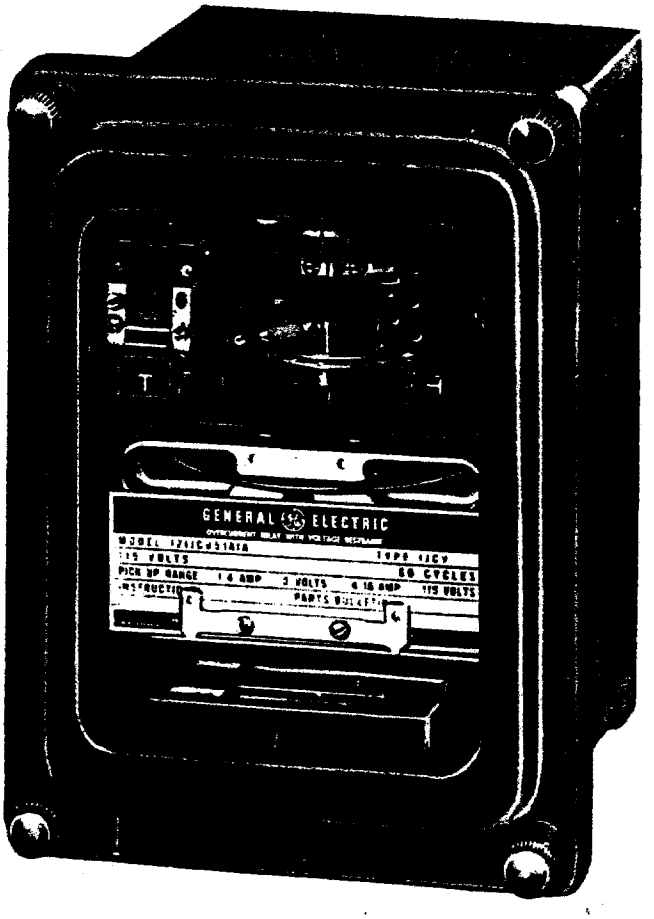
INSTRUCTIONS

GEH-2029A
Supersedes GEI-28763E,
GEI-33838 and GEH-2029

TIME-OVER CURRENT RELAYS WITH VOLTAGE RESTRAINT

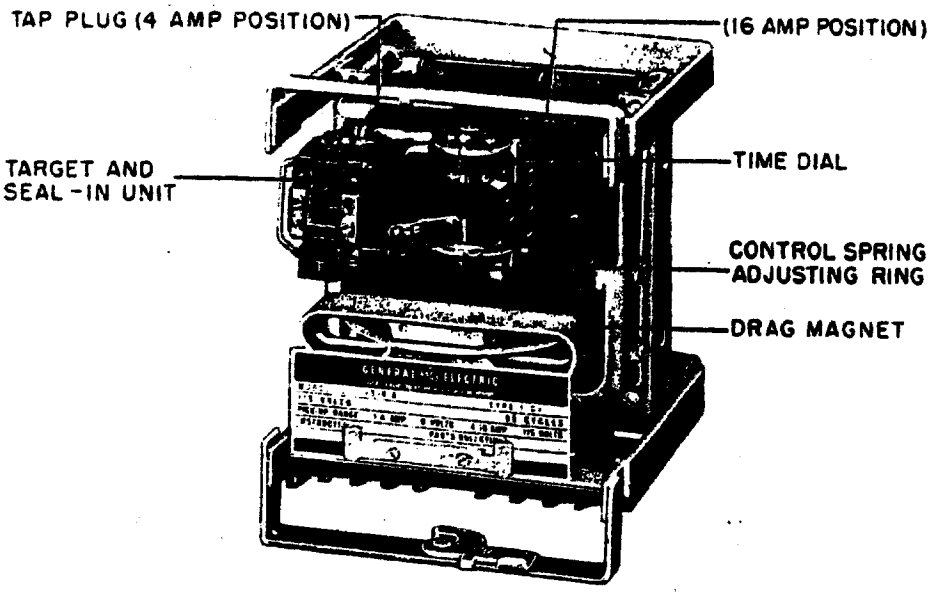
Types

IJCV51A
IJCV51B
IJCV52A
IJCV52B

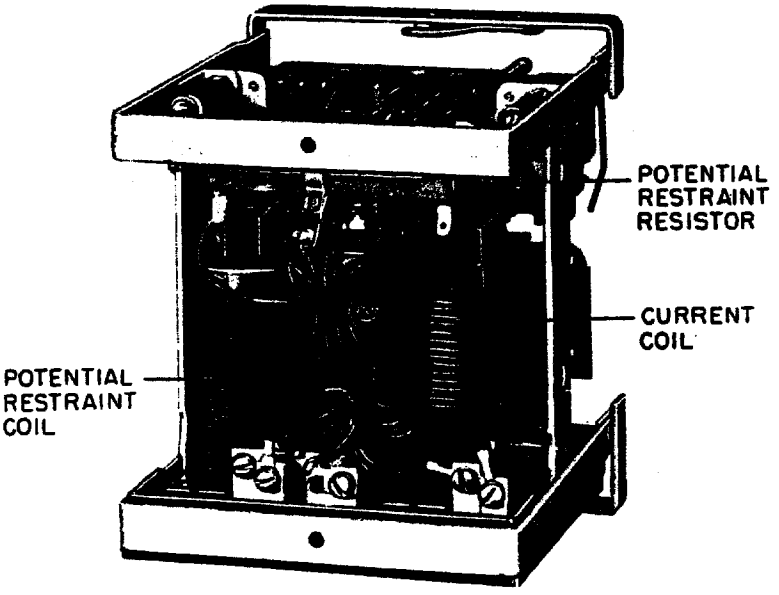


CONTENTS

GENERAL ELECTRIC



A - Front View



B - Back View

Fig. 1 (8026496, 8026498) IJCV51A Relay Removed from Case

TIME-OVERCURRENT RELAYS WITH VOLTAGE RESTRAINT TYPE IJCV

DESCRIPTION

The Type IJCV relays are drawout, induction-disk time-overcurrent relays having voltage restraint and inverse time characteristics. Table I is a tabulation of the various forms covered by these instructions.

TABLE I

Relay	Contact Circuit(s)	Instantaneous Overcurrent Unit
IJCV51A	one	No
IJCV51B	one	Yes
IJCV52A	two	No
IJCV52B	two	Yes

Fig. 1 shows front and back views of an IJCV51A relay with its components identified by nomenclature used throughout the text.

APPLICATION

System fault back-up protection should be provided at the source of fault current, the generator. Such protection should provide against the generator continuing to supply short-circuit current to a fault in an adjacent system element because the fault may not have been removed by other protective equipment. The Type IJCV relay was designed for the purpose of providing external-fault back-up protection for the generator.

Phase-fault protection should be provided for the generator by either three single-phase Type IJCV relays or by three single-phase distance relays and a timer. The choice between the two types of protective equipment should be goverened by the type of system protective relaying with which the external-fault back-up relays are to be selective. In general, Type IJCV relays should be used when the generator connects to a bus at generator voltage, because such relaying equipment is most selective with inverse-time overcurrent relaying that is generally used for lines connected to such a bus. The distance relays should generally be used with unit generator-transformer arrangements because the distance relays will be most selective with distance or pilot relaying that is generally used for high-tension lines. An inverse-time overcurrent relay should be used for ground-fault protection.

The current source for Type IJCV relays should be current transformers at the neutral end of the generator windings when such CT's are available. With these connections, in addition to external-fault back-up protection the relays will provide generator fault back-up protection even if the generator breaker is open or there are no other sources of generation on the system. If the neutral CT's are not available, then line-side CT's should be used. With these connections Type IJCV relays will be operative as fault back-up protection for the generator only when the generator breaker is closed, and there is another source of generation on the system.

Phase-to-phase voltage should be obtained from the generator potential transformers. Loss of potential to the Type IJCV relay will cause the relay to trip if the generator load current, expressed in relay secondary amperes, is greater than the zero voltage pickup current of the relay. An additional relay, the Type CFVB, is available for protection against false tripping due to this accidental loss of the relay's restraint voltage.

The voltage-restrained overcurrent phase relays and the inverse-time overcurrent ground relay should be arranged to trip a hand reset auxiliary relay that will trip the main and field breakers and operate an alarm. When the Type IJCV relay is used to provide both primary generator short-circuit protection as well as external-fault back-up protection, as in the case when there are no neutral CT's available for phase differential relaying, this equipment should also operate to shut down the prime mover.

CALCULATION OF SETTINGS

Pickup with full voltage restraint of the Type IJCV relay should generally be set between 200 percent and 250 percent of full load current on regulated generators, and between 150 percent and 200 percent full load current on unregulated generators.

