



INSTRUCTIONS

GEI-44233 F
Supersedes GEI-44233 E

TIME-OVERCURRENT RELAYS

TYPE IAC66K

GENERAL  ELECTRIC

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This instruction book has had a major revision. Please check your previous revision to compare material.

TIME OVERCURRENT RELAYS

TYPE IAC66K

DESCRIPTION

The type IAC66K relay is similar to the IAC51B except: (1) the U-magnet construction has been altered to give a very long time operating characteristic, Fig. 1; (2) the tap ranges are shown in Table 1, and (3) the relay has two instantaneous units, one standard unit, and one special high dropout unit. The standard is mounted in the front of the relay while the special unit is mounted in the rear. The internal connections are shown in Fig. 3 and the outline and panel drilling in Fig. 7.

APPLICATION

The Type IAC66K relay is used for motor protection. Typical external connections for motor protection are shown in Fig. 4. The recommended settings for the three units are as follows:

	UNIT	P.U. SETTING MULTIPLES OF FULL LOAD CUR.
TIME OVERCURRENT UNIT	51	1.15 to 1.4
NORMAL DROPOUT INST. OVERCURRENT UNIT	50/IOC-A	8 to 15
HIGH DROPOUT INST. OVERCURRENT UNIT	50/IOC-B	2 to 3

Based on these settings, the ratings of the three units should be chosen as follows:

MOTOR FULL LOAD CURRENT	RECOMMENDED RATINGS		
	51 UNIT	50/IOC-A UNIT	50/IOC-B UNIT
0.8 - 1.7	1 - 2	10 - 40	2 - 6
1.4 - 2.6	1.5 - 3	10 - 40	4 - 12
1.8 - 4.3	2.5 - 5	20 - 80	4 - 12
1.8 - 4.3	2 - 6	20 - 80	4 - 12
2.9 - 5.0	4 - 8	20 - 80	4 - 12

When adjusted as shown above, the relay operates as follows:

1. For overloads, the 51 unit times out, picking up external auxiliary 51X, which rings the alarm bell.
2. For locked rotor, the 50/IOC-B unit will pick up instantaneously and the 51 unit will pick up with time delay. When both units have operated, the breaker is tripped to cause shut down of the motor.
3. For a fault, the 50/IOC-A unit will pick up instantaneously to trip the breaker and cause shut down of the motor.

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.

To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.

RATINGS

The induction unit ranges and taps available are given in Table I.

TABLE I

COIL-AMPS	TAP A	TAP B	TAP C	TAP D	TAP E	TAP F	TAP G
1-2	1.0	1.1	1.2	1.4	1.6	1.8	2.0
1.5-3	1.5	1.7	1.9	2.1	2.4	2.7	3.0
2.5-5	2.5	2.8	3.1	3.5	4.0	4.5	5.0
2-6	2.0	2.5	3.0	3.5	4.0	5.0	6.0
4-8	4.0	4.5	5.0	5.6	6.3	7.1	8.0

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 target and seal-in coil as indicated in Table II.

TABLE II

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	0.13	7
Impedance @ 60 cycles	0.53	52

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 or the target and seal-in coils of the protective relay.

The standard instantaneous unit ranges available are 4-16, 10-40, 20-80 and 40-160 amperes.

The high dropout instantaneous unit ranges available are 2-6, 4-12, 10-30 and 20-60 amperes.

CHARACTERISTICS

The time-current characteristics for the Type IAC66K relay induction unit are shown in Fig. 1.

Fig. 2 shows the time-current characteristics of the standard instantaneous unit.

The special high dropout instantaneous unit is designed to yield dropout values of 80 percent, or higher, of pickup current.

BURDENS

Burden data for the coils of the induction unit are given in Table III. The data are calculated for five amperes from measurement at minimum pickup current or at five amperes when minimum pickup exceeds five amperes.

TABLE III

COIL-AMPS	FREQ.	VOLT AMPS	WATTS	P.F.	1 SEC. RATING
1 - 2	60	118.4	15.2	0.13	145 AMP
	50	98.5	12.7	0.13	145
1.5 - 3	60	52.5	6.7	0.13	250
	50	43.7	5.6	0.13	250
2.5 - 5	60	18.8	2.5	0.13	300
	50	15.7	2.1	0.13	300
2 - 6	60	29.5	3.9	0.13	300
4 - 8	60	7.4	0.95	0.13	400
	50	6.2	0.79	0.13	400

*

Burden data for the standard instantaneous unit coils are given in Table IV.

TABLE IV

COIL-AMPS	FREQ.	VOLT-AMPS	WATTS	P.F.	1 SEC. RATING
4 - 16	60	5.0	4.75	0.95	145 AMP
	50	5.0	4.75	0.95	145
10 - 40	60	0.83	0.79	0.95	290
	50	0.80	0.76	0.95	290
20 - 80	60	0.21	0.20	0.95	450
	50	0.20	0.19	0.95	450
40 - 160	60	0.052	0.049	0.95	450
	50	0.05	0.048	0.95	450

Burden data for the high dropout instantaneous unit are given in Table V.

