-voltage relays is the minimum voltage for a given tap setting at which the contacts just make.

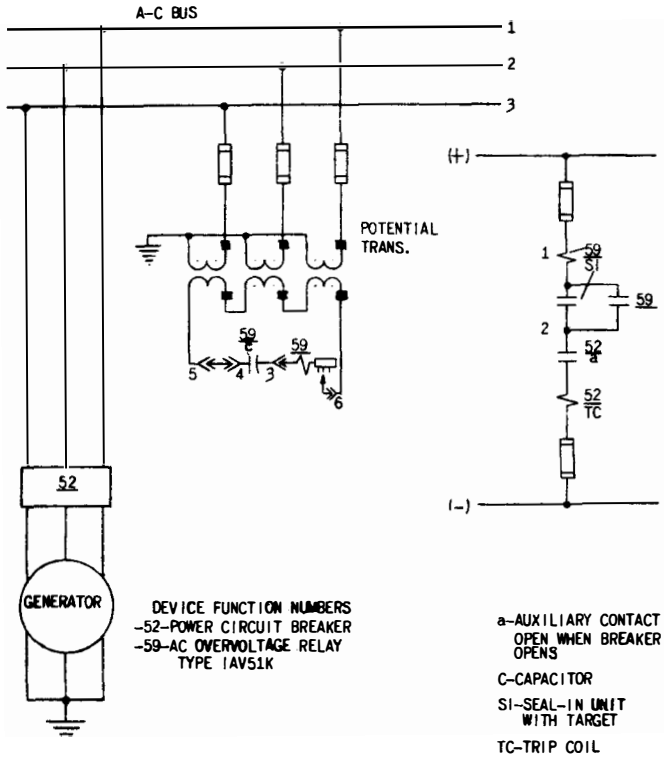


Fig. 7 Connection Diagram For The Type IAV51K Relay

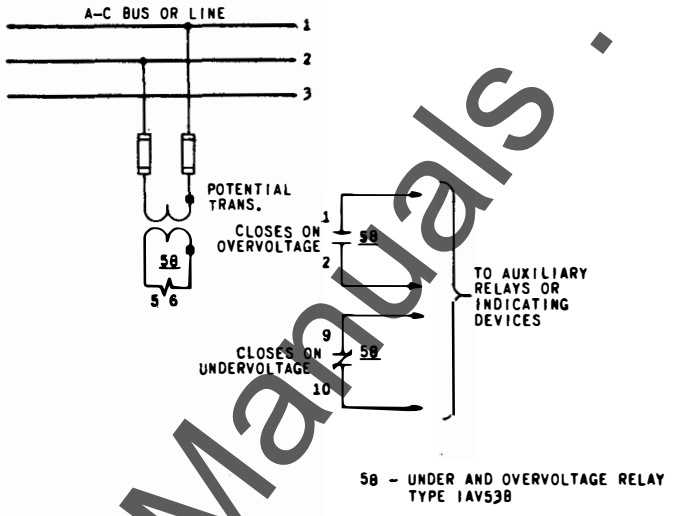


Fig. 8 Connection Diagram For The Type IAV53B Relay

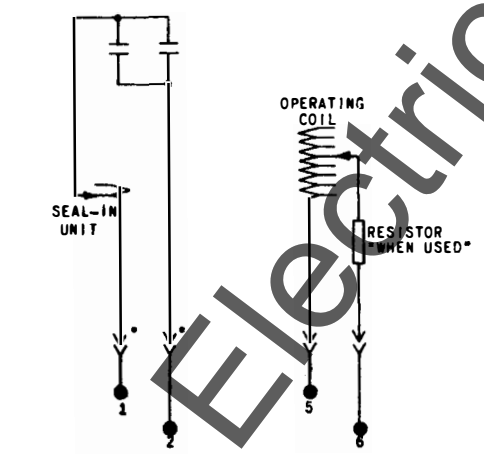


Fig. 9 Internal Connections Of The Type IAV51A Relay, Front View

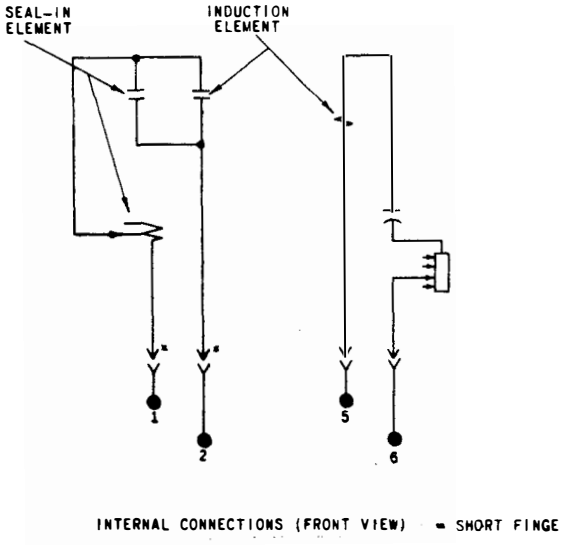


Fig. 10 Internal Connections Of The Type IAV51D Relay, Front View

Fig. 7 (W3A143)

Fig. 8 (K-6400200)

Fig. 9 (K-6209664)

Fig. 10 (K-6400439)

On the under- and overvoltage relays such as the IAV53A, IAV53B, IAV53C, and IAV53D, the operating voltage for a given tap setting is the minimum voltage at which the left-hand contacts close. The right-hand contacts will then close at a certain percentage of operating voltage. If it is desired to change this percentage, the right-hand moving contact may be rotated on the shaft after first loosening the clamping screws that hold it in place. Changing the position of this contact gives an adjustment of this contact gives an adjustment of the voltage to close the right-hand contacts between 50 and 95 percent of the voltage which closes the left-hand contacts. Changing the position of the right-hand contacts changes the voltage at which the left-hand contacts close. Hence, simultaneous adjustmentes for closing left and right contacts must be made to obtain a desired characteristic.

TIME SETTING

The time of operation of the overvoltage relays is determined primarily by the setting of the time dial, while that for the under- and overvoltage relays is determined by the spread of the contacts as explained under "Voltage Setting." Further adjustment is obtained by moving the permanent magnet along its supporting shelf; moving the magnet in toward the back of the relay decreases the time while moving it out increases the time.

Fig. 1 shows the time-voltage characteristics of the Type IAV51A and IAV52A relays with the dial setting for obtaining each characteristic. To make time settings, set the time dial to the number required (to give the desired characteristic) by turning it until the number lines up with the notch in the adjacent frame. The time indicated by the curves is the time required to close the relay contacts when the voltage is suddenly increased from a value below pickup to the value on the curve.