The relay time setting is determined by system selectivity requirements. Though the current decrement curves of the generator must be taken into consideration to determine the actual operating time of the Type IJCV relay, simplifying assumptions can be made which facilitate application of the Type IJCV relay and yet maintain a satisfactory operating performance. The maximum fault current condition for which time-current coordination must be obtained should be based on the transient reactance of the generator.

If the calculations are further based on the premise that for a bus fault the voltage presented to the Type IJCV relay is zero, then the Type IJCV can be coordinated with the bus and/or system relaying on a straight overcurrent basis. Coordination of the Type IJCV relay and other system relays for system faults where voltage will be presented to the Type IJCV relay is thereby assured. This conservative assumption of the zero-voltage fault is equally applicable to the unit generator-transformer case even though the IJCV restraint voltage may come from generator potential transformers. The justification for this application assumption is its inherent conservatism, and the basic fact that the operating characteristic of the Type IJCV relay is fairly constant for all low voltage conditions.

OPERATING CHARACTERISTICS

A typical pickup characteristic of Type IJCV relays is shown in Fig. 2 and a typical phase-angle characteristic is shown in Fig. 3.

Pickup is affected by the phase angle of the fault current. The variation is approximately seven percent of tap setting and may be neglected for most applications.

* Typical time-current characteristics of the induction unit are shown in Figs. 5 and 6. Fig. 4 is the time-current characteristic of the instantaneous overcurrent unit.

RATINGS

INDUCTION UNIT

* The current coil ratings are given below:

TABLE I - 0.8 - 3.2 amp tap range (one second rating = 58 amps)

Tap	0.8	1.0	1.2	1.6	2.0	2.4	3.2
Continuous Current Rating	1.0	1.1	1.2	1.3	1.5	1.6	1.7

*Indicates revision

2-8 amp tap range (one second ratings = 130 amps)

Tap	2	2.5	3	4	5	6	8
Continuous Current Rating	2.5	2.7	3.0	3.4	3.7	4.0	4.2

4-16 amp tap range (one second rating = 260 amps)

Tap	4	5	6	8	10	12	16
Continuous Current Rating	5.0	5.5	6.0	6.8	7.6	8.0	8.6

The relay will pick up at tap value when rated voltage is applied to the restraint circuit. With zero voltage on the restraint circuit the relay will pickup at 25 percent tap value. Fig. 2 shows the pickup current required for any value of restraint voltage.

The voltage restraint coil is rated continuously for the nameplate voltage at rated frequency.

CONTACTS

The current closing rating of all contacts is 30 amperes for voltages not exceeding 250 volts. The current carrying capacity is affected by the tap selection on the target and seal-in unit.

TARGET AND SEAL-IN UNIT

TABLE II

TARGET AND SEAL-IN UNIT RATINGS

Function	Amperes, AC or DC	
	2-Amp Tap	0.2-Amp Tap
Operating Range	2-30	0.2-2
Tripping Duty	30	5
Carry Continuously	3	0.3
Resistance (DC)	0.13	7
Impedance @ 60 cycles	0.53	52

INSTANTANEOUS OVERCURRENT UNIT

The instantaneous overcurrent unit is adjustable over a 4-to-1 range. The continuous and one second rating of this unit are limited by those of the induction unit.

BURDENS

INDUCTION UNIT

* The potential burdens at rated voltage and rated frequency are given in Table III.

TABLE III

POTENTIAL BURDEN

Volts	Freq	Watts	Vars	Volt Amp
120	50	9.26	14.4	17.1
120	60	9.43	17.3	19.7
199	50	9.36	14.4	17.2
199	60	10.4	15.8	18.9
208	50	10.7	14.4	17.9
208	60	11.9	15.8	19.8

*Indicates revision

The current circuit burdens with five amperes flowing in the lowest tap are listed in Table IV. The burden on any other tap with five amperes flowing is approximately $\left(\frac{\text{Lowest Tap}}{\text{Actual Tap}}\right)^2$ times the burden for the lowest tap.

*

TABLE IV

CURRENT CIRCUIT BURDENS

Range	Freq.	Tap	Amp	Imp Ohm	VA	PF
0.8-3.2	50	0.8	1	27.5	27.5	0.42
2-8	50	2	5	4.40	110	0.42
2-8	60	2	5	5.20	130	0.40
4-16	50	4	5	1.10	27.5	0.42
4-16	60	4	5	1.30	32.4	0.40

INSTANTANEOUS OVERCURRENT UNIT

The current burden of this unit at five amperes is listed in Table V.

*

TABLE V

Range	Freq.	Amp	Imp Ohms	VA	PF
2-8	50	5	0.800	20.0	0.95
2-8	60	5	0.824	21.6	0.95
4-16	50	5	0.200	5.00	0.95
4-16	60	5	0.206	5.2	0.95
10-40	50	5	0.032	0.80	0.95
10-40	60	5	0.033	0.83	0.95
20-60	50	5	0.008	0.20	0.95
20-80	60	5	0.008	0.21	0.95
40-160	50	5	0.002	0.05	0.95
40-160	60	5	0.002	0.05	0.95

INSTALLATION

RECEIVING

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 the relay, an examination should be made for any damage sustained during shipment. If injury or damage resulting from rough handling is evident, a claim should be filed at once with the transportation company and the nearest Sales Office of the General Electric Company notified promptly.

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

*Indicates revision

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.

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.

CAUTION

Every circuit in the drawout case has an auxiliary brush. It is especially important on current circuits and other circuits with shorting bars that the auxiliary brush be bent high enough to engage the connecting plug or test plug before the main brushes do. This will prevent CT secondary circuits from being opened.

LOCATION AND MOUNTING

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

The relay should be mounted on a vertical surface. The outline and panel drilling diagram is shown *in Fig. 14.

CONNECTIONS

* The internal connection diagrams are shown in Figs. 10 to 13.

Typical external connections are shown in Fig. 8. Since it may also be desirable to use the Type IJCV relay for external-fault back-up protection with unit generator-transformer equipments. Fig. 9 shows the choices of connections available to obtain the necessary protection. It should be noted that auxiliary potential transformers are required in Fig. 9 to obtain the proper phase relationship when using generator voltage to detect line-side faults.

SETTINGS

THE CONNECTING PLUG MUST FIRST BE REMOVED BEFORE ANY SETTINGS ARE ATTEMPTED.

Induction Unit

The current at which the induction unit operates to close its contacts may be selected by changing the position of the tap plug in the tap block at the top of the relay. Screw the tap plug into the tap marked for the desired current.

Target and Seal-in Unit

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

The tap screw is the screw holding the right-hand stationary contact of the target and seal-in unit. To change the tap setting 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 ot adjustment. Screws should not be in both taps at the same time.

Instantaneous Overcurrent Unit

Select the current above which is desired to have the instantaneous overcurrent unit operate and set the adjustable pole-piece so that the top of the hexagon head is even with the desired calibration on the scale. To raise or lower the pole-piece loosen the locknut and turn the adjustable pole-piece to the desired value and then tighten the locknut.

*Indicates revision

MAINTENANCE

PERIODIC TESTS

It is recommended that a mechanical inspection and an operational test be performed at least annually and if possible at the same time associated equipment is tested.

The interval of time may vary depending on the relative importance of individual protective equipment, and its exposure to unfavorable conditions, such as extreme heat, moisture or fumes. Dust and dirt may contaminate the relay when the protective cover is removed.

Periodic inspection consists of checking the contacts for corrosion and pitting, the bearings for cracks or dust and dirt, the air gaps for any foreign material and the relay calibration.

SERVICING

MECHANICAL ADJUSTMENTS

Disk and Bearings

The lower jewel may be tested for cracks by exploring its surface with the point of a fine needle. The jewel should be turned up until the disk is centered in the air gaps, after which it should be locked in this position by the set screw provided for this purpose.

All air gaps must be clean and free from foreign material.

Contact Cleaning

For cleaning fine silver contacts on each unit, a flexible burnishing tool should be used. This consists of 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.

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 is included in the standard XRT11A tool kit obtainable from the factory.

RECALIBRATION

Pickup Setting

The relay is first set for pickup current at zero restraint volts. The correct procedure is:

a. Screw the tap screw into the four-ampere tap.

b. Connect relay terminals 5 and 6 (current operated circuit) through a pure resistance load box to a source of good wave form at rated voltage and frequency.

c. Adjust the control spring by inserting a tool in the notches of the spring adjusting ring. Turning to the right increases pickup while turning to the left decreases pickup. The spring should be adjusted so that the contacts will just close at approximately 1.0 ampere.