TABLE V

COIL-AMPS	FREQ.	VOLT-AMPS	WATTS	P.F.	1 SEC. RATING
2 - 6	60	20.0	14.0	0.70	75
	50	16.5	11.5	0.70	75
4 - 12	60	5.0	3.5	0.70	145
	50	4.1	2.9	0.70	145
10 - 30	60	0.80	0.56	0.70	270
	50	0.67	0.47	0.70	270
20 - 60	60	0.20	0.14	0.70	450
	50	0.17	0.12	0.70	450

CONSTRUCTION

The induction unit is the basic unit in all IAC relays. These units are of the induction-disk construction type. The disk is actuated by a current operating coil on a laminated U-magnet. The disk shaft carries the moving contact which completes the alarm or trip circuit when it touches the stationary contact. The disk shaft is restrained by a spiral spring to give the proper contact-closing current and its motion is retarded by a permanent magnet acting on the disk to give the correct time delay.

There is a seal-in unit mounted on the front to the left of the shaft. 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 standard instantaneous unit is a small instantaneous hinge-type unit mounted on the right front side of the induction unit. Its contacts are normally connected in parallel with the contacts of the main unit. Its coil is connected in series with the operating coil of the main unit.

When the current reaches a predetermined value, the instantaneous unit operates, closing the contact and raising its target into view. The target latches in the exposed position until released by pressing the button beneath the lower left-hand corner of the relay cover.

The special high dropout instantaneous unit is constructed without a target, and is designed to drop-out at 80 percent of pickup, or higher. The pole piece is constructed and secured with a special wave washer so that it can be rotated to the most favorable position. The armature has been shortened for the same purpose. This unit is mounted in the rear of the relay. Its coil is connected in series with the operating coil of the main unit but its contact is electrically separate.

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 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.

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 operation of the relay.

ACCEPTANCE TESTS

Immediately upon receipt of the relay an INSPECTION AND ACCEPTANCE TEST should be made to ensure that no damage has been sustained in shipment and that the relay calibrations have not been disturbed. If the examination or test indicates that readjustment is necessary, refer to the section on SERVICING.

These tests may be performed as part of the installation or acceptance tests at the discretion of the user.

VISUAL INSPECTION

Check the nameplate stamping to ensure that the model number and rating of the relay agree with the requisition.

Remove the relay from its case and check that there are no broken or cracked molded parts or other signs of physical damage, and that all screws are tight.

MECHANICAL INSPECTION

1. There should be no noticeable friction when the disk is rotated slowly clockwise. The disk should return by itself to its rest position.
2. Make sure the control spring is not deformed nor its convolutions tangled or touching.
3. The armature and contacts of the seal-in unit as well as the armature and contacts of the instantaneous units should move freely when operated by hand; there should be at least 1/32 inch wipe on the seal-in unit and both instantaneous unit contacts.
4. The targets in the seal-in unit and in the standard instantaneous unit must come into view and latch when the armatures are operated by hand and should unlatch when the target release lever is operated.
5. Make sure that the fingers and shorting bars agree with the internal connections diagram.

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. SEE FIG. 6.

DRAWOUT RELAYS GENERAL

Since all drawout relays in service operate in their cases, it is recommended that they be tested in their cases or an equivalent steel case. In this way, any magnetic effects of the enclosure will be accurately duplicated during testing. A relay may be tested without removing it from the panel by using a 12XLA13A test plug. This plug makes connections only with the relay and does not disturb any shorting bars in the case. The 12XLA12A test plug may also be used. Although this test plug allows greater testing flexibility, it requires CT shorting jumpers and the exercise of greater care, since connections are made to both the relay and the external circuitry.

POWER REQUIREMENTS GENERAL

All alternating-current operated devices are affected by frequency. Since non-sinusoidal waveforms can be analyzed as a fundamental frequency plus harmonics of the fundamental frequency, it follows that alternating-current devices (relays) will be affected by the applied waveform.

Therefore, in order to properly test alternating-current relays it is essential to use a sine wave of current and/or voltage. The purity of the sine wave (i.e. its freedom from harmonics) cannot be expressed as a finite number for any particular relay, however, any relay using tuned circuits, R-L or RC networks, or saturating electromagnets (such as time-overcurrent relays) would be essentially affected by non-sinusoidal wave forms.

TIME-OVERCURRENT UNIT

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 block.

The operating time from the Number 5 time-dial setting at five times minimum pickup setting should be within seven percent of the value shown in Fig. 1.

With the time dial at No. 10 time setting and the tap plug in the lowest tap, apply sufficient current in the relay to definitely close the contacts. Reduce the current to 75 percent of tap value and the disk should reset all the way to the No. 10 dial-setting position.

STANDARD INSTANTANEOUS UNIT

With the target in the down position, check the pickup at the minimum calibration mark using rated frequency. The pickup current should be within ± 15 percent of the minimum rating on the nameplate.

HIGH DROPOUT INSTANTANEOUS UNIT

Set the unit for the minimum calibration shown by the nameplate rating. With rated frequency applied, the pickup current should be within ± 15 percent of the minimum rating on the nameplate.

Dropout current should be at least 80 percent of the minimum rating on the nameplate.

TARGET AND SEAL-IN UNITPICKUP AND DROPOUT TEST

1. Connect relay studs 1 and 2 (see internal connections diagram) to a DC source, ammeter and load box so that the current can be controlled over a range of 0.1 to 2.0 amperes.
2. Turn the time dial to the ZERO TIME-DIAL position.
3. Increase the current slowly until the seal-in unit picks up. See Table VI.
4. Move the time dial away from the ZERO TIME-DIAL position; the seal-in unit should remain in the picked up position.
5. Decrease the current slowly until the seal-in unit drops out. See Table VI.

TABLE VI

TAP	PICKUP CURRENT	PICKUP CURRENT
0.2	0.15-0.195	0.05 OR MORE
2.0	1.50-1.95	0.55 OR MORE

INSTALLATIONLOCATION

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 diagram is shown in Fig. 7.