Fig. 2 shows the characteristics of the Type IAV53A and IAV53B relay. The time characteristic of the relay automatically determined by the setting of the ratio of the voltage to close the right contacts to the voltage to close the left contacts. Fig. 4 shows the time-voltage characteristics of the Type IAV53D relay. No curve is given for the Type IAV53C since its time-voltage characteristics are explained under the section heading "Operating Characteristics."

The time-voltage characteristics are plotted in percent thus making them applicable for all tap settings.

INSPECTION

At the time of installation, the relay should be inspected for tarnished contacts, loose screws, or other imperfections. If any trouble is found, it should be corrected in the manner described under "Maintenance."

OPERATION

Before the relay is put in service, it should be given a partial check to determine that factory adjustments have not been disturbed. On relays which have time dials, the dials will be set at zero before the relay leaves the factory. It is necessary to change this setting in order to open the relay contacts.

The pick-up voltage should be checked on one or more taps on relays which close contacts on increasing voltage. The drop-out voltage should be checked on one or more taps on relays which close contacts on decreasing voltage.

The time-voltage curves should be checked for one or more settings.

Recommended test connections for the above test are shown in Fig. 18 for the overvoltage relays such as the Types IAV51A, IAV51D and IAV52A. The under- and overvoltage relays such as the Types IAV53A, IAV53B, IAV53C and IAV53D can be checked for time of closing left contacts by using connections shown in Fig. 18, and for closing right contacts by the connections shown in Fig. 19. Of course the seal-in unit shown in the figure is not used in the case of the IAV53B and IAV53D, but all stud numbers are correct. Stud numbers 1 and 2 should be substituted for stud numbers 9 and 10 on Fig. 19 for testing the undervoltage contacts of the Type IAV53C relay. (See internal diagram, Fig. 15).