Now the relay may be set to pick up at the particular value of restraint voltage. The procedure is:

d. In addition to the connections already made in (b) above, connect relay terminals 7 and 8 (potential restraint circuit) to the same source. Terminal 7 must be connected to the same side of power as terminal 5.

e. Adjust the pure resistance load box so that four amperes are flowing in the current circuit.

f. Adjust the slide-band resistor at the back of the relay until the contacts just close for the restraint voltage required.

Time Setting

The closing time of the Type IJCV relay may be adjusted according to the following procedure.

a. Place the tap plug in the four ampere tap.

b. Connect the relay as in (b) of the Pickup Section and adjust the load box for five amperes in the current coil.

c. With zero restraint voltage and the time dial set at No. 10, adjust the drag magnet for a closing time of 3.53 to 3.87 seconds. Moving the alnico drag magnet on its shelf toward the main shaft decreases the closing time. Moving the drag magnet away from the shaft increases the closing time. After the magnet has been correctly adjusted be sure to tighten its clamping nut.

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, specifying the quantity required and describing the parts by catalogue numbers as shown in Renewal Parts Bulletin Nol GEF-4040.

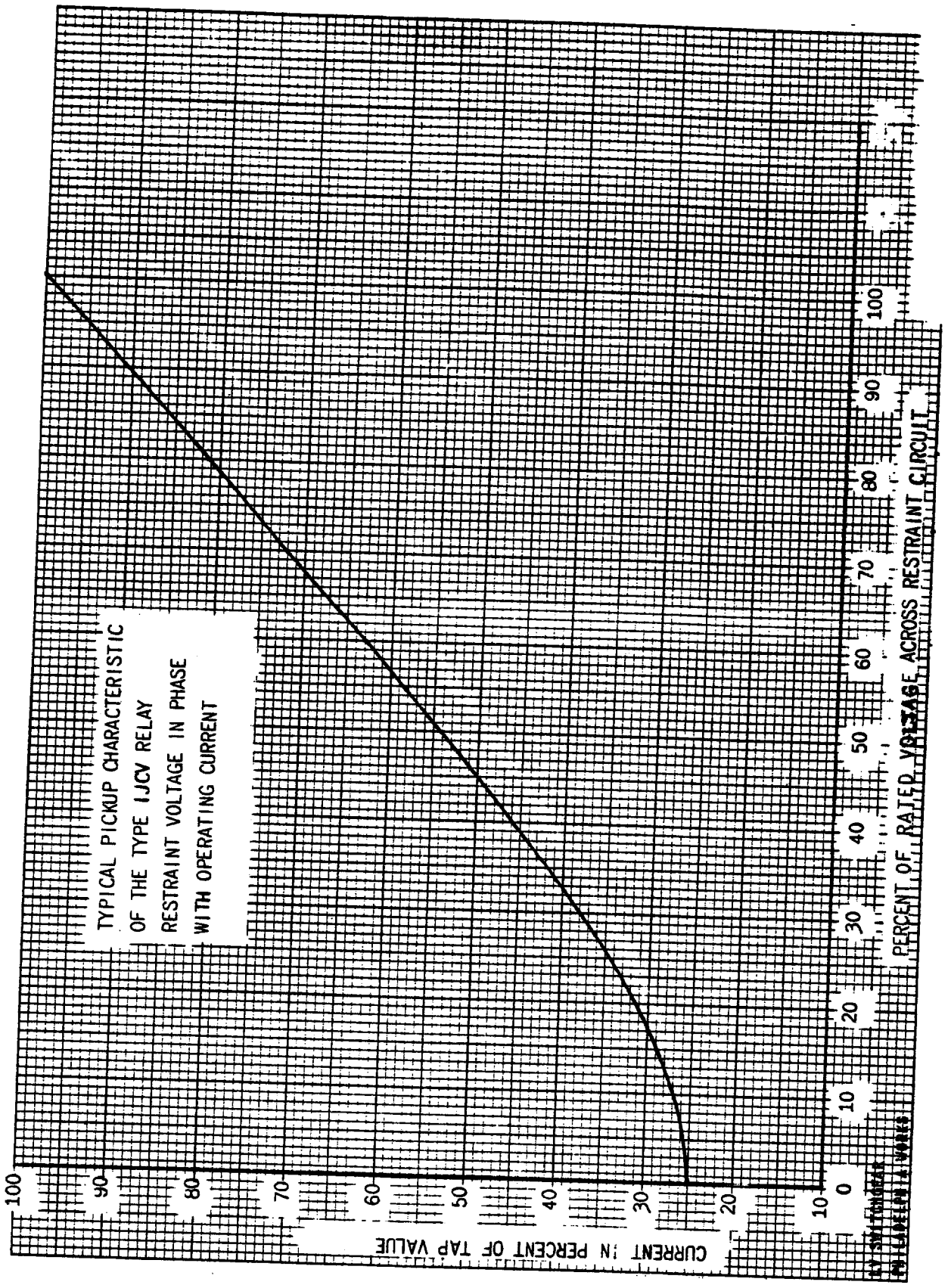


Fig. 2 (6400785-2 Sh. 2) Typical Pickup Characteristic of Type IJCV Relays

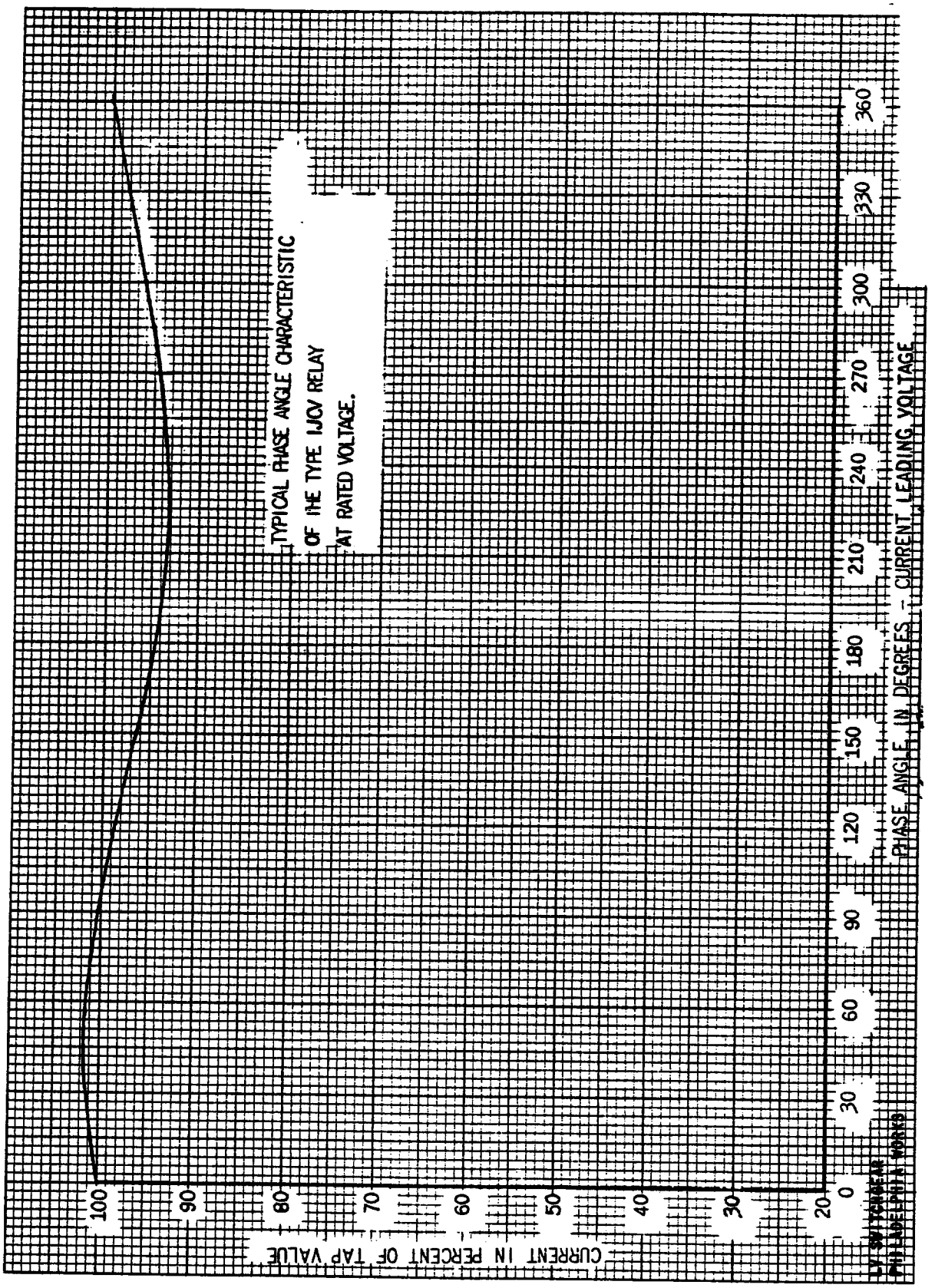


Fig. 3 (6400785-1 Sh. 1) Typical Phase-angle Characteristic of Type IJCV Relays

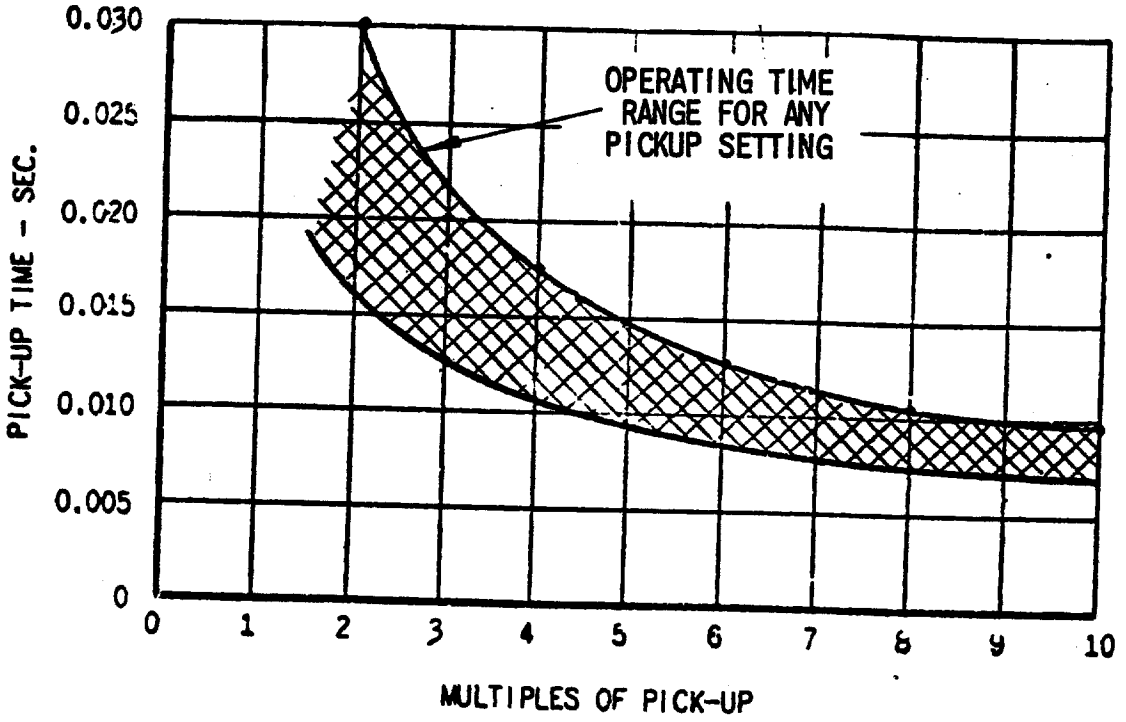


*Fig. 4 (6306872-5) Typical Time-current Characteristic of the Instantaneous Overcurrent Unit

*Indicates Revision

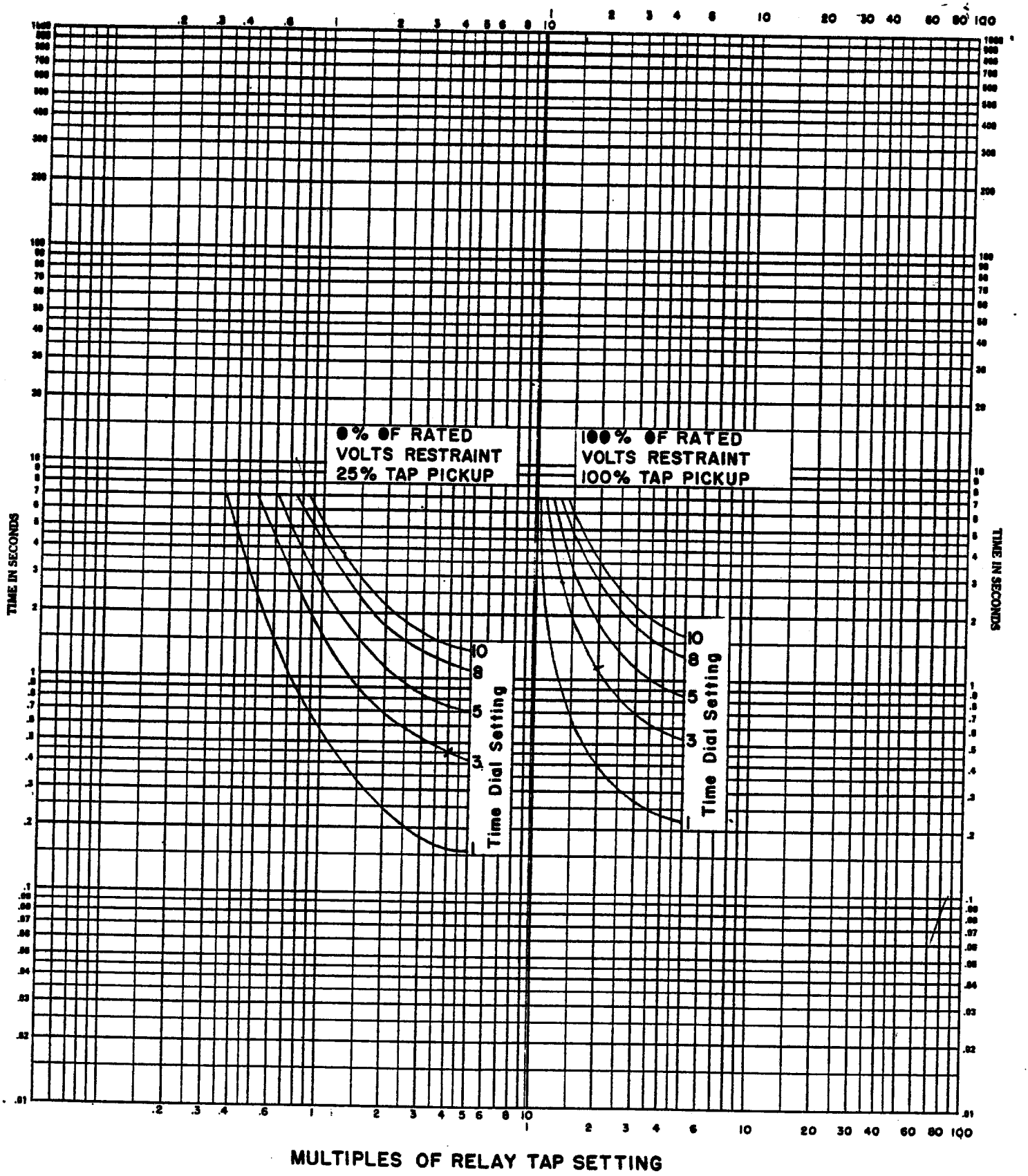


*Fig. 5 (088B80290-0 Sh. 1) Typical Time-current Characteristics of Type IJCV Relay with 0% or 100% of Rated Restraint Voltage.