CONNECTIONS

The internal connection diagram is shown in Fig. 3. A typical external wiring diagram is shown in Fig. 4.

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.

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.

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 points listed below be checked at an interval of once a year.*

These tests are intended to ensure that the relays have not deviated from their original settings. If deviations are encountered, the relay must be retested and serviced as described in this manual.

TIME-OVERCURRENT UNIT

Perform the tests described in the ACCEPTANCE TEST section. The tap that is in service may be used instead of the lowest tap; this will not change the test limits.

INSTANTANEOUS UNIT

Check that the instantaneous unit picks up at the desired current level, as outlined in the ACCEPTANCE TEST section. If the unit is not set at the minimum calibration mark, pickup should be within ± 15 percent of the mark for which it is set.

HIGH DROPOUT INSTANTANEOUS UNIT

Check pickup and dropout current to the limits outlined in the ACCEPTANCE TEST section.

TARGET AND SEAL-IN UNIT

Check pickup and dropout as outlined in the ACCEPTANCE TEST section.

CONTACT CLEANING

For cleaning relay 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 it will clean off any corrosion thoroughly and rapidly. Its flexibility ensures the cleaning of the actual points of contact. Do not use knives, files, abrasive paper or cloth of any kind to clean relay contacts.

SYSTEM TEST

Although this instruction book is primarily written to check and set the IAC relay, overall functional tests to check the system operation are recommended at intervals based on the customer's experience.

SERVICING AND ADJUSTMENTSTIME-OVERCURRENT UNIT

If it is found during installation or periodic testing that the time-overcurrent unit is out of limits, the unit may be recalibrated as follows:

Rotate time dial to No. 0 time-dial setting and check by means of a lamp that the contacts just close.

Where the contacts just close can be adjusted by running the stationary contact brush in or out by means of its adjusting screw. This screw should be held securely in its support.

With the contacts just closing at No. 0 time setting, there should be sufficient gap between the stationary contact brush and its metal backing strip to ensure approximately 1/32 inch wipe.

Pickup Tests

The current at which the contacts operate is determined by the position of the tap plug in the tap block at the top of the relay. Screw the tap plug firmly into the tap marked for the desired current (below which the unit is not to operate).

When changing the current setting of the unit, remove the connecting plug to short circuit the current transformer secondary circuit. Next, screw the tap plug into the tap marked for the desired current and then replace the connecting plug.

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.

Time Setting

The setting of the time dial determines the length of time the unit requires to close its contacts when the current reaches a predetermined value. The contacts are just closed when the dial is set on zero. When the dial is set on 10, the disk must travel the maximum amount to close the contacts and therefore this setting gives the maximum time setting.

The primary adjustment for the time of operation of the unit is made by means of the time dial. However, further adjustment is obtained by moving the permanent magnet along its supporting shelf; moving the magnet toward the disk shaft decreases the time, while moving it away increases the time.

STANDARD INSTANTANEOUS UNIT

Select the current above which is desired to have the instantaneous 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 it up or down and then tighten in position.

The contacts should be adjusted to make at about the same time and to have approximately 1/32 inch wipe. This adjustment can be made by loosening the screws holding the stationary contacts and moving the contacts up or down as required.

HIGH-DROPOUT INSTANTANEOUS UNIT

The high-dropout, instantaneous unit is similar to the standard, instantaneous unit except it has no target and dropout current is approximately 80 percent of the pickup current. Fig. 5 is a picture of the high dropout unit.

The adjustable core (A) sets the pickup level. Turning the core down (clockwise, top view) lowers the pickup, while turning the core up (counterclockwise, top view) increases the pickup. Before attempting to turn the core, the locknut (B) must be loosened. After adjusting the core, the locknut must be retightened. When loosening or tightening the locknut, the sleeve (C) to which the shading ring (D) is attached must be held to prevent it from turning. Rotation of the shading ring sets the dropout level and thereby determines the quietness of operation in the picked up position. The core has been factory set to obtain 80 percent dropout at the minimum setting. Should it be necessary to change the dropout setting, the sleeve (C) to which the shading ring (D) is attached must always be turned in the clockwise direction (top view). This will prevent the sleeve and shading ring assembly from being loosened.

The unit will pickup at the scale-plate marking plus or minus 15 percent with gradually applied current.

The mean air gap should be approximately 1/16 inch, the contact gap approximately 3/32 inch, and the contact wipe approximately 1/32 inch.

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 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 plug in the 2-ampere tap.

The tap screw is the screw holding the right-hand stationary contact of the seal-in unit. 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.

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 the part wanted, and the complete model number of the relay for which the part is required.