The relay may be tested while mounted on the panel, either from its own or another source of power, by inserting a separate testing plug in place of the connecting plug. Or, the cradle can be drawn out and replaced by another which has been laboratory tested.

MAINTENANCE

These relays are adjusted at the factory and it is advisable not to disturb the adjustments. If for any reasons, they have been disturbed, the following points should be observed in restoring them:

DISK AND BEARINGS

The lower jewel may be tested for cracks by exploring its surface with the point of a fine needle.

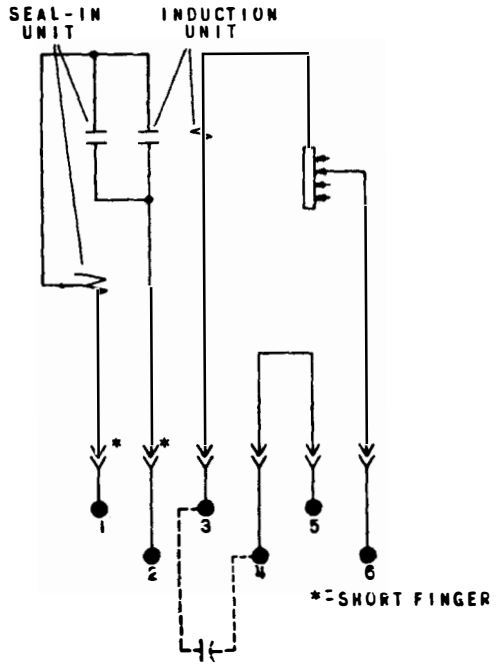


Fig. 11 Internal Connections Of The Type IAV51K Relay Front View

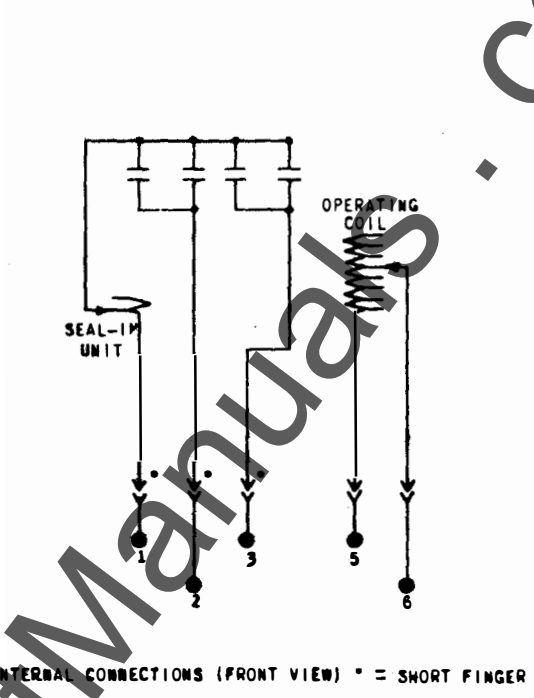


Fig. 12 Internal Connections Of The Type IAV52A Relay, Front View

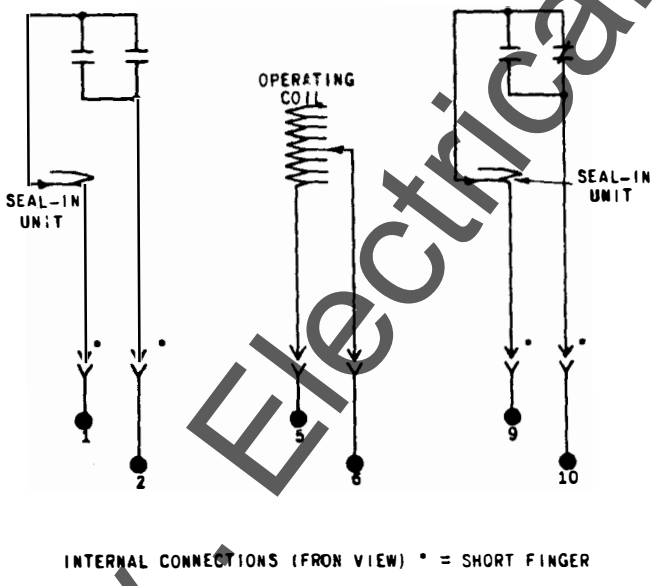


Fig. 13 Internal Connections Of The Type IAV53A Relay, Front View

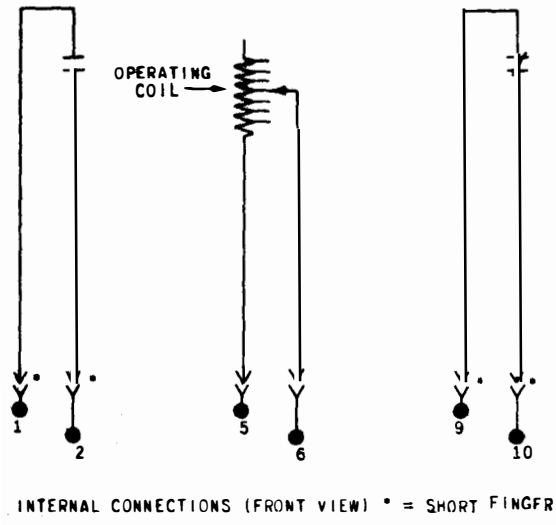


Fig. 14 Internal Connections Of The Types IAV53B And IAV53D Relays, Front View

Fig. 11 (362A514)
Fig. 12 (K-6209665)
Fig. 13 (K-6209666)
Fig. 14 (K-6400143)

If it is necessary to replace the jewel, the jewel should be turned up until the disk is centered in the air gap, after which it should be locked in position by the set screw provided for the purpose.

CONTACT CLEANING