*Indicates Revision

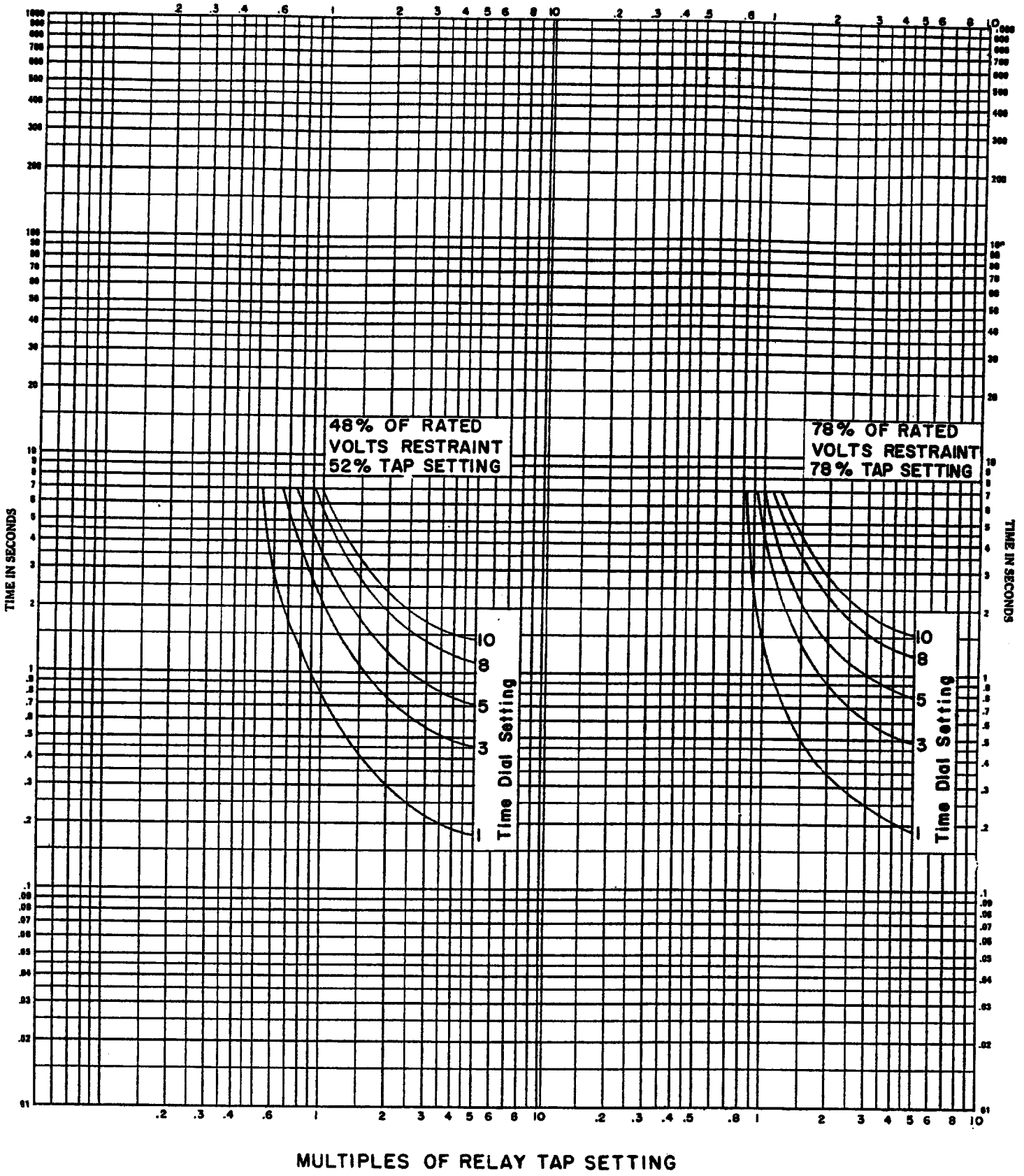


*Fig. 6 (0888B0290-0 Sh. 2) Typical Time-current Characteristics of Type IJCV Relay with 48% or 78% of Rated Restraint Voltage.

*Indicates Revision

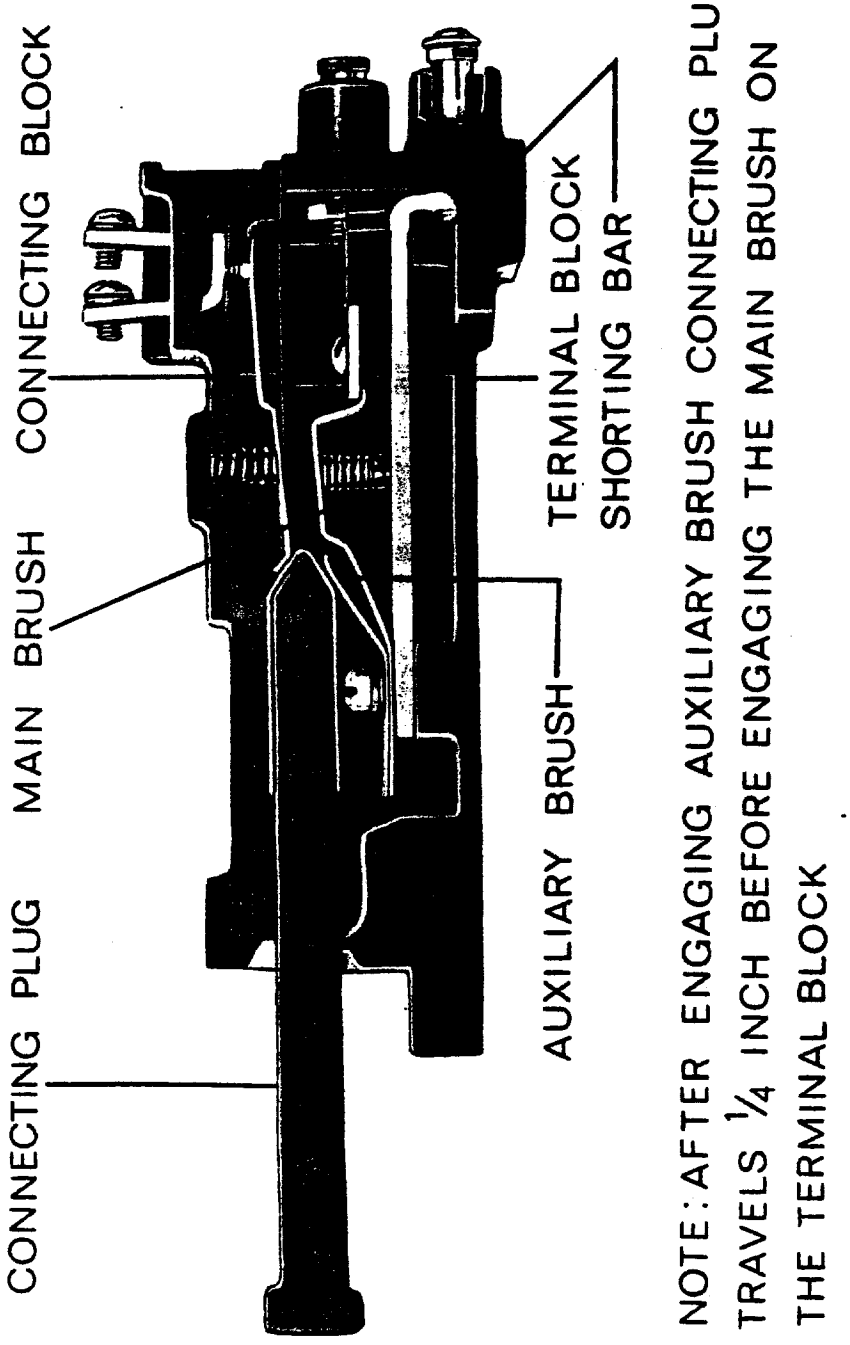
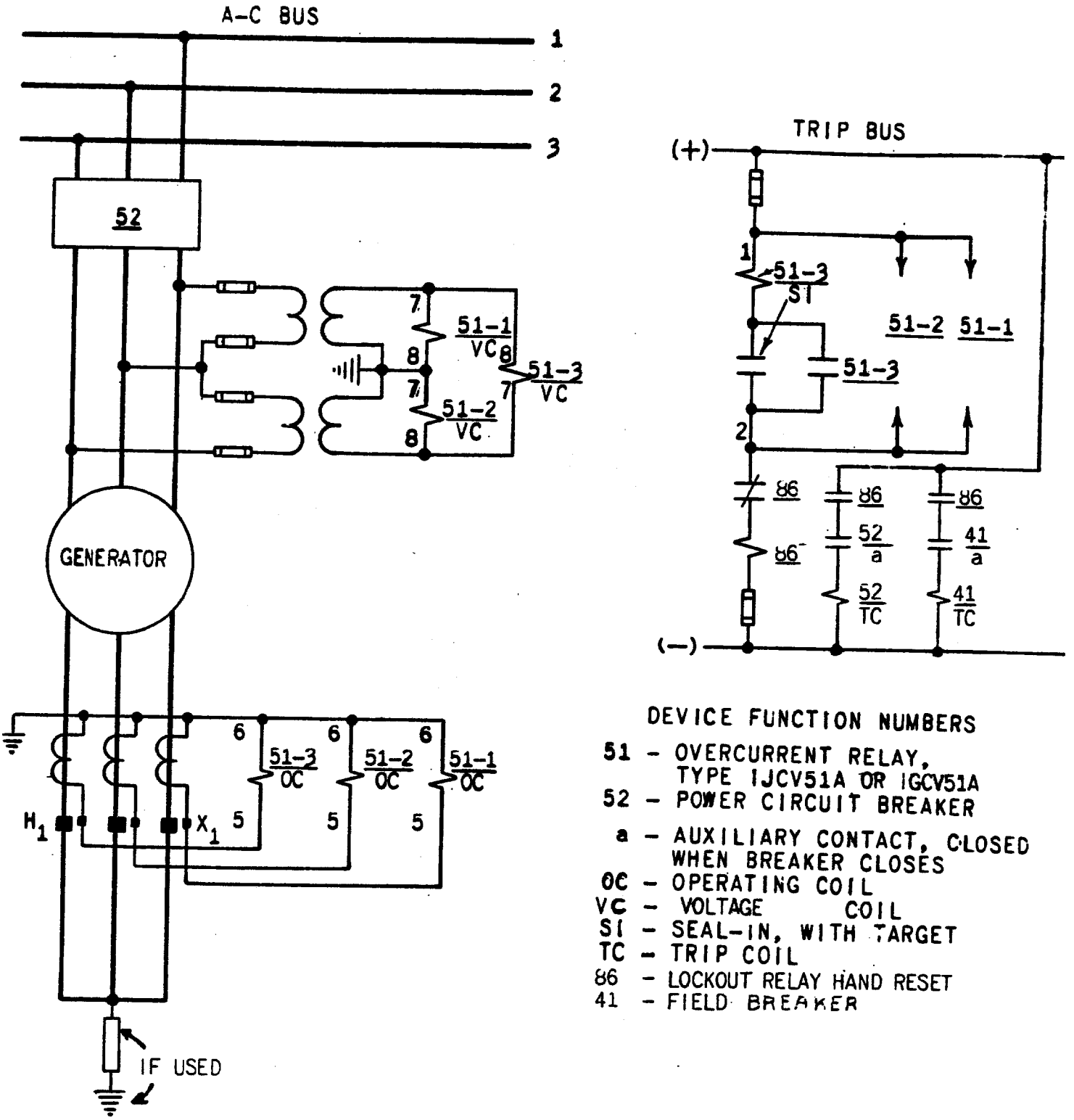