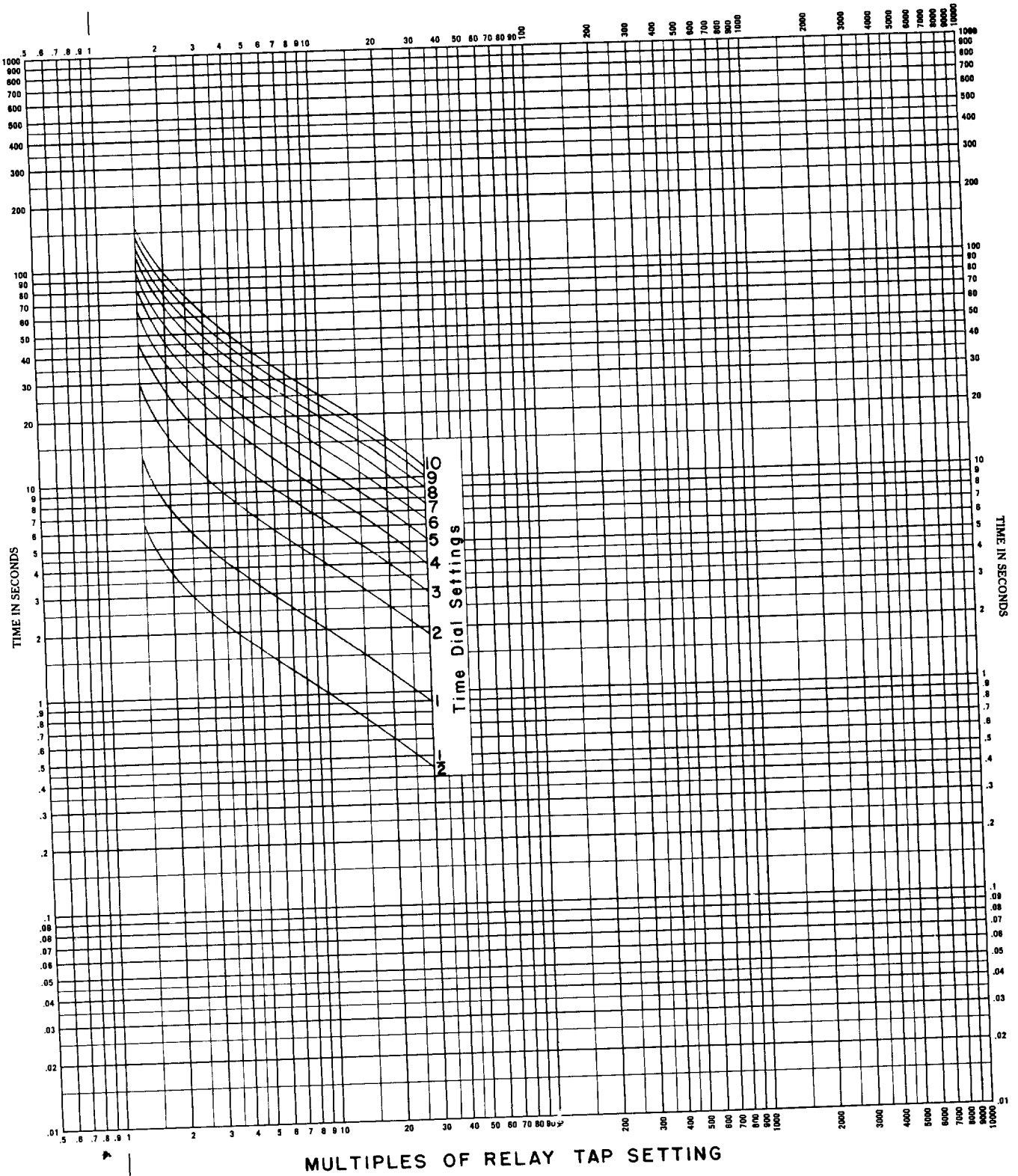
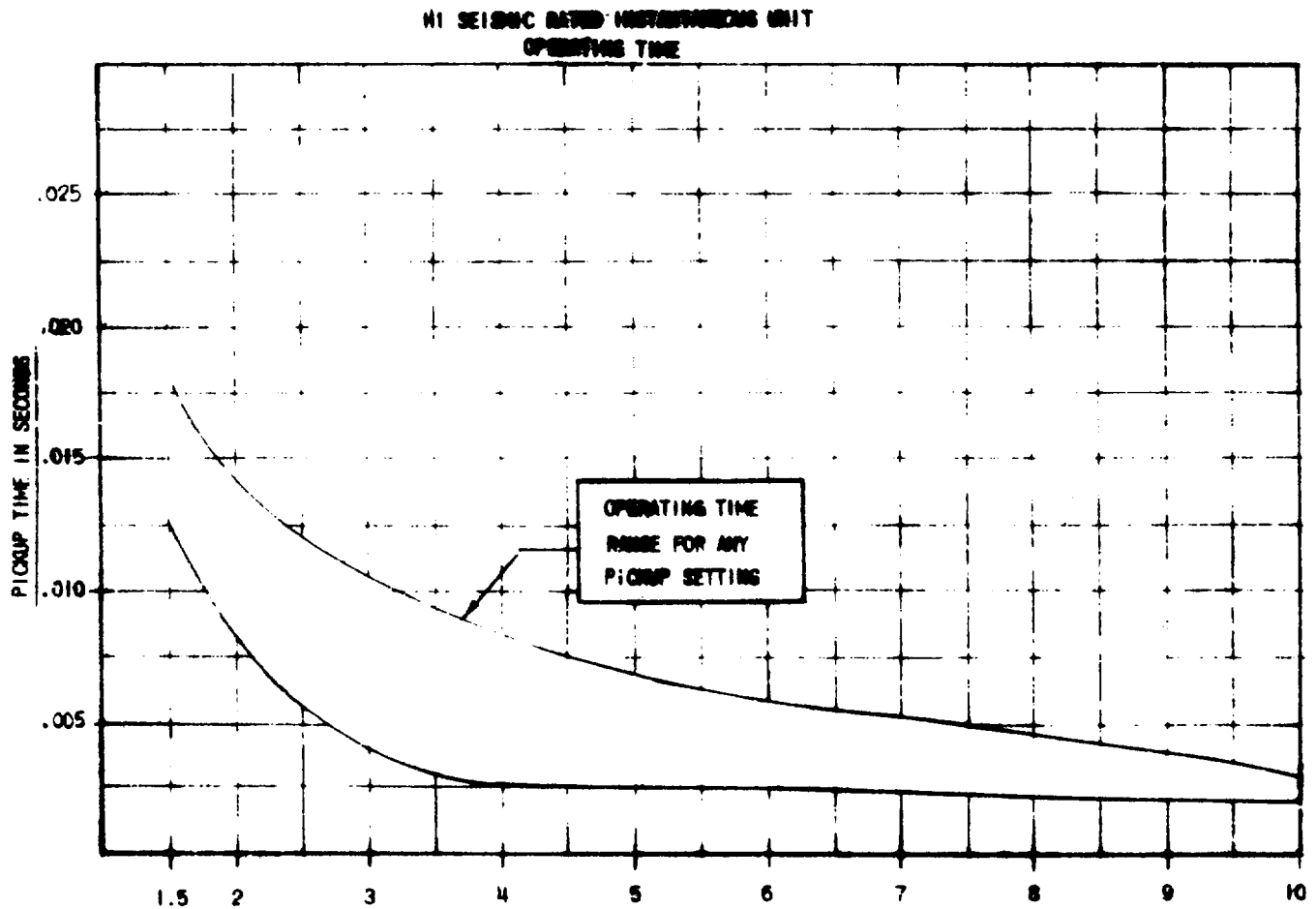