For cleaning fine silver contacts, a flexible burnishing tool should be used. This consists of a flexible strip of metal with an etched roughened surface, resembling in effect a superfine file. The polishing action is so delicate that no scratches are left, yet corroded material will be removed rapidly and thoroughly. The flexibility of the tool insures the cleaning of the actual points of contact. Sometimes an ordinary file cannot reach the actual points of contact because of some obstruction from some other part of the relay.

Fine silver contacts should not be cleaned with knives, files, or abrasive paper or cloth. Knives or files may leave scratches which increase arcing and deterioration of the contacts. Abrasive paper or cloth may leave minute particles of insulating abrasive material in the contacts and thus prevent closing.

The burnishing tool described above can be obtained from the factory.

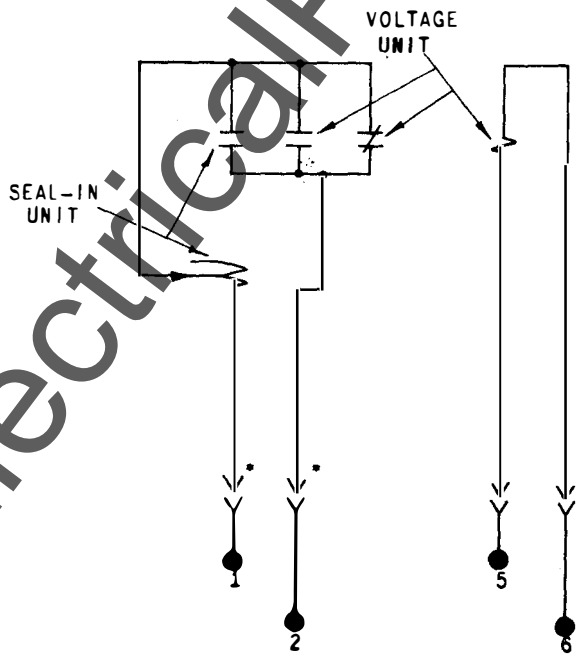
PERIODIC TESTING

An operation test and inspection of the relay at least once every six months are recommended. Test connections are shown in Figs. 18 and 19.

RENEWAL PARTS

It is recommended that sufficient quantities of renewal parts be carried in stock to enable the prompt replacement of any of those worn, broken or damaged. Parts bulletin number GEF-2149 gives a list of those most subject to wear in ordinary operation and to damage due to possible abnormal conditions.