Fig. 7 (8025039) Cross Section of Drawout Case Showing Position of Auxiliary Brush

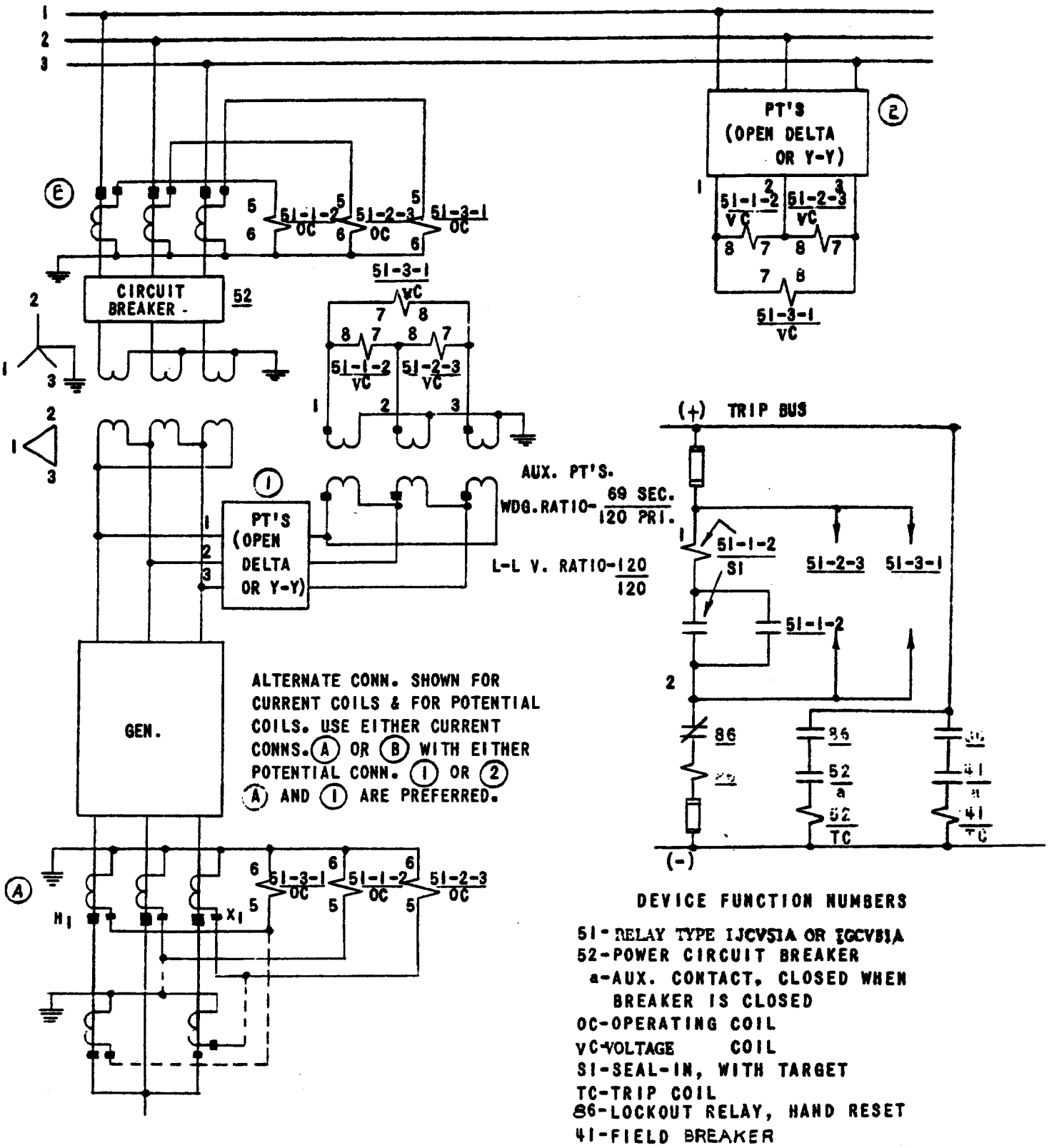


DEVICE FUNCTION NUMBERS

51 - OVERCURRENT RELAY, TYPE IJCV51A OR IGCV51A
52 - POWER CIRCUIT BREAKER
a - AUXILIARY CONTACT, CLOSED WHEN BREAKER CLOSES
OC - OPERATING COIL
VC - VOLTAGE COIL
SI - SEAL-IN, WITH TARGET
TC - TRIP COIL
86 - LOCKOUT RELAY HAND RESET
41 - FIELD BREAKER

*Fig. 8 (6400786-9) Typical External Connections of IJCV51A Relays for Back-up Protection Against External Faults