FIG. 1 (0888B0273-0) Time-current Characteristics of Type IAC66K Relay



* FIG. 2 (0208A8695-1) Time-current Characteristic of Standard Hi-Seismic Instantaneous Unit

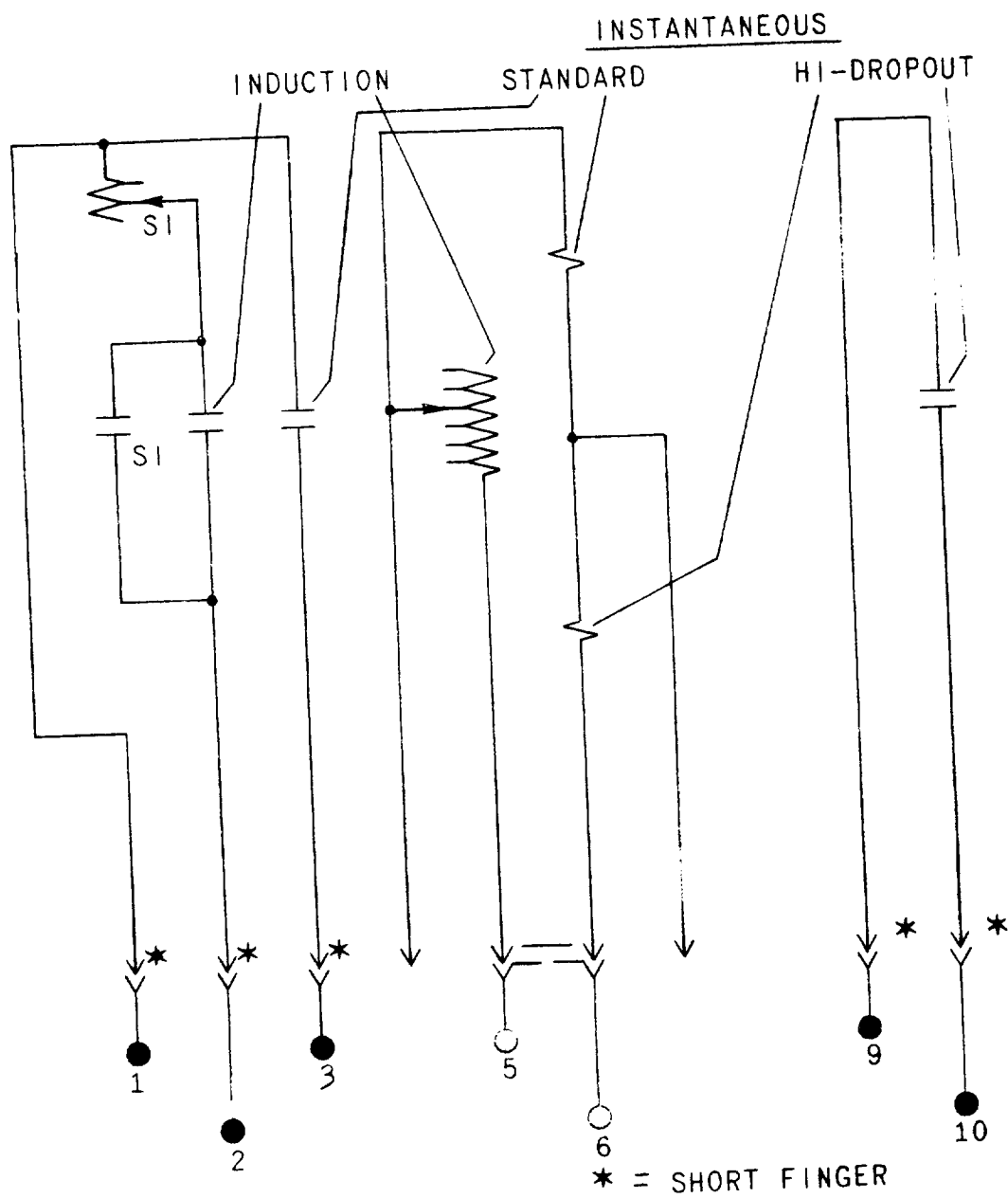
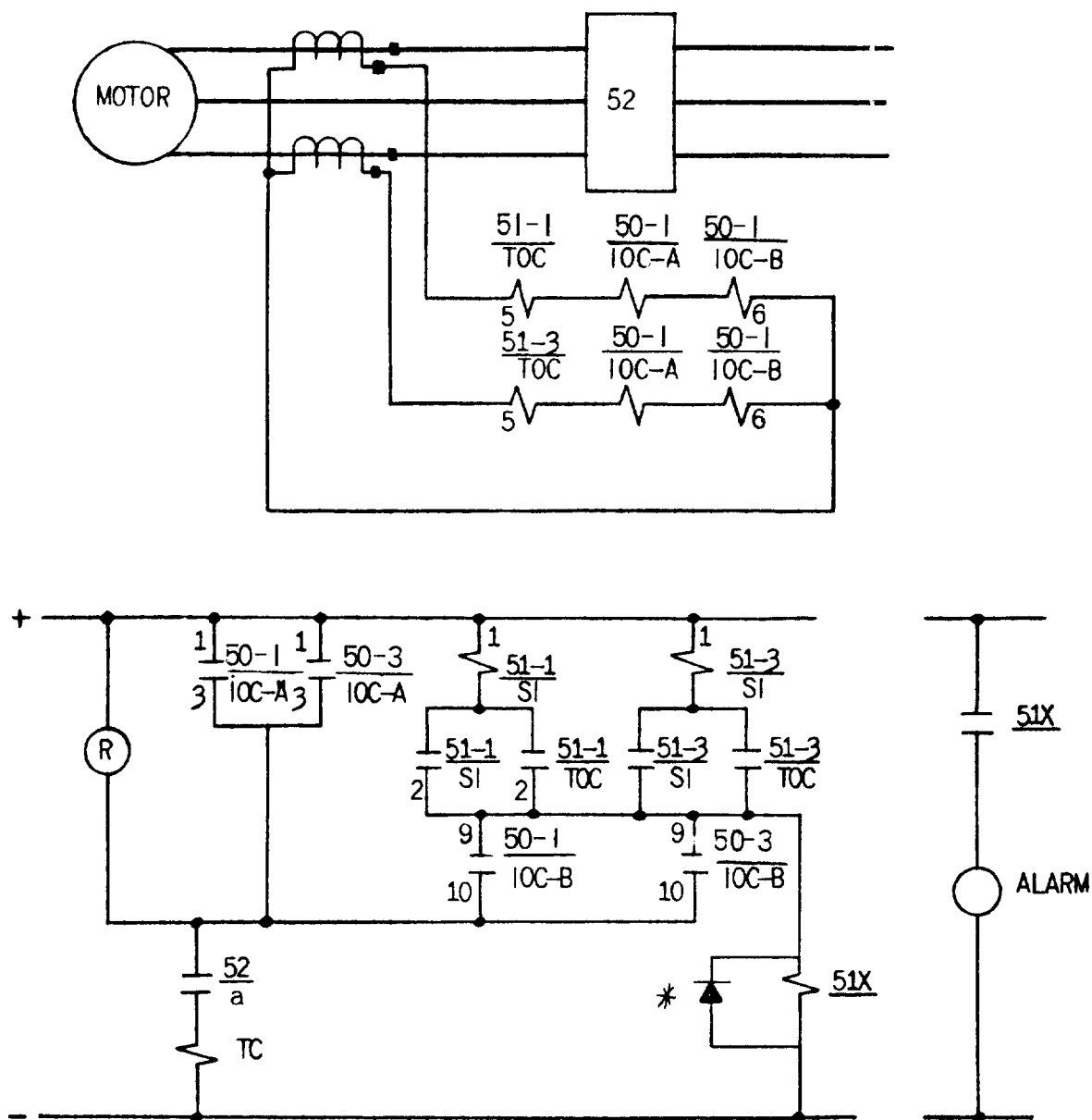