When ordering renewal parts, address the nearest Sales Office of the General Electric Company, specify quantity required, name of part wanted as shown by Figs. 16 and 17 and give complete nameplate data, including serial number. If possible give the General Eelectric Company's requisition on which the relay was furnished.



INTERNAL CONNECTIONS (FRONT VIEW) * = SHORT FINGER

Fig. 15 (K-6400385)

Fig. 15 Internal Connections Of The Type IAV53C Relay, Front View

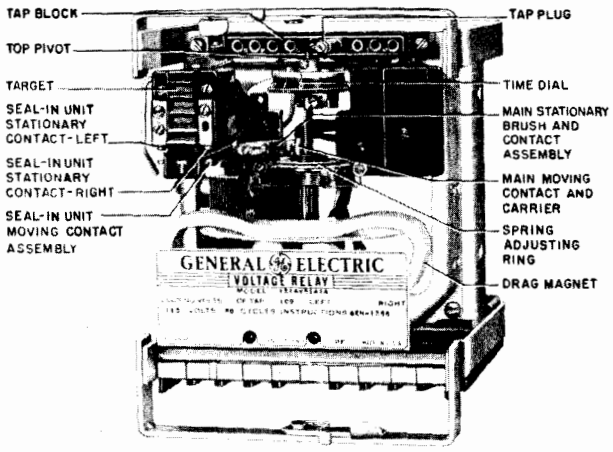


Fig. 16 (8007378) Front View Of Type IAV51A Relay Withdrawn From Case

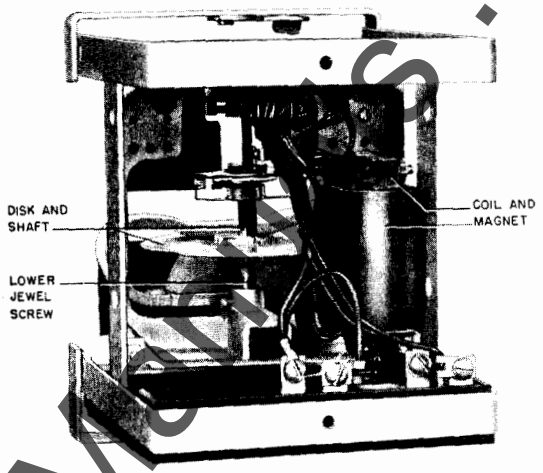


Fig. 17 (8007379) Back View Of Type IAV51A Relay Withdrawn From Case

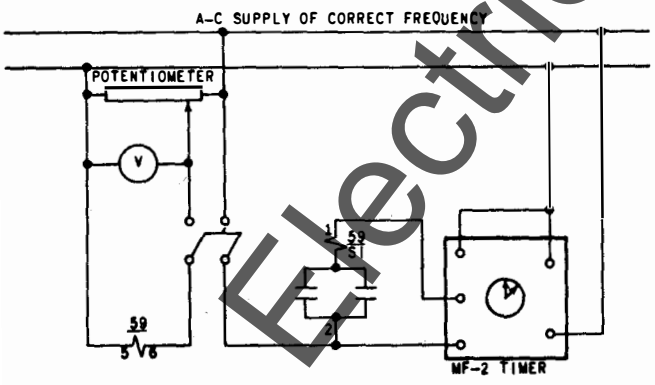


Fig. 18 (K-6154391) Test Connections For Overvoltage Relays

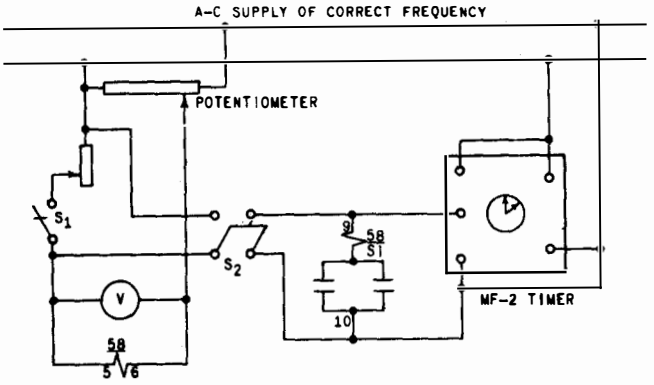


Fig. 19 (K-6375693) Test Connections For Undervoltage Contacts Of Over- And Undervoltage Relays