*Indicates Revision

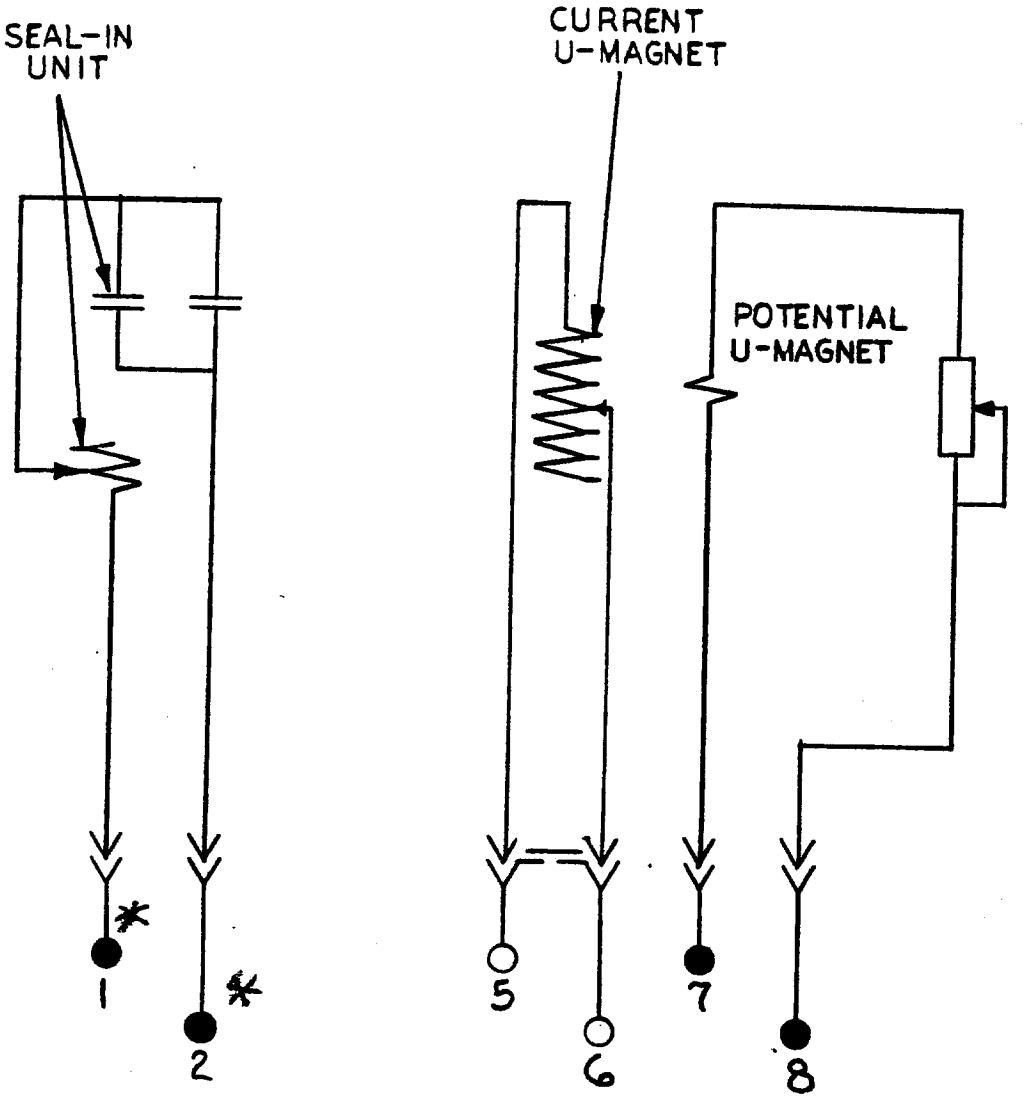


DEVICE FUNCTION NUMBERS

51 - RELAY TYPE IJCV51A OR IGCV51A
52 - POWER CIRCUIT BREAKER
a - AUX. CONTACT, CLOSED WHEN BREAKER IS CLOSED
OC - OPERATING COIL
VC - VOLTAGE COIL
SI - SEAL-IN, WITH TARGET
TC - TRIP COIL
86 - LOCKOUT RELAY, HAND RESET
41 - FIELD BREAKER

*Fig. 9 (0418A0710-8) Typical External Connections of IJCV51A Relays for Protection Against Faults on High-Side of Wye-Delta Transformer Bank

*Indicates Revision



○ = SHORT FINGER

*Fig. 10 (6400740-3) Internal Connections of IJCV51A Relay (Front View)

*Indicates Revision

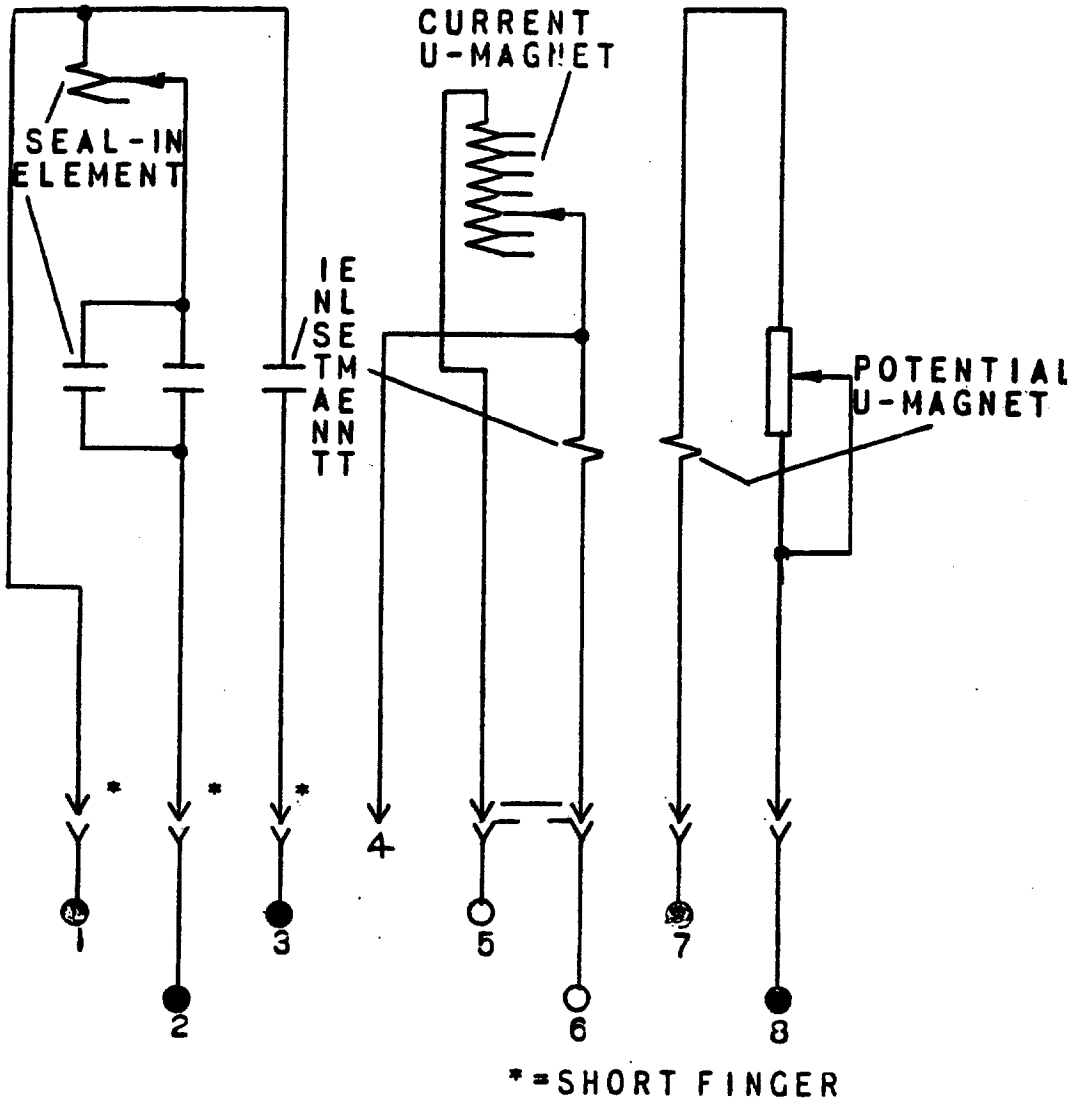
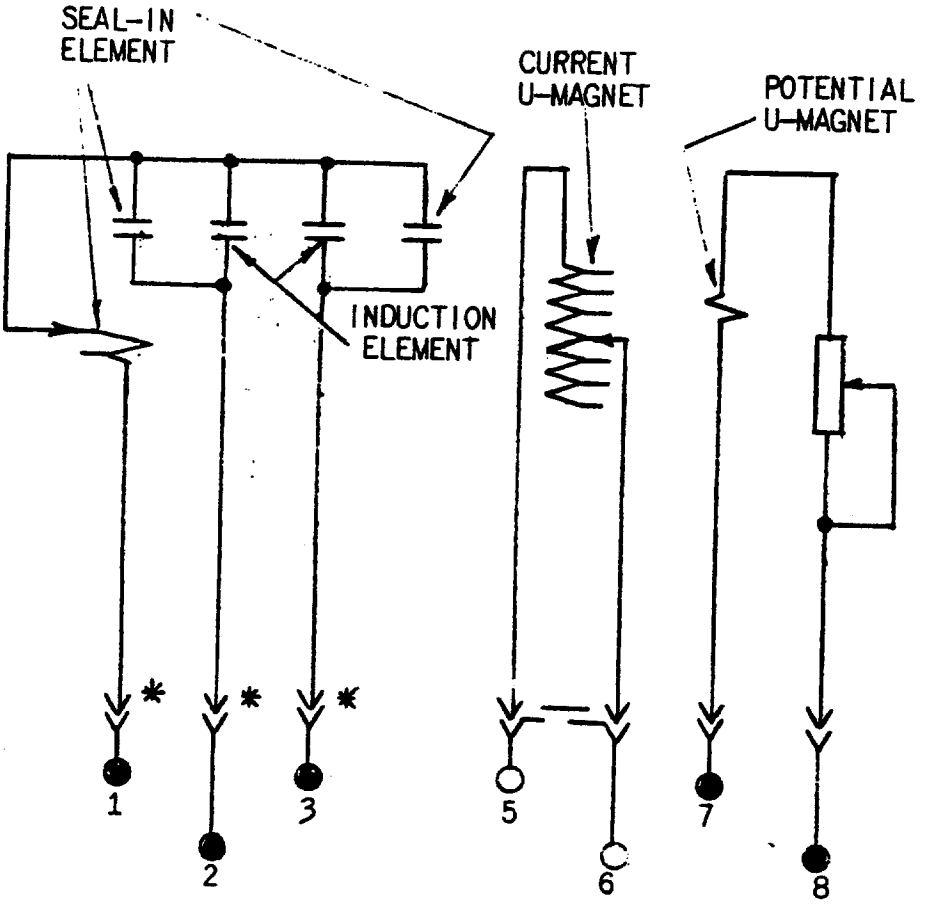