FIG. 3 (402A903-1) Internal Connections Diagram for Type IAC66K Relay (Front View).



* USE WHEN NECESSARY FOR CONTACT ARC SUPPRESSION

51	TIME OVERCURRENT RELAY
51X	AUXILIARY RELAY
50/IOC-A	NORMAL DROPOUT INSTANTANEOUS OVERCURRENT UNIT
52	POWER CIRCUIT BREAKER
50/IOC-B	HIGH DROPOUT INSTANTANEOUS OVERCURRENT UNIT
52/a	AUXILIARY CONTACT CLOSED WHEN CIRCUIT BREAKER IS CLOSED
TC	TRIP COIL

FIG. 4 (104A8568-3) Typical External Connections for Motor Protection Using Type IAC66K Relays

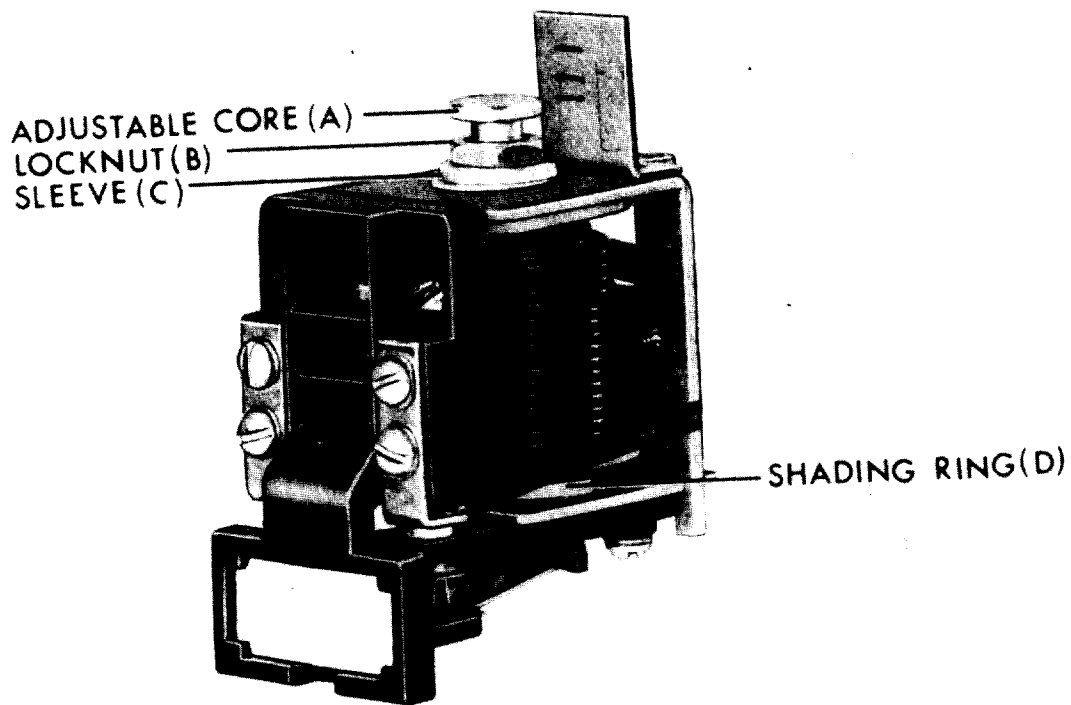
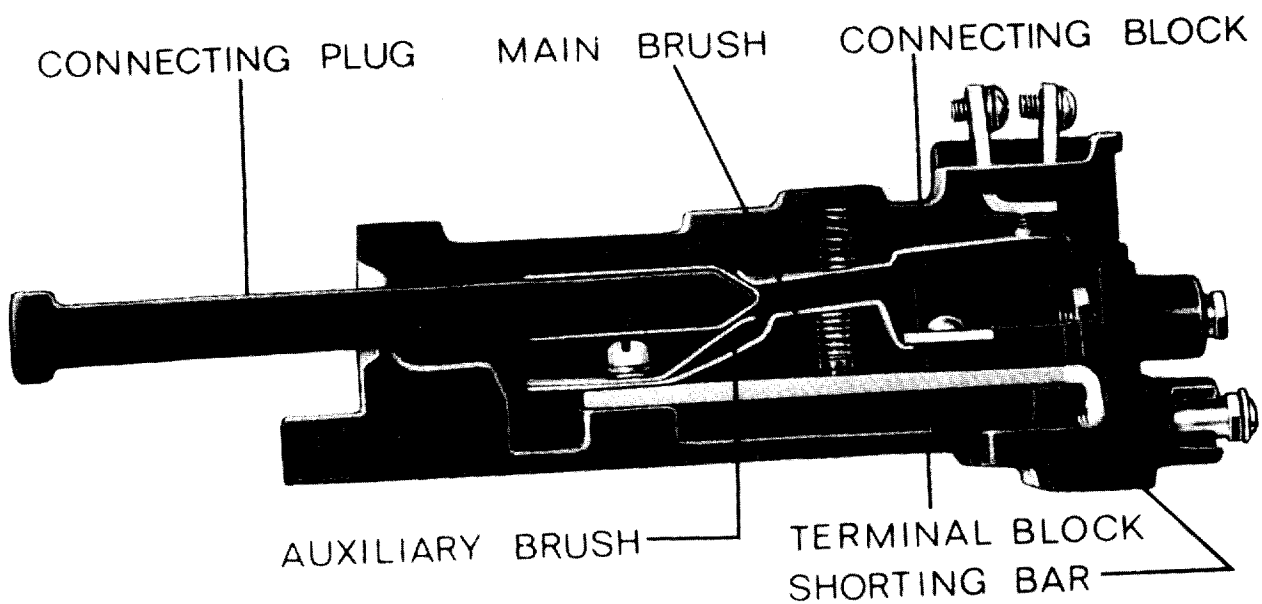
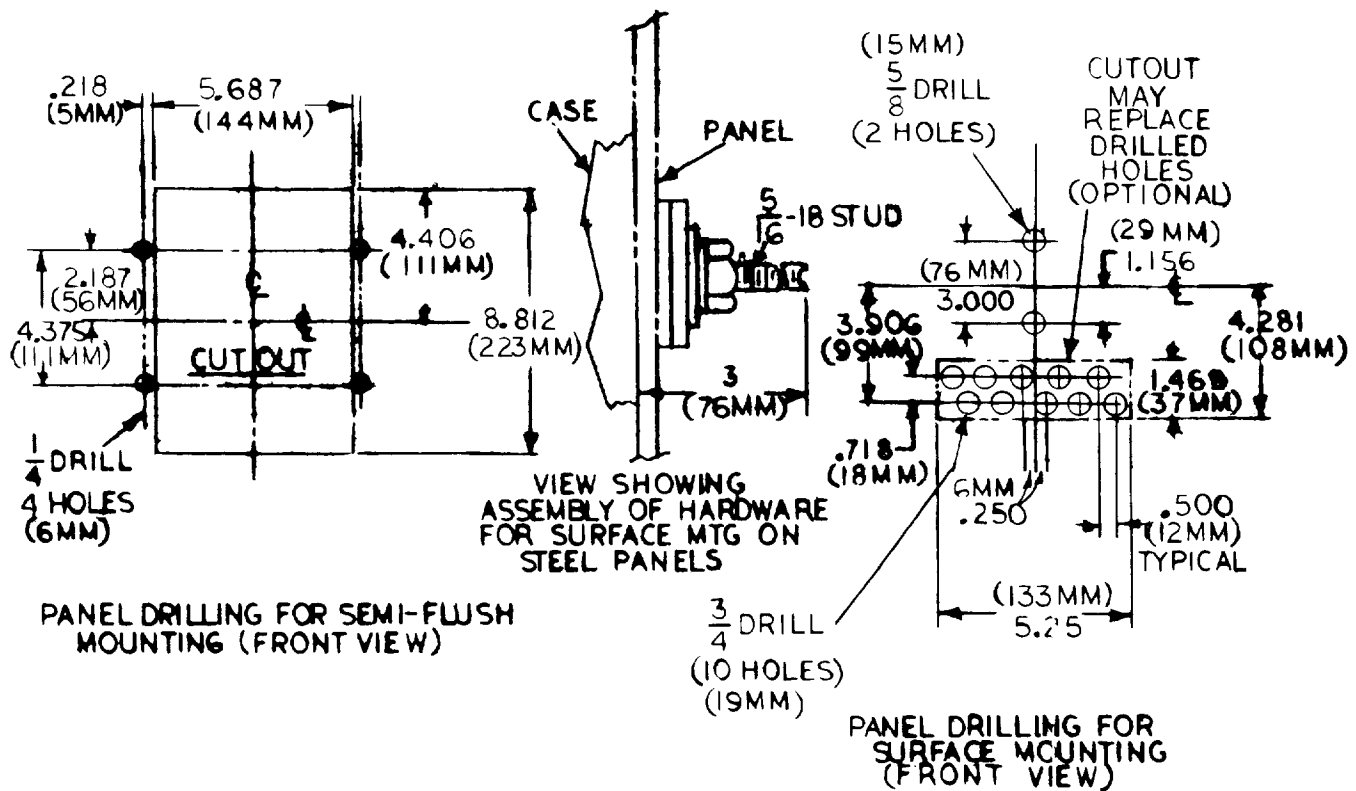
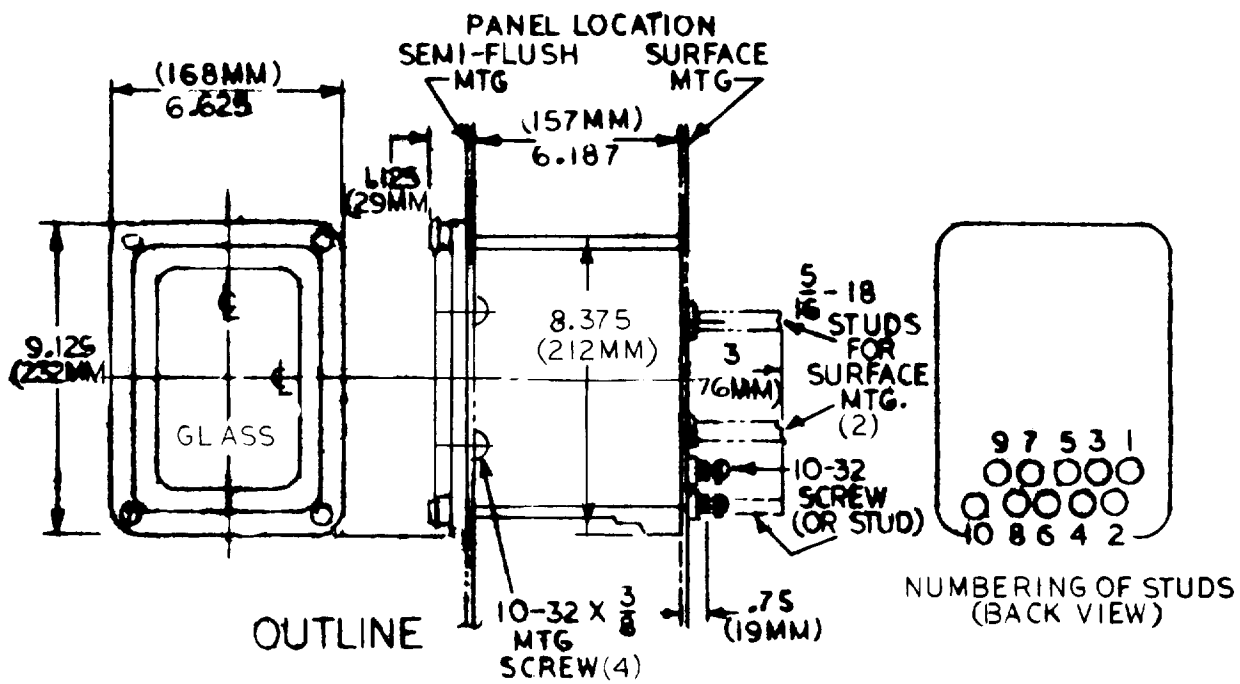


FIG. 5 (8036365) Construction of the High Dropout Instantaneous Unit



NOTE: AFTER ENGAGING AUXILIARY BRUSH CONNECTING PLUG TRAVELS $\frac{1}{4}$ INCH BEFORE ENGAGING THE MAIN BRUSH ON THE TERMINAL BLOCK

FIG. 6 (8025039) Cross Section of Drawout Case Showing Position of Auxiliary Brush



* FIG. 7 (K-6209271-6) Outline and Panel Drilling for the Type IAC66K Relays