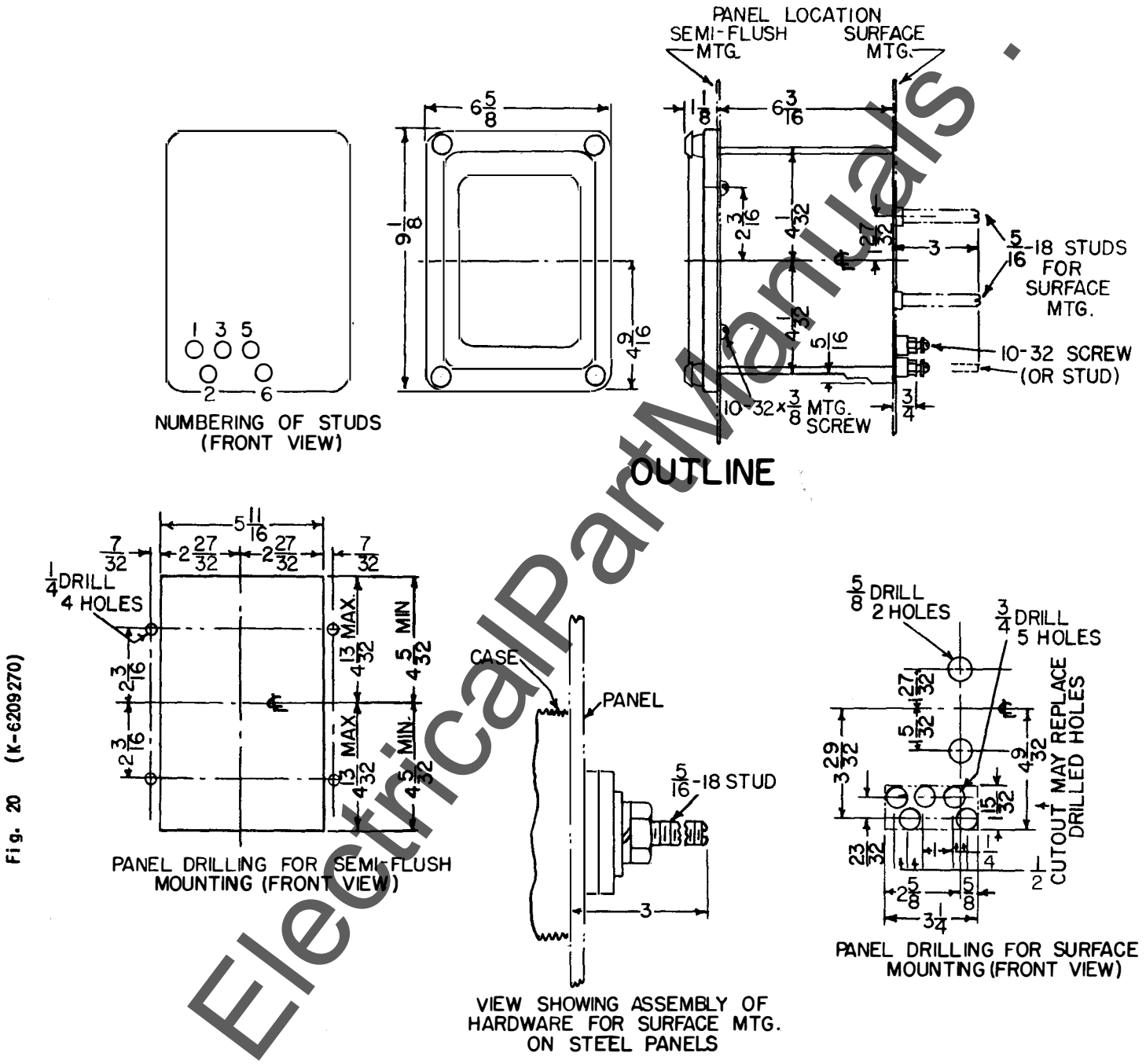


Fig. 20 (K-6209270)