*Fig. 11 (6556474-1) Internal Connections of IJCV51B Relay (Front View)

*Indicates Revision



*= SHORT FINGER

*Fig. 12 (0362A0674-1) Internal Connections of IJCV52A Relay (Front View)

*Indicates Revision

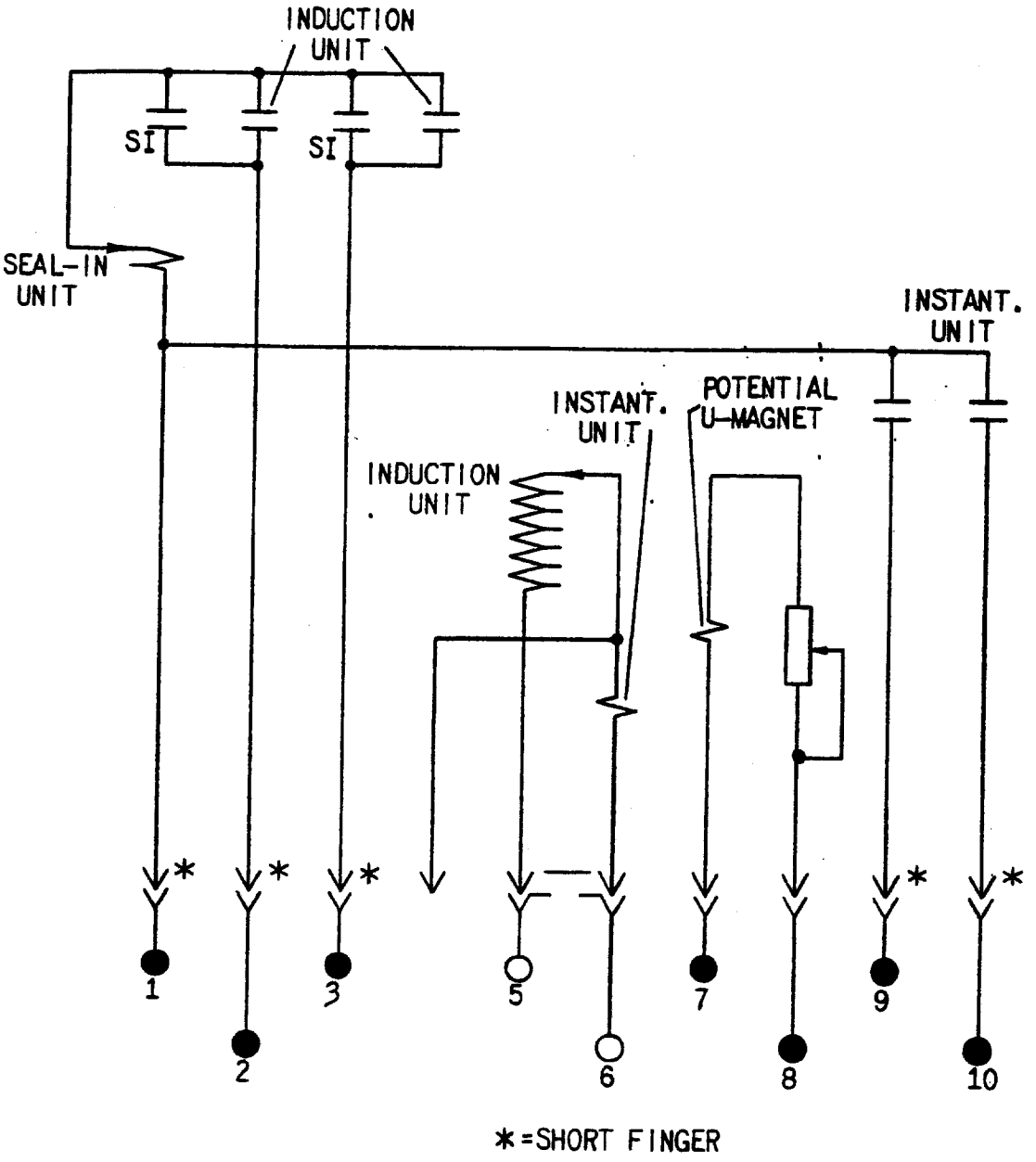


*Fig. 13 (0418A0787-1) Internal Connections of IJCV52B Relay (Front View)

*Indicates Revision

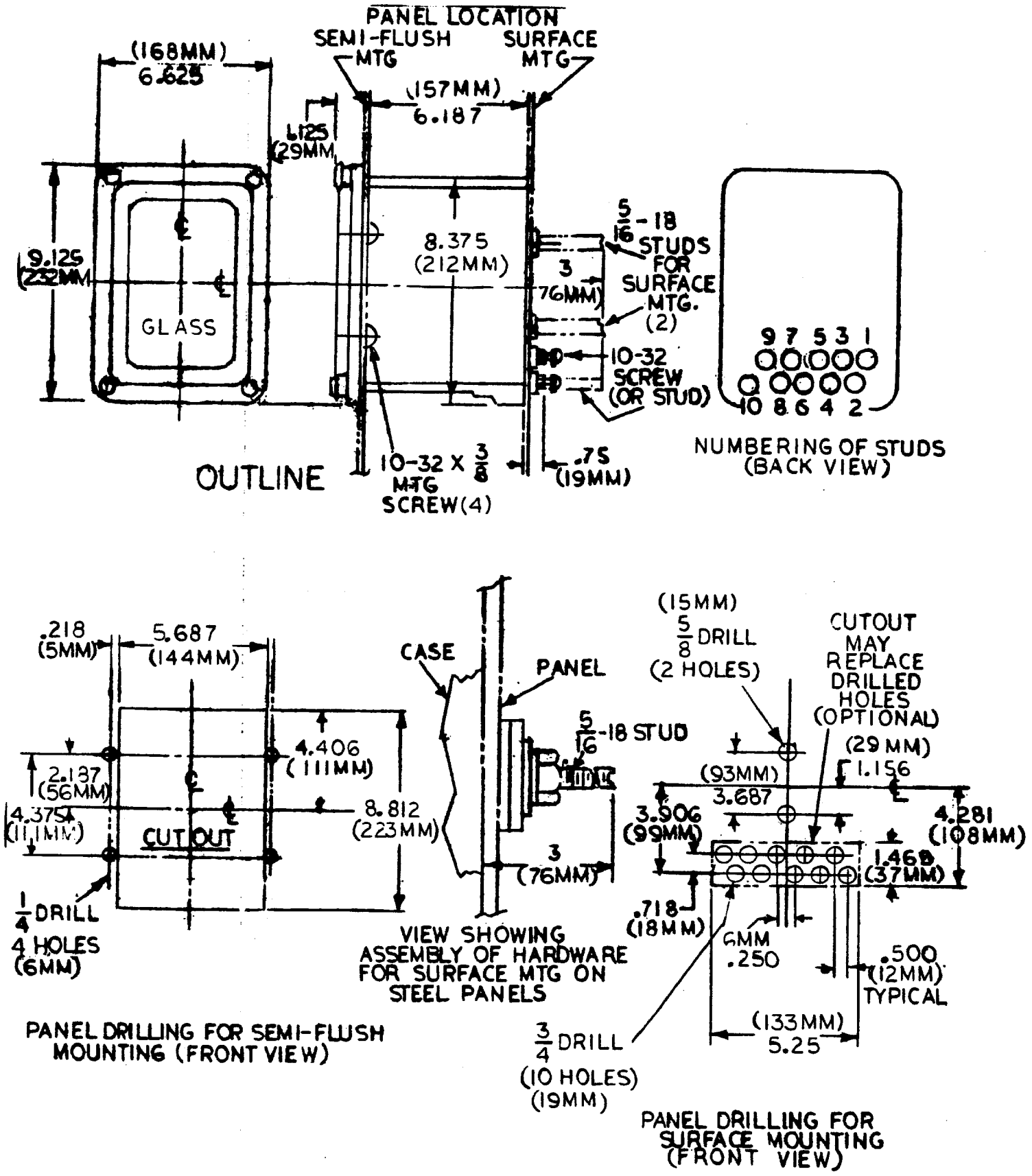


*Fig. 14 (6209271-5) Outline and Panel Drilling of Type IJCV Relays

*Indicates Revision