Fig. 20 Outline And Panel Drilling For Relay Types IAV51A, IAV51D, IAV52A And IAV53C

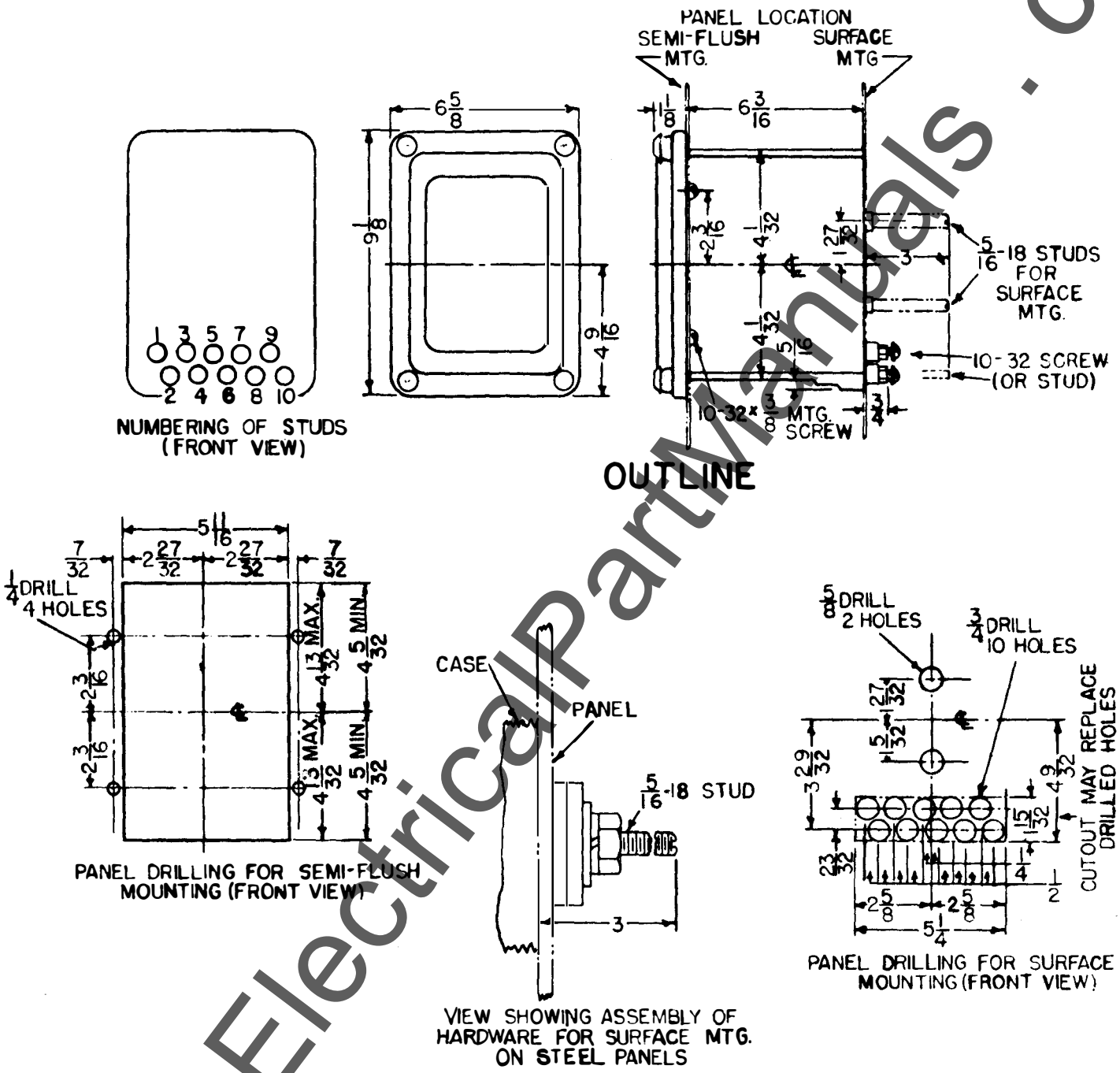


Fig. 21 (K-6209271)

Fig. 21 Outline And Panel Drilling For Relay Types IAV51K, IAV53A, IAV53B And IAV